MUNICIPALITY OF ANCHORAGE

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Mayor Ethan Berkowitz

WATERSHED & NATURAL RESOURCES ADVISORY COMMISSION

December 20, 2019

Animal Control Advisory Board
Municipality of Anchorage
P.O. Box 196650
Anchorage, AK 99519-6650

Dear Board Members:

Cats are now the most numerous household pets in the Municipality of Anchorage, a reflection of national trends. However, for several reasons, cats and cat owners are not held to the same standards as dogs or dog owners. Other pets, such as rabbits and ferrets, are also treated somewhat differently, with little or no justification. We hope to engage your board in a collaborative effort to rectify this imbalance.

In our advisory capacities, we have overlapping responsibilities with regard to pets and their impacts on people and the natural environment. Anchorage's Animal Control Advisory Board is a key player in municipal and state efforts to care for and control domestic pets, particularly those concerning the health, welfare, and safety of animals and people in our community. Some of the principal concerns of the board include (1) strategic planning, enforcement, public education, prioritizing capital needs, and increasing the number of pets adopted, claimed, rescued and housed; (2) reviewing and making recommendations on municipal ordinances related to animals; and (3) promoting safe and healthy use of public spaces by pets and pet owners.

Anchorage's Watershed & Natural Resources Advisory Commission serves as a technical liaison between municipal departments, the community, and state and federal agencies that manage water quality, watersheds and natural resources. The principal concerns of our commission include (1) sustaining the economic and community benefits of healthy creeks, watersheds and natural habitats; (2) restoring and improving fish and wildlife habitat; and (3) increasing community stewardship of aquatic and other natural resources within the Municipality.

Pets and pet ownership clearly affect local water quality, wildlife, and human health and safety. Many of the environmental and public health impacts are discussed in "Animal Control in Anchorage, Alaska: Cats and Dogs Deserve Fair and Equal Treatment," a report prepared by a member of our commission. In addition to presenting evidence that uncontrolled pets, particularly cats, adversely affect the environment and human health through disease and predation—and providing outdoor sources of food for pets and feral cats supports other invasive species like rats and mice and attracts wild predators like bears into neighborhoods—the report provides a list of management recommendations. Some of these recommendations fall under the purview of the Animal Control Advisory Board, while others are more appropriately addressed by the Watershed & Natural Resources Advisory Commission.

Wherever our technical and advisory responsibilities overlap, however, we can better serve the public and municipal agencies by collaborating, coordinating, and supporting one another's recommendations.

To that end, we ask that you consider the merits of the objectives and management recommendations listed in "Animal Control in Anchorage, Alaska: Cats and Dogs Deserve Fair and Equal Treatment." Before we can delve into the details, it is best that we agree that the issue warrants our joint attention, that our ultimate objectives are shared, and that we will coordinate and support the recommendations, perhaps to the extent that our recommendations are submitted jointly.

Step 1 – Agreeing to collaborate. If your advisory board believes this issue deserves our attention, please let us know if you are willing to commit to a process that will ultimately result in one or more resolutions to the Assembly and Mayor. Our missions and public interactions are unique, albeit overlapping, and it might be best if our two advisory groups worked on the issues in separate but parallel tracks, rather than holding joint meetings. It would be helpful to know up front if our resolutions will be submitted separately or jointly; however, this could also be determined as the process unfolds.

Step 2 – Agreeing on objectives. We suggest that the objective listed in the attached report be used as a starting point. Please let us know if this objective is suitable or if you would like to revise it.

Step 3 – Agreeing on recommended solutions. After investigating and assessing the historical and current status of pets in the municipality and comparing our local situation with national findings, we have identified a number of potential solutions recommended by experts in pet care and control, water quality issues, wildlife management, environmental science, and public health. Many of these solutions—which could meet the objective outlined above as well as raise more funding to better care for and control pets—are more clearly under the jurisdiction of the Animal Control Advisory Board than the Watershed & Natural Resources Advisory Commission. However, any solution that satisfies the proposed objective will improve our community's care and control of pets, human health, and the natural environment. We hope to work together to achieve whatever solutions we can agree upon.

We believe our advisory commission has started the ball rolling by writing the report and sharing an earlier draft of the report with the Animal Control Advisory Board in March 2019. At that time, your board members indicated a willingness to consider taking action.

We hope you will agree that this issue is serious, multi-faceted, and worthy of our joint consideration. Please review the objectives and recommended solutions in the attached report and let us know as soon as possible if you would like to join us in this effort to improve pet care and control in the Municipality.

Sincerely,

David M. Nyman, P.E.
Chair

Attachment

Animal control in Anchorage, Alaska: Cats and dogs deserve equal treatment

Prepared for the Anchorage Animal Control Advisory Board
and
Anchorage Watershed and Natural Resources Advisory Commission,
Municipality of Anchorage, Alaska

by Rick Sinnott

December 2019

"Those who'll play with cats must expect to be scratched."
Miguel de Cervantes

EXECUTIVE SUMMARY

Ev'ry time I come to town, the boys keep kickin' my dawg aroun'.
James Bland

Purpose

The purpose of this report is to compare pets and pet care and control in Anchorage, Alaska, with national statistics, scientific studies and expert advice to better understand why cats in particular are treated differently and to make recommendations to rectify the inequality.

After a detailed introduction that discusses Anchorage's and Alaska's dog and cat-related laws and policies, a results section analyzes Anchorage's animal control statistics from 2008 to 2017. Research on pets and pet control follows in the discussion section to provide a national context and to learn from the mistakes and solutions of others. Finally, conclusions are summarized and a list of recommendations is provided. An extensive bibliography of citations – most of which include links to the document – supports the findings, conclusions and recommendations.

Findings

Dogs and cats are not treated equally

- Anchorage's dogs have been required to be on a leash or confined since the first dogcatcher and pound were established in 1917. A cat leash law came much later and is rarely enforced.
- The public seems to believe that free-ranging cats and feral rabbits are "natural" or "normal," while free-ranging dogs and ferrets are not.
- Owning a dog requires a municipal license, but owning a cat does not.
- Cat licensing has been considered by the Anchorage Assembly on at least three occasions; however, opposition from cat owners has forestalled any action, and the issue has not been brought before the Assembly since 2002.
- Dog license fees support food and shelter for homeless animals, adoption services, education programs and ongoing efforts to create a safe, dog-friendly community; thus, dog owners are funding municipal cat care and management.
- Only dog owners are required to affix metal tags on their pets bearing the number and year of the most recent rabies vaccination certificate.
- Cats and ferrets are not required to wear an ID tag or to be microchipped unless they leave their owner's property, an undertaking for which stray, "indoor-outdoor," and even some "indoor-only" cats are well known.
- Because of the requirement to wear ID and rabies tags, stray or lost dogs are much more likely to be returned to their owners than cats.
- Free-ranging dogs are much more likely to be apprehended than cats in Anchorage where no municipal control officer is assigned to capture stray and feral cats.
- Anchorage dog owners are much more likely to be fined than cat owners for a variety of infractions (e.g., no license, no rabies tag, running loose, aggressive behavior, failure to fill a hole dug by the dog in an off-leash area).
- The fines established for comparable violations such as failure to have a dog license/cat ID are higher for dog owners than cat owners.
- Anchorage prohibits owning wolf-dog hybrids, but not wild cat-domestic cat hybrids.

- State law allows ownership of wild cat-domestic cat hybrids after the third generation of crossing with domestic cats; however, any identifiable admixture of wolf is enough to prohibit ownership of a wolf-dog hybrid as a pet.
- Anchorage's dangerous-animal ordinance applies to all domestic animals; however, cats are rarely classified as dangerous even though the ordinance does not specify severity of human injury until level 5 (the highest level of threatening or aggressive behavior).
- Dog owners may be sued under the common law's "one-bite" rule, which doesn't seem to apply to cats.
- State law allows a person to shoot a dog that is harassing wildlife (under certain conditions), but cats may not be shot for harassing wildlife.
- State law classifies some species of feral pets (including ferrets, European rabbits, pigeons, rats and mice) and other feral domestic animals (such as feral swine) as "deleterious exotic" animals or invasive species, but not feral cats.

Animal control

- Pet cats outnumber dogs in Anchorage (74,600 cats vs. 68,300 dogs), as they do nationally.
- In addition to pet cats, Anchorage has an estimated 30,000 unowned (feral and stray) cats.
- Pet populations continue to grow in concert with the human population.
- However, the number of dogs and cats handled by Anchorage Animal Care and Control has declined substantially in the last decade, which has contributed to a decline in the number of pets that animal control has adopted out and euthanized.
- In Anchorage, dogs and cats are adopted and reclaimed at substantially higher rates than nationally.
- In Anchorage, three times as many cats are euthanized as dogs, a higher rate for cats and lower rate for dogs than nationally.
- Anchorage Animal Care and Control has been understaffed and underfunded for decades.
- Most dog owners don't purchase or renew their licenses; targeted information/education campaigns and better enforcement are needed.
- Establishing license fees for cats, if the same as those for dogs, could raise more than $1 million annually for one or more cat control specialists and other animal control programs such as free sterilization, information/education campaigns, and better enforcement.
- State law prohibits release of pets into the wild, and owners of almost every stray, "indoor-outdoor," and "barn" cat are in violation of that law.
- Several national and local organizations have asked the municipality and Alaska Board of Game for authorization to release cats into the wild and maintain outdoor feeding stations for cat "colonies," and many individuals already feed semi-owned and feral cats outdoors.
- The national movement to employ TNR (trap-neuter-return) for controlling free-ranging cat populations is not only illegal in Alaska, it has never been shown to be cost-effective or to work at a scale larger than one or two cat "colonies" for a short period of time.
- Thus, the only legal, practical and cost-effective method for reducing Anchorage's free-ranging cat population is removal, where the cats are offered for adoption but would be permanently confined or euthanized as a last resort. Permanent confinement would not be cost-effective unless facilities were built and run by volunteers using donations or grants, but might be an acceptable solution if the public does not support euthanizing feral and stray cats.

Environmental issues

- Feral cats are considered one of the world's 100 worst invasive species by the IUCN, one of the 50 top invasive species in western states by the Western Governor's Association, and a species with high invasive potential by the Alaska Natural Heritage Program.
- A recent meta-analysis of previous studies published by the National Academy of Sciences of the United States of America supports the contention that cats are the most harmful invasive mammal worldwide.
- Free-ranging dogs can harass and kill wildlife, but that problem has largely been brought under control in most communities in the U.S., including Anchorage.
- However, free-ranging cats are not adequately controlled. Cats kill as many as 7 million small birds and mammals in Anchorage annually, using estimates derived from scientific studies.
- Food left outside for pets and stray or feral cats, including several illegal cat "colonies," attracts wildlife in violation of the Alaska state law which prohibits feeding bears, coyotes, foxes and several other wild animal species found in and around Anchorage.

Public health

- Rabies in pets has been brought under control and nearly eliminated in the U.S. with vaccinations; however, other serious zoonotic diseases have been largely ignored.
- Many cat bites and scratches are treated prophylactically because cats, unlike dogs, are typically not required to wear a collar with a rabies tag.
- One of the most significant zoonotic diseases is toxoplasmosis, one of five neglected parasitic infections of the U.S. that have been targeted by the Centers for Disease Control and Prevention for public health action.
- Cats are the definitive hosts for the protozoan parasite *Toxoplasma gondii* that is broadcast throughout the municipality in the feces of free-ranging cats.
- Toxoplasmosis infects millions of people nationwide, as well as wildlife (including marine mammals such as the endangered beluga whales in upper Cook Inlet).
- Toxoplasmosis can cause a variety of psychiatric problems in adults, as well as severe sickness and death in both immunosuppressed people and newborn babies.
- Despite infecting, injuring and killing more people than rabies in recent decades, the clear and present threat of toxoplasmosis has never triggered a quarantine of potential carriers (i.e., cats) in accordance with regulations promulgated by the Alaska Division of Public Health.
- The CDC has recently warned that cat-scratch disease is more dangerous to humans than previously thought.

Litter and solid waste

- Anchorage's pet dogs contribute an estimated 25 tons and cats 17 tons of feces per day, while the cats use an estimated 12 tons of litter per day. Much of this ends up in the landfill, which is not designed to accommodate the absorbent clay particles.
- Free-ranging cats alone add 8 tons of feces per day to the environment.

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"We must work toward a time when it is just as socially unacceptable to abandon a cat on public or private property as to abandon a horse, cow, or dog."
D. A. Jessup

"Dogs come when they're called. Cats take a message and get back to you later."
Mary Bly

INTRODUCTION

"The problem with cats is people."
Deborah Rivel

Pets, or companion animals, have become an important factor in all our lives in recent decades as their numbers increase. Pets are found in most American homes. But even if you don't own a pet, you are affected by their presence, either because your friends or family members own a pet, your taxes support animal control, domestic and feral pets kill wild birds at your feeder, or they defecate on your lawn or in city parks and playgrounds.

Because some pets, particularly cats, are abandoned or allowed to roam freely and many become feral, their impacts are magnified. This report analyzes state and municipal animal control practices and compares them to national practices. Special emphasis is given to the care and control of feral cats because they have been largely ignored in Anchorage as elsewhere.

This review of the literature and current animal control policies and practices is intended to inform the decisions and recommendations of two municipal advisory commissions. The Anchorage Animal Control Advisory Board advises local decision-makers on the care and control of domestic animals in the municipality, while the Anchorage Watershed and Natural Resources Advisory Commission makes recommendations regarding the management and pollution of watersheds and the maintenance and control of wild animal populations.

Pet numbers

Cats and dogs are the most popular pets in North America. The pet cat population has exceeded the dog population in recent years, and that's without counting feral and stray cats, which aren't typically claimed as pets. Not only are the numbers of cats staggering, they are unexpected. You might even say they snuck up on us. Numbers of pet cats in U.S. households tripled in 40 years from about 30 million in 1970 to about 90 million in 2010 (Lepczyk et al. 2010). Pet cats are now estimated to number about 94 million compared to about 90 million dogs (APPA 2017). Add to this the number of free-roaming, abandoned, and feral cats, estimated to range from 70 to 100 million (AAFP 2012). Feral and free-roaming dogs can also present problems; however, loose dogs are much more likely to attract the attention of animal control officers, government agencies and the public.

No governmental, commercial or nonprofit organizations compile statistics on pet ownership nationwide; however, attempts have been made by the American Society for the Prevention of Cruelty to Animals (ASPCA), the National Council on Pet Population Study and Policy (NCPPSP), the American Veterinary Association (AVA), and the Pet Food Institute to estimate numbers of pets in homes and animal shelters (ASPCA 2003).

According to the American Pet Products Association (APPA), 68% of U.S. households have at least one pet (APPA 2017). Millennials are slightly more likely to own dogs and cats than generation X or baby boomers while older Americans tend to own fewer dogs and cats (Table 1). A major reason millennials give for acquiring a pet is "having a pet is a good way to get ready to have a family" (PR Newswire 2017).

Table 1. Cat and dog ownership in the United States by generation (APPA 2017).

Age group	% of U.S. adults[1]	% own cats	% own dogs
Millennials (born 1994-1980, aged 18-36)	31	35	38
Generation X (born 1965-1979, aged 37-51)	25	27	26
Baby boomers (born 1946-1964, aged 52-70)	31	32	31
Older	12	6	5

[1] U.S. adults (≥18 years old) as of 2016 using millennial births between 1981-1997 (CNN 2017: 75.6 million millennials, 61.2 million gen X, 74.1 million baby boomers, 29.9 million older Americans = 240.8 total).

There are no census data on numbers of pets in the Municipality of Anchorage and no local governmental or nongovernmental agencies have attempted an independent estimate. The municipality bases its estimate on a "pet calculator" used by the American Veterinary Medical Association, which depends on the number of residents or households in a community (M. Tierney, Municipality of Anchorage, personal communication; AVMA 2019*a*). According to the AVMA calculator, the Municipality of Anchorage, with approximately 304,000 residents (2017), has an estimated 74,600 pet cats and 68,300 dogs.

That estimate is for owned pets. Domestic cat populations are augmented by many unowned, free-ranging cats. Some experts and organizations estimate the number of stray and feral cats in a community to be as high as the number of owned cats (Hurley and Levy 2013). For example, the Koret Shelter Medicine Program (2017) cat calculator, based "on a composite of many studies," estimates a city with a population the size of Anchorage has 46,500 indoor-only pet cats (according to their owners), 30,400 indoor/outdoor pet cats, and 43,429 "community" (stray and feral) cats for a total of over 120,000 cats. Hurley and Levy (2012) estimate similarly high numbers for a community the size of Anchorage; however, they note that even these estimates may be low because the figure for free-roaming cats doesn't include those that aren't fed by humans and, therefore, haven't been counted.

A much more conservative estimate based on several studies is one feral cat for every 10 residents (Levy et al. 2014), which is about 30,000 unowned cats in Anchorage, or over 104,000 cats total. This report will use that lower estimate, partly because Anchorage has a less hospitable climate than most U.S. cities, although our city's winters are not particularly harsh compared with other northern-tier states and Canadian provinces. Anchorage also has coyotes and other wild predators that kill free-ranging cats, but so do many other North American communities. Some studies have found evidence that a colder climate (e.g., New York state, Poland) and the presence of feline predators such as coyotes may limit the hunting of indoor/outdoor (e.g., Kays and DeWan 2004) but not free-ranging (Wierzbowska et al. 2012). cats in protected areas. Sims et al. (2008) reported an order of magnitude increase in the density of cats in urban green spaces without large predators, but this effect was limited in scope and not applicable to citywide cat populations.

In an effort to reframe the debate, most feral cat advocates have started referring to feral and stray cats as "community" cats, attempting to re-conceive the animals as valued members of our community (Schaffner 2017). By doing so they hope to characterize free-roaming cats as individuals who share our streets and community rather than invasive pests detrimental to human interests.

Pets in shelters

While pets are often well-loved – to the point of being treated like family members by many owners – millions of pets are passed on to other people, abandoned, dropped off at shelters, or euthanized every year.

Approximately 8-12 million pets enter animal shelters nationwide every year (ASPCA 2003). About 5-9 million are euthanized (60% of dogs and 70% of cats). Shelter intakes are about evenly divided between those pets relinquished by owners and those picked up by animal control. Less than 2% of cats and about 15-20% of dogs taken in by shelters are returned to their owners according to the NCPPSP. Most returned pets were identified by tags, tattoos, or microchips. Dogs are far more likely to carry some form of identification than cats.

What many have deemed an overpopulation of pets is driven as much by supply as demand. Failure to spay or neuter pets, especially pets released into the wild or allowed to roam free, results in many unwanted animals. While 75% of owned pets are neutered, only 10% of pets received by shelters have been spayed or neutered, according to the ASPCA. The large number of stray and feral cats, most of which are not neutered, are a major reason why so many former pets and their offspring end up in shelters.

Trap, neuter and return (TNR)

Domestic cats rarely if ever live in a colony in the wild. So-called cat "colonies" are found primarily in urban and suburban areas, and the density of feral cats and cat "colonies" is directly correlated with human population density (Liberg et al. 2000, Sims et al. 2008, Ferreira et al. 2011, Aguilar and Farnworth 2013). People who practice TNR find "colonies" of feral and free-roaming cats that have been attracted to a food source (Schmidt et al. 2007) – often garbage or other human offal – or provide a food supply until a "colony" develops. The cats are live-trapped and sterilized, sometimes vaccinated, and then they are taken back to the point of capture and released to live outdoors. Typically, the caretakers continue to supply food to facilitate more captures and to ensure the health and well being of the released cats. Once established, cat "colonies" tend to persist as long as food and other resources, like shelter, are available (Aguilar and Farnworth 2013).

This international effort – called TNR for trap-neuter-return – began in London and Rome in the 1950s and came to America in the 1970s. The ultimate goal is supposedly to reduce the feral cat population through attrition. The sterilized cats, it is claimed, will ultimately die of old age.

Although its proponents cite many successes, and the technique appears to have reduced the size of individual, small "colonies" for limited periods, TNR has never been shown to work on a community-wide scale or for any extended length of time (Longcore et al. 2009, Crawford et al. 2019). It's very difficult to capture and sterilize every individual in a population of free-roaming cats (Guttilla and Stapp 2010). Ignorant or irresponsible cat owners abandon more reproductively intact cats, assuming that the cats belong in the wild or that others will take care of them. Stray cats from adjacent areas and indoor-outdoor cats continue to produce kittens. Consequently, cat numbers don't decline. Instead, the number of "colonies" and caretakers keeps increasing. The largest TNR program in the nation, which has neutered and re-abandoned over 180,000 cats, is not expected, even by its proponents, to reduce the number of feral cats in San Diego County, California (Jessup 2004). Beijing, China, which "cleansed" the city of free-ranging cats in preparation for the 2008 Summer Olympics, was re-populated by 500,000 to 5 million stray and feral cats by 2012. The city is now relying on volunteers to trap,

neuter and release cats in a misguided and naive effort re-eradicate the cats more humanely (Brund 2012). It is an effort destined to fail.

TNR is a popular, albeit unproven, method of cat "control" in 49 states. However, because it is illegal in Alaska to release cats into the wild, TNR isn't an option for animal control in Anchorage.

Most cats won't kill rats

One of the reasons why communities tolerate or even welcome the presence of free-roaming cats is the nearly universal belief that cats eliminate (or at least reduce) pest species, like house mice and rats. Common sense suggests this is not the case. Egypt, where cats were supposedly first domesticated thousands of years ago, is still overrun with rats and mice – as is every other urban and farming community where cats are the primary control agent.

Chicago supports at least 650 managed cat "colonies" (Danner 2016), yet the city has been named the "rattiest city in the nation" by Orkin, the national pest control company, every year since 2013 (Braff 2016, DeBat 2017, Orkin 2018*a*). This dubious distinction was recently ratified (pun intended) by RentHop, an apartment search service, which dubbed Chicago the "rat capital of the world" because the company had received more rat complaints than any other city in 2017 (Petsko 2018). The city's rat population was forecasted to reach 50,000 by 2016, while its cat population probably exceeded 660,000 pet and 270,000 feral cats, based on the AVMA's cat calculator and other experts. Far from confirming the conventional wisdom that cats control rats, the rat population in Chicago keeps climbing despite the city having 20 times as many cats as rats.

Orkin, by the way, offers advice on how to control a feral cat infestation (Orkin 2018*b*). It doesn't involve TNR.

Scientific research also offers evidence that cats seldom hunt rats, much less reduce their populations (Forbush 1916, Glass et al. 2009, Parsons et al. 2018). After analyzing over 300 videos of feral cat and rat interactions in a Brooklyn recycling facility, using both cameras and radio frequency tags, Parsons et al. (2018) documented only 20 stalking events and three kills. Parsons concluded that "The cats didn't really bother [doing anything] when the rats were on the open floor" (Chen 2018). If you need video confirmation of that, you can find a sample of the study's videos on YouTube (New Scientist 2018).

On a much larger scale, the estimated rat population of Baltimore, Maryland, remained essentially unchanged over the 60-year period between the 1940s and 2004 (Glass et al. 2009) – this in a city with so many free-ranging cats that an estimated 5,000 are killed by vehicles annually (Childs and Ross 1986). The city's estimated population of feral cats alone is 200,000 (Bell et al. 2013).

Alley Cat Allies, which lobbied for the law, claims that since 2007 Baltimore has had "one of the country's best ordinances supporting Trap-Neuter-Return and feral cats" (Alley Cat Allies 2018). The ordinance changed the definition of abandoned animal to exclude feral cats, and caregivers are exempted from kennel regulations and limits on the number of pets an individual may own (Animal Law Coalition 2007). Subsequently, a proposal was made to adopt a similar law for the entire state of Maryland (Arnold 2014), despite the lack of evidence that Baltimore's ordinance has had any effect.

Gregory Glass, a researcher at the University of Florida who has studied cat and rat interactions for decades, says proposals to use cats to control rats are placebos that "make people who want to do something feel better about themselves" (Chen 2018).

A photo, they say, is worth a thousand words. Edward Howe Forbush (1916), a Massachusetts state ornithologist and an early conservationist who wrote a book on the domestic cat, cites an account of a quarantine officer who had heard shipmasters claim many times that having a cat on a ship keeps rats out of a cabin. One captain who owned, in his words, "an exceptionally good cat" assured the fumigator that it was impossible for rats to inhabit his cabin. The cabin was fumigated anyway and, unfortunately, someone forgot to remove the cat. When the cabin door was opened they found one dead cat and 24 dead rats. Forbush published the photo in his book.

State laws

In Alaska, as elsewhere, animal control is largely the responsibility of local governments. However, several Alaska statutes and regulations supersede and guide local regulations and enforcement efforts (Animal Legal & Historical Center 2018). It is noteworthy that, with two exceptions – owning a hybrid as a pet and release into the wild – cats are not specifically mentioned in the following state laws while free-ranging dogs, ferrets, rabbits, rats and even such relatively innocuous pets as doves and gerbils are considered deleterious or exotic by definition.

Cruelty and well-being. Alaska law has established minimum standards of care for domestic animals (AS 03.55.100). Animal cruelty includes knowingly inflicting severe and prolonged pain or suffering, intentional poisoning, and negligent failure to care for an animal, which results in death, severe pain or prolonged suffering (AS 11.61.140). Exceptions include legitimate scientific research, humane destruction such as that practiced by veterinarians and animal shelters, accidental events incidental to fishing, hunting and trapping activities, and sporting events such as dog mushing and rodeos. Defendants may be required to reimburse the state or a custodian for all reasonable costs and may be prohibited from ownership or custody of animals for up to 10 years.

Alaska was the first state to allow judges to provide for the well-being of pets in divorce actions, pets may be included in protective orders for domestic violence, and designated domestic animals are eligible for trusts, provided they are in effect no longer than 21 years (Animal Legal & Historical Center 2018).

Public health and safety. Alaska law expresses the public's desire to ensure that pets receive adequate care and attention. However, state law also concerns itself with dangerous dogs, but not cats. Any person may lawfully kill a vicious or "mad" (rabid) dog (AS 03.55.010). A "vicious" dog is considered to be one which when unprovoked has ever bitten or attacked a person (AS 03.55.020).

Alaska has no specific dog-bite statute. The state follows a "one-bite" rule, which holds owners responsible for injuries only if they knew or should have known their dog was dangerous (Rudolph undated *a*). Lawsuits are usually considered under the state's common-law negligence rule, in which the injured person must prove that the dog's owner failed to use reasonable care to control the animal, and that this failure caused the injury (Rudolph undated *b*). There is no comparable "one-bite" rule for cats, presumably because they aren't considered

dangerous. Thus, the owner of a peekapoo or miniature Chihuahua is liable to be sued in accordance with the one-bite rule, but not the owner or caretaker of a semi-wild cat.

There are precedents for state regulation of cats as well as dogs where human health is at risk. The Alaska Division of Public Health has promulgated regulations for rabies vaccination and quarantine of dogs, cats and ferrets (7 AAC 27.022). Vaccinations are required for all three species; however, only dog owners are required to affix metal tags on their pets bearing the number and year of the vaccination certificate.

In addition to rabies, any other animal disease reported in an area that is "dangerous to the health" of humans is subject to investigation by the Alaska Division of Public Health (7 AAC 27.020). If a threat to human health actually exists, potentially infected animals may be quarantined to prevent the spread of the disease. During the quarantine, all peace officers are empowered to euthanize or, at their discretion, capture and hold all animals subject to the quarantine order that are not held in restraint in facilities or on private premises.

Surprisingly, the state's responsibility to investigate and quarantine diseased pets has never been exercised in the case of cats infected with *Toxoplasma gondii*, a common zoonotic disease (capable of being transmitted from animals to people) transmitted by cats that is deadly to some people. Toxoplasmosis is far more dangerous to Americans than rabies these days. Toxoplasmosis infects about a million Americans every year and about 750 die from the infection (Furtado et al. 2011). Approximately half of toxoplasmosis deaths are from eating raw or insufficiently cooked meat infected with *T. gondii* oocysts acquired from cat feces (ADHSS 2005), while the other half are presumably contracted through direct exposure to cat feces.

In comparison, some 30,000 to 60,000 people are administered post-exposure prophylaxis for potential contact with rabies and only one to three cases are reported annually (CDC 2017*b*). All 23 human mortalities from rabies in the U.S. between 2011 and 2017 were contracted from dogs in foreign countries or wild animals. No one has died from rabies in Alaska since the 1940s (Potempa 2004).

Information campaigns, a vaccine, cooperation of humane organizations, and an enforceable requirement to vaccinate pets have been largely successful at controlling rabies in dogs and other pets. Conversely, toxoplasmosis – a disease that is spread by cats – is not being taken seriously by the public, humane organizations, or regulatory agencies.

Dogs "annoying" wildlife may be shot. Alaska Statute 35.55.030 allows anyone who observes a dog "habitually annoying" any animal, domestic or wild, including any dog who "evinces a disposition which makes it likely that it will without provocation bite an animal or fowl," to lawfully kill the dog, when at large. The owner or keeper of the dog, if known or reasonably identifiable, must be notified and given reasonable opportunity to restrain the dog before it is lawful to kill it. This statute applies to dogs only.

In 2005 Wisconsin considered allowing hunters to shoot free-roaming cats – which were defined as cats not wearing a collar or other signs of domestic ownership – because of their impacts on native species (Anonymous 2019). The Wisconsin Conservation Congress voted 6,830 to 5,201 in favor of the measure and forwarded its recommendation to the state's Natural Resources Board for consideration. The board "declined to pursue the issue any further," probably because the recommendation was wildly unpopular.

Feeding some wildlife species is prohibited. Another state regulation, 5 AAC 92.230, prohibits feeding specified game animals, including bears, coyotes, and foxes, either intentionally or negligently. Food left outdoors for pets or unowned domestic animals like feral cats is likely to attract one or more of these wild species (Hawkins et al. 2004, Theimer et al. 2015, Leikam and Kerekes 2018), thereby negligently violating the law. This law is difficult to enforce when it occurs on private property because violations are both widespread and typically hard for an enforcement officer to observe. Most citations result from the intervention of neighbors or other concerned citizens.

Hybrids of wolves and wild cats cannot be owned as pets. Pursuant to state regulation (5 AAC 92.029), the Alaska Board of Game regulates all animal species and breeds imported into the state. The board has prohibited possession of many exotic pets – including chimpanzees, tenrecs, and bushbabies -- often due to concern over spreading disease to native species.

Domestic dogs and cats have always been on the list of species allowed without a permit (the so-called "clean list"); however, wolves and wolf-dog hybrids (i.e., wolf hybrids) may not be possessed without a permit, and a permit cannot be issued for pet wolf hybrids (5 AAC 92.030).

Similarly, the Alaska Board of Game has restricted ownership and imports of wild cat hybrids, or any offspring of a domestic cat and a wild species of cat – e.g., breeds known as Bengal, Safari, Savannah, and Chausie cats – unless the animal is at least four generations removed from a wild ancestor (5 AAC 92.030). The American Association of Feline Practitioners also opposes the breeding of domestic and wild cats and discourages ownership of early generation (F1, F2, F3) hybrids due to their unpredictable nature (AAFP 2017). Nevertheless, wild cat hybrids are gaining in popularity nationwide (Eckermann-Ross 2014) and are occasionally found in Alaska (Halpin 2008, Neyman 2010).

Pets cannot be released into the wild. The State of Alaska prohibits the release of pets – including cats, dogs, rabbits, and ferrets – into the wild (5 AAC 92.029[b]). "Into the wild" does not necessarily mean wilderness or rural areas outside of a community, as some have interpreted it. It means outdoors, unconfined or unleashed, where human control is absent and the animal may choose to roam at will.

Many Alaskans appear to have little knowledge of this law or choose to ignore it. For example, European rabbits have been released in Alaska since at least the 1930s and some of those populations have become established (Paul 2009). Colonies of rabbits, which are not native to Alaska, have been released and fed throughout Anchorage for at least 50 years. The Rabbit Creek Inn, a restaurant near Potter Marsh that served rabbit on the menu, was renowned for its local colony of hundreds of feral rabbits. The rabbits lived on, dispersing throughout the neighborhood, after the inn went bankrupt and closed in 1986 (Bryson 2003).

Cats and dogs have also been released into the wild, sometimes accidentally, but too often abandoned by owners who are moving or otherwise unable or unwilling to care for the pet any more. Dogs are sometimes driven to the end of a rural road and released, while cats are simply let out the door. There are no estimates for how often this happens.

The law prohibiting release into the wild and others like it are not without detractors. In response to rising numbers of feral cats in the Matanuska-Susitna Valley, the local cat rescue group blamed the borough's leash law, which applies to cats as well as dogs, because the borough animal shelter wouldn't give feral cats to the rescue group knowing that they would be

released illegally (Hollander 2017*a*). Several organizations that promote release of feral cats – e.g., Mojo's Hope and Alley Cat Allies – have petitioned both the Municipality of Anchorage and the Alaska Board of Game for permission to trap, neuter, and release feral cats into the wild (Metych-Wiley 2014, Alley Cat Allies 2017*b*). The organizations have also asked for approval to maintain outdoor feral cat "colonies" in the municipality. In 2017 the Alaska Board of Game denied a public request to allow the release of neutered male feral cats into the wild (Hollander 2017*b*).

Hunting and trapping feral pets. Alaska state law defines "game" and "animal" but not "wildlife." "Animal" means "any species with a vertebral column (backbone)" (5 AAC 92.990[2]). "Game" means "any species of bird, reptile, and mammal, including a feral domestic animal, found or introduced in the state, except domestic birds and mammals; and game may be classified by regulation as big game, small game, fur bearers or other categories considered essential for carrying out the intention and purposes of AS 16.05 – AS 16.40" (AS 16.05.950[19]). Thus, pet birds and mammals and other domestic birds and mammals are not considered game animals unless they become feral. It appears to be a quirk in the law that both pet and feral reptiles are classified as game because only domestic birds and mammals are exempted from the definition. Native reptiles are rare in Alaska, and have been found only in the southeastern panhandle.

State hunting regulations allow licensed hunters to shoot "feral nonindigenous gallinaceous birds" such as chickens, pheasants, quail, chukar and turkeys (5 AAC 85.070) and "deleterious exotic wildlife" (5 AAC 85.075), which includes former pets such as feral ferrets, rats and mice, pigeons and Eurasian collared doves, and "Belgian hares" (European rabbits) that are unconfined and unconstrained (5 AAC 92.990[a][21]). There are no restricted seasons or bag limits for these animals.

The Alaska Department of Fish and Game may also issue a "wild animal control license" to trap, shoot or euthanize "nuisance wildlife" (5 AAC 92.420) including deleterious exotic wildlife as well as feral domestic birds and mammals (5 AAC 92.990[a][53]). By this definition, feral cats are "nuisance wildlife" in Alaska, but Fish and Game has never issued a "wild animal control license" to trap, shoot or euthanize feral cats.

It is noteworthy that some former pets are deemed "deleterious exotic" species, but not feral dogs or cats. Of course, anyone may shoot a feral dog in accordance with state law. Feral cats are not only the most ubiquitous feral species and by most measures cause the greatest harm to the environment, they are the only former pet species that the state has chosen to not control.

Invasive species management and control. The Alaska departments of Natural Resources and Fish and Game collaborate on managing invasive species (ADF&G undated). Vertebrate species on the state's list of invasive species include Norway rat, house mouse, European starling, rock dove (or pigeon), red-legged frog, northern pike and Atlantic salmon. A decade ago the state commissioned the University of Alaska-Anchorage's Alaska Natural Heritage Program (ANHP) to assess and compile a list of potentially invasive species (McClory and Gotthardt 2008). Cats were included on the ANHP's list of non-native species with the wherewithal to become invasive in Alaska. The risk was deemed high, but the state hasn't chosen to include feral cats on its official list of invasive species.

Clearly, despite some official concern and lots of scientific evidence, the state does not consider feral cats to be invasive. However, there is precedent for taking that step. Hawaii has listed feral cats as an invasive species (Hawaii Invasive Species Council 2018) and the Western

Governors' Association (2018) recently added feral cats to a list of the top 50 invasive species in the western states. Feral cats are deemed one of the world's 100 worst invasive species by the Invasive Species Specialist Group of the International Union for Conservation of Nature (ISSG 2018). A recent meta-analysis of previous studies published by the National Academy of Sciences of the United States of America supports the contention that cats are the most harmful invasive mammal worldwide (Doherty et al. 2016). In Alaska, Norway rats, house mice, and rock doves are all pets that have been released into the wild, and those species are on the state's invasive species list. Why not feral cats?

There is also regulatory precedent in Alaska for differentiating between feral and pet populations. Pet rats, house mice, ferrets, European rabbits, rock doves (pigeons), and Eurasian collared doves are not on the state's invasive species list, however feral individuals of these species are listed as invasive or "deleterious exotic" animals. The same might be done for feral cats or dogs.

Municipal laws

The first known metal dog license in America was issued in 1853, although paper licenses preceded tags and the earliest record of a dog license comes from Holland in 1446 (Bandy 2017).

Cat licenses appear to have been invented much later. In 1876, a Scottish cat lover named Gordon Stables wrote a book about cats (Stables 1876) in which he argued "We have a law to protect even our wild birds, why not one for the protection of my friend the harmless, useful cat?" He proposed that a "small tax" be imposed on all cats and a home be established for lost cats "precisely on the same principles as the home for lost and starving dogs." The revenue from the license fee "would be very large, and it would not only help to clear the country of a whole army corps of thieving, prowling, homeless cats, but give to the cats of respectable people a greater value in the eyes of the law."

A century ago, Forbush (1916), citing Stables and others, claimed that cat licenses were not a new idea and that they were "first advanced by humane societies and cat lovers as a means of protection to cats." However, according to Forbush, by the early 1900s legislation to license cats had been proposed in many states, "and we find many cat lovers in opposition."

The early 20th century was a time of great progress for wildlife conservation in North America. Our wild animal populations were disappearing and, led by sport hunters and other conservationists, the federal government and states took notice. The Lacey Act of 1900 restricted commercial hunting by prohibiting interstate transport and sale of wildlife harvested illegally under state law. Not only was it the first major federal wildlife law, it encouraged states to pass additional hunting laws. President Teddy Roosevelt created the first national wildlife refuge in 1903. The Migratory Bird Treaty Act was first enacted in 1916 to ensure cooperation between the United States and Great Britain (acting on behalf of Canada) in conserving all birds migrating across North America.

In 1916, bolstered by the success of these national and international efforts, two conservationists convinced the New York State Forest, Fish and Game League to ask the New York state legislature to require cat licenses (Wilson and Vreeland 1917). They proposed an annual fee of 25 cents. The resolution was drafted by Dr. William T. Hornaday, another early leader in the conservation movement.

Wilson and Vreeland (1917) highlighted many of the same concerns with free-ranging cats expressed in this report. They noted that cats were an introduced species. They cited an estimate of 25 million cats in the United States, possibly twice that number. They cited an estimate of 3.5 million birds killed annually in New York state. They observed that cats carry infectious diseases, although they were unaware of the parasite that causes toxoplasmosis. *Toxoplasma gondii* had been discovered in 1908; however, its obligate link to cats and cat feces remained unknown until 1970 (Dubey 2008).

Despite these concerns, both Forbush (1916) and Wilson and Vreeland (1917) observed a strange reaction when the cat "question" was raised before local assemblies. It was "the occasion for some levity." Controlling cats has always seemed like a funny idea to some people.

Wilson and Vreeland (1917) noted, however, that at least one community had acknowledged the cat "question" and was doing something about it. Montclair, New Jersey, enacted one of the first American cat license laws in 1915. Besides the license, cats were required to carry a visible tag (or a collar bearing the owner's name and address), vagrant or unidentified cats were not permitted to run at large and, using the proceeds from the license fees, the town hired a warden to trap and euthanize cats without IDs. Forbush (1916) mentioned another early municipal convert. St. Petersburg, Florida, also adopted a cat license in 1915.

It appears as though cat owners have always believed cat licenses are a radical, new idea.

Anchorage's first leash law – for dogs only – was established over a century ago. The townsite manager of Anchorage published a notice to dog owners on June 4, 1917, advising them that dogs running at large would be picked up by the newly employed dogcatcher and placed in the city's first dog pound beginning on June 11 (AEC 1917). If unclaimed after seven days, notice would be posted at least four times within 30 days and, if still unclaimed, the dog would be "disposed of." Subsequent notices clarified that being "disposed of" might include being sold or euthanized. A penalty of $1, plus ten cents for every day impounded, would be levied. The law predated Anchorage's incorporation, when the nascent city was run by the Alaskan Engineering Commission.

Today Anchorage has a set of ordinances (Title 17, Anchorage Municipal Code) that regulate possession and handling of pets. The municipality's Department of Health and Human Services contracts with Animal Licensing and Placement Services, a subsidiary of Doyon Universal Services, JV, to provide domestic animal care and control services to the municipality by Anchorage Animal Care and Control (AACC).

Thus, AACC enforces Title 17, which includes responding to animal welfare concerns and nuisance complaints, investigating dog bites and animal attacks, assisting loose and injured animals, reuniting lost pets with owners, providing adoption services for unowned pets, educating elementary school children on dog behavior and how to prevent dog bites, and euthanizing seriously injured and unwanted pets.

Municipal oversight of animal control is provided by a contract administrator in the department of health and human services (currently Michael Tierney) and a nine-member Animal Control Advisory Board. The Anchorage Police Department also enforces Title 17.

The AACC's strategic plan, completed in 2006, was informed by the results of a pet-related survey of partners and stakeholders, including 130 organizations ranging from law enforcement

to animal welfare groups and community councils (MOA 2006). Respondents evinced a great deal of support for animal control. Most supported increased enforcement (58%) and public outreach (54%), cat licensing (57%), and dog parks (83%). Although 94% of respondents supported microchips as a means of identification, only slightly over 50% supported mandatory microchipping of all pets. Consequently, the strategic plan advised against mandatory microchipping at that time.

Cruelty and well-being. The municipality has several ordinances that define and address animal cruelty (AMC 8.55). The city's definition of "animal" includes all vertebrates, excluding non-domestic animals and humans, unless otherwise stated. It is unlawful for any person, with criminal negligence, to cause or allow an animal to fight another animal or human being with the exception of several provisions such as self-defense or in defense of a person or property (AMC 8.55.020).

This ordinance appears to unleash the possibility of a variety of legal challenges in that it includes "fights" with non-domestic animals. For instance, a pet is allowed to "fight" an animal if it is hunting or for "abating predators" and when the injury or damage is to "a species appropriate to the work of the animal." But the municipality doesn't regulate hunting in any sense – that is the province of the Alaska Department of Fish and Game. Dogs are allowed under state law for use in hunting some species. However, cats are not a legal means for "abating predators" (e.g., shrews, ermine, insect-eating birds?), nor are they a legal method or means for hunting. And even if they were, the owner would be required to possess a hunting license and conform to state hunting regulations. Thus, free-roaming cats that hunt any wild animals (i.e., not including unprotected species such as rats, house mice, pigeons, and European starlings) may be violating state hunting regulations and their owners may be aiding and abetting the crime by letting the cats outdoors.

Licensing. Licenses are required for all dogs over four months old (AMC 17.15.010). Current cost of a three-year license is $63 for an unsterilized and $39 for a sterilized dog. Dog licenses must be reissued with each change in ownership. Nonresidents must obtain a license for any dog brought into the city for competition for 30-90 days; however, these licenses are free. Nonresidents are required to purchase a license for any dog kept in the municipality for 90 days or longer.

The license serves as proof of ownership, allows legal access to city-maintained dog parks, and is a regularly updated form of identification that supplements a dog's ID tag or microchip, which may contain out-of-date information. Dog license fees also support food and shelter for homeless animals, adoption services, education programs and ongoing efforts to create a safe, dog-friendly community. Licenses may be issued for one to three years. Licenses for unsterilized dogs cost less than for sterilized dogs to encourage owners to neuter or spay their dog.

Cats are not licensed in the municipality. This is one of the most egregious differences in the regulatory control of cats versus dogs. By 1900 the U.S. Congress had authorized communities in the Alaska Territory to incorporate and establish "dog taxes" among other duties and functions of a local government (Haycox 2006:216). More than a century later the state's largest city appears to be unwilling or unable to license cats. Licensing serves many purposes, not the least of which are encouraging responsible pet ownership and paying for local pet control activities. Cat owners are not doing their part.

All dogs, cats and ferrets over four months old must have a current rabies vaccination, which is required for dogs before a license may be issued (AMC 17.30). The rabies tag must be affixed to the animal's collar or harness and worn at all times, unless the animal is on the property of the owner or custodian, in competition, in training, or hunting. Cats and ferrets are not required to wear a rabies tag when they are microchipped and registered.

Other pet-related licenses include an animal litter license for people who sell or reconvey not more than three litters of dogs or cats in a calendar year ($25 per litter). A commercial facility license is issued to people or facilities who board or groom dogs, cats and other pets; reconvey four or more dogs or cats in a calendar year; or breed more than three litters of dogs and/or cats in a calendar year ($150 annually). A mushing facility license allows possession of four or more adult dogs for dog-mushing purposes ($150 bi-annually for four to 10 animals and $200 annually for eleven or more animals). Finally, owners of four or more dogs, cats and several other listed pets, or any combination of seven or more of these pets, are required to obtain a multi-animal facility license (same as the mushing facility license).

Despite the law, most dog owners don't obtain licenses for their pets. For example, only about 25% of the dogs in Anchorage were licensed in 2007 (Anonymous 2007). Dog licenses garnered $250,000 that year, far less than AACC's $1.6 million contract for municipal animal control.

Requiring a license for cats with comparable fees could more than double the amount available for animal control services in Anchorage. In a best-case scenario – if every pet cat in Anchorage was sterilized and their three-year license fee was $39, just like dogs – Anchorage would raise an additional $970,000. If the license fee for intact cats, like dogs, was higher, the potential annual revenue could easily exceed $1 million. Using some of that revenue to better enforce the license law for dogs (and cats) would almost make animal control self-sustainable.

In 1975 the Anchorage Borough Assembly doubled the fee for dog licenses from $4.50 to $10 for a two-year period (Anonymous 1975). They also doubled the fine for owners who allowed unsterilized and unlicensed dogs to run wild from $25 to $50. Assembly member Tony Knowles, who introduced the amendment, said "we must try to get a handle on the (animal) population problem." However, cats were not considered to be as much of a problem as dogs. No cat license was required. While the new ordinance charged owners $25 to recover an impounded, unlicensed dog and $15 for a licensed dog, only $5 was required to reclaim an unlicensed cat. The Assembly also increased the fee for adopting a dog from $10 to $25 to defray the costs of spaying and neutering and immunization. Adopting a cat cost $15 for the same services.

Cat licensing has been considered by the Assembly on at least three other occasions. In 1992, when the municipality had an estimated population of 30,000 cats, over 10% of the city's felines were handled by the animal control center (Doogan 1993). According to Animal Control, only 4% of those cats were claimed by their owners in 1982 compared to 28% of the dogs.

To address this issue, in 1993 the Assembly proposed charging $15 for an annual cat license but was overwhelmed with opposition to the idea (Doogan 1993, Shinohara 2001*a*). Nine years later, one assembly member, Dick Traini, recalled the emotional testimony. "We had little old ladies saying, 'It's a human being. It has feelings.' It was terrible."

An earlier attempt to require cat licenses "was just dead before we passed Go," according to assembly chairman Mark Begich (Doogan 1993). According to Mike Doogan, who was riffing on

the idea that cats don't like collars, "in cat-people circles, 'they just wouldn't like it' ends any argument" (Doogan 1993).

In 2002 a proposal to require an annual $6 license for cats (annual dog licenses by then were $15) triggered another avalanche of opposition (Shinohara 2001*b*, MOA 2006). Opponents told the lawmakers that enforcement would be impossible and intrusive, and the license would make cat ownership too expensive (Pryor 2002*a*, Doogan 2002). Dog owners who testified, obviously, had a different perspective (Shinohara 2001*a*, Pryor and Shinohara 2002). One reason cited by cat owners was that a license was unlikely to motivate an owner to retrieve their lost cat, a rationale that subsequent research has proven false. Cat owners argued that if cats are licensed the fees should be smaller than license fees for dogs because cats are smaller than dogs and cost less to control; however, many dogs are as small as cats (APOP 2018), and one of the reasons less money is spent on cat control is little effort is expended. Nevertheless, the Assembly decided to back away from licenses and only require that cats have a visible ID tag or microchip (Pryor 2002*b*).

Notably, the issue of cat licensing has not been brought before the Assembly since 2002.

ID requirements. Dogs are issued identification tags with their license. The tags include only a license registration number. Dogs may also carry an identification tag on their collar with the dog's name or contact information for its owner or a veterinarian.

Although cats are not licensed, AMC 17.10.012 requires that cats over the age of four months carry identification in the form of a tag or microchip, but only when the cat leaves the private property of the owner or custodian or is uncontrolled by a leash or confinement. Cat identification tags and microchips must contain the name, telephone number and address of the owner.

Control and confinement (leash law). It is unlawful for a pet to be in a public place unless it is controlled by a leash, except that control by command is allowed in some situations if it is conducted in a manner that minimizes impact with the general public (AMC 17.10.010). Owners or custodians may not allow female pets in estrus to come into contact with an unsterilized male of its species, except for planned breeding purposes (AMC 17.10.20[A]). Pets with a known infectious or contagious disease may not be kept without proper and adequate veterinary care and confinement (AMC 17.10.20[B]).

Although compliance with the leash law is far from perfect among dog owners, cats are much more likely than dogs to roam free in violation of one or more of these laws. Most cats are infected with *T. gondii* at some point in their lives; however, no effort is expended to confine infectious cats or to enforce the ordinance that requires confinement.

Officers may issue a citation for a loose dog or cat without proving negligence.

The municipality has designated seven areas as dog parks for unconfined activities designed to minimize impacts on other park users (AMC 17.10.090). However, even in these areas owners must exercise a great deal of control over their dogs: females in estrus are prohibited, the owner or custodian must remain with the dog, dogs must be leashed or under voice command, dog feces must be picked up by the owner or custodian, and owners and custodians are responsible for all actions of their dogs.

No such areas have been designated for cats, presumably because most cats cannot be controlled by command or easily retrieved outdoors, and free-roaming cats are less likely to be observed and seem to be more acceptable to the public than free-roaming dogs.

Disturbances and nuisances. It is unlawful for owners of dogs, cats or other pets to allow them to make "chronic animal noises," to upset garbage on public or private property, or to leave its feces on public or another person's private property (AMC 17.10.015). Although compliance is low and rarely enforced for dog feces, picking up cat feces outdoors is a challenge few owners have accepted.

Dangerous animals. The municipality has provided for the public's health and safety, and the safety of other domestic animals, by establishing procedures for dealing with pets "which have demonstrated, by specific behavior, the potential threat of causing physical injury to humans or other animals" (AMC 17.40.010). Because its purpose statement doesn't specify "domestic" animals, this ordinance would appear to apply to the threat of physical injury to wildlife. However, that is not clear. The five levels of threatening and aggressive behavior defined in the same ordinance each specify the threat is to be directed at people or "domestic" animals.

Any domestic or feral animal may run afoul of this ordinance; however, dogs are the animal most frequently considered aggressive (M. Tierney, personal communication, 2018). It is possible that only one cat has been so classified (M. Tierney, personal communication, 2019).

Demonstrably dangerous pets are classified by five levels of threatening and aggressive behavior:

- **Level one** behavior consists of an unrestrained animal that menaces, chases, displays threatening or aggressive behavior, or otherwise threatens or endangers the safety of any person or domestic animal.
- **Level two** behavior is established when an animal bites or causes physical injury to any domestic animal, or if an unrestrained animal kills any unrestrained domestic animal.
- **Level three** behavior occurs when an animal under restraint inflicts an aggressive bite or causes any physical injury to a human.
- **Level four** behavior is when a) an unrestrained animal inflicts an aggressive bite or causes physical injury to any human, b) an unrestrained animal kills a domestic animal that is restrained, or c) an animal, regardless of whether it is restrained, for the second time injures or kills a domestic animal.
- **Level five** behavior is established when a) an animal, regardless of whether it is restrained, causes serious physical injury or the death of any human, b) an animal is used as a weapon in the commission of a crime, or c) an animal previously classified as a level three or four, or as a potentially dangerous animal under a prior enactment of municipal code, commits a level three or four behavior after the owner receives notice of the prior level three or four classification.

Exceptions and special conditions apply to animals that cause injury to owners, custodians, trainers or members of their families or for other specified reasons.

Owners and custodians of animals that are put on notice for aggressive behaviors are required to restrain or confine the animal, with restrictions increasing with each level. For example, an animal classified at level one must be restrained so the animal cannot reach any public sidewalk or adjoining property and may not be under control by command. Level five animals must be

euthanized, and the animal's owner may be suspended from owning any other pets, including those currently in possession, for a specified period. The terms of these conditions may be modified as the result of administrative appeals by the owner.

It is noteworthy that this ordinance appears to address aggressive or predatory behavior directed at domestic animals, but not wild animals. Of course, dog owners may be cited under state law when their pet harasses or kills wildlife, and dogs may be shot legally for pursuing wild animals, but once again cats and cat owners have dodged responsibility for aggressive depredations. Wild animals are not unowned – like feral dogs and cats – they are owned by us all.

For the purpose of rabies abatement, pet owners and custodians are required to report all animal bites to the animal care and control center (AMC 17.30.060). Victims and medical practitioners are also required to report animal bites. Most pet owners do not report bites to the authorities, particularly bites that involve family members.

Impoundment and adoption. An animal without identification is kept three full business days unless redeemed earlier by the owner. Animals with identification are held for a period not less than five full business days. Animal control officers are required to make every reasonable attempt to contact registered owners. Animals may be maintained for longer periods if an owner has been contacted and has provided a good reason why he or she cannot redeem the pet sooner.

All dogs and cats adopted out by the AACC are microchipped and must be spayed or neutered at the time of adoption or by a specified date.

Enforcement. The numbers vary from year to year, but about seven animal control officers respond to approximately 600 requests for service each month. A comprehensive review conducted by the National Animal Control Association in 1999 concluded that the municipality needed approximately 17 animal control officers, instead of the seven officers then employed. Since 1999, Anchorage's human population has increased about 15%, as has the number of dogs and cats. Thus, while its cat and dog populations have increased substantially, Anchorage has no more animal control officers now than 20 years ago.

Some of Alaska's laws and Anchorage's animal control ordinances apply only to dogs, and many ordinances that apply to other pets are enforced selectively. For instance, officers pick up stray dogs, but seldom pick up stray or feral cats. Animals who have injured someone or behaved in an aggressive manner take priority over loose animals (M. Tierney, personal communication, 2019), which suggests that the focus is on dogs. People may rent a humane trap from AACC to capture a nuisance animal on their property and then call for an animal control officer to pick it up (M. Tierney, personal communication, 2019). Municipal code defines "confinement" as a fenced pen, yard or structure "which prevents the exit of any animal confined therein" (AMC 17.05.010). Unlike most dogs, most cats cannot be released into a fenced yard with any reasonable expectation that they will remain there. Yet there seems to be no official or social onus against letting cats into the "back yard."

Inexplicably, some of the municipal fines for dogs and cats are different (AMC 17.70.020), while others appear to apply chiefly to dog owners because cats are seldom apprehended. For example, failing to license your dog will cost you $75, $100 and $150, but the owner of a cat without an ID is fined $50, $75, and $100 for the first, second, and each subsequent violation. Free-ranging cats don't require a visible ID tag (they may be microchipped), which means they

need to be caught and scanned, but a free-ranging dog without a visible tag is noticeably in violation. Dog owners can be fined for violating the rules established for off-leash areas (e.g., not leaving the dog alone or keeping it under voice control, picking up feces, or filling holes the dog has dug), but these rules don't apply to cats. The fines for these violations are $75, $100 and $150 for the first, second, and each subsequent violation. Both dog and cat owners may be fined the same amounts for violations involving animals in public places, disturbances and nuisances, but once again these are more likely to apply to dogs than cats. The ordinance that requires the owner of a pet in estrus to keep it from mating with a free-ranging male (AMC 17.10.020) is much more likely to be enforced for a dog than a cat, even though more cats roam free, because cats tend to be more secretive and are more difficult to catch and to identify an owner.

Leash laws are also enforced on state and federally managed lands in the municipality. Two large, popular areas for dog walking are Chugach State Park and the Campbell Tract.

Chugach State Park encompasses 700 square miles, most of it within the municipality. A person must keep dogs and other domestic animals on a leash in the park's developed facilities, typically parking areas at trailheads, and maintain voice control in undeveloped areas when the pet is off leash (11 AAC 12.130). With an estimated one million visits annually, many accompanied by dogs, rangers issued only seven citations for unrestrained dogs between 2011 and 2017 (K. Hensel, Acting Superintendent, personal communication, 2018). This is not because compliance is high. Park rangers rarely catch offenders; when they do, they typically give verbal warnings and tend to issue citations only in the most egregious instances. Fines are $50 with a $10 processing surcharge. A citation has never been issued for an unrestrained cat in the state park. Few people take their cat for a walk in the park; however, the thousands of residences that border the park are almost certainly a source of many free-ranging cats.

Campbell Tract is managed by the federal Bureau of Land Management (BLM). The large natural area is criss-crossed by many maintained and unmaintained trails and surrounded by the municipality's largest park, Far North Bicentennial Park, which is also a popular place to exercise dogs. Unrestrained dogs, cats and other domestic animals are prohibited under a notice published in the Federal Register (Oct. 13, 1998), which closed Campbell Tract to "dogs and domesticated animals not on a leash," and 43 CFR 8360.0-5. Federal enforcement officers patrol Campbell Tract and have issued warnings and citations for unleashed dogs; however, due to vacancies in law enforcement staff, few patrols were conducted between 2010 and 2017 and no citations were issued for unrestrained dogs or cats (B. Million, Field Manager, BLM, personal communication, 2018).

A state statute enacted nearly 70 years ago, well before statehood, allows any person to shoot a dog that "habitually annoys any … animal or bird either domestic or wild, or evinces a disposition which makes it likely that it will without provocation bite an animal or fowl" when the dog is at large (AS 03.55.030). The owner or caretaker of the dog, if known or reasonably identifiable, must be notified and given reasonable opportunity to restrain the dog before it is lawful to kill it.

Given the instinctive and well known ability of cats, even well fed cats, to kill wild mammals and birds and given that pet cats outnumber dogs and that there are almost as many feral and stray cats as pet cats, it is abundantly clear that cats today pose a greater threat to wildlife than dogs. And yet AS 03.55.030 applies only to dogs, probably because free-ranging dogs far outnumbered cats in Alaska when the law was enacted, and the adverse impact of cats on wildlife was not as well documented and, if suspected, considered to be irrelevant.

Environmental impacts

Our pets – particularly dogs and cats because they are so numerous – affect the environment in several ways: pollution; disease; wildlife harassment, competition and predation; and carbon footprint.

Pollution. Because cats and dogs are our most numerous pets, their fecal waste is considerable. According to the USDA, a dog produces ¾ pound and a cat produces 1/3 pound of feces per day on average, or about 275 pounds and 110 pounds/year, respectively.

At these rates, Anchorage's dog population contributes 25 tons and cats add another 17 tons of waste daily. Dogs get most of the bad press because dog excrement is not only more voluminous, it's so "public," according to a book devoted to the topic called The Pet Poo Pocket Guide: How to Safely Compost and Recycle Pet Waste (Seeman 2015). Although all pet owners are required by Title 17 to pick up animal waste on public or another person's private property (17.10.015[B]) – and even in their own yard – the municipality's "Scoop the Poop" website doesn't mention cats (MOA undated). Scoop the Poop Day is all about dogs.

The Fairbanks Soil and Water Conservation District and the USDA's Natural Resources Conservation Service have published a brochure explaining how and why dog owners, especially mushers, should compost dog feces (NRCS 2005). Another advocate of composting dog feces, to keep it out of the landfill, notes that the heat from a well-managed compost bin will kill most bacteria and pathogens (Ackland 2018). All of the experts, however, recommend that composted dog feces be used on lawns and flower beds, not vegetables grown for human consumption

Cleaning up after our pets burns up other public resources. For example, dog waste is the largest component of litter, by weight, in Toronto parks. Cat and dog waste make up 3.8% of the garbage from residential collections in San Francisco (Seeman 2015). While cats contribute less feces than dogs, the contents of litter boxes may double the amount of cat-related waste taken to the municipal landfill. With pet cats using approximately 10 pounds of litter each month, that adds up to 3.9 million tons of litter alone per year in the U.S. (Bedwell-Wilson undated).

In Anchorage, the litter boxes of 74,600 pet cats contribute an estimated 373 tons of solid waste (not counting the feces) each month. Most of that finds its way into the municipal landfill, which is not designed to process absorbent clay litter (Bedwell-Wilson undated). However, all of the cat feces and litter doesn't make it to the landfill. Many indoor-outdoor cats defecate outside, and some cat owners dump litter boxes on or near their property or flush it down the toilet (Dabritz et al. 2006), which are also problematic for the environment and human health.

Pet feces impairs local waterbodies (Davis and Davis 2010). Because of their size and relatively high numbers, dogs are among the biggest culprits. The microbial load (enterococci) from an average pile of dog feces is equivalent to 6,940 "fecal events" from a large bird (Wright et al. 2009). The EPA estimates that two or three days' worth of dog feces from a neighborhood with about 100 dogs could contribute enough harmful bacteria to temporarily close a bay, and all watersheds within 20 miles of it, to swimming and shellfishing (Carini 2014).

Although experts advise picking up dog feces as soon as possible many owners – as many as 40% according to one estimate – fail to heed that advice (Carini 2014). One novel solution to dog feces in parks is a joint effort by the city of Cambridge, Massachussetts, and the

Massachussetts Institute of Technology. Pet owners collect the waste in a special biodegradable bag and drop it into a "methane digester" that releases methane to power old fashioned street lamps (Carini 2014).

Pet cats probably contribute less to non-point water pollution than dogs because indoor-only and most indoor-outdoor cats use litter boxes most of the time. However, stray and feral cats defecate primarily outdoors, just like dogs, and owners rarely pick up cat feces deposited outdoors. Eliminating unowned stray and feral cats would forego the accumulation of 8 tons or more of animal waste from Anchorage's environment every day.

Disease. Humans can contract a variety of diseases and parasites from their pets. Rabies is the most familiar. The number of human deaths in the U.S. attributed to rabies has been declining steadily since the 1970s, due in large part to rabies vaccination programs for dogs, as well as successful outreach and animal control, and dogs are no longer considered a rabies reservoir in the U.S. (CDC 2017*b*). Nonetheless, each year from 60 to 70 dogs and more than 250 cats are reported rabid (CDC 2017*b*). Both dogs and cats can infect humans; however, rabies is extremely unusual in southcentral Alaska, and has been limited in recent decades to dogs brought to Anchorage from western Alaska (Rinehart 1994, Andrews 2017, Alaska Section of Epidemiology 2018).

In a recent meta-analysis of 21 studies, cats with outdoor access were 2.77 times more likely to be infected with parasites than indoor-only cats (Chalkowski et al. 2019). Rather surprisingly, parasitic infestation of cats is more likely at higher latitudes even though parasite richness and diversity is typically greater at lower latitudes. Each degree increase in absolute latitude increased parasite infection by 4% (Chalkowski et al. 2019). Rodents, a common prey animal of cats, are also more likely to carry diseases that affect humans at higher latitudes.

Cats and dogs transmit many infectious diseases besides rabies that affect humans (Kravetz and Federman 2002, Gerhold and Jessup 2012), and some of these are emerging diseases (Chomei 2014). In fact, because most dogs and cats now sleep with their owners in the United States, the likelihood of contracting a bacterial, parasitic, or viral infection from a pet is increasing (Chomel and Sun 2011). Typhus, a bacterial disease associated with fleas from rats, is also spread by fleas unique to cats (Daugherty 2019). Sporotrichosis is an emerging fungal disease in South and Central America that is transmitted to humans from cats. Feral cats are particularly susceptible. The disease can cause joint pain in humans that may be confused with rheumatoid arthritis. Infections of the central nervous system may result in difficulty thinking, headache and seizures. Currently rare in the U.S. and not monitored, an "unprecedented zoonotic epidemic" has occurred in Brazil, and *Sporothrix brasiliensis* is showing signs of becoming drug resistant (Gremião et al. 2017), a serious threat considering the few drugs available for treating fungal infections (Young 2019).

One of the most significant zoonotic diseases is toxoplasmosis, one of five neglected parasitic infections of the U.S. that have been targeted by the Centers for Disease Control and Prevention for public health action (CDC 2018). Toxoplasmosis wasn't linked to cats and cat feces until 1970 (Dubey 2008).

As many as 16-40% of Americans have been infected with *Toxoplasma gondii*, a protozoan parasite, a little less than half of them from swallowing oocysts excreted into the environment by cats (Boyer et al. 2011). It was once thought that most humans contract toxoplasmosis by eating uncooked or undercooked meat; however, testing has now confirmed very low frequencies of *T. gondii* in retail meats sold in the U.S. suggesting that cat feces is frequently

the direct cause of toxoplasmosis (Boyer et al. 2011). Additional findings show congenital toxoplasmosis is passed from mothers with no exposure to typical cat risk factors (like living with a cat). Some of these infections are likely waterborne.

T. gondii oocysts contaminated a municipal water supply in Victoria, British Columbia (Aramini et al. 1999). In that case, the first documented, the oocysts were believed to have come from domestic cats or lynx. Both species tested positive for the parasite, but cats were much more abundant in the watershed and, therefore, are the more likely source of the disease. To prevent similar outbreaks, Jones and Dubey (2010) recommended that access of cats to the areas around water tanks or reservoirs should be limited and cat feces should not be flushed into the municipal sanitation system. Where possible, they suggested, cat owners should be encouraged to keep cats indoors to minimize contaminating water supplies.

Furthermore, because cats are the definitive hosts, all contaminated food and water – thus all toxoplasmosis infections in humans – is ultimately the result of contact with cat feces. The oocysts that cause the infections can survive for years in the environment. Oocysts contaminate soil but have also been found on dog fur and keypads (Aguirre et al. 2019).

Although most infections result in flu-like symptoms, toxoplasmosis poses a significant risk to the health of some humans, and the lack of identifiable symptoms at the time of infection do not predict the manifestation of serious complications later in life (Aguirre et al. 2019). For example, infants who exhibit no symptoms at birth are at risk of developing eye disease several decades later in life, with chorioretinitis, leading to vision loss, affecting more than 4,800 infected adults annually (Vutova et al. 2002, Jones et al. 2014). Immunocompromised adults are also at risk. Ten percent of all deaths of people with HIV are directly from toxoplasmosis (Hill and Dubey 2002).

Although most adults who contract toxoplasmosis experience no significant symptoms, surviving the initial infection may still leave people at risk for other diseases and disabilities. For example, a positive correlation occurs between older adults who have experienced toxoplasmosis and brain tumors (Vittecoq et al. 2012), and the disease may affect memory impairment in elderly people (Gajewski et al. 2014, Jones et al. 2014).

Approximately 85% of women of child-bearing age in the U.S. are susceptible to acute toxoplasmosis infections (Jones et al. 2003). Women who become infected before conception rarely transmit the disease, but the risk of infecting a developing infant increases during pregnancy to 60-90% during the third trimester. One or two babies per 10,000 children born contract toxoplasmosis congenitally from their mother (Van kessel and Eschenbach undated), or about 400 to 4,000 cases annually nationwide (Jones et al. 2003). Most cases of congenital toxoplasmosis are treated, and fatalities are rare (Hoshino et al. 2014). However, if infected with toxoplasmosis in the first trimester, one in ten human fetuses will be aborted, become malformed, or suffer other injury. Congenital toxoplasmosis can result in mental retardation, seizures, blindness, delayed mental development, low IQ, and other learning disorders which may occur years after the infection (Burgdorf et al. 2019).

Toxoplasmosis may change human behavior, and individuals with latent toxoplasmosis are susceptible to a variety of mental illnesses, including severe depression, bipolar disorder, obsessive-compulsive disorder, schizophrenia, and anxiety disorders (Houdek 2017, Aguirre et al. 2019, Burgdorf et al. 2019). Mothers who contract toxoplasmosis have an increased risk of self-directed violence, including suicide (Pedersen and Norgaard-Pedersen 2012). There appears to be a link between toxoplasmosis and nonfatal attempts at suicide (Zhang et al.

2012), and women infected with toxoplasmosis are 54% more likely to attempt violent suicides and twice as likely to succeed as women who haven't been infected (Wilcox 2012).

Recent research has even found a difference in sexual behavior and fantasies in people infected by *T. gondii* (Flegr and Kuba 2016). Toxoplasmosis is correlated with a higher level of arousal from fear or danger, and a higher risk of traffic accidents (Burgdorf et al. 2019).

Wildlife, including marine mammals such as beluga whales and sea otters (Nuwer 2014, Dabritz et al. 2006, Aguirre et al. 2019) as well as game animals, can contract toxoplasmosis from cat feces. VanWormer et al. (2013) believe the terrestrial contribution of parasites from domestic and feral cats to marine ecosystems is higher than native cat species due to their much larger populations and concentration in urban areas near the coast.

Ironically, *T. gondii* oocysts shed in cat feces also kill wild birds. In Hawaii, reintroduction efforts for the 'alala, the Hawaiian crow which is one of the most endangered birds in the world were stymied in the 1990s when the crows started dying from toxoplasmosis (Work et al. 2000, Strohecker 2017). Because of their scavenging habits and large numbers in Anchorage, ravens and black-billed magpies have ample opportunities to become infected. Hawaii's endangered state bird, the nene, a close relative of our Canada goose, has also been fatally infected with *T. gondii* (Work et al. 2015). Anchorage has thousands of Canada geese that spend summer and fall in and near lawns, athletic fields and urban ponds frequented by cats. Toxoplasmosis can also kill bald eagles (Szabo et al. 2004).

T. gondii oocysts can infect the wild meat we harvest and eat. An Anchorage woman who had eaten a medium rare steak from a moose shot by her husband on Joint Base Elmendorf-Richardson nearly lost her baby 10 weeks later (Colosimo et al. 2013, Brasch 2013, Isada 2014). The congenitally infected child was born prematurely with a rapid heart rate, fluid around his organs and lesions on his eyes and brain. Fortunately, the doctors diagnosed the problem quickly and the lesions healed by the time the child was a year old. Lynx are hosts for *T. gondii* and may have been the source of the parasite; however, domestic and feral cats are far more prevalent than lynx in the habitats frequented by moose found on JBER.

In an urban and suburban area where white-tailed deer and cats are abundant, like moose and cats in Anchorage, antibodies to *T. gondii* were found in 52% of the cats and 59% of the deer. High cat densities were the most likely reason for the increased infection rate of urban deer (Ballash et al. 2014). Similarly, wild felids are also at risk from diseases transmitted by domestic cats. Carver et al. (2016) found that proximity to urban and suburban areas increased exposure of wild felids to several pathogens – including *Bartonella*, feline herpesvirus-1 (FHV-1), and *Toxoplasma gondii* – suggesting that domestic cats were the vector, through direct contact or fleas or as prey items. Cats have also been implicated in high rates of toxoplasmosis in small and medium-sized wild animals such as mice, rabbits, squirrels, woodchucks, weasels, raccoons (Fredebaugh 2010), mink and river otters (Barros et al. 2018). In areas with more free-roaming cats, the rate of infection was higher.

Although serologic surveys indicate that the rate of infection has decreased in humans in the U.S. in recent decades (Jones et al. 2014), some experts (Torrey and Yolken 2013) believe that as cats become more numerous, "it will become progressively more difficult to avoid exposure." Unfortunately, toxoplasmosis is not a nationally reportable disease, therefore its true magnitude remains unknown (Aguirre et al. 2019). Influenced by patterns of climate change and expansion of global travel and trade, the likelihood of an animal-borne, infectious disease pandemic, like toxoplasmosis, has never been higher (Schwab et al. 2018, Aguirre et al. 2019).

Wildlife harassment, competition, and predation. Dogs and cats attack and harass wildlife, compete with wild predators for prey species, and hybridize with some wild canids and felids (Bergman et al. 2009, Hughes and MacDonald 2013). Although some experts believe dogs are the most abundant terrestrial predator worldwide, cats are a close second, if not more abundant. One pro-cat estimate claims a global population of 600 million pet cats (McLamb 2013, Peterson et al. 2012), supplemented by at least 100 million feral cats. That estimate for feral cats may be low, because 60 million of them are believed to reside in the United States alone. It's likely that many countries have no idea how many feral dogs or cats they have.

In some countries, dogs are the most abundant carnivores and significantly disrupt ecosystems (Young et al. 2011, Holderness-Roddam and McQuillan 2014). For example, although the most serious impacts typically result from large numbers of free-ranging dogs, a single dog was implicated in a significant population decline of endangered kiwis in New Zealand, killing 600-800 of 1,000 of the large, flightless birds over a six-week period (Pierce and Sporle 1997, Taborsky 1988). The most serious environmental impact of dogs worldwide is predation on endangered species, for which dogs are the third most harmful terrestrial mammal (after cats and rats), particularly in Central and South America, Southeast Asia, and the Caribbean (Doherty et al. 2016, Doherty et al. 2017). Worldwide, cats have caused seven times the number of local extinctions as dogs (Doherty et al. 2016).

Less-than-lethal impacts of pets must also be taken into account. Some wildlife species avoid humans, particularly those accompanied by dogs. For example, several prey and predator species are detected less frequently along trails used by people and dogs (George and George 2006, Lenth et al. 2008), although where the separate effects of dogs and people can be teased apart, some studies have found that the wildlife is reacting to the humans, rather than their accompanying dogs (Reed and Merenlender 2011). Chronic avoidance behavior results in underutilized habitat, which means smaller populations.

Dogs can affect wildlife even while leashed (Weston and Stankovich 2014). For example, bird diversity and abundance appears to be reduced for a short period after a person walks through an area with a leashed dog, an effect that is magnified by many dog walkers in a concentrated area (Banks and Bryant 2007). In this study, a solitary hiker or two people walking together had about half the effect as a person walking with a leashed dog. Ground-dwelling birds were most affected. However, the study found no net difference in bird diversity or abundance between areas with and without regular dog walking, suggesting that long-term impacts may be small. One of the largest studies of dog impacts, using trail cameras in 33 protected areas in North America, found 99% of dogs on trails and 89% of off-trail dogs were accompanied by humans (Parsons et al. 2016). Prey avoided dogs, humans and coyotes temporally, but did not avoid them spatially. The researchers concluded that humans are perceived as a greater risk than coyotes, and this increases when dogs accompany their owners. Nevertheless, current dog management practices in the protected areas appeared to be effectively reducing environment impacts because prohibiting dogs in those areas reduced the presence of dogs by a factor of 10 and leash laws increased leashing rates by 21%.

Behavior and activities of local wildlife populations may be significantly affected when wildlife and dogs occur at high densities in constrained areas, such as small parks, or with endangered species. Although this issue has not been studied as much as cat predation and associated disturbances, the literature is increasing at an exponential rate (Weston et al. 2014).

Most researchers have observed that using leashes is far better than letting dogs roam freely (e.g., Weston and Stankovich 2014). However, Forrest and St. Clair (2006) found no significant differences in bird and small mammal abundance and diversity in woodland parks near Edmonton, Alberta, when dogs were confined to leashes versus allowed to run free. The researchers concluded one of three factors may explain the apparent lack of impact. First, the dogs may not have affected birds and small mammals in the vicinity of human trails because even the activity and behavior of unleashed dogs was negligible. They noted that off-leash dogs seldom wander far from the trail and do so for only brief periods. Second, wildlife, particularly birds, in suburban and urban areas may be fairly tolerant of moderate levels of human activity, even when accompanied by dogs. Third, wildlife adapted to the presence of coyotes may reduce the novelty and hence reaction to free-running dogs. Alternatively, the researchers noted, there may have been impacts but they were not able to detect them. Habitat diversity may have swamped minor differences in responses to the dogs. Or widespread non-compliance to the leashing law may have obfuscated the difference between unleashed dog areas and leashed areas with many unleashed dogs.

Leashing is considered to be the most effective way to reduce harmful impacts in areas where dogs are likely to encounter wildlife, and the practice is considered more enforceable than voice commands (Weston and Stankovich 2014). Despite being the law in most of the United States, in some settings unleashed dogs are the rule and leashes the exception.

Unlike cats, dogs are not considered to be exploitative competitors with native carnivores (Vanak and Gompper 2009). While feral dogs may have localized impacts, most dog populations are highly dependent on human-derived food and gain a relatively small proportion of their diet from wild prey. Dogs are less likely to compete with wild canids in areas, like Alaska, where the native large carnivore community is robust.

Most states allow the prosecution of dog owners or the killing of dogs that chase or harass wildlife, but these laws are seldom enforced (Tischler 2007). Young et al. (2011) recommended more research on the environmental impacts of free-ranging dogs, public awareness campaigns, implementing and enforcing leash laws, better storage of edible garbage, and sterilization. These are essentially the same policies and actions recommended by many other experts for free-ranging cats.

In Anchorage, dogs can kill voles, squirrels, and snowshoe hares, and some dogs chase and sometimes injure animals as large as moose. Their impact is limited by leash laws, a certain amount of doggish clumsiness due to socialization and evolution (DecodingScience Staff 2019), and the scarcity of free-ranging or feral individuals.

Cats are another matter entirely. Most cats are instinctive and adept hunters. Even well fed cats hunt, but the thousands of free-ranging cats, especially feral cats, kill a disproportionate number of wild animals. Credible estimates of the number of wild birds killed annually in the Lower 48 states range from 1.3 to 4 billion (Loss et al. 2013). Cats kill an additional 6.3 to 22.3 billion mammals annually. Similarly high numbers of wild bird kills – approximately 100-300 million – have been estimated for Canada's much lower population of cats (est. 8.5 million pet and 1.4 to 4.2 million feral; Blancher 2013).

To add another frame of reference that supports the magnitude of these figures, researchers in Great Britain estimated a population of 9 million cats "brought home" 57 million mammals, 27 million birds and 5 million reptiles and amphibians in five months (April-August) of 1997 (Woods et al. 2003). Let's break that down. The study period encompassed less than half a year,

although most wildlife captures occur in warmer months; e.g., between March and November in the southern U.S. (Loyd et al. 2013). Not all prey items are brought home. Using "kittycams," Loyd et al. (2013) found that free-roaming pet cats carried only 23% of their prey items back home (they ate 28% and left 49% unconsumed at the site of capture). Feral cats are known to kill and consume far more prey items than pet cats. Britain is now believed to have more than 11 million cats, relatively few of them feral, while the U.S. has close to 200 million cats, half of them feral or strays.

Using the formula provided by Loss and his coauthors, and using only the lowest figures in each range they provided, Anchorage's 104,000 cats kill an estimated 1,148,000 birds and 5,975,000 mammals annually.

Those numbers may seem unbelievably high, but they represent only about 11 birds per cat annually, on average. The high kill rates of wild birds and mammals is being driven by the large number of cats, particularly free-ranging and feral cats. In some urban areas (e.g., in Great Britain) the density of pet cats exceeds 4,000 per square mile (Sims et al. 2008) and, although there is some evidence that cats tend to kill birds in poorer condition than those that strike windows, the estimated number of birds killed is large relative to their breeding density and productivity (Baker et al. 2008).

Birds are not as numerous as they used to be. North America has suffered a cumulative loss of nearly 3 billion birds since 1970, including many common species that have adapted to human-altered landscapes. Analyzing data on 529 avian species, Rosenberg et al. (2019) found a 29% reduction in less than 50 years. The researchers believed their estimate was low because it only including losses in breeding populations. Species that did not experience population declines were large birds, birds that spend most of their breeding season in treetops, and small birds that are not attracted to bird feeders – in other words, birds less vulnerable to cat predation. While the researchers did not determine the cause of the declines, they suggested that habitat loss was probably the main driver, particularly habitat loss from agricultural monocultures and urbanization. It is not merely coincidental, however, that both agricultural and urban areas are well supplied with free-ranging cats. Losing breeding habitat is bad enough, predation from cats adds insult to injury. Monitoring data suggest that the decline in bird numbers will continue without targeted conservation action (Rosenberg et al. 2019). Reducing predation by cats is an achievable solution, far more likely than shrinking the amount of land devoted to growing food for people and domestic animals, or returning urban and suburban areas to natural habitats.

Not all cats kill wildlife. Cats, like people, are getting fatter (Associated Press 2019), and perhaps that will reduce predation rates somewhat. But one adept cat can compensate for a whole living room full of fat cats. For example, a New Zealand scientist documented all the animals that his well-fed barn cat brought home – brought home! – during its 17-year lifetime: 221 mice, 63 rats (mostly juvenile), 35 rabbits (mostly juvenile), 4 hares (all juvenile), 2 weasels, 223 birds, 9 skinks, 1 frog (Flux 2007). It's probably safe to say that that cat killed far more animals than that. Now consider how many wild animals a feral cat can kill.

Many bird researchers have documented evidence of cat predation on their subjects. In Australia, a single, neutered, stray cat altered the nesting behavior of a colony of endangered terns, causing the complete reproductive failure of all 111 nests and the deaths of at least 40 chicks and 6 adults. The subsequent breakdown in social cohesion allowed a falcon to kill more terns, including most chicks in a nearby colony. In addition to killing birds, this example highlights the persistent, indirectly lethal effects of a cat by reducing the parental care of its prey

(Greenwell et al. 2019). Another research project calculated that an estimated population of 25 feral cats killed an estimated 1,012 shearwaters per month, or nearly 1.5 birds per cat per day, on an island in Mexico and that wasn't the cats' only source of food (Keitt et al. 2002).

An analysis of over 20,000 injured wild animals brought into a wildlife rehabilitation facility (McRuer et al. 2016), corroborates how destructive cat predation can be. Even when veterinary treatment and rehabilitative care were provided for the victims of cat attacks, mortality exceeded 70% for small mammals and 80% for birds. Cats were the second and fourth greatest cause of small mammal and bird admissions, respectively. Cats were the fourth and second greatest causes of mortality for small mammals and birds, respectively. These statistics suggest that birds may have been less likely to survive long enough to be brought into a facility and more likely to die during treatment. Wildlife injured by cats had a greater mortality rate than other causes of injury.

The mortality rate attributed to cats is undoubtedly low. Wildlife clinics typically record an injury as cat-caused if the person who brings it in saw the cat injure the animal. Most injuries are from unknown causes; however, many of these are cat-related. What often kills birds is not the puncture wounds but the germs on a cat's teeth and gums that contain enough bacteria to overwhelm a bird's immune system. According to an urban-wildlife specialist who works at Portland's Wildlife Care Center, "a bird is more likely to survive a gunshot than a cat bite" (Barcott 2007).

Individual free-ranging dogs have larger ranges than cats in rural areas. One study found that while cats may pose a more intensive threat to wildlife near anthropogenic features such as homes and barns, the impacts of free-ranging dogs may be more geographically extensive in rural areas (Morin et al. 2018). Adverse impacts of dogs may be mitigated, however, by their relatively short forays into natural areas and tendency to remain near roads and trails (Sepúlveda et al. 2015). Studies such as Morin et al. (2018) may underestimate cat incursions into rural areas. Due to their nocturnal hunting habit, small size and stealth cats are more difficult than dogs to observe and monitor in rural areas. For example, in a study combining radio collars and trail cameras, Comer et al. (2018) found that while as many as 20 of their collared cats passed within 50 meters (55 yards) of more than one camera, over the three-year period only one of the collared cats was captured by a camera.

Levels of cat ownership are highest in urban areas, resulting in dense aggregations of cats, and suburban areas are increasingly encroaching on protected natural areas. Because most cats tend to concentrate hunting activities near human dwellings, but cats residing in areas with fewer buildings and less extensive artificial surfaces tend to range farther than cats from more urbanized habitats, several researchers have proposed providing buffer zones of 300-400 meters (328-437 yards) to as great as 2.4 km (1.5 miles) between neighborhoods and protected habitats (Metsers et al. 2010, Hanmer et al. 2017).

Pets can also compete with wild animals for food. Clearly, cat predation significantly reduces the number of prey animals available for wild predators ranging in size from ermine to lynx and from boreal owls to goshawks. A less recognized impact is competition for herbivorous foods. Feral rabbits, for example, eat many of the same foods as snowshoe hares.

Like dogs, cats contribute to a "landscape of fear" for prey species (Bonnington et al. 2013, Mahlaba et al. 2017) and high cat densities may adversely impact avian productivity even when predation rates are low (Beckerman et al. 2007), leading to a species- and habitat-specific assessment of risk that has ripple effects on entire ecosystems (Laundré et al. 2010).

Wildlife can contract infectious diseases from pets. For example, wolves on the Kenai Peninsula used to be unburdened by lice; however, contact with dogs in the last half of the 20th century has spread lice among the wolf and coyote populations, resulting in poor quality pelts and significant suffering, and louse-infested wolves have dispersed from the Kenai Peninsula to adjacent areas in south-central Alaska (Golden et al. undated).

Feral cat populations are expected to increase as the climate warms (Aguilar et al. 2015). Hybridization with pets is problematic in some parts of the world, particularly where the pets outnumber their endemic wild cousins. For example, the endangered Scottish wildcat (*Felis silvestris*) has experienced a significant amount of hybridization from interbreeding with free-roaming domestic cats (French et al. 1988). Domestic cats do not present such a problem in Alaska because our native lynx are more likely to eat a domestic cat than to mate with one. However, dogs have hybridized with wolves and coyotes in Alaska.

Invasive species. Hawaii recently added feral cats to their state list of most impactful invasive species (Else 2018), and feral cats (specifically including those in TNR programs) are also highlighted in the Top 50 Invasive Species in the West, a list compiled by the Western Governors' Association from nominations submitted by the invasive species coordinators in each state (Western Governors' Association 2018). Based on each state's ranking system, feral cats were considered the 13th most impactful terrestrial species in the western states.

Researchers and managers have expressed similar concerns, and the environmental impacts of cats are not confined to islands, as feral cat proponents often argue (Hohnen et al. 2016, Loss and Marra 2017). For example, Crooks and Soulé (1999) found domestic cats far outnumber native predators like foxes or coyotes in fragmented suburban ecosystems, and cat predation has resulted in local extinctions of scrub-dwelling birds. A recent meta-analysis of previous studies by Doherty et al. (2016) supports the contention that cats are the most harmful invasive mammal worldwide. Government agencies across North America that are responsible for managing wildlife, natural or environmental resources, parks and recreation, veterinary and human health, agriculture and animal control largely agree with these findings (Lepe et al. 2017). Experimental research has shown how predation by a low-density cat population can extirpate a population of small native mammals on the mainland (Frank et al. 2014).

Thus, invasive species experts in Alaska, the western United States, and one of the world's most respected conservation organizations have listed feral cats as one of the top invasive species of concern.

Carbon footprint. Pets have a huge carbon footprint in North America, primarily because of the high-protein content of pet foods (Schwartz 2014, Heinze 2017). A medium-sized dog has a carbon footprint similar to a large sport-utility vehicle. In fact, America's dogs and cats consume about 19% of the dietary energy that humans do. To put it another way, our pet dogs and cats consume as much dietary energy as approximately 62 million Americans, or about one-fifth of the U.S. population (Okin 2017).

Pets are a wonderful thing, but there's no denying that pet ownership in America poses significant costs to humans, pets, and wildlife. It behooves us to manage our relationship with dogs and cats with due consideration for others.

ANCHORAGE ANIMAL CONTROL STATISTICS (2008-2017)

"Everything comes to those who wait … except a cat."
Marilyn Peterson

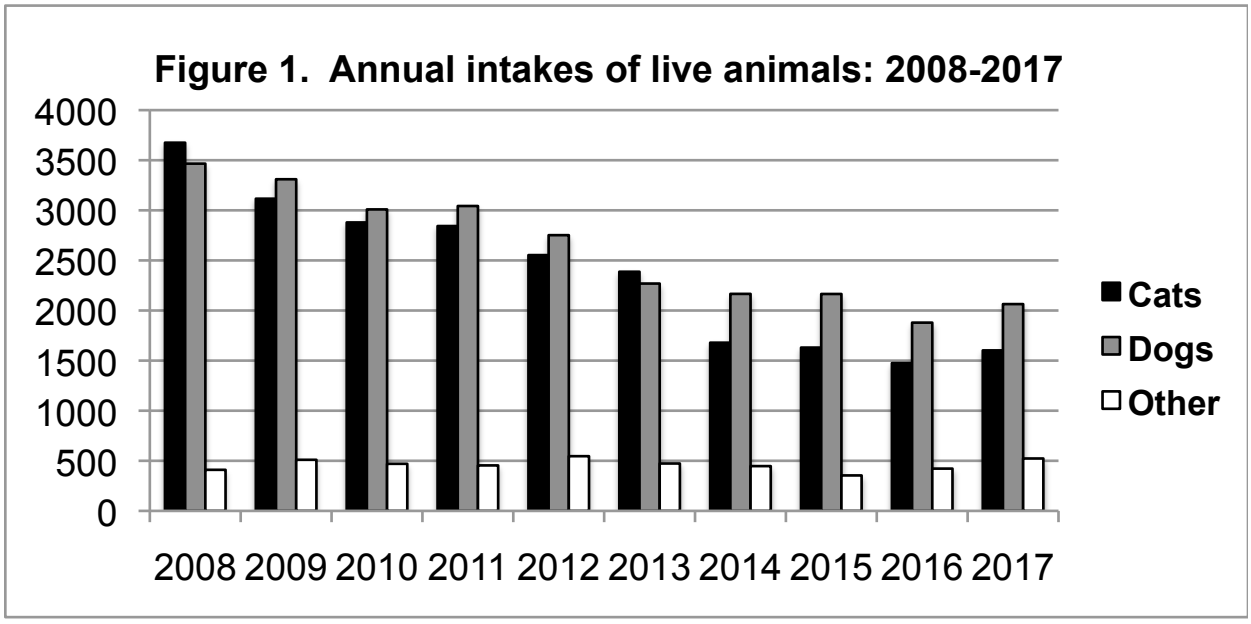
Anchorage Animal Care and Control submits monthly reports to the Anchorage Division of Health and Human Services. This chapter summarizes those reports for a recent decade, with some comparisons to earlier figures contained in the Animal Care and Control Services Strategic Plan (MOA 2006). In this chapter all reported annual means are for the 10-year period from 2008 through 2017.

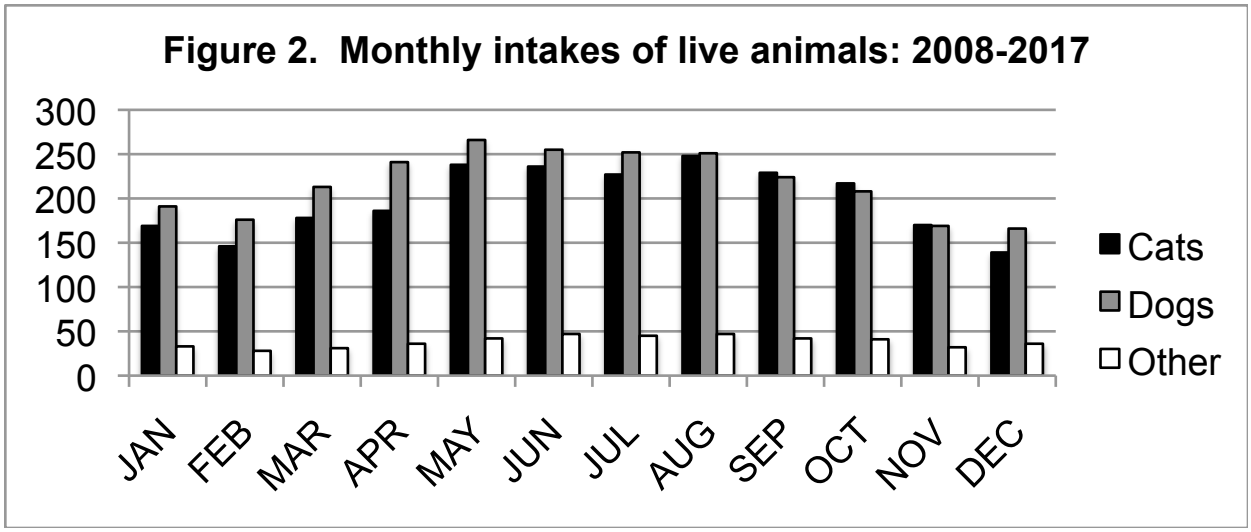
Categories of intakes and outcomes used by AACC are consistent with those designed to collect statewide and national statistics (Shelter Animals Count 2018); however, the AACC doesn't record relative age (adult vs. puppy/kitten).

Intakes

Intakes include all animals received by or brought into the AACC center. Intake categories include impounds, protective custody, strays, owner-surrendered animals, returned animals, owner requested euthanasia, and dead on arrival (Appendix A, Appendix B).

Intakes of live animals (i.e., all intakes minus "dead on arrival") have declined substantially since 2008, with cat numbers falling faster than dog numbers (Fig. 1). Live intakes in 2016 and 2017 were about half of what they were in 2008. Intakes of live animals peak in summer months (Fig. 2).





Nationally, about 50% of total shelter intakes are cats (HSUS 2019*b*). In Anchorage dog intakes outnumbered cat intakes in 8 of the last 10 years (Fig. 1). Seasonally, dog intakes outnumber cats except in fall (August-November) when the proportion of dogs to cats is close to equal (Fig. 2).

Impounds. Impounded animals are those brought into Animal Control for bite quarantine or enforcement investigations. Annually, impounded cats and dogs almost always outnumber – often by two or three times – pets taken in for protective custody. Because the number of animals under both of these categories is relatively small, they are combined in Figure 3. More dogs (mean = 142) than cats (mean = 38) are impounded. The number of impounded dogs has declined from a high of 195 in 2009 to 110 in 2017. The number of impounded cats has declined slightly.

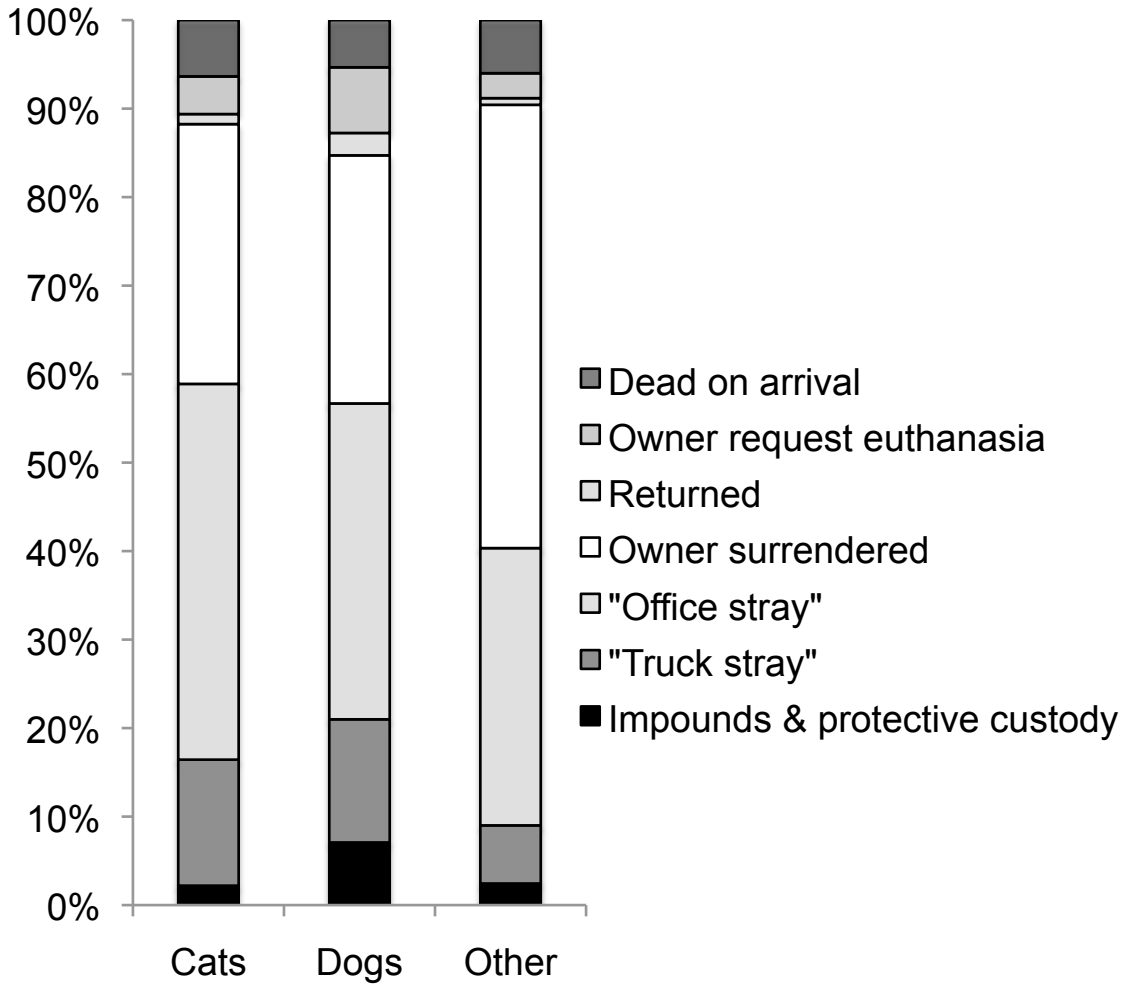
Protective custody. "An officer shall take an animal not subject to impoundment into protective custody when necessary to preserve the animal's health or safety and humane care and treatment" (AMC 17.25.090). Impounds include animals brought to the animal control center by the police or fire department or when an animal control officer is called to assist the police or fire department by picking up the animal in a case not involving animal cruelty (e.g., APD is taking someone with an animal into custody for drunk driving).

More dogs (mean = 66) than cats (mean = 22) are brought in for protective custody. Unlike impounds, the number of dogs and cats taken into protective custody has not declined.

Strays. Animal Control differentiates between a "truck stray" and an "office stray" (M. Tierney, personal communication, 2018). A "truck stray" is a stray animal picked up by an animal control officer in the field. An "office stray" is a stray animal brought by a member of the public to the animal control center.

The animal control center received more stray cats than dogs in the early half of the past decade (2008-2013), but has taken in more stray dogs than cats in recent years (2014-2017, Appendix A). The public brings nearly three times as many dogs and cats to the AACC center as are delivered by animal control officers. Over the past decade the number of "truck strays" has been comprised of slightly more dogs (mean = 407) than cats (mean = 389), but more cats than dogs are "office strays" (mean = 1,160 vs. 1,044, Fig. 3).

Figure 3. Mean annual intake by category: 2008-2017



Owner surrendered. This category includes animals relinquished by their owner or caretaker for a variety of reasons. More cats were surrendered by owners in 2008-10 and 2013, but less cats were surrendered than dogs in 2011-12 and 2014-17. Over the past decade, the numbers of dogs (mean = 820) and cats (mean = 802) surrendered have been comparable (Fig. 3).

Returned. These are animals adopted and then returned within 30 days of the adoption. Twice as many dogs as cats were returned in most years (Fig. 3); however, the number of annual returns are relatively small for both cats (mean= 31, range 21-39) and dogs (mean = 74, range 49-96).

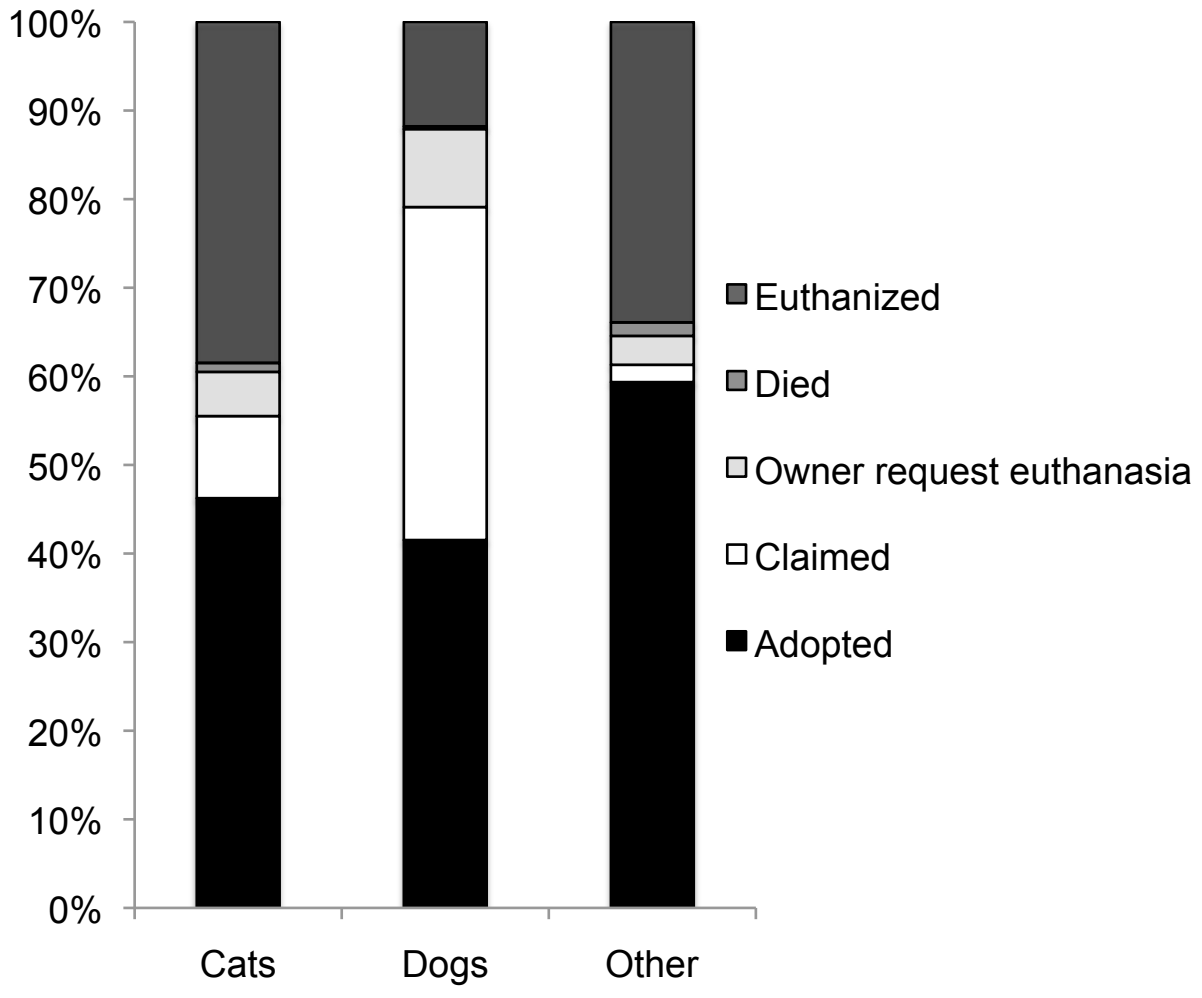
Owner requested euthanasia. Animal Control will euthanize an animal when requested by its owner. Owners request euthanasia nearly twice as often for dogs (mean =217) as cats (mean = 116, Fig. 3).

Dead on arrival. Some animals are dead when picked up by an animal control officer or are brought to the AACC center after dying. Slightly more cats (mean = 174) than dogs (mean = 156) are brought in dead (Fig. 3).

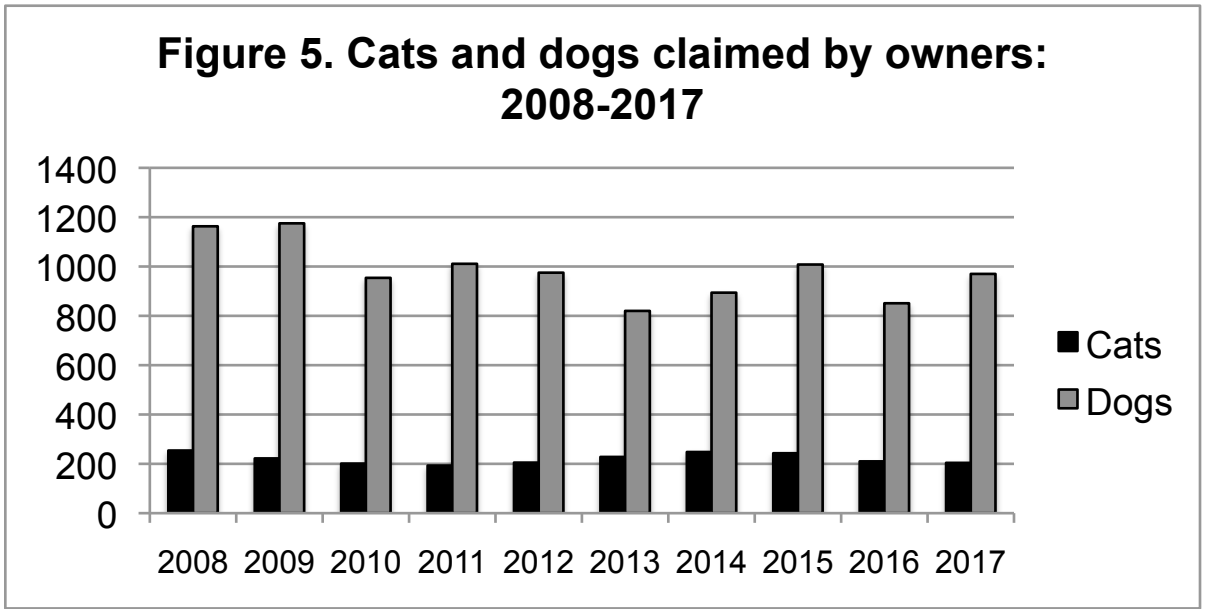
Outcomes

Outcomes are the fates of animals after arriving at the AACC center. Categories include claimed, adopted, owner requested euthanasia, died, missing, released to wild, transferred, and euthanized (Appendix A, Appendix B). "Owner requested euthanasia" is a category in both intakes and outcomes. The figures in intakes include the number of animals for which euthanasia was requested. The figures in outcomes include the actual number of animals in this category that were euthanized that month or year. These figures are used differently in the analysis, as will be explained later.

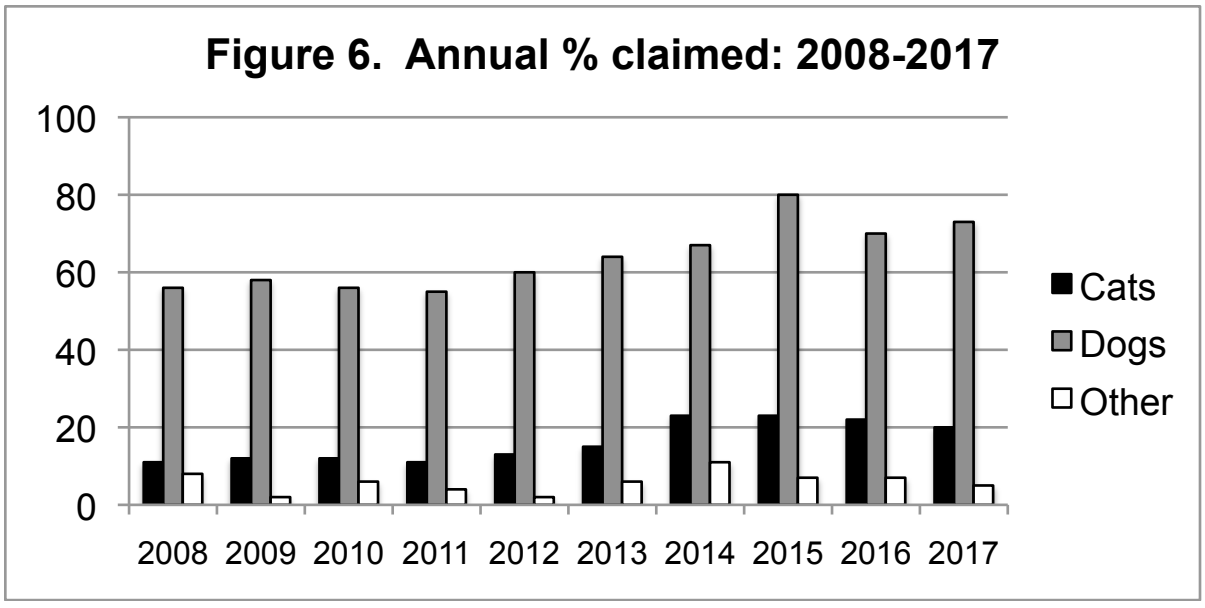
Figure 4. Mean annual outcomes: 2008-2017



Claimed. Lost and stray animals can be claimed by owners from Animal Control. Nearly five times as many dogs (mean = 982) are claimed than cats (mean = 221, Fig. 4, Appendix A). The annual number claimed has declined slightly for dogs and remained relatively stable for cats over the past decade (Fig. 5).

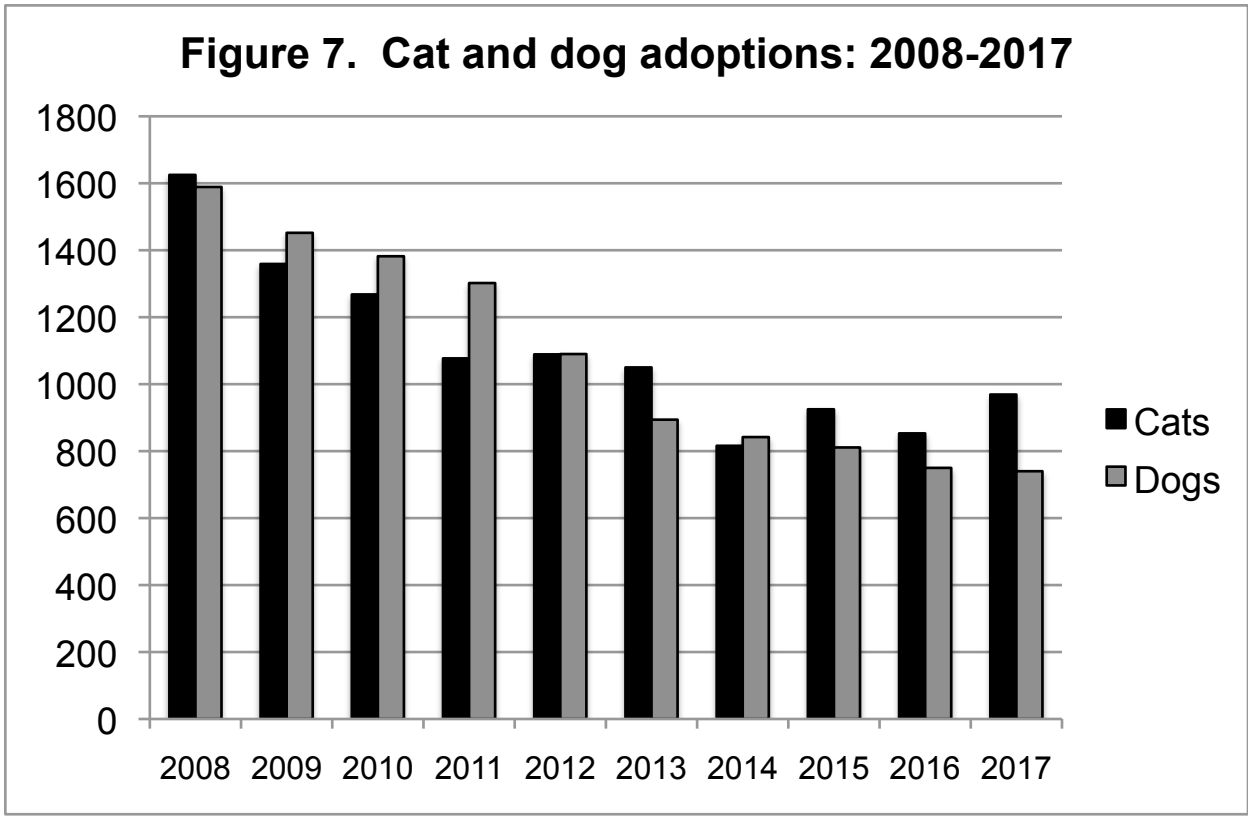


The percentage of animals claimed each month and year depends on the number of live animals that can feasibly be claimed, which is calculated by dividing the number claimed by "total live intake" minus "owner surrendered" minus "owner requested euthanasia (intakes)" (M. Tierney, personal communication, 2017). The percentage of dogs claimed annually (range 55-80%) is considerably higher than the percentage of cats (range 11-23%, Fig. 6). The percent claimed climbed for both dogs and cats, peaking in 2015 (80% of dogs vs. 23% of cats) but has declined slightly since then (Fig. 6).



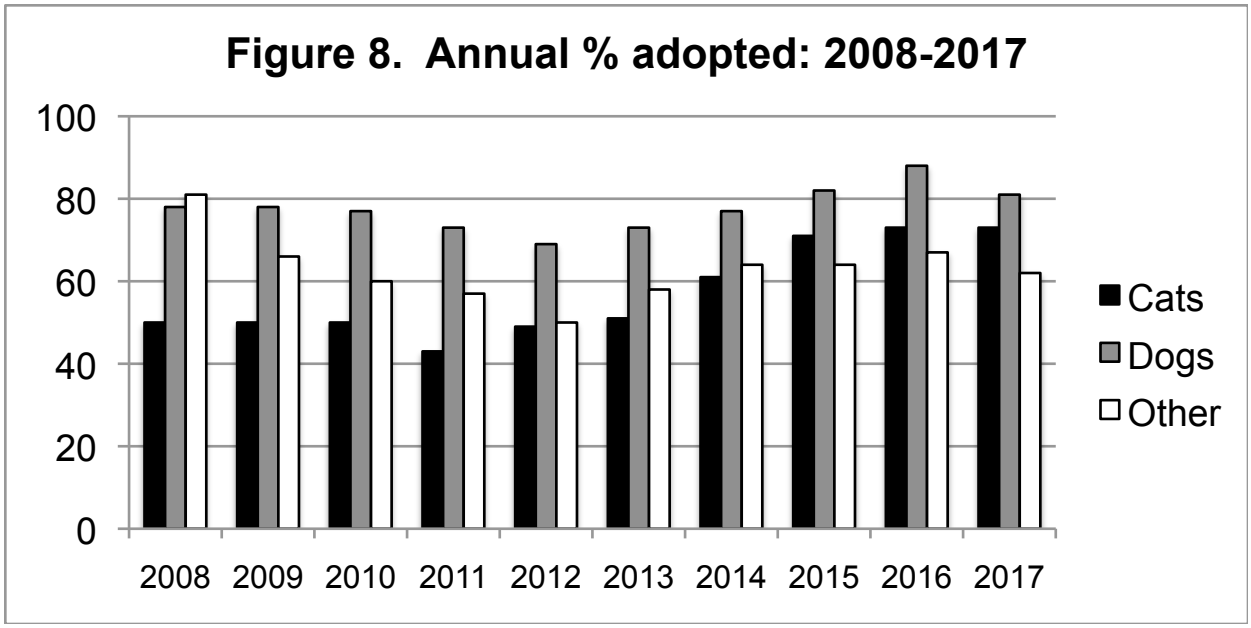
Nationally, some 3% of cats and 19% of dogs that enter shelters are returned to their owners annually (ASPCA 2018). A much higher percentage of animals are claimed in Anchorage, ranging from 11-23% for cats and 55-80% for dogs (Fig. 6).

Adopted. This category includes animals adopted from the AACC center. Over the past decade slightly more cats (mean = 1,103) have been adopted annually than dogs (mean = 1,085, Fig. 4). However, the numbers fluctuate and in some years more dogs are adopted than cats (Fig. 7).



The percentage of animals adopted each month and year depends on the number of live animals that are available to be adopted, which is calculated by dividing the number adopted by "total live intakes" minus "claimed" minus "owner requested euthanasia (intakes)" (M. Tierney, personal. communication, 2017). A higher percentage of dogs are adopted than cats (Fig. 8).

Nationally, some 50% of cats and 48% of dogs that enter shelters are adopted annually (ASPCA 2018). Adoption rates are substantially higher in Anchorage, ranging from 43-73% for cats and 69-88% for dogs (Fig. 8).



Owner requested euthanasia. Some owners request that their pet be euthanized. The number of pets for which the owner requested euthanasia is included in the intake figures. However, animals aren't euthanized immediately for various reasons, and the actual number euthanized in a month or year are tallied in the outcome figures.

The number of cats euthanized at the request of their owner is lower than the number of dogs (Fig. 4).

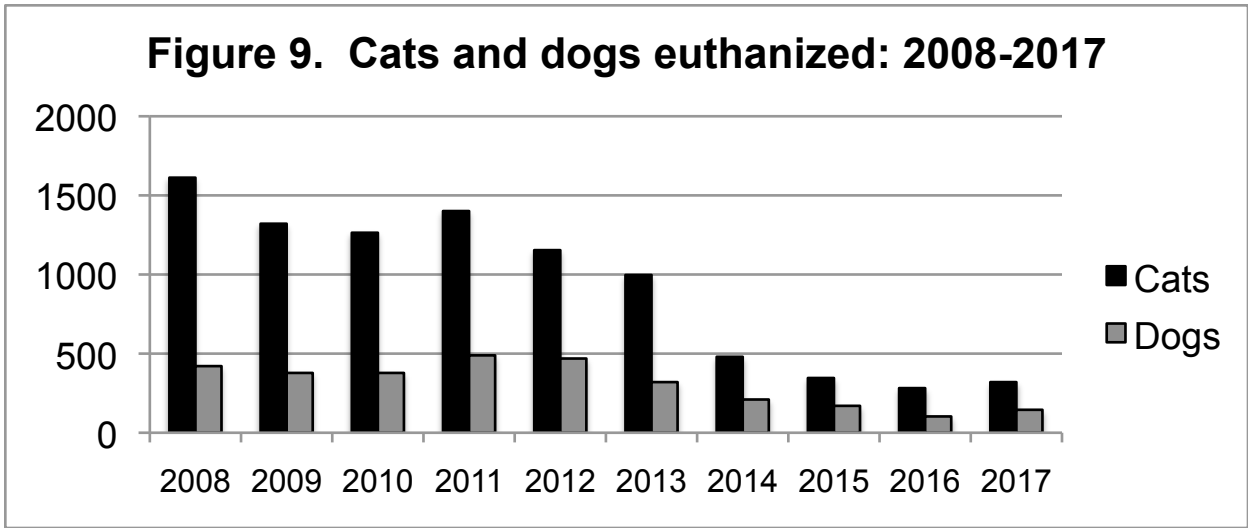
Died. Occasionally, an animal dies while in the custody of Animal Control. These are rare occurrences for dogs (mean = 8) and cats (mean = 24, Fig. 4).

Missing. This category includes animals on the Animal Control inventory that cannot be located. It does not occur often, but occasionally animals are stolen from the kennels. Only 4 cats and 3 dogs have been reported missing in the past decade.

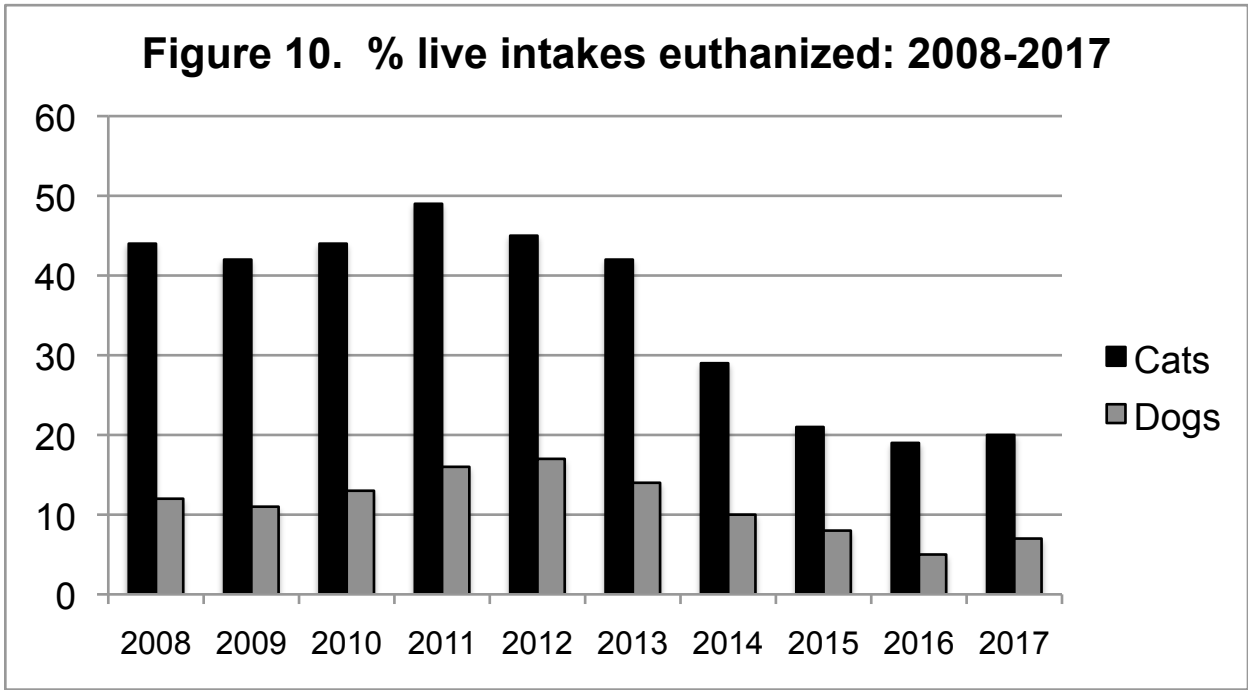
Released to wild. This category includes animals released back into the wild. No cats or dogs were released to the wild by the AACC. It is rare to receive an animal that is not domesticated, but people occasionally bring wild animals such as snowshoe hares into Animal Control. In the past decade, only 6 "other" animals, presumably hares or other small wild animals, were released, all in 2009.

Transferred. Some animals are transferred out of state to a sanctuary. This happens very rarely, but 4 cats were transferred in 2014. Two wolf-hybrids were transferred in 2010 and another canine in 2017. One "other" animal was transferred in 2015 and 2017.

Euthanized. Over the past decade, three times as many cats (mean = 918) were euthanized than dogs (mean = 308, Fig. 4). Earlier in the past decade the number of cats euthanized at the AACC center was even more skewed (Fig. 9). Euthanasia has decreased substantially for both cats and dogs. Although the gap between dogs and cats has narrowed considerably, approximately twice as many cats have been euthanized in recent years (Fig. 9).



Another way to look at this data is the percentage of live animals at intake that are euthanized. Over the past decade, 38% of cats and 12% of dogs were euthanized (Fig. 4, Appendix A). However, the euthanasia rate has dropped substantially in the last decade for both cats and dogs. Between 2008-2013 the annual euthanasia rate for cats ranged from 42-49% and for dogs it was 11-17% (Fig. 10). In the last three years (2015-2017) the annual rate for cats has ranged from 19-21% and for dogs 5-8%, a commendable achievement.

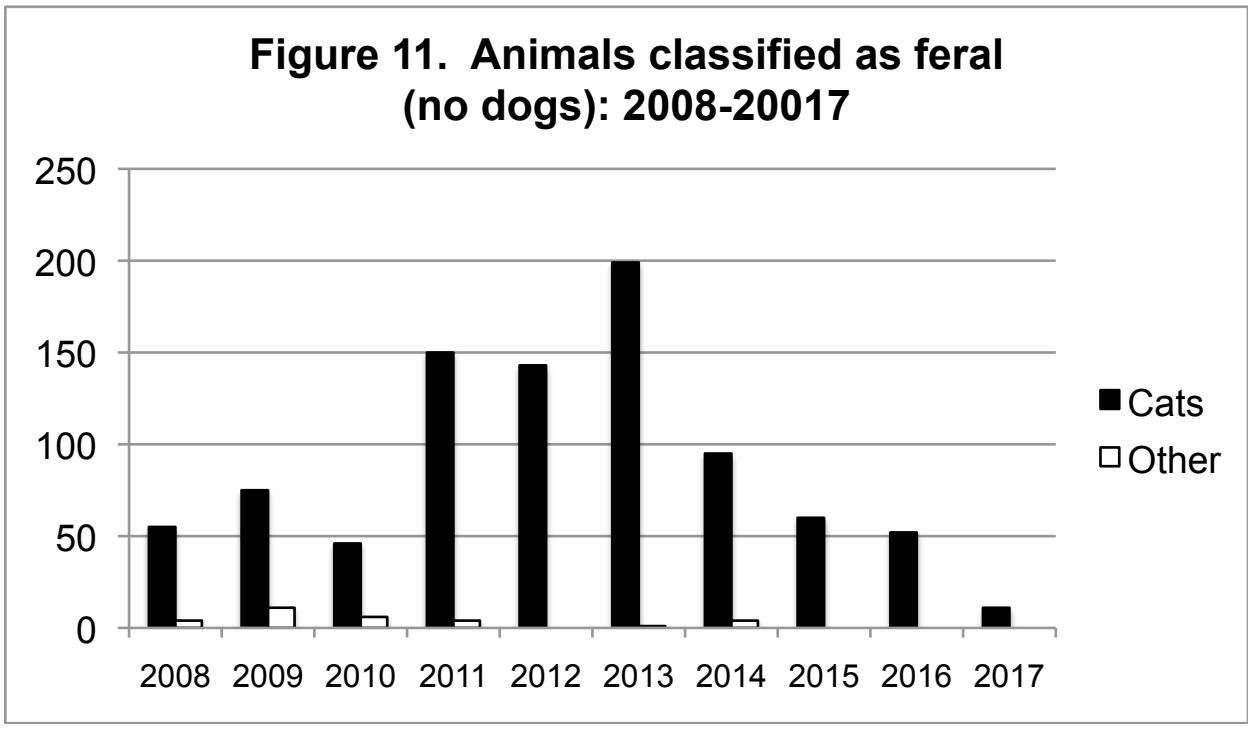


Nationally, some 27% of cats and 20% of dogs that enter shelters are euthanized annually, according to the ASPCA (2018). The HSUS (2017*a*) claims 70% of cats are euthanized in shelters. Like Anchorage, Hurley and Levy (2013) found euthanasia rates had decreased for dogs and increased for cats in many communities during the previous decade.

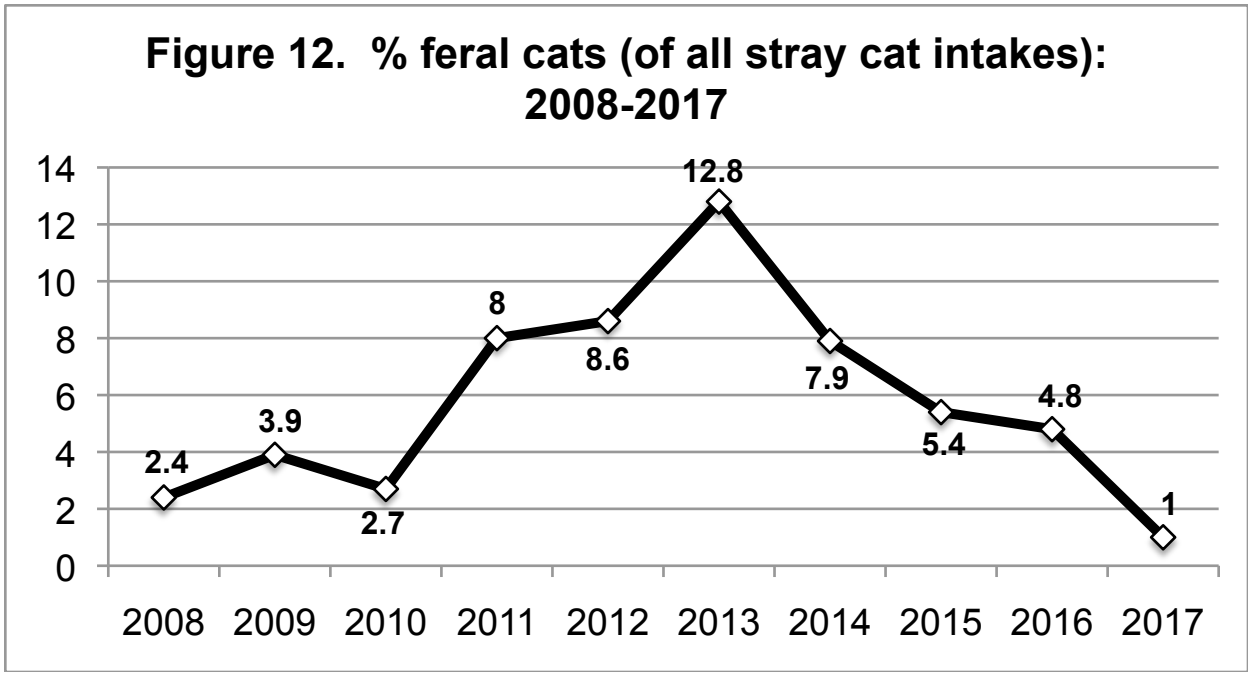
Feral. A feral domestic animal is generally one that lives outdoors and has little or no human contact. The AACC definition is much more limited. Their records consider the feral category as a subset of the euthanized outcome. In other words, Animal Control considers only unowned animals with serious anti-social behavior to be feral, and these animals are euthanized.

Animals**,** mostly cats, are considered feral by the AACC if they are fearful, avoid human contact, and fail to demonstrate any social responses to human interaction. This is a subjective category that can be remediated. For example, some unowned cats enter the facility and initially exhibit hostile or fearful behaviors but are not ultimately deemed feral. While not an exact science, an unsociable, feral cat is not adoptable as a pet. All feral domestic animals are euthanized by the AACC.

In the past decade no dogs and very few "other" animals have been considered feral (Fig. 11). Cats predominate in this category (mean 89, range 11-199). The number of cats classified as feral increased substantially, peaking in 2013 at 199, but had declined to 11 by 2017 (Fig. 11).

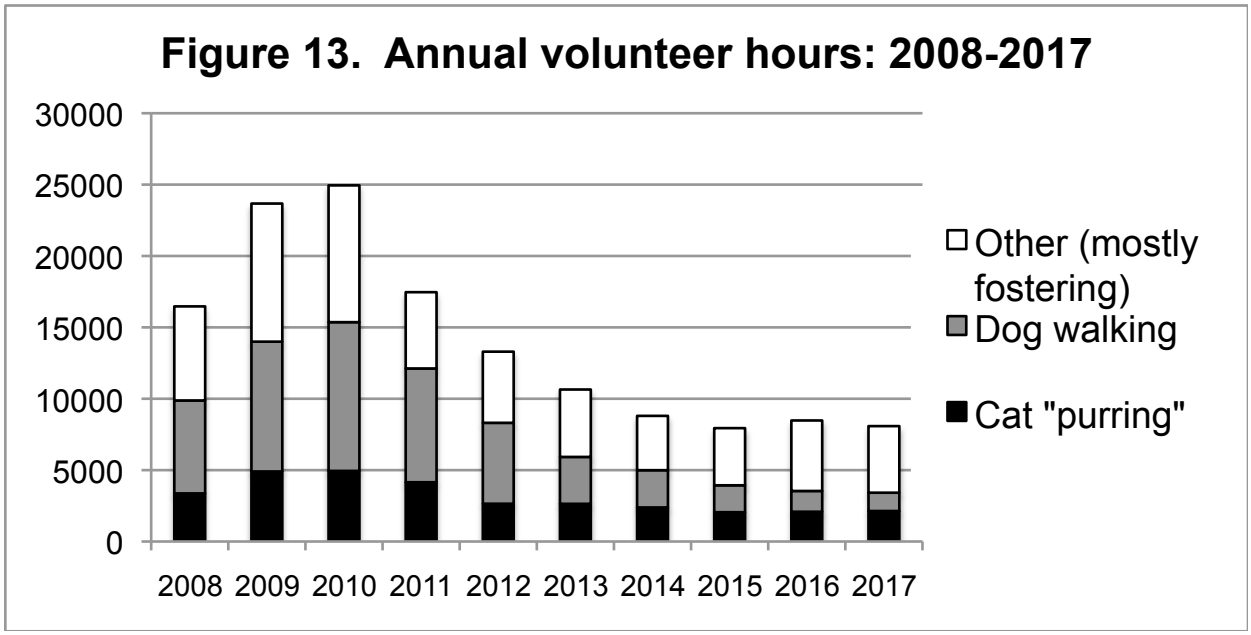


Another way to look at this phenomenon is the percentage of feral cats among all stray cats brought in (Fig. 12). This also peaked at 12.8% in mid-decade, then declined to 1% in 2017. These figures in no way represent the true number of feral cats in Anchorage. As discussed earlier, the AACC's definition of a feral cat is very restricted. With no special effort being made to collect stray cats, to reduce or eliminate free-roaming cats, or to educate the public regarding the environmental and public health impacts of feral cats, fluctuations in the number of "feral" cats tabulated by the AACC are likely due to personnel, social or organizational changes that determine which cats are "unadoptable."



Volunteer hours

Volunteers contribute a great deal to the care and adoption of animals held at the AACC center. Volunteers work with animals at the center in a variety of ways. The three largest categories of help are in fostering, dog walking and “cat purring” (Fig. 13, Appendix A). The latter two figures are interesting because they illustrate differences in the way the public, as represented by volunteers, treats dogs and cats. Volunteer help peaked early in the decade and has fallen to about one-third of that level in the last 4 years (Fig. 13). This reflects to a large extent the declining number of intakes.



Fostering. Fostering is when a volunteer takes an animal home, either because it is too young to adopt or has a medical condition that requires constant attention (M. Tierney, personal communication, 2017). Fostering is only used until the animal is considered ready for adoption. Many of the animals are kittens and puppies (M. Tierney, personal communication, 2019). The pets' species are not listed in the monthly reports.

Dog walking. Volunteers work with and exercise dogs turned into the Animal Control center. The number of hours spent walking dogs has declined more precipitously than other volunteer activities (Fig. 13).

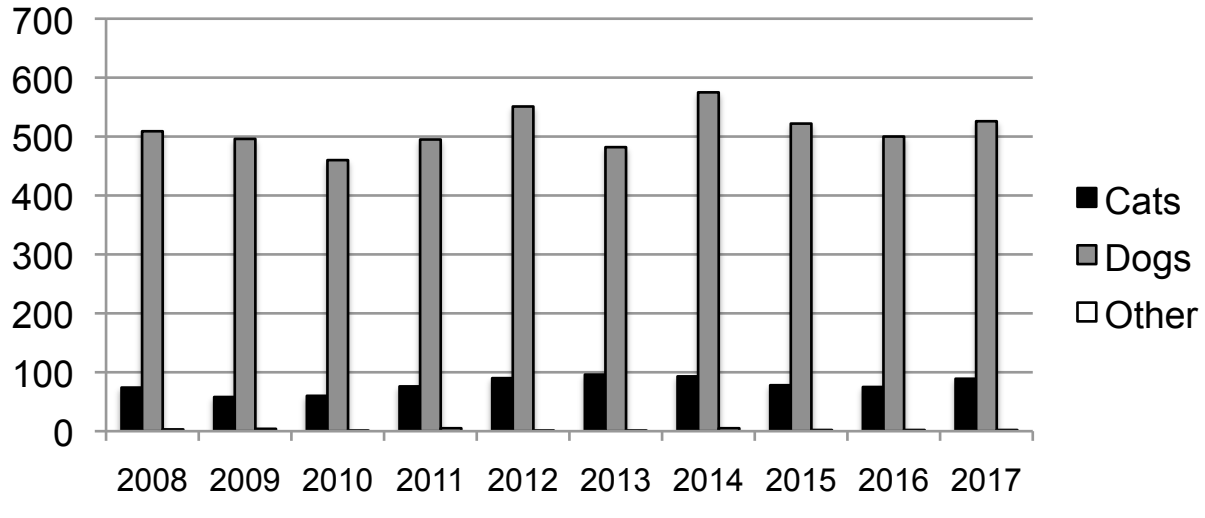
Cat purring. "Cat purring" is Animal Control's term for handling and socializing cats (M. Tierney, personal communication, 2017). The animal control center has a room where volunteers spend time interacting with cats. Human socialization can turn a cat that was initially deemed unadoptable (i.e., feral) into a desirable pet. The number of volunteer hours spent handling cats has declined to about half the levels early in the decade (Fig. 13).

Enforcement

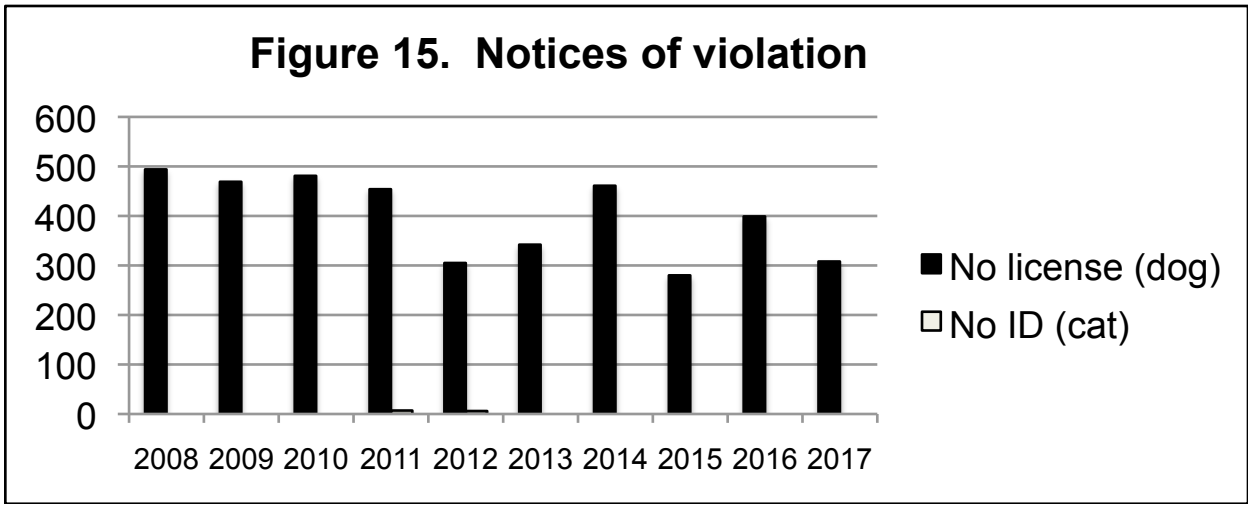
This report doesn't delve too deeply into Anchorage's enforcement of animal-related laws, partly because Animal Control does not differentiate between dogs, cats or other pets in most of the enforcement categories included in the monthly reports. However, there are a couple of notable exceptions (Appendix A, Fig. 14, Fig. 15).

The monthly reports tally dog and cat bites separately. As might be expected, the number of reported dog bites (mean = 512) greatly exceeds the number of reported cat bites (mean = 79, Fig. 14). Much of the difference may be driven by actual or perceived differences in the severity of dog and cat bites. There's good reason to believe that dogs are more likely to bite a stranger or acquaintance and cats are more likely to bite or scratch a friend or family member. The former injury is more likely to be reported than the latter. Thus, while both dog and cat-related injuries are underreported, cat-related injuries, particularly scratches, are probably underreported to a far greater degree.

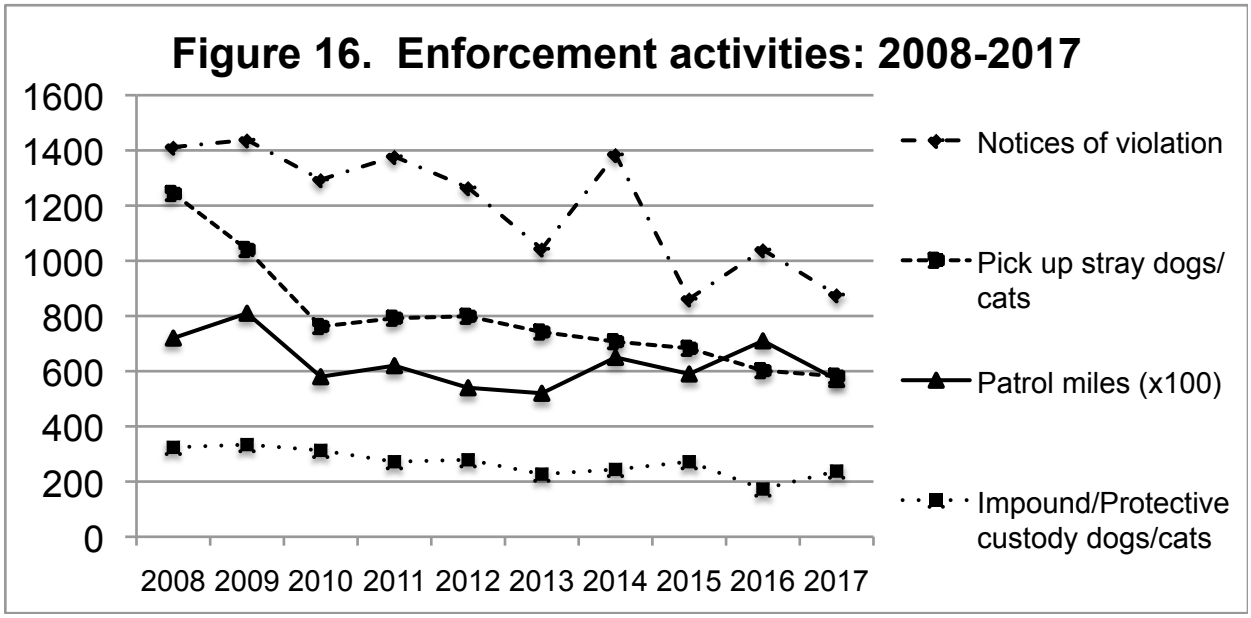
Figure 14. Reported animal bites: 2008-2017



Because dogs require licenses but cats do not, the number of notices of violation (NOVs) for unlicensed dogs may be compared to the number of citations issued for cats without ID tags or microchips. Owners of unlicensed dogs (mean = 399) are 400 times more likely to receive an NOV than owners of cats not sporting an ID tag (mean = 1, Fig. 15).



The annual number of miles driven and the number of dogs and cats impounded or placed in protective custody have declined only slightly over the last decade (Fig. 16). However, the number of stray dogs and cats picked up and the number of NOVs issued have declined substantially. Almost twice as many NOVs were issued in 2008 compared to 2017 and the number of strays taken in by the AACC decreased a similar amount.



DISCUSSION

"As every cat owner knows, nobody owns a cat."
Ellen Perry Berkeley

It's easy to conclude that cats are treated very differently from dogs in state and municipal law, in the control and enforcement of free-ranging pets, in the redemption and adoption of pets taken to shelters, as well as in the attitudes and behaviors of owners and the public at large. It's less easy to understand why. Differences appear to lie in owner behavior and responsibilities, public expectations, state and municipal laws, municipal care and control funding, and the recommendations of experts.

Owner behavior and responsibilities

Cats and dogs have changed physically since they were first domesticated. In the past 2,000 years domestic cats have increased in size and are now 16% larger than their wild relatives (Bitz-Thorson and Gotfredson 2018). Over a much longer span of time dogs have decreased in size. The average dog is about 25% smaller than the average wolf, and the variation in the size of different breeds is phenomenal.

Although domestic cats have become larger, their brains have grown very little over time. Compared to a variety of other orders and suborders, felids have exhibited the smallest increase in brain size, much smaller than their fellow carnivores, the canids, a difference attributed to relative sociality (Shultz and Dunbar 2010).

The domestic cat is one of the world's most numerous pets and yet, with the exception of birds used in falconry, it is among the least domesticated (Bitz-Thorson and Gotfredson 2018). This has important ramifications on how cats are perceived and how they affect the environment.

Control and confinement (leash law). In many jurisdictions cats, unlike dogs, are not required to be leashed (Smith 2009). One historical justification seems to be the need for cats to patrol homes and agricultural areas for pests. Dogs have also been used as guardians of livestock and other property or as hunting companions. Agriculture and herding are not practiced in urban areas, where most Americans now live, and most people's experience and concern about rats and mice now relates to homes and businesses. Nevertheless, despite the feline reputation, a snap trap is far more efficient at killing rodents in a home or other building than a cat. Forbush (1916) observed that "the only advantage of the cat as a rat trap is that it is self setting."

Dog owners are much less likely to allow dogs to run free. There is certainly resistance to and noncompliance with leash laws, but dog owners generally recognize the problems with free-ranging dogs and many comply with leash laws, at least in urban areas. Considerable peer pressure is exerted on dog owners who habitually let their pets run at large and those met on trails without leashes or some measure of voice control. Cats, on the other hand, are expected to roam and hunt, and peer pressure to leash or confine pet cats is almost nonexistent and universally resisted by owners.

ID tags and microchips. Most dogs wear collars. Unlike dog owners, many cat owners are unwilling to collar their pet (Wisch 2005). Many cat owners worry about strangulation. This argument has been used since at least the early 20th century (Forbush 1916). Some individuals

and groups argue that placing a collar on a cat or keeping it indoors is unethical because it violates the basic instinctive nature of a cat. The same argument could be made, of course, for dogs.

Unfortunately, it can be difficult to reunite a cat with its owner without some form of identification. Nationally, only about 2% of cats entering shelters are reunited with their owners (Slater 2001). Cats with identification are approximately 20 times more likely to be reclaimed than unidentified cats (Lord et al. 2009).

In a nationwide survey, Weiss et al. (2012) found that in the most recent instance where pet owners had lost pets 11% of dogs and 56% of cats had no license or ID tag, rabies tag, or microchip.

People who find a stray pet are much more likely to find the owner of a dog than a cat (Lord et al. 2007*c*). Most finders attempt to locate an owner by contacting a local shelter, placing a newspaper advertisement, walking the neighborhood, and putting up signs. Only 8% of finders initially surrendered the animal to a shelter.

Unlike most dog owners, many cat owners seem to believe that a collar is an inconvenience, an affront, or likely to be a dangerous accessory. To address these concerns, a study of cats randomly assigned to wear one of three types of collars – plastic buckle, breakaway plastic buckle safety, and elastic stretch safety – found 72.7% successfully wore their collars for the entire six-month study period (Lord et al. 2010). Owners' initial expectations of the cats' tolerance of the collar and the number of times the collar was reapplied on the cats' necks were the most important factors predicting success. Eighteen cats (3%) caught a forelimb in their collar or caught their collar on an object or in their mouth. Of course, if a cat isn't allowed to roam outside, it's much less likely to be harmed by a collar malfunction because the owner will notice and fix the problem. Of the 478 microchips that were scanned at the conclusion of the study, 477 (99.8%) were functional. The authors cautioned that because even indoor cats can become lost, veterinarians should recommend that all cats wear identification collars as the most obvious means of identifying an owned pet. Because some cats are adept at shedding their collars, microchips are an important form of backup identification.

In a popular article (Anonymous 2010) describing the study conducted by Lord et al. (2010), the lead author, Linda Lord, explained that "part of the success of a cat wearing a collar is the expectation of the owner. For some owners, if a collar came off once, they were done." The Cat Channel ran a version of the popular article and took an informal, non-scientific poll of their audience that was still instructive. Only 33% of respondents had cats with collars. Forty-four percent of the respondents claimed their cat was indoor-only, 12% said their cat wouldn't tolerate it, and 10% said collars are too dangerous. And yet the researchers had addressed these concerns by offering suggestions for fitting cat collars and by reminding owners that indoor cats can get lost and indoor-outdoor cats are more likely to get lost than injured by a collar.

With collar improvements and expert advice, injuries and deaths are rare. Calver et al. (2013) interviewed 107 veterinarians and found an average rate of one collar injury per 2.3 years of veterinary practice. Cat injuries and deaths from fighting and road accidents were much more common and, the researchers noted, collars offer the option of ID tags and predation deterrents.

Updating information on an ID or microchip is also important. Of 291 pet cats brought to a veterinary hospital and a low cost spay/neuter clinic in Oklahoma City, only 59% were wearing

an ID tag with correct information (Slater et al. 2012). Most owners interviewed believed carrying identification was very or extremely important. The most common reason for not using a tag was their cat was "indoor-only" (35%), with another 10% reporting their cat was uncomfortable wearing a collar. Another study found that 41% of owners who were searching for a lost cat admitted that it was an "indoor-only" cat (Lord et al. 2007*a*).

Another nationwide survey examined the fates of 4,083 microchipped stray dogs and cats taken to shelters (Lord et al. 2009). Many more dogs were microchipped than cats and a higher proportion of dog owners (2,191/2,956, 74%) were found than cat owners (298/469, 64%). The main reasons why owners could not be found were incorrect or disconnected telephone number (34%), owner did not return calls or respond to a letter (24%), and animal was registered to another group (17%). Only 58% of microchipped pets were registered in a database.

Microchips aren't foolproof. The chief problem with microchips is that when people move or pets are transferred to new owners the names or addresses aren't changed. One solution is regular email reminders to update the information (Goodwin et al. 2018).

In some communities cats, like dogs, must be licensed. In Montreal cats must wear a license at all times (even if never allowed outside). It's also illegal to feed a stray cat or allow cats to roam. According to Taylor (2017), "licensing is a tool to change perceptions." These communities have noticed a huge decrease in the number of unclaimed cats, which means many fewer cats are euthanized (Taylor 2017).

Victoria, British Columbia, recently implemented several of the most controversial recommendations of this report (Crescenzi 2019). City bylaws now require all cats to be on a leash or in a kennel when they're in a public setting. An owner will be warned for the first infraction, but fined $150 for subsequent failures to keep their cat under control. Cats are also banned from trespassing on private property without the occupier's permission. The city is considering cat licensing and spaying or neutering all cats over six months of age, unless there are outstanding medical or breeding circumstances.

There is pushback, however, and some well-known humane organizations are contributing to the argument that cats and dogs should be treated differently. For example, the Humane Society of the United States, in its "Municipal Pet Policy Toolkit" (HSUS 2019*a*), recommends the following policies for licensing dogs and cats:

- "Dog licensing: Dog licensing can be a useful tool that helps municipalities reunite lost pets with their owners, ensures that pets receive vaccinations against diseases and provides a funding mechanism for other animal-management uses, such as a spay/neuter fund."
- "Cat licensing/owned cat laws: Cat licensing is generally not the best use of municipal resources. It is time-consuming, opposed by many cat-owners, difficult to enforce and not very effective at reuniting cats with their owners."

The same document contains the following advice for leash/at-large laws for dogs and cats:

- "Preventing owned dogs from roaming freely is important because loose dogs pose a risk to public safety (dog bites, car accidents, etc.), other animals and themselves."
- "Attempting to control free-roaming cats with the same type of leash laws developed for loose dogs has not proven to be effective and thus the HSUS recommends that the issue of cats at large be addressed separately."

Later, the document justifies free-roaming (aka "community") cats with "Do not try to restrict an activity that is actually good for the community!" Can better examples be found to illustrate the bias towards free-roaming and unlicensed cats?

In Alaska, the Matanuska-Susitna Borough and the cities of Palmer, Wasilla, Houston, and Nome require cat as well as dog licenses, and ID tags must be worn whenever the animal leaves the owner's property (with some exceptions for sport hunting and other events).

Sterilization. Over 80% of the pet cats in the U.S. are sterilized, a higher rate than dogs, according to Hurley and Levy (2013). According to Weiss et al. (2012), owners reported 88% of cats and 80% of dogs were sterilized in a nationwide survey. These figures obscure an interesting difference: female dogs were significantly more likely to be sterilized than male dogs, but there was no significant difference between female and male cats.

Only about 2% of "community" (i.e., stray and feral) cats are sterilized (Hurley and Levy 2013, HSUS 2019*b*). Consequently, stray and feral cats produce 80% of the kittens born every year in the U.S. (HSUS 2019*b*). This high reproductive rate explains why cats are admitted to shelters at higher rates than dogs (Hurley and Levy 2013). Unfortunately, 75% of kittens born to free-roaming cats die or disappear in their first six months, and deaths are most often due to trauma (Nutter et al. 2004).

Pet reproduction and overpopulation are tied to the knowledge and responsibility of individual pet owners. Approximately one-quarter of dog and cat owners believed that a female dog or cat should have a litter before being sterilized. Notably, about one-third weren't sure, meaning that over half of pet owners aren't familiar with basic reproductive facts, including one of the best ways to avoid pet overpopulation.

Responsible cat care and control also depend on attitudes of pet owners. In the United Kingdom, which has a demonstrably different attitude toward some aspects of pet care and control than the U.S., over 80% of pet owners support routine neutering (Wongsaengchan and McKeegan 2019). However, about 10% of the respondents believed pets should be neutered only for medical reasons. Men were more likely than women to agree with routine neutering, and people who had reduced the amount of meat in their diet were more likely to oppose routine neutering. Cat owners supported neutering more than dog owners.

In the U.S., owners relinquishing cats to a shelter were less knowledgeable about the frequency of estrus in cats than dog owners were about dogs (Salman et al. 1998). This finding was reinforced by a British study that reported 86% of pet cats hadn't been neutered by the age of four months, the recommended age limit (Welsh et al. 2013). Cats were significantly more likely to be neutered by four months of age if their owners intended to have their cat neutered by this age, they were microchipped, or they were from households in deprived regions. The likelihood of being neutered by six months of age was significantly increased for cats that were insured, obtained from an animal welfare organization, given their second vaccination, from a household with an annual income of over £10,000 (about $13,750), or owned by people intending to have their cat neutered by this age. The authors believed more effort should be dedicated to publicizing the recommended neutering age of four months to cat owners.

Many veterinarians and veterinarian clinics, at least in Australia, fail to provide information on the need to sterilize cats or offer the service without explaining why it is necessary or when to perform it (Crawford and Calver 2019). Veterinary nurses and nursing students tended to be

more conservative than veterinarians and veterinarian students, preferring to sterilize cats after four months due to concerns about anesthetic risk.

Lost pets and strays. In many U.S. shelters, including the AACC center, more than half of the total intake is stray animals (Weiss et al. 2012). It shouldn't be surprising that most strays are cats. Adult cats tend to be more autonomous than dogs, and many pet cats do not show signs of secure attachment to their owners (Potter and Mills 2015). Because cats are expected to roam at will and feed on birds and other wild animals, pet owners generally delay searching for lost cats longer than dogs (Weiss et al. 2012).

Using a national telephone survey of households owning a pet within the past five years, Weiss et al. (2012) observed that 15% of dog and cat owners had lost a pet. Dogs had higher recovery rates (93%) than cats (75%), and dogs were returned using different search methods. Dogs were most commonly found by searching the neighborhood, or they returned on their own. Fourteen percent of lost dogs were found using an identification tag (Weiss et al. 2012). In an earlier study of 138 lost cats and 187 lost dogs in Ohio, Lord et al. (2007a) found that 66% of "lost" cats returned on their own. Median recovery time was five days. Thirty-five percent of lost dogs were found by calling or visiting a local shelter and 18% because of an ID tag (Lord et al. 2007b). Median recovery time was two days. In this study, 19% of cats and 48% of dogs had some form of identification.

Based on a sample of lost cats compiled in 2013, the Missing Pet Partnership found that 84% of 128 lost "outdoor-indoor" cats and 92% of 153 "indoor-only" cats that had escaped outside were found within a five-house radius of their owner's home (Albrecht 2013).

Another study noted that only 61% of missing cats were found within one year, with 34% recovered alive by the owner within 7 days, but few cats were found alive after 90 days (Huang et al. 2018). An active, physical search increased the chance of finding the cat alive, because 75% of "lost" cats were found within 500 meters (about 550 yards) of their home. However, indoor-outdoor cats traveled much farther than missing indoor cats. Up to 75% of indoor-outdoor cats traveled over 1,600 meters (nearly a mile) compared with 75% of indoor cats, who were found little more than a football field away from home.

Lost cats are less likely than dogs to have an ID tag or microchip. Because 7% of lost dogs and 25% of lost cats were never found by their owner, ID tags and microchips are an essential but underutilized tool (Weiss et al 2012).

Most stray cats are not so much lost as ignored or abandoned. It's not unusual for a cat to be "owned" and fed by more than one household. Or, as the American Society for the Prevention of Cruelty to Animals (ASPCA) has observed, "dogs are sought, cats come home." Except when they don't.

Reasons for relinquishment. Pet relinquishment can account for 25-50% of shelter intakes in most communities (Dolan et al. 2015). Dog characteristics such as age, size, breed, training, medical or behavioral issues, and sickness or injury play a role. Human characteristics are also influential. For example, adults less than 50 years old, those with low annual incomes and those who haven't graduated from high school are typically more likely to relinquish dogs. Not living alone and living in a rental property are also associated with higher relinquishment rates.

Owner expectations are also important. Many pet owners claim the time and effort they expend on caring for a dog is more than they expected (Dolan et al. 2015). Dogs kept outside are more likely to be relinquished than indoor dogs. Relinquishment rates can vary from community to community. While low income is a risk factor, most people with lower incomes do not relinquish their dog (Dolan et al. 2015). When the cost of caring for the dog exceeds the funds available to a low-income family, financial assistance or advice on other resources may be a solution that prevents relinquishment (Dolan et al. 2015). Because most people relinquish their dog at shelters, appropriate interventions may keep many of these pets out of the shelter.

Pet owners relinquish dogs and cats for many of the same reasons; however, the reasons are ranked differently. Most surveys are of single shelters or localized areas. One large study (Salman et al. 1998) often cited by national humane organizations such as the American Humane Association (2012) surveyed people relinquishing dogs and cats at 12 shelters located in New Jersey, New York, Tennessee, Kentucky, Colorado and California (Table 2).

Table 2. Top 15 specific reasons* given for relinquishing cats and dogs to 12 U.S. shelters: 1994-1995 (n=7,980; Salman et al. 1998).

Rank	Reason	No. cat owners (%)	Reason	No. dog owners (%)
1	Too many in house	348 (11)	Moving	341 (7)
2	Allergies	262 (8)	Euthanasia for illness	322 (7)
3	Moving	254 (8)	Landlord	278 (6)
4	Cost of pet maintenance	206 (6)	Cost of pet maintenance	224 (5)
5	Landlord	198 (6)	Euthanasia for old age	223 (5)
6	No homes for litter	187 (6)	No time for pet	212 (4)
7	House soiling	163 (5)	Inadequate facilities	198 (4)
8	Euthanasia for illness	159 (5)	Too many in house	189 (4)
9	Personal problems	119 (4)	Pet illness(es)	175 (4)
10	Found animal	89 (3)	Personal problems	169 (4)
11	Euthanasia for old age	81 (3)	Bites	138 (3)
12	Pet illness(es)	78 (2)	No homes for litter	130 (3)
13	Inadequate facilities	68 (2)	Aggressive to people	126 (3)
14	Incompatible with other pets	66 (2)	Escapes	125 (3)
15	Inside destruction	53 (2)	House soiling	124 (3)

* Respondents could list up to five reasons.

“Too many” was ranked first by cat owners but eighth by dog owners and “no homes for litters” was also ranked much higher for cats (6^{th}) than dogs (12^{th}). This suggests that cat overabundance is a national problem that expresses itself at the level of the individual pet owner or household. According to the APPA (2017), households own an average 1.49 dogs and 2.0 cats. In a nationwide telephone survey of households that had owned a pet within the past five years, Weiss et al. (2012) found that the median number of owned dogs and cats was 1 and 2, respectively.

These differences suggest that crowding, due to acquiring too many individuals (including, perhaps, adopted strays) and unanticipated reproduction, was more problematic for cat owners than dog owners.

Other reasons were ranked very differently. House soiling was much higher for cats (7th) than dogs (15th). Four of the top 15 reasons for cats were not on the same list for dogs: allergies (2nd), found animal (10th), "incompatible with other pets" (14th), and "inside destruction" (15th). The four perceived problems on the dog list that were not among the top concerns of cat owners were "no time for pet" (6th), biting (11th), aggression towards people (13th) and escapes (14th).

The perception of aggression is an interesting difference between dog and cat owners. Although biting and aggressive behavior towards people were reasons given for relinquishing dogs, cat owners did not consider aggression to be off-putting. That's despite evidence that many cats are aggressive. A 2009 study of 336 cats with behavioral problems that spanned eight years found that nearly half (47%) of the owners listed aggression as the primary behavior problem (Becker 2016). "Inappropriate elimination" was second at 39%. Sixty-four percent of the cats directed their hostility toward other cats and 36% toward people. Of the cats that acted aggressive towards people, 78% bit or clawed their owner. According to Becker, cats with aggression issues are far more common than most people realize. Her recommendation for managing this owner-directed aggression? "Give kitty some space and time to chill out" and "If your cat bites you to wake you up in the morning, he'll need to be kept out of the bedroom at night."

Many dog owners appear to be unprepared to exercise their dogs, while many cat owners expect their pets to defecate and urinate indoors, just not on the carpet. The prominence of "dog biting" as a category is interesting because cats also bite and scratch people, but perhaps because the injury is less painful it is considered to be less of a problem. Twelve percent of relinquished dogs and 9% of cats had bitten someone, according to the owners, but 93% of the cat owners believed that cats bite or scratch as a form of play, not aggression (Salman et al. 1998). Cats can display aggression towards humans due to sound phobia and other fear-related reasons (Amat et al. 2008). However, cat owners may learn to avoid their aggressive (aka "playful") pets, while some dogs have been bred to bite or threaten strangers.

The top reason for relinquishing dogs and third most common reason for cats was moving. Most of these pets had lived with the owner for less than two years. Young adults tend to be more mobile, and young adults seem to be using shelters at a significantly higher rate than would be expected, based on the age distribution of the U.S. population (New et al. 1999, Weiss et al. 2015).

Shore et al. (2003) interviewed 57 owners who relinquished pets because they were moving and found the majority had given up their pet solely because of the move and related issues such as landlord restrictions.

Salman et al. (1998) lumped the many reasons given for relinquishing pets to shelters into broader categories (Table 3). Note that most of the top reasons for surrendering cats and dogs are related to human lifestyle and housing issues, as well as human expectations. Animal characteristics such as health, aggression and other behaviors are largely at the bottom of the list.

Table 3. Reasons given for relinquishing cats and dogs to 12 U.S. shelters by category: 1994-1995 (n=7,980; Salman et al. 1998).

Category	% cat owners[1] (rank)	% dog owners[1] (rank)
Human lifestyle	35 (1)	25 (3)
Human housing issues	36 (2)	29 (1)
Animal behavior – other	21 (3)	29 (2)
Household animal population	15 (4)	8 (7)
Human preparation and expectation	15 (5)	15 (5)
Request for euthanasia	12 (6)	16 (4)
No apparent owner	8 (7)	5 (9)
Aggression toward animals	7 (8)	8 (8)[2]
Animal medical and health	7 (9)	8 (8)[2]
Aggression toward people	5 (10)	10 (6)
Animal characteristics	2 (11)	4 (11)
Miscellaneous or no reason given	2 (12)	5 (10)

[1] Totals greater than 100% because owners could give up to five reasons.
[2] Tied.

The most significant reasons given for relinquishing cats vs. dogs can be compared by noting which reasons are more than two ranks apart. Thus, cats were much more likely to be surrendered to a shelter because of perceived problems with human lifestyle, the household animal population, and for no apparent owner. Dogs were much more likely to be surrendered for euthanasia (most often for illness or old age) and aggression towards people.

Salman et al. (1998) also observed that cat and dog owners behaved differently when surrendering young animals. When turning a litter into a shelter, 15% of dog owners and 33% of cat owners also surrendered the mother.

The same data were re-examined by Scarlett et al. (1999) with a closer look at selected health and personal issues. As a category, health and personal issues were the leading reasons cited for relinquishing cats and the third most common category for dogs. The top three sources of dogs surrendered because of health and personal issues were friends (36%), shelters (23%) and breeders (10%). The top sources for cats were friends (34%), strays (21%) and shelters (16%). Most of these dogs (60%) and cats (78%) had been acquired at little or no cost. The median length of ownership was 7-11 months. Cats were significantly more likely to have been owned for three years or more (33% of cats vs. 24% of dogs). Thirty-two percent of dogs surrendered to shelters were reportedly purebred.

Dogs relinquished for health or personal reasons were more likely to have spent most or all of their time outdoors (56%). When outside, 82% reportedly spent most of the time in a fenced yard or on a leash.

People have a higher frequency of allergies to cats than to dogs (Eggleston and Wood 1992). Nevertheless, allergies may be a misleading excuse for relinquishing a pet. People suffering from an undefined allergy may relinquish a pet simply because it is easier and cheaper than submitting to an allergic examination. Even when an allergy isn't pet-related many specialists recommend getting rid of the animal anyway. Also, blaming an allergy may be a more socially acceptable reason for surrendering a pet than others. This may explain why among those

people surrendering a cat, ostensibly due to an allergy in the family, 15% had dogs and 11% had other cats at home (Scarlett et al. 1999). "Moving" – one of the most frequently cited reasons for surrendering cats and dogs – may also be a socially acceptable way to relinquish pets that exhibit unanticipated behaviors or have been found to be incompatible with the owner's lifestyle (Adkins 2008).

Scarlett et al. (1999) allowed people to list up to five reasons for relinquishing their pets. Typically, owners surrendering their pet because of an allergic reaction gave that as the only reason, whereas a nonaggressive behavioral problem, housing issue, or inappropriate expectation were the most common other categories cited by people with health and personal issues (Scarlett et al. 1999).

Owner expectations play an important role in the decision to relinquish a pet. Several of the same researchers compared characteristics of relinquished pets to those in households by adding a nationwide mail survey of pet owners (n=6,585; New et al. 2000). Relinquished pets were significantly less likely to be neutered, and were younger and of a mixed breed. Dogs were at increased risk of relinquishment if they cost less than $100 or had bitten someone. All pets were at increased risk of relinquishment the more frequently they soiled the house, exhibited destructive behavior, or were considered overly active. Educational efforts at first point of contact should be used to inform and educate new pet owners. The window of opportunity is short because the length of time in the household is often limited for pets deemed to be incompatible with the owner's lifestyle and expectations.

When pets are adopted from shelters or rescue organizations there is an opportunity to inform and educate new owners; however, most pets are acquired from family, friends and other sources. Targeting information to the appropriate people in these transactions may be challenging (Scarlett et al. 1999).

As many as 28% of cat owners and 20% of dog owners obtained their pet from family or friends (APPA 2015). Weiss et al. (2015) conducted a nationwide telephone survey to learn more about the broader practice of re-homing pets. They estimated 6.12 million households (6% of all pet-owning households) transfer pets every five years. Pets were most likely transferred to a friend or family member (37%), closely followed by being taken to a shelter (36%). Cats were more likely to be transferred to a shelter (40%) than dogs (35%) and less likely to be given to a friend or family member (30% cats vs. 41% dogs). Owners who relinquished a pet for a reason other than family issues were more likely to take it to a shelter. For respondents who rented, housing was the primary reason for relinquishment. Respondents with low incomes were significantly more likely to give up a pet for cost and housing issues rather than pet-related issues.

Many people seem to be using shelters as an alternative to veterinary medical hospitals for euthanizing old or sick pets (Kass et al. 2001). The authors argue that the number of old and seriously ill pets taken in by shelters overstates the magnitude of high intake levels and euthanasia rates because these animals should not be counted as contributing to the surplus of pets in the U.S.

Feral and release to wild. Free-roaming dogs and cats cause major public health and environmental problems and raise concerns for animal welfare (Slater 2001). Dogs have long been considered more of a problem than cats or other pets because dogs may form packs or threaten people, they are more apt to harass or kill livestock and big game animals, they are a well-known carrier of rabies, they are much more visible than cats, and they used to be more

numerous than cats. Under the common law, cats were considered to be harmless animals that were traditionally allowed to roam at large (Smith 2009). For these reasons, animal control laws have traditionally concentrated primarily on dogs.

However, the focus of these concerns has been upended in recent decades. Cats are now the most numerous pet in the U.S. and feral or free-roaming cats may be as abundant as those kept as pets. Cats also carry rabies, pose other unique threats to human health (e.g., toxoplasmosis), and kill billions of wild animals annually. Compared to dogs, feral and free-roaming cats are now the larger threat.

A feral cat is defined by Gosling et al. (2013) as "a cat that is unapproachable in its free-roaming environment and is capable of surviving with or without direct human intervention, and may additionally show fearful or defensive behaviour on human contact." Attempts have been made to better assess whether a cat is feral and, perhaps more importantly, its sociability to humans for the purposes of adoption (Slater et al. 2010, Slater et al. 2013, ASPCA 2017*a,b*).

Nationally, most people (81%) prefer to leave stray or feral cats in the wild rather than having them caught and euthanized (HSUS 2019*b*). This, however, is a false dichotomy. Most people would also rather not euthanize stray and feral dogs, but they don't let them run wild. Cats are being treated differently. For example, not only are most people opposed to reducing the number of feral and stray cats, 10-12% claim to feed them (HSUS 2019*b*), which is undoubtedly a low estimate due to social desirability bias (Psychology Concepts 2011-2017).

A survey of Ohio households found a much higher rate of feeding stray and feral cats (26%: Lord 2008). Lord found 79% of participants had seen free-roaming cats at least occasionally. Only 23% of the feeders had ever taken one to a veterinarian, and 23% also reported that at least one of the cats had produced a litter in the preceding year.

And yet, like dogs, cats – particularly free-roaming cats – cause conflict between neighbors. Ringgaard (2016) surveyed almost 2,000 people in Denmark and found that 71% of cat owners let their cats roam freely despite the fact that one-third of the respondents don't like cats. Researchers studying free-roaming cats in England found most pet cats frequent areas within 300 yards of their home (Derbyshire 2011). A cat's territorial marking behavior, using feces and urine, can be a serious source of dispute between neighbors.

In urban areas in Israel, higher densities of stray and feral cats are found in mixed commercial and residential districts compared with solely residential neighborhoods. Neighborhood socioeconomic status significantly influenced the frequency of unneutered cats and kitten density (Finkler et al. 2011). The authors believed cat management and cat welfare efforts could be improved by focusing on neighborhoods hosting higher cat densities, low neutering rates, and high kitten densities.

Researchers in Canada have observed a slightly different distribution pattern, with the highest densities of free-roaming cats in high-density, low-income residential neighborhoods that were farther from the woods (Flockhart et al. 2016, Hand 2019). The spatial distribution of free-roaming cats was dramatic and hot spots were obvious. In communities such as Guelph (Ontario) and Anchorage, nearby natural areas harbor predators that cats may learn to avoid (or be eaten).

The findings of these studies are not necessarily incompatible. Free-roaming cats often need shelter as well as food. Climate and weather constraints are important in determining an area's

suitability as cat habitat (e.g., Israel and Canada present different challenges), as is the density, design, condition, and human occupancy of structures.

Free-roaming cats are not easy to count because they aren't easy to see. Presently, the number of free-roaming cats in Anchorage can only be estimated using formulas based on communities in the Lower 48 states and southern Canada. If stray and feral cats are to be monitored in Anchorage, a promising method for estimating population size is the distance sampling model developed for urban cat sampling (Flockhart et al. 2016, Hand 2019). Camera trapping and capture-mark-recapture are both proven techniques used for estimating wildlife populations in nature areas (Bengsen et al. 2011, Elizondo and Loss 2016, Hansen et al. 2018). Camera trapping is being employed in the $1.5 million Cat Count in Washington, D.C., but would probably not be appropriate in urban areas because people would steal or disable the cameras. An accurate and precise estimate of cat numbers would better inform public decision-making and allow a reproducible measure of progress.

Rabbits, rats, ferrets and other pets. Other pets are not considered to be as problematic as loose, unlicensed or unvaccinated dogs and cats. However, as with cats, some of the biggest problems seem to stem from the urge to release these pets into the wild. Pet owners either believe some pets belong in the wild, they are unable to pass them on to another owner, or they are incapable of euthanizing them.

In Anchorage pet owners have dumped aquarium fish, turtles, rats, and rabbits into the wild (ADFG 2017). Goldfish and turtles probably don't survive long in this climate; however, the *Elodea canadensis* often used in freshwater aquariums has become an invasive plant in Alaska, and aquaria dumping is almost certainly how the exotic weed was introduced to Alaska's rivers and lakes (ADFG 2017). A comprehensive assessment of the biological and economic factors that influence the release of pet reptiles and amphibians found that the most common (and therefore least costly), larger bodied and long-lived pets were most likely to be released into the wild (Stringham and Lockwood 2018). These factors may also influence the release of mammalian pets such as dogs and cats, particularly those that are obtained at low or no cost.

Rats are listed as "deleterious exotic wildlife" in Alaska (5 AAC 92.990[a][52]) and may not be released into the wild (5 AAC 92.029[b]).

Dumping pet rats is problematic in the municipality because Anchorage is one of the few port cities in the world without robust populations of brown or roof rats (Fritts 2007, Combs et al. 2018). In fact, the city appears to have no established population of rats. At least some Anchorage residents have long been aware of the city's unique status and are adamant that the city remain rat free (National Research Council 1973:1046). But Anchorage may be one pregnant rat away from losing its unique status. Therefore, possessing, selling, and breeding rats is prohibited in Anchorage without a permit for scientific research or other purpose in the public interest (AMC 16.90.030). Only one permit has been issued – to the psychology department at the University of Alaska Anchorage (Fritts 2007). The permit allows students to adopt these rats after they are no longer needed in the laboratory; however, only one sex is permitted each year and all adopted rats must be taken to a home outside of Anchorage. No one knows how well enforced this provision is, but albino and hooded varieties of pet rats have been found in city parks and running loose at Anchorage International Airport (Associated Press 2003, Lee 2007).

Rabbits pose a similar problem because they are not a native species and they are likely to compete with or spread diseases to snowshoe hares. Rabbits are the third most popular

companion animal in the U.S., with estimated numbers ranging from 3-7 million over the past decade, according to APPA and AVMA surveys (House Rabbit Society 2014*a*). Shepherd (2008) estimated 6.2 million rabbits were kept as pets in the U.S., an increase of 1 million from 2001 to 2006. The number of feral rabbits almost certainly exceeds the number of pet rabbits because, even more than cat owners, rabbit owners seem to believe their exotic pets (pet rabbits are European rabbits) belong outdoors. Alaskans are no different. Many Anchorage, Eagle River and Chugiak neighborhoods support dozens of free-ranging rabbits, sometimes leading to complaints from the neighbors.

Because estimates of pet rabbits don't consider feral rabbits or even rabbits in shelters, which may be considerable, the number of pet rabbits exceeds the number raised for food in the U.S. (Grannis 2002).

Nationally, rabbits are the third most common pet to be surrendered to shelters (House Rabbit Society 2014*b*). In a study of four shelters in Massachusetts and Rhode Island, 23% of pet rabbits turned into shelters were euthanized, a much lower rate than cats or dogs (Cook and McCobb 2012). Most of the rabbits were surrendered by an owner (77%) and the adoption rate was 59-80%. Unlike cats, most of the rabbits (81%) were unaltered. Like surrendered cats, most rabbits are relinquished because their owners were moving, or because they were done taking care of them or there were too many in the household (Ledger 2010, Cook and McCobb 2012, Ulfsdotter 2013, Ellis et al. 2017).

There is some evidence that a large number of rabbits are purchased without much forethought (Ulfsdotter 2013), often around Easter (Daly 2017). Rabbits are seen as low-cost, low-maintenance "starter" pets for children (Daly 2017). When pet rabbits are relinquished it's most often to friends and family, rather than to a shelter (Ellis et al 2017). Of these studies, however, only Daly (2017) mentions release to the wild or abandonment as a likely outcome, suggesting that "family and friends" may sometimes be an untraceable euphemism for abandonment.

Other communities are experiencing growing populations of feral rabbits. In Vancouver, British Columbia, a population established a few years ago has grown to thousands of rabbits (Plana 2018). In Cannon Beach, Oregon, the local animal shelters and a rabbit rescue organization are saturated with rabbits and the city doesn't want to trap or kill them because they are popular with tourists (Associated Press 2018). Similarly, in Calgary, Alberta, Victoria, British Columbia, and Billings, Montana, feral rabbits have established populations and are increasing (Offin 2018, Doctorow 2010, Paterson 2018, Healy 2004).

Alaskan communities are not immune. Anchorage, Juneau, Valdez, Wasilla, Sitka, Fairbanks, and Soldotna have thriving colonies of feral rabbits (Campbell 2000, Gooch 2006, Shinohara 2010, DeGrave 2015, Disher 2009, Sayer 2017, Bliss 2018, Chomicz 2018, Associated Press 2005).

In an interesting parallel to what's happened with feral cats, feral rabbits are attracting a large and devoted following of volunteer caretakers. For example, Las Vegas has thousands of feral rabbits – no one has a clue just how many thousands – and thousands of people who feed and care for them (Giaimo 2017). Because of this, official actions to control the population have been ineffective. A contractor hired to remove at least 80% of the bunnies overrunning a mental health facility within six months caught only 258 rabbits. A few months later, the population had rebounded. In the meantime, although releasing rabbits into the wild is illegal and considered to be abandonment, various volunteers and groups are advocating for a trap-neuter-return policy.

Elsewhere, a national rabbit rescue organization wants us to call feral rabbits "community rabbits" and is looking for volunteers to establish multiple feeding stations (House Rabbit Society 2015). "Community rabbit situations are on the increase," the organization claims, "and rescue groups and shelters are strained to their limits with abandoned rabbits."

In Australia, a continent overrun with feral European rabbits, researchers have attempted to ascertain the proportion of females that must be sterilized before populations decline (Twigg and Williams 2002). Sterilizing 60-80% (the highest levels tested) only reduced the seasonal peak in rabbit abundance.

Like other introduced exotic pets, rabbits can carry diseases that might spread to wild relatives. The large and growing population of feral rabbits on Vancouver Island, British Columbia, has been racked by rabbit hemorrhagic disease, the first North American outbreak of the virus (Seal 2018). Although the virus had been previously found in several domesticated rabbits in the U.S., it had been eradicated (The Center for Food Security & Public Health 2016). Fortunately, snowshoe hares are reportedly unaffected by the virus.

The State of Alaska has classified feral rabbits as "deleterious exotic wildlife" (5 AAC 92.990[a][52]) and prohibits their release into the wild (5 AAC 92.029[b]).

Ferrets – because they are weasels domesticated as a hunting aid – are thought by some to pose a threat to wildlife if released into the wild. Nevertheless, people are allowed to own ferrets as pets in 48 states (only Hawaii and California prohibit ferrets; Luna 2017). Nationally, an estimated 748,000 ferrets are owned by 334,000 households (AVMA 2012), but this estimate is almost certainly low. California has outlawed ferrets since 1933. Some estimate as many as 100,000 to 500,000 ferrets are kept as pets in California despite the law. Certainly there are more pet ferrets than most people realize. For instance, when Michigan reversed its prohibition on owning ferrets in the 1990s, the number claimed as pets jumped to 200,000 overnight (Umbach 1997). Umbach's (1997) summary of issues and options noted that ferrets were more likely to be prey than predator in the wild, and would not survive more than about three days in the wild according to one source, although he stretched that to a few weeks just to be safe.

Despite their fierce reputation, ferrets do not seem to pose a significant problem to native wildlife. Based on a survey of multiple state and county officials from a wide array of natural and agricultural agencies, Lepe et al. (2017) found less than one sighting of a feral ferret per year, with no discernable impact on wildlife noted. Indeed, people who defend ferrets as pets point to domestic cats as an example of a pet that actually constitutes a substantive threat to wildlife, and yet cats are allowed in all 50 states with few restrictions (Herman 2000).

Fish and Game regulations have a low threshold for "feral." Swine, ferrets and nonindigenous gallinaceous birds (e.g., turkeys, chickens, pheasants) are considered feral "if the animal is not under direct control of the owner, including being confined in a cage or other physical structure, or being restrained on a leash" (5 AAC 92.029[d][1]). However, somewhat surprisingly, the much more abundant and problematic free-ranging domestic cats and rabbits are not included in the state's definition.

Legal liability. The domestic cat and its wild ancestor are not native to North America. Christopher Columbus may have brought cats to the western hemisphere in 1492 (Zielinski 2009). They were certainly transported to North America by the early colonists. In fact, the earliest known Europeans to colonize North America, the Norse who established a short-lived settlement in Newfoundland in about 1000 AD, were well acquainted with cats and carried them

aboard their boats for pest control (Solly 2018). But cats were not welcome as indoor pets until the 1960s, about a decade after the invention of kitty litter (Alley Cat Allies 2017*a*). Kitty litter became a multi-billion dollar industry because it accommodated indoor cats. Perhaps because the tidal wave of felinity is of relatively recent origin, most states and local jurisdictions have not adopted specific laws for cats as they have for dogs (Smith 2009).

This avoidance behavior can be taken to ridiculous lengths. Maine, for example, does not include cats in the definition of "animal" under its animal trespass statutes (Wisch 2005). Oregon's definition of "exotic" animals includes wolves and bears – endemic species before being wiped out – but specifically exempts domestic dogs and cats (Gorman and Levy 2004). Colorado defines domestic cats as "companion animals," thus exempting cats from the list of "domestic or exotic wildlife" that may be considered public nuisances under tort law (Gorman and Levy 2004).

Great Britain, the origin of much of our common law, takes feline privilege a step further. Cats are not defined as domestic animals by British law; thus cats have the "right to roam" (In Brief undated, Nurse and Ryland 2013, Crowley et al. 2019). Owners have a common law duty to take reasonable steps to ensure their cats do not cause damage to someone's property or injure anyone, but cats cannot trespass in the legal sense. Therefore, owners cannot be held accountable for where their cats go. Furthermore, a person cannot do anything to harm a cat, and taking a free-roaming cat from its owner – by capturing it and transporting it to a shelter, for instance – is tantamount to theft.

It gets worse. Under the United Kingdom's Animal Welfare Acts a cat owner could be cited for keeping his or her cat indoors all the time because it denies a cat "the ability to exhibit its natural behaviours and the opportunity to properly express itself" (Nurse and Ryland 2013). In a "plain English guide" of their 2013 analysis of British laws regarding cat welfare, Nurse and Ryland (2014) claimed that a cat "cannot realistically be fenced in."

Despite this legalistic arm waving, cats can be fenced in and, more to the point perhaps, it doesn't seem to impair their long-term quality of life. An experiment that placed shock collars on some cats for over a year while allowing others to roam free found that the cats quickly learned to associate the audio warning cue on their collar with an electric barrier and that they were seemingly unfazed by the experience (Kasbaoui et al. 2016).

All states require some sort of licensing for dogs. Only Rhode Island requires cats to be licensed (Wisch 2005). Overall, state legislatures appear highly reluctant to license cats (Wisch 2005). However, many local jurisdictions require owners to license cats as well as dogs. In Anchorage we need to look no farther than the Matanuska-Susitna Borough (Mat-Su Animal Shelter undated). Perversely, feral cat advocacy groups like Alley Cat Allies oppose cat licensing because so few unlicensed cats are reclaimed (Alley Cat Allies undated *b*).

While local laws imposing strict liability for harm caused by one's domestic animal exist, they are usually applied to dogs (LaCroix 2006). Thus, "although the owner of a domestic cat has an absolute property right in the cat, he is absolutely not liable for what the cat does, because cats are not considered dangerous" (LaCroix 2006). Obviously this exception in common law, reflecting the historically limited perspective that cats do little harm, is ignorant of the environmental damage cats inflict on wild animals and feline diseases such as toxoplasmosis that kill both humans and other animals.

Dog licensing is important not only as a mark of ownership, but for ensuring that rabies vaccinations are renewed. Many jurisdictions, like Anchorage, require a dog owner to present evidence of a current vaccination before a license may be issued. Because cats are often not required to be licensed, much less wear a collar, identifying the vaccination status of a cat requires a law enforcement officer to ask for paperwork from the owner, if one can be found.

Complicating the matter, tort law considers cats to be in the same class as bees because they are "so unlikely to do harm if left to themselves and so incapable of constant control if the purpose for which it is proper to keep them is to be satisfied" (Restatement [Second] of Torts, cited by Gorman and Levy 2004). Thus, according to Gorman and Levy (2004) "absent extreme circumstances, individuals would not be liable under tort law for harm caused by cats." Similarly, the Restatement (Second) of Torts appears to lend support to the argument that feral cat caretakers are not liable for trespass of their free-roaming charges (Smith 2009).

Thus, the management of pets, particularly cats, is largely left to local governments. Local ordinances that prohibit free-roaming cats and include caretakers of feral and stray cats in the definition of owners may supersede tort law (Smith 2009). Increasingly, local governments are passing ordinances to control (or, conversely, to support) feral cats. Unfortunately, local ordinances are not necessarily based on the best available scientific evidence but on public opinion (Gorman and Levy 2004, Deak et al. 2019).

While responsibility and care for pets is well defined in local and state laws, as well as common law, most jurisdictions have no laws governing the care and ownership of feral and stray cats (Fry 2010). Anchorage is no exception. Fry (2010) argues that people do not generally "possess" a feral cat because they don't typically care where it spends most of its time, they rarely try to confine it, and their interactions are often limited to providing the animal with food or water. This limited relationship, however, could just as easily describe the "adoption" of a stray cat, so-called "barn cats," or even some indoor-outdoor pet cats. More proactive than most jurisdictions – up to a point – Kern County, California, considers an "owner" to be "any person who owns, possesses, controls, keeps, cares for, harbors or has custody of the animal for fifteen (15) or more consecutive days, except for feral cat caretakers, a veterinarian or an operator of a grooming shop, a kennel or a pet shop engaged in the regular practice of this business" (LaCroix 2006). The exception for feral cat caretakers is an example of the nonsense perpetrated by the feral cat lobby. Why not exempt feral dog caretakers while you're at it?

In the absence of specific laws, a legal sliding-scale is likely to apply wherein a person who has fed and cared for a feral cat for years is more likely to be considered its owner than someone who has only fed the cat for several days or weeks (Fry 2010), unless a local ordinance specifies otherwise.

Several states and local jurisdictions have enacted laws that define ownership of feral cats (Fry 2010). Delaware and Maine consider anyone who controls or feeds a feral cat for three or seven days, respectively, its owner. In Rhode Island a person becomes the owner of a feral cat if he or she allows the cat to remain on or be fed on their property.

Local jurisdictions are expected to define liability. However, relevant legal cases are almost nonexistent, so there is little or no precedent for determining liability in the event of damage or injury.

It is likely, however, that in jurisdictions like Anchorage with no local ordinances assigning ownership for feral cats, courts and juries may be unwilling to afford protection to feral cats or

assign responsibility to their caretakers (Fry 2010). There are several Alaska state laws that may be relevant. For example, state law prohibits releasing cats into the wild, which renders trap-neuter-release programs illegal. Alaska law also prohibits feeding a specified list of wild predators and "deleterious exotic species," including mice, rats and pigeons, all of which would consume food left outside for feral cats. Both intentional and negligent feeding are prohibited.

In jurisdictions where the caretaker of a feral cat is considered its owner, that person may be subject to tort liability for nuisance claims (Fry 2010). An owner of a cat may be liable to a nuisance claim when their cat habitually defecates or urinates in the plaintiff's yard. A California court ruled in favor of plaintiffs who alleged that uncovered trash in a neighbor's yard was causing a large number of cats to be attracted into the plaintiffs' yard, thereby interfering with the plaintiffs' use and enjoyment of their property.

In damage suits the key question is whether the owner has a duty to control the cat's behavior and if the damages caused by the cat were reasonably foreseeable (Fry 2010).

It's possible that a caretaker of a feral cat may be exposed to criminal liability for neglect and abandonment if, at some point, he or she ceases to care for the animal (Fry 2010). The possibility of criminal penalties, if known, could serve as a significant deterrent to potential caretakers of feral and stray cats.

National law may also be used to ameliorate the environmental impacts of domestic and feral cats (Hatley 2003, LaCroix 2006). Gorman and Levy (2004) considered the federal Endangered Species Act (ESA) the "ideal candidate" for controlling feral cats. The ESA has been invoked for the eradication of cats on islands but not on the mainland, where eradication would be more difficult and expensive. However, public opinion is also a factor (Deak et al. 2019). Agencies have encountered significant opposition to controlling feral species, like wild horses and burros, when trying to protect native species pursuant to the ESA.

The federal Migratory Bird Treaty Act used to be considered a potential weapon in the fight against cat predation on wild birds (Hatley 2003, Jorjani 2017); however, a recent opinion issued by U.S. Department of the Interior's Office of the Solicitor ruled that the MBTA does not prohibit incidental, accidental or even foreseeable taking or killing of migratory birds unless the take is hunting related (Jorjani 2017). Thus, cat predation is to be considered no more a violation of the MBTA than other foreseeable events like collisions with windows, vehicles, transmission lines, or wind turbine blades.

But all of these structures and devices are integral to modern society. No one expects people to board up all their windows or stop driving vehicles. In contrast, as valuable as they are for companionship and mental health, pets, particularly pets allowed to roam at will, are not necessary. The choice to own a pet – dog, cat, whatever – should entail responsibility to avoid all reasonably foreseeable impacts on the environment.

If only "direct and affirmable purposeful actions" can be violations of the MBTA, then what about cat owners who own a "barn cat" whose *raison d'etat* is to indiscriminately kill birds and mammals, who brag about the hunting prowess of their indoor-outdoor cat or post pictures of their cat's prey items on YouTube and other social media, or who make no attempt to scare a bird away before their cat pounces (fibermaven 2009, BigJoe Kasulis 2013, Hagel 2015, Bond 2016). No one brags about killing birds with their windows or vehicles, and electrical utilities don't brag about killing birds with transmission lines, towers or wind turbines. "Reasonable" precautions should include keeping cats indoors or otherwise under control, or not owning a cat

in the first place. Certainly, abandoning a cat or releasing a cat into the wild presupposes that the cat will prey on wild birds. Everyone knows feral and free-roaming cats kill birds and, in a perverse sense, that predation is "hunting related."

Public expectations, attitudes, opinions and knowledge

A considerable amount of research has explored the attitudes, opinions, and knowledge of pet owners. The expectations and other characteristics of domestic and feral cat proponents – compared to dog owners, conservationists, and the general public – are relevant to the issue of outdoor cats.

Acquisition. Appearance and breed are among the most consistently cited characteristics in selecting a dog; however, the animal's behavior and temperament, size, breed, age, coat color, health, cost, compatibility with owner lifestyle, previous experience, and whether it is purebred, neutered or intact also appear to be important (Bir et al. 2017, Bir et al. 2018). Women were more likely than men to believe dogs should be adopted from a shelter or rescue organization, but a person's age, income, education, and region of residence also played a role (Bir et al. 2017). Social desirability bias may be at play, however, and people may indicate a preference for appearance and breed based on what is currently popular or socially acceptable (Bir et al. 2018).

Dogs and cats are obtained differently, according to a survey conducted by the American Pet Products Association in 2015-2016 (Table 4, ASPCA 2018).

Table 4. Sources from which Americans obtain pet dogs and cats (ASPCA 2018).

Source	Dogs	Cats
Breeder	34	3
Animal shelter/rescue organization	23	31
Friends/relatives	20	28
Other person	12	6
Stray	6	27

The differences between dogs and cats is striking, particularly the proportion obtained from breeders vs. strays. A previous survey by APPA found 35% of cats were acquired as strays in 2012.

Another recent, nationwide survey found different proportions (Weiss et al. 2015). For dogs, 27% were obtained from a friend/relative/neighbor, 23% from a breeder, and 17% from a shelter. For cats, 28% were obtained from a friend/relative/neighbor, 24% from strays, and 18% from a shelter. Although the figures are different, with the biggest discrepancies in the proportions obtained at shelters, these categories include the top reasons in both national surveys. Notably, a much larger proportion of cats than dogs were "re-gifted" in the sense that they were previously owned and often free, although many shelters require new owners to pay for neutering.

The NCPPSP estimates about 65% of pet owners acquire their pets free or at low cost. According to the APPA (2017), friends and relatives are among the most common sources for a pet dog (25%) and cat (26%). However, dogs are more likely than cats to be obtained from a

breeder (25% vs. 4%) or private party (10% vs. 6%). Cats are more likely than dogs to be obtained as a stray (32% vs. 4%) or from a shelter or humane organization (28% vs. 22%), or are bred at home (6% vs. 1%). Relatively few dogs (14%) or cats (11%) are purchased from an independent pet store or chain.

There is a growing appeal for adopting dogs from shelters and rescue organizations, which is likely the result of decades of public information and education campaigns (Bir et al. 2017).

Some people want to own a distinct breed of dog or cat, while others are happy sharing their home with mixed breeds. Whether a pet is purebred or not appears to be much less of a concern among cat fanciers because most cats are mixed breed.

Nationally, about 25% of dogs (HSUS 2019*b*) and 8% of cats (Scarlett et al. 1999) in shelters are purebred. Relatively few pet cats are purebred. Approximately 7.5% and 10% of cats brought into private veterinary clinics in the U.S. (Lund et al. 1999) and Great Britain (Sánchez-Vizcaíno et al. 2017) are purebred; however, these figures may be higher than the general population due to a greater likelihood of owners seeking medical treatment for purebred cats. Perhaps a better estimate, albeit one without a good source, is that only about 2% of all cats in the U.S. are purebred (Anonymous 2018). The American Humane Association (2012) estimated that only 5% of the pet cats in the U.S. are not domestic shorthairs, the most common but not the only variety of mixed breed cat.

Many cities and counties, particularly in California, regulate the sale of dogs and cats by pet stores. In 2017, California became the first state to require that all dogs, cats, and rabbits sold in pet stores be rescued pets (Fortin 2017). People may still purchase pets from breeders, but after January 2019 a pet store may only sell these animals if they are from a rescue organization or shelter. This law was opposed by the American Kennel Club (AKC) and others (Guidry 2017) on the grounds that it will replace a pet supply that is currently regulated and inspected with sources that are unregulated and uninspected (i.e., shelters and rescue organizations).

One of the most common municipal pet laws is a limitation on the number of pets in a household, and it's becoming more common (Wisch 2004). For example, Los Angeles allows three dogs or cats per household (Hall 2013). The city is considering raising the limit on cats to five. A similar proposal to raise the limit on dogs to five failed several years earlier. No one knows how many cats are in Los Angeles or how many cats are kept in the average household because cats aren't required to be licensed.

These ordinances often become contentious because many pet owners believe they are capable of caring for more pets and object to such restrictions (Howle 2004, Miller 2010). Ordinances may restrict the number of pets based on whether the property is single-family or multi-family (Wisch 2004). Ordinances that attempt to limit numbers of pets based on size, rather than simply the number, may face difficulty. Nationally, households with more than one cat own an average of 3.7 cats (APPA 2009-2010). Apparently, people who own cats tend to own a lot of them.

Owner personalities and expectations. More pet owners are single females or married, younger, Caucasian, live in a house, live in more rural areas and belong to households where everyone is employed full time. Their General Health measure is higher and average BMI is lower. However, pet ownership involves trade-offs. For example, rates of asthma are higher (Saunders et al. 2017). People who owned a cat were more likely than dog owners to be

female, Caucasian and have asthma. These findings are correlations, not necessarily cause-and-effect; therefore, some of the health-related findings may be due to other socio-demographic factors (Saunders et al. 2017).

Our choice of a pet appears to be reflected in our gender and political preferences, down to the very core of our personalities (Kidd and Kidd 1980, Haslam and Alba 2014) and moods. For instance, women and liberals tend to prefer cats as pets while men and conservatives tend to prefer dogs. Haslam and Alba (2014) believe that our choice boils down to our "social dominance orientation," with men and conservatives often preferring a pet that follows orders. Dog owners tend to be happier than cat owners and are more likely to be married and own a home (Petter 2019). In fact, dog owners score higher on all aspects of wellbeing compared with cat owners, and differ on the Big Five personality traits, emotion regulation strategies, and need satisfaction (Bao and Schreer 2016).

Female cat owners have more intense relationships with their cats than male owners (Wedl et al. 2011). Cats influence human moods only by decreasing negative moods, not by increasing positive moods (Turner et al. 2003).

While dogs and other pets can trigger flights of fancy in their owners, cat owners seem to be more inspired than most. Exhibit A: the millions of cute and silly cat videos posted on YouTube, Facebook, Instagram and other social media forums. Abigail Tucker, author of The Lion in the Living Room: How House Cats Tamed Us and Took Over the World, a New York Times bestseller, is not unusual when she explains why cats are special. "Cats," she believes, "look uncannily like us … Even better, they look like our infants" (Tucker 2016).

The point is not to make fun of or vilify one or the other. It's important to realize that, for whatever reason, many people identify with or appreciate cats more than dogs and vise versa. One pet is unlikely to be a suitable substitute for the other (Menchetti et al. 2018).

People who own dogs and cats believe they have different personalities, and they ascribe these traits to other dog and cat owners (Perrine and Osbourne 2015). Dog owners tend to rank higher (and rank other dog owners higher) in extraversion, agreeableness and conscientiousness, while cat owners rank higher in neuroticism and openness to new ideas (Gosling et al. 2010). A tangible example of this was demonstrated by comparing two new-age data sets – Facebook posts from 72,559 people and profile images of 62,338 Twitter users – with corresponding age, gender and personality scores (Preotiuc 2016). Both data sets strengthened the findings from previous studies that cat people are more neurotic and open to experience, while dog people are more conscientious, extraverted and agreeable.

People with dogs and cats in the same household ascribe similar personality differences to their pets (Menchetti et al. 2018).

Humans seem to have more empathy for unfamiliar dogs than people, according to two recent studies (Hosie 2017). One asked participants if they would donate "about $10" to "save Harrison from a slow, painful death," while the other described an attack "with a baseball bat by an unknown assailant." Participants were more likely to donate money and be more sympathetic to the victim of the attack when it was a dog vs. a person.

Level of attachment. Most people are emotionally attached to their pets. Among people who have children and own a pet, 85% carry photos of their children in their wallet and 49% carry photos of their pets (Anonymous 2012).

As a group, cat owners may be slightly less attached to their pets, in part because of the high proportion of cats obtained as strays. Over 90% of dog and cat owners from all acquisition categories expressed high levels of attachment compared to only 85% of owners of cats acquired as strays (Freiwald et al. 2014). A major factor may be the false impression of cat owners and the general public that cats, because they are instinctive hunters, belong "in the wild." Consequently, the outdoor exploits and behaviors of cats are not as carefully controlled as dogs and there is less peer pressure to do so (Shinohara 2005).

Or cat owners may reflect the traits of their pet. Many dogs show signs of separation anxiety when their owner is not present. This is not among a dog's most attractive characteristics, and it may be related to the pack instinct. Cats are different. In one experiment cats showed no sign of separation anxiety (Potter and Mills 2015). Cats may be more vocal when their owner is not present; however, researchers have hypothesized that this is a sign of frustration, not distress (Knapton 2015).

Knowledge of pet characteristics and behavior. Many pet owners lack basic knowledge to prevent accidental litters or provide basic health care (Ramón et al. 2010, Welsh et al. 2014). This applies to human health as well. Pet owners recognized the human health risk of only half of a list of 11 infectious zoonotic pathogens carried by pets (Stull et al. 2012). Despite the high frequency of cat and dog bites and scratches every year in pet-owning (36%) and non-pet-owning (10%) households, pet-owning households with individuals at higher risk from an infection from a bite or scratch – very young, elderly and immunosuppressed – are no more knowledgeable about pet-associated disease risks than other households, with or without pets. In fact, households with individuals at higher risk were almost as likely to own a pet (55%) than the average household (64%) in this study (Stull et al. 2012).

As a group, cat owners appear to be less knowledgeable than the public regarding the impacts of cats on the environment (Peterson et al. 2012, Metych-Wiley 2014).

Pet care. Owning a dog, cat, even a rabbit costs more than most people think (McWhinney 2009, Guzman 2017). The ASPCA (undated) has broken down the annual cost of caring for several popular pets. Litter bumps up the cost of caring for cats, rabbits, ferrets and guinea pigs. Dogs don't necessarily require health insurance, crates, training classes or professional grooming. Subtracting those annual expenses, a cat costs about the same as a medium-sized dog, a little more than $1,000 for the first year and less in subsequent years, after the pet has been spayed or neutered. Other pets can also be surprisingly expensive. A rabbit costs about $800 and a ferret about $600 the first year and about $480 and $570, respectively, after that. Another estimate found the average lifetime cost of owning a dog ranges from $5,980 for small dogs to $7,800 for large dogs (Sisolak 2016). The lifetime cost of owning an indoor cat ($7,640) is close to that of a large dog because cats live longer and litter can be more expensive than cat food.

Dog owners take their pets to the veterinarian more often (2.7 vs. 2.2 visits in past 12 months) and spend more on their pets than cat owners in almost every category of pet-related and health-related expenses (McWhinney 2009, APPA 2017).

Cat owners are less likely to take their pet to a veterinarian for vaccinations or an annual exam than dog owners (Freiwald et al. 2014). Shelter-acquired cats were more likely to have been taken to a veterinarian than cats obtained as strays. Outdoor-only cats are less likely to have been taken to a veterinarian than other pet cats (Ramón et al. 2010). Dog owners claim they

would be willing to spend at least $7,000 more to save their pet from a life-threatening illness or disease than cat owners (i.e., $10,725 vs. $3,454), while people who own both a dog and a cat claim they'd spend over $10,000 to save either pet (Brown 2017). The average cost of health insurance for dogs is nearly twice as high as it is for cats, according to a survey of the 11 top pet insurance agencies, even though the average claims for the top ten ailments are slightly higher for cats than dogs ($267 vs. $253; ValuePenguin 2018).

Dog owners walk 870 miles per year or more than 21 miles per week, on average, while non-pet owners average less than 14 miles per week (Francis 2019). Not only do dog owners report walking more than before they owned their dog, 23% believe that their pet has made them more sociable and 16% feel more connected to the community (Francis 2019).

Our sense of smell is rudimentary compared to many mammalian species; however, odors trigger emotions and memories buried deep in the brain. It is interesting in this regard that psychologists have found that dog owners are much more capable of identifying their pet by smell than cat owners (Wells and Hepper 2000, Courtney and Wells 2002). As the researchers pointed out, this may be due to the stronger odor of dogs.

For these and other reasons, experts believe cats are not valued as much as dogs by their owners (New and Kelch 2004, Perrin 2009, Stavisky 2014), a sentiment reflected in the public at large (Associated Press 2010, Dell'Amore 2013). A nationwide telephone survey found 74% of adults liked dogs a lot, but only 41% liked cats a lot (2% disliked dogs a lot, 15% disliked cats a lot; GfK Roper 2009). Notwithstanding the preponderance of cute and crazy cat photos and videos, dogs may even be more popular than cats on social media (Phillips 2018).

But you'd be hard pressed to find a cat aficionado who agreed with this assessment. Taking it to an extreme, an influential cat lover named Robert Mercer claims cats are more valuable than people on welfare because, he believes, a human has no inherent value, being only worth what he or she can earn, but a cat is valuable because watching them provides pleasure (Wiener 2017). Needless to say, Mercer is a billionaire.

Environmental concerns. Most people don't give much thought to environmental issues on a day-to-day basis. Two groups who are very concerned about the effects of humans on wildlife are conservationists and those with concerns about animal welfare. Instead of cooperating, though, these two groups have very different perspectives and are more often at odds with one another. Often the difference boils down to a desire to protect individual animals versus a broader concern to maintain species and environmental functions and values.

For instance, in British Columbia the two groups were asked to take a wildlife values survey by ranking the level of perceived harm caused by 12 human activities on a scale of 1-7 (Dubois and Fraser 2013). The selected activities were all known to have substantial, yet different, direct or indirect effects on wild animals and populations. The rankings (with 1 perceived as the most harmful activity and 12 the least harmful) were highly consistent across all groups, as follows:

1. Urban development
2. Pollution
3. Resource development
4. Agriculture
5. Poaching
6. Pest control

7. Pet trade
8. Road/railroad kill
9. Window strikes
10. Sport hunting
11. Cat predation
12. Relocation

However, there were some significant differences related to cat predation. Urban residents scored most activities to be slightly more harmful than rural residents, except for cat predation (and road/railroad kill), which rural residents consistently believed were more harmful than the urban residents did. "Low engagement" individuals rated all activities as more harmful than did "high engagement" individuals, except for cat predation.

This study asked participants to rate perceived threats. The low ranking for cat predation almost certainly reflects, in large part, a lack of knowledge on the real impacts. For example, Loss and Marra (2017) compared estimates of window strikes with cat predation and found cats were far more destructive. Similarly, while vehicles and trains kill many millions of wild animals annually, they don't kill as many as cats. Sport hunting, poaching and pet trade are often demonized, frequently for good reasons, by people who are concerned about animal welfare, but those activities kill (or remove from natural habitat) far fewer wild animals than cats. Participants with a strong animal welfare orientation were the only group to rank cat predation last – even lower than relocation, which was defined as the capture and movement of wild animals from one location to another but some participants misunderstood to mean the spread of invasive species – although "low engagement" individuals were almost as unconcerned about cat predation relative to relocation. Thus, it's not really surprising that "low engagement" individuals ranked cat predation higher than "high engagement" individuals in both groups. "High engagement" individuals from both groups ranked cat predation higher than pet trade, pest control, window strikes, sport hunting, and relocation and nearly as high as road/train kill and poaching. In other words, "high engagement" individuals considered cat predation as one of the biggest threats to wildlife after the top four activities – urban development, pollution, resource development, and agriculture – that every user group agreed were the biggest threats.

Engaging one's mind is a precondition to changing one's mind. Many cat owners either don't know, don't care, or are unwilling to acknowledge the adverse impact of cats on wildlife (Crowley et al. 2019). In a national survey conducted by the American Bird Conservancy (2015), 35% of cat owners claim they keep cats indoors all the time and 31% most of the time. Of these, 68% keep cats indoors primarily for the safety and health of the cat. Yet nearly half of cat owners (47%) have seen their cats with captured animals.

While 41% of all survey respondents expressed concern about cats preying on wildlife, 53% of cat owners claimed to be concerned. But these claims may have suffered from social acceptability bias because the cat owners were responding to a survey conducted by a bird conservation organization. Other beliefs measured in the same survey were less reassuring. Although 70% of all respondents believed that cats, like dogs, should not be allowed to roam free, only 54% of cat owners felt this way. Twenty-three percent of cat owners had not neutered or spayed their cats (39% said it was not necessary, 16% hadn't gotten around to it, and 14% thought it was too expensive). Notably, 30% of those owning primarily outdoor cats had not sterilized them. And even these responses may have been skewed by social acceptability bias.

Not only do cat owners often fail to perceive or acknowledge the effect of their cats on wild birds, their opinions are not influenced by the number of prey animals their cats bring home

(McDonald et al. 2015, Hall et al. 2016). Most cat owners do not concede that cats are a problem or harmful to wildlife and are opposed to containment as a control measure, voicing opinions such as “but it’s nature,” “but other wildlife is harmful to wildlife,” and “my cat chooses for herself whether to stay in or go out” (McDonald et al. 2015).

Many cat owners are either in denial or extremely defensive about their cat’s predatory behavior. McDonald et al. (2015) found that 60% of cat owners disagreed that “domestic cats are harmful to wildlife,” 61% expressed unwillingness to “keep my cat on my property between sunset/sunrise,” 73% did not believe that “domestic cats killing wildlife is a serious problem,” and 98% were unwilling to “keep my cat on my property at all times.”

But it’s not solely denial or defensiveness; there is a critical difference in perception. Cat owners are more likely than others to believe that cats killing wildlife is not a problem (Hall et al. 2016, Crowley et al. 2019). Vegans and vegetarians are more likely to feed their dogs a vegetarian diet, but express less guilt about feeding their cats meat (Rothgerber 2015). Cat owners are less likely to be concerned about pet feces polluting surface water (Dabritz et al. 2006). Cat owners don’t like and rarely use collars (Slater et al. 2012, Crowley et al. 2019), ID tags, or microchips (Lord et al. 2007*a*, Lord 2008, Slater et al. 2012). Although collar-mounted anti-predation devices have proven somewhat effective at reducing bird predation (Nelson et al. 2005, Ruxton et al. 2006, Calver et al. 2007, Gordon et al. 2010, Willson et al. 2015, Hall et al. 2015), most owners don’t like those either (Calver et al. 2007, Thomas et al. 2012, Crowley et al. 2019). Cat owners are more likely to oppose licensing (Dabritz et al. 2006, Hall et al. 2016, Thomas et al. 2012) and compulsory sterilization (Thomas et al. 2012).

Research from Chile suggests that cats owned by irresponsible people – those that don’t register their cat or provide a litter box, for example – are more likely to hunt and kill wildlife than those owned by responsible people (Escobar-Aquirre et al. 2019). Thus, convincing pet owners to be more responsible in one problem area – or forcing compliance through peer pressure, regulation or enforcement – might result in the same owners becoming more sensitive or amenable to fixing other issues.

Even knowledgeable and responsible cat owners display a wide gap between beliefs and behavior. For example, a large set of presumably responsible cat owners were asked about their beliefs and behaviors in Australia (Elliott et al. 2019). The participants were deemed responsible owners partly because they were willing to participate in a survey of responsible ownership characteristics; however, some of their behaviors bore this out. Three-quarters of the owners reported that their cats had been neutered and a similar percentage reported their cats had been micro-chipped. Nevertheless, even though the majority of owners agreed that cats should be kept indoors at night (89%), only two-thirds of owners reported keeping their own cat indoors at night. This in a country – Australia – where most people claim to have a high degree of support for cat containment compared to other countries. The reason for their permissive behavior was explored in other cited research wherein cat owners were significantly more likely than non-owners to agree that cats should be allowed to express natural behaviors, such as hunting and roaming at night.

A similar study of responsible dog owners found them to be much more likely to behave responsibly (e.g., 98% reported confining their dogs); however, like cat owners, there was a gap between beliefs and behaviors (Rohlf et al. 2010). This study concluded that making compliance easy would encourage and facilitate responsible behavior, as does legislation that mandates proper care and control.

Knowing which sources of information are considered trustworthy can help inform how informational and educational materials are disseminated. To that end, Elliott et al. (2019) asked cat owners and non-cat owners who they trusted most for advice about cats. Veterinarians were the most trusted sources on cat care and management, followed by the Royal Society for the Prevention of Cruelty to Animals (RSPCA), an international humane organization. Friends, family and Internet searches were somewhat less trusted. Least trusted sources included social media and pet shops. Cat owners also accepted advice from cat shelters other than the RSPCA and, to a lesser extent, local government sources. A study of veterinary clients in the U.S. also found veterinarians to be the most trustworthy source of information on cat care and management, followed by other cat owners with similar issues, then family and friends and finally the Internet, although other researchers have reported a higher rate of reliance on the Internet and it is likely to grow in importance (Kogan et al. 2009). Thus, campaigns that work with local veterinarians, cat shelters, and local government officials are likely to reach a broader, more receptive audience. Furthermore, like most societal norms, peer pressure from other pet owners and even non-owners plays a large role in compliance and attitudes toward responsible pet management (Rohlf et al. 2010, Hall et al. 2016).

It goes without saying that most cat owners oppose euthanasia (Centonze and Levy 2002, Peterson et al. 2012, Wald et al. 2013, Lohr et al. 2014). Individuals who perceive negative impacts to wildlife from outdoor cats are more likely to consider the use of lethal control methods as humane (Wald and Jacobson 2014).

People who support maintaining "colonies" of outdoor cats are even more convinced that feral cats should be condoned and appreciated. In a nationwide survey comparing the beliefs and opinions of TNR advocates with professional conservationists, most of those in favor of TNR held beliefs that contradict existing scientific knowledge and common sense (Peterson et al. 2012). For example, the majority of TNR advocates agreed or disagreed with the following statements about cats:

- should be treated as protected wildlife (79% agreed [59% strongly])
- fill a natural role as predators (59% agreed, 23% unsure)
- are a reservoir for disease (86% disagreed [72% strongly])
- ONLY harm wildlife on islands (59% disagreed, 39% unsure)
- contribute to decline of native birds (60% disagreed)
- are eventually eliminated by TNR (69% agreed)
- colonies should be managed by euthanasia (99% disagreed)
- colonies should be managed using TNR (98% agreed)

The answers of professional conservationists were typically the polar opposite. Beliefs expressed by TNR advocates have also been shown to be at odds with wildlife managers with experience managing feral cats and the public at large (Lohr et al. 2014, Wald et al. 2016).

Cats are treated differently from dogs in many ways. Perhaps it all boils down to the "aura of self-sufficiency" that cats project (Tucker 2016, Taylor 2017, Crowley et al. 2019).

Support for free-roaming cats. That cats are great hunters is no exaggeration. However, their ability to control pests is largely unproven. Based on many anecdotal claims, a recent experiment hypothesized that the presence of cats could discourage rat and mouse activity around rural homesteads, while dogs could not (Mahlaba et al. 2017). The researchers found that on homesteads with only cats or only dogs, rodent activity was reduced, but not significantly. Only those homesteads with both cats and dogs experienced significant reductions in rodent activity. Cats and dogs differ in their hunting techniques and therefore

exert different selective pressures on rodent pests. So-called “barn cats” are unlikely to reduce populations of rats and mice, which seem to have developed innate and learned behaviors to avoid predation by cats or dogs operating independently.

A classic study from England, which looked at rats and cats on only four farms and a cottage, concluded that if at least four cats were released on a farm after the rats had been completely exterminated, “they will maintain the immediate area of the farm buildings rat-free” (Elton 1953). However, the cats “will not necessarily clear a farm of an existing rat infestation” and stacks of hay or other animal foods more than about 50 yards from the building occupied by cats continued to have rat infestations, often heavy ones.

In fact, there is some evidence that trained dogs, such as terriers that are known to kill four or five rats a minute in New York City, especially those that work in packs, can be more efficient at killing rats than cats (Engelhaupt 2017). The record holder for killing rats is a 13-pound terrier named Jacko. In the sport called rat-baiting a prescribed number of rats would be dumped into a small arena and the dog let loose. In the early 1860s Jacko killed 100 rats in 5 minutes and 28 seconds and 1,000 rats in less than 100 minutes (100 rats at a time). He once killed 60 rats in 2 minutes and 40 seconds – or a rat every 2.7 seconds (Various 2010, Wikipedia 2019). No cat could keep up. But no one is proposing that we release packs of terriers into the wild.

Conventional wisdom inflates the value of cats as vermin killers, while overlooking the role of feral cats as vermin in their own right. For example, the Occupational and Safety Health Administration (OSHA) recently removed feral cats from its list of vermin in its national shipyard standards (National Safety Council 2019). This was in response to more than 500 comments – almost half from a mass mailing campaign – in support of de-listing because classifying feral cats as vermin, they claimed, would lead to mistreatment and interfere with TNR programs. No consideration was given to disease transmission (e.g., toxoplasmosis) to shipyard workers or impacts on wild birds and mammals.

Is “vermin” too harsh a word to describe feral cats? The Merriam-Webster definition of “vermin” includes a) small common harmful or objectionable animals that are difficult to control, b) birds and mammals that prey on game, and c) animals that at a particular time and place compete (as for food) with humans or other animals. The Cambridge Dictionary defines “vermin” as small animals and insects that are harmful or annoying and are difficult to control. The word “vermin” was derived from the Anglo-French word of the same spelling meaning “noxious animals.”

Cat owners and “semi-owners” tend to support TNR and are unwilling or unable to recognize the downsides. Most caretakers of feral and stray cats also own pet cats (Zito et al. 2015). They typically acknowledge that feral cats are unadoptable; however, they still consider them pets (Centonze and Levy 2002). Zito et al. (2015) differentiated between casual feeders and semi-owners. Semi-owners do not believe they own the cat, but had interacted with the cat for at least a month and had fed the cat frequently. Semi-owners are more likely to sterilize free-roaming cats than those who interact casually; however, compared to people who owned actively or passively acquired cats, semi-owners were far less likely to confine “their” cats, take them to a veterinarian or provide external identification or a microchip, and they reported far more kittens being born.

Rather surprisingly, one study found that those feeding the most feral and stray cats tended to feed each cat less, on average, than those feeding fewer cats. Not enough food was provided in some instances to meet all of the cats’ daily energy requirement; therefore, cats fed by

"heavy" feeders often had to search for additional food sources in order to complete their daily dietary requirements (Gunther et al. 2016).

Supplemental feeding, a key component of TNR programs, increases the population density of free-ranging cats and may affect the prevalence of pathogens in urban animals by increasing aggregation and altering foraging strategies (Hwang et al. 2018).

Alley Cat Allies and other cat-centric organizations frequently publish misleading statements to promote the idea that feral and free-roaming cats are "normal" or "natural" (Lepczyk et al. 2010). For example, a "law and policy brief" on Alley Cat Allies' website claims that "The notion that cats belong only indoors or as 'owned' pets is contrary to the natural history of the *Felis catus* species, a species that has flourished outdoors for 8,000 to 10,000 years" (Chu and Anderson 2007). The same "brief" had no reservations about publishing the results of a nationwide telephone survey of 1,205 adults that included an oversample of 202 women, aged 40 and older, "because this is an important constituency for Alley Cat Allies." As the general public often does not have strong opinions regarding feral cats, they are particularly vulnerable to biased information and terminology (e.g., "community cats") provided by groups such as Alley Cat Allies (Wald et al. 2013).

Public opinions. Attempts to manage free-roaming pets, particularly cats, have often foundered on the reefs of public opinion (McLeod et al. 2019). Many polls and questionnaires have found that the public prefers non-lethal methods, including TNR, over lethal options (Loyd and Hernandez 2012, Wald et al. 2013, ABC 2015).

Some insight into this issue comes from an unexpected quarter. A national survey of people who donated to animal-related causes found that 12% of the U.S. population had given money to an animal-related cause in the past 12 months, while noting that a previous survey, in 2017, had found 13% had given money to those causes (Anderson 2019). Of those donors, 82% had given money to companion animal charities. Only 25% of the donors had contributed to wildlife-related causes, including for endangered species. To look at it another way nearly 82% of the donations aimed to protect dogs and cats (the most common and familiar pets), while 25% of the donations were to be split among tens of thousands of wild animal species, many of them threatened with extinction. The small proportion of donors to wildlife organizations can be partially explained, the author claims, by a lack of familiarity rather than the donors' lack of motivation. People who donate to animal-related causes are more likely to be vegan or vegetarian, to live with companion animals, and to go fishing regularly compared to the general public. Only 9% donate exclusively to animal-related causes. The vast majority have other interests, but a common connection seems to be vulnerability. For example, other causes supported strongly by donors included food banks, children's charities, and emergency relief efforts.

Feral cats are perceived by many as vulnerable. Why don't more people recognize the environmental damage inflicted on small wild animals by cats? Because wild animals killed and injured by cats aren't as familiar as one's companion animal. And most people tend to believe that cat predation is "natural." That's just what cats do. Other anthropogenic causes of death – like oil spills, communication towers, motor vehicles, and windows – are often cited as major human-caused problems by people defending cat predation.

Public opinion is being shaped by the debate on feral and free-ranging cats, particularly on the Internet and social networks. TNR advocates have attacked lethal control for decades and promoted TNR programs in hundreds of local jurisdictions, often by ignoring or criticizing

scientific evidence regarding the environmental impact of cats or the lack of proof that TNR works (Guttilla and Stapp 2010, Loss et al. 2018, Longcore 2019, Read 2019, Woinarski et al. 2019). TNR advocates frequently challenge scientific estimates of large numbers of feral cats, claiming instead that feral cat populations are declining based solely on windshield surveys and evidence that TNR programs often result in lower numbers of cats brought into shelters and lower euthanasia rates (Houser 2015). Obviously, fewer cats are brought to shelters when TNR caretakers are allowed to establish and maintain outdoor "colonies," and when fewer cats are brought in, fewer cats are euthanized. It's a self-fulfilling prophecy.

Loss and Marra (2018) have compared these disinformation campaigns to the obfuscation and denialism attending proposals to regulate serious threats to public health such as DDT, cigarette smoking, and climate change. In their perspective, prominent advocates of free-ranging cats, like Alley Cat Allies and Peter Wolf's Vox Felina blog, are "merchants of doubt" tantamount to the industries and special interests who cast doubt on consensus among the scientific community to prolong public controversy and hamstring necessary policy changes for decades.

Loss and Marra (2018) are not alone. Some environmental scientists have identified an increasing trend in denialism as advocates with a vested interest in opposing scientific consensus on a topic, such as the impacts of invasive species or the efficacy of TNR, minimize or deny the magnitude of an environmental threat (Russell and Blackburn 2017). This trend began in the popular press and social media – where it has increased exponentially since the 1990s – but is increasingly moving into scientific journals, a reflection of scientific uncertainty and underlying motives and values (Russell and Blackburn 2017, Ricciardi and Ryan 2018). Unlike normal scientific debates, which are evidence-based, deniers use rhetorical arguments to disregard, misrepresent or reject scientific evidence in order to cast doubt on researchers and their work (Ricciardi and Ryan 2018*a*, Ricciardi and Ryan 2018*b*).

Not surprisingly, some scientists and animal rights advocates have taken exception to being labeled science deniers (Lynn et al. 2019). However, in denying that advocates of free-ranging cats are deniers, these authors reinforce and compound the act of denial by claiming, among other things, that invasive species scientists have lost their "moral compass." Lynn et al. (2019) give greater or equal weight to "the harming of sentient, sapient, and social individuals, such as cats" than to the harm that cats do to other creatures. They insist that domestic cats have an "intrinsic value" in conservation. Finally, they claim that Loss and Marra (2018) are mistaken in equating individuals who advocate for free-ranging cats with corporate disinformation campaigns against tobacco or climate science. However, in doing so, they fail to acknowledge the encouragement, support and funding contributed by large corporate interests, such as the pet food industry and several large humane organizations, to those who deny that too many cats pose a serious problem.

Some TNR proponents are even opposed to objective population censusing (such as the camera trapping being conducted in Washington, D.C.) because they believe the program is "compiling a hit list" (Clifton 2018) and are "steadfastly and unwaveringly opposed" to any research that is willing to consider euthanasia as an option (Alley Cat Allies 2018).

Obviously, the way a message is framed can either confuscate or facilitate understanding and compliance. Despite the propaganda and denialism of TNR advocates, hundreds of studies have illustrated the adverse impacts of free-ranging cats. No studies have concluded cats are good for the environment. And yet, many cat owners and less-informed members of the public remain unconvinced. Some experts believe that while the risk of wildlife population declines caused by pet cats justifies precautionary action, campaigns based on wildlife protection alone

are unlikely to succeed outside of Australia or New Zealand, where cat impacts on unique native fauna are widely acknowledged (Wald and Jacobsen 2014).

In the United States simply providing individuals who strongly believe that cats do not pose a risk to wildlife with additional information about cats killing birds may not necessarily modify these beliefs, which are important predictors of attitudes toward cat management (Wald and Jacobson 2014). Restrictions on free-roaming cats benefit cats; thus, cat welfare (e.g., lowering risk of traffic accidents, poisoning, infectious diseases, fight-related injuries, and threats from wildlife) is a more acceptable rationale to most cat owners than environmental concerns (McDonald et al. 2015, Hall et al. 2016, Crowley et al. 2019).

Some evidence suggests that dog owners will respond to the same kind of message to increase compliance with leash laws (Jorgensen and Brown undated). Dog walkers are often aware of the leash law and at least some reasons why it is important, but because they are ambivalent they are more likely to respond to messages directed at influencing norms and perceived control, rather than just attempting to influence attitudes (Bowes et al. 2017). Personal contact through patrolling and enforcement in combination with outreach may be a more effective strategy. And appeals to responsible pet ownership, incentivizing compliance (e.g., by giving loose pets one free ride home), enlisting the help of local residents who don't own pets, and strict enforcement when other methods fail may be the best combination of all (National Canine Research Council 2016).

Other experts believe that changes in risk perception may result in behavioral change. Therefore, knowledge of and attitudes towards cat-related threats to wildlife and human diseases could be used to develop information/education programs to better inform cat owners and others (Gramza et al. 2016).

Rather than telling cat owners that their pets pose a problem with wildlife, researchers have discovered that involving cat owners in a study of their pets' movements led to changes in owner knowledge, attitudes, and behavior such as keeping the cat indoors more often, particularly at night (Roetman et al. 2018). Notably, the main reasons these owners gave for keeping cats indoors were to limit hunting and protect wildlife and other pets, to keep the cat safe, and because they didn't want it to roam as far as the radio-collars indicated.

In another study (McLeod et al. 2017), 512 cat owners in Australia who did not confine their cats were randomly assigned to view one of three short video messages: one framed to highlight the negative impact of cats' on wildlife and biodiversity (i.e., a wildlife protection perspective), one framed to highlight the health and safety benefits of keeping cats contained (i.e., a cat benefit perspective), and a control message focused on general information about cats (i.e., a neutral perspective). Mediation analysis revealed both the 'wildlife protection' and 'cat benefit' messages increased owners' motivation to contain their cats and their beliefs that they could effectively contain their cats to achieve the desired outcomes. In turn, higher levels of motivation and belief that containment would have a positive impact led to increased intention and adoption of cat containment. In addition, the effects of the 'cat benefit' message were strengthened by the cat owner's bond to their pet, suggesting audience segmentation may improve the effectiveness of interventions.

Polls that do not present realistic trade-offs that put management decisions in context may have limited value because the public is generally unaware of the magnitude of environmental impacts of free-roaming cats (Chu and Anderson 2007, Wald et al. 2013) or the costs and benefits associated with a wildlife management technique (Lohr et al. 2014). Presented with

such relevant information in the context of reducing feral cat populations, Hawaiian residents ranked lethal traps, sharpshooters, live capture with euthanasia, and TNR in that order, from best to worst options (Lohr et al. 2014). This was the opposite order that an uninformed audience would have chosen, based on other research.

Recognizing that owners, not pets, must be held accountable, Canadian communities are replacing old animal control ordinances with "responsible pet ownership" rules (Taylor 2017). Taylor (2017) suggests avoiding characterizing the problem as "cat overpopulation" because that puts cat owners on the defensive. Instead, he recommends more neutral labels such as "Cat Population Taskforce."

According to McLeod et al. (2019) the aim should be "to work with, not on, individuals, organizations and communities." In most cases, the authors argue, interventions should attempt to influence a small number of highly positive behaviors, which have a high probability of being adopted but are currently not practiced. McLeod et al. (2019) have even constructed a formula for ranking potential outcomes of interventions:

Total weighted impact =
effectiveness x (maximum possible penetration – observed penetration) x likelihood of adoption

The ranking of a preferred outcome depends in part on the targeted community and its interactions with other members of the community. In the example used by McLeod et al. (2019), 24-hour containment was considered the most effective intervention, primarily based on its effectiveness at achieved stated goals and its current low level of adoption. A much less effective strategy, keeping cats indoors only at night, was ranked second because it had a similarly abysmally low rate of adoption but a much higher likelihood of acceptance. Routine sterilization was ranked third because it was a very effective strategy with a high likelihood of adoption, even though it was already practiced by many cat owners. The other interventions considered – ID tags, limiting cat numbers, mandatory microchipping, and registration – were ranked from fourth to seventh, in that order, largely based on their relatively high likelihoods of adoption combined with moderate levels of penetration. This method of tailoring a strategy – which inevitably requires a commitment of funding, time and effort – to the particular circumstances and needs of a community seems to be a powerful tool.

The same data set can be displayed graphically (McLeod et al. 2019). This is an interesting and informative method, but perhaps less useful to decision-makers and the public than ranking strategies in order of most to least potential impact. These methods that depend on social science and psychology depend heavily on knowing the audience. Thus, they require qualitative and quantitative survey techniques such as questionnaires, interviews, and focus groups. Human behavior is subject to multiple drivers and barriers. Overlooking one or more can render an analysis of potential interventions worthless or at least less effective than it might have been (McLeod et al. 2019).

Yet another social science perspective believes that where there is a plethora of conflicting information, providing consumers with more information is not likely to be an effective strategy (McLeod et al. 2019). Debunking misinformation requires more than just passing out accurate information. For example, research has shown that merely mentioning a commonly held myth – in an effort to correct it – often reinforces that myth. Not everyone is a careful reader and our

preconceptions and past experience often blinds us to new information that contradicts what we already "know."

Public campaigns to improve consumers' ability to identify reliable information might prove promising (Vainio 2019). Becoming a discriminating consumer of information is something that we should have all learned in school. As adult decision-makers we are all caught in a crossfire of conflicting opinions and "alternative facts," particularly on controversial issues. But adult Americans are poor judges of whether a statement is fact or opinion and are more likely to consider both facts and opinions as "factual" when the statement appeals to their personal biases (Concha 2018). Only 14% of American 15-year-olds are able to reliably distinguish fact from opinion in reading tests (Johnson 2019). Schools might be the last, best hope for teaching most people how to distinguish reliable, factual sources from opinion and false leads. Unfortunately, many teachers don't know how to teach this, don't have the time or energy to deviate from their curricula, or don't want to be bothered. So maybe we have to start with the teachers. Obviously, this issue is of critical importance to all manner of private and public decisions, not just whether or not it's a good idea to let one's cat roam freely.

Any of these methods needs to be carefully applied and then scientifically evaluated to determine what worked and why (McLeod et al. 2019).

Public information and education. There has been a cultural shift in how pet owners relate to their pets, particularly in terms of responsibility and the perception that pets are part of the family (Rowan and Kartal 2018). This shift is most evident among dog owners. In the 1970s, when humane campaigns to address pet overpopulation started in the U.S., about 25% of the total dog population was believed to be free ranging. Today there are relatively few "street" dogs, and the euthanasia rate for dogs in shelters has dropped by more than 90% while the pet dog population has doubled. The percentage of owned dogs adopted from shelters and rescue groups has increased from 15% to over 35% during the past decade. The relative proportion of dogs adopted or purchased (i.e., a deliberate choice) has increased while the proportion acquired from an acquaintance or as a stray (i.e., often serendipitously) has dropped. The increase in dog owner responsibility is attributed to successful legislative, education, and sterilization efforts to control overpopulation by municipal authorities, veterinarians, and shelters.

Circumstantial evidence confirms this trend. Nationally, the relative level of personal spending on pets and related products climbed in the 1960s, leveled off from about 1970 to 2000, then began climbing again. Similarly, veterinary expenditures were stable until about 2000, then began to climb dramatically. In other words, both veterinary and pet product spending has been growing faster than general consumer spending since 2000, an indirect measure of a growing attachment to pets. Dogs are increasingly seen as indoor pets. One indicator is the percentage of dogs allowed to sleep indoors at night. Over half of pet dogs sleep in the owner's bed – the ultimate indoor experience – while less than 10% sleep outside. This trend may have been facilitated by the increasing proportion of small and medium-sized dogs. In fact, another study found that small dogs are much more likely to be allowed (or sneak) into their owners' beds than medium and large dogs and that 62% of cats sleep with their adult owners while another 13% sleep with children (Chomel and Sun 2011).

Adoptions have become a significant factor in reducing euthanasia of dogs and cats since about 2010 (Rowan and Kartal 2018). This trend is also attributed to national and local ad campaigns. Microchips for pet identification became available in the mid-1980s, but competition among microchip companies delayed their use in the U.S. Now microchips are widely available.

A combination of factors has markedly decreased shelter intake and euthanizations: sterilization, adoption, dog containment, and pet identification (through licensing compliance and microchipping). Individual and community levels of control over pet dogs have increased steadily from the 1970s to the present. The proportion of dogs allowed to roam free is negligible in most North American communities, although it can be noticeable in some urban and rural communities.

It is worth noting that, without this level of control, dogs would be just as big a problem as cats are today. In countries where registration, ID tags, vaccination, sterilization and public education are not required or enforcement is lax, dog populations are often controlled, if they are managed at all, by culling, and dog management is far from perfect (Smith et al. 2019).

Although cat intakes and euthanizations have benefited from increased rates of sterilization and adoption, cats are much less frequently contained or equipped with identification. It's long past time for cat owners to exhibit the same level of responsibility that we've come to expect from dog owners. As with dog owners, increasing the responsibility of cat owners will require laws, public education, and serious efforts to control overpopulation by municipal authorities, veterinarians, and shelters.

A counter-intuitive method for increasing adoption rates is to waive adoption fees (Crawford et al. 2017). The idea is controversial because conventional wisdom suggests that people who would avail themselves of a free pet might be less responsible owners. Crawford et al. (2017) tested this assumption at a shelter in Australia and found that the program was extremely popular. They observed no differences in the demographics between people receiving free cats and those paying fees, nor any differences in cat demographics, their fates after adoption, medical and behavioral issues, likelihood of using collars, registration, or allowing cats to roam freely. Thus, they believed that shelters should not shy away from occasional free adoption events, especially during overflow periods.

Municipal care and control

Animal control is a relatively new function of government. America's first animal rescue organization, the American Society for the Prevention of Cruelty to Animals (ASPCA) was founded in 1866. The first low-cost spay and neuter clinic was established in 1971 (Logan 2013). Local governments followed suit, but progress has been slow and is still evolving.

In many ways, dogs were the focus of the early laws and information efforts. Now, with cats outnumbering dogs as pets and the number of feral cats far outstripping feral dogs, the time has come to control free-roaming cats, particularly feral cats. Feral cat control is an "emerging issue" in municipal ordinances (Logan 2013). Several cities have enacted progressive ordinances, and model codes are available (Logan 2013).

Licensing. Licensing can reduce the number of stray and feral pets. A decade ago almost 40% of the stray cats trapped in the city of Calgary were euthanized. After mandatory cat licensing more than half of all impounded cats are returned to their owners, and only 10% are euthanized (Taylor 2017). One reason cat owners don't like licensing is their belief that cats don't like collars and the collars may cause injuries. Some cat owners are convinced that licensing facilitates are rounding up unlicensed cats and euthanizing them (Sawicki 2014). Conversely, several major humane organizations support cat licensing because it makes owners responsible for their pets and raises their value to society.

Opponents of cat licenses have been criticizing it as a "cat tax" for over a century (Forbush 1916, Smith 2009). Their arguments – that compliance is low, that revenues generated are insufficient to meet the expense, that people will avoid paying the fee by simply abandoning cats or surrendering them to shelters – could all be cited by dog owners as reasons to not license dogs. But we know from experience that dog licensing works.

Forbush (1916) coined the best rejoinder to those who claim that cat licensing won't work. "No one," he wrote, "is competent to pass upon the advisability or probable effect of cat license legislation until it has been tried and perfected in the light of experience."

Sterilization. Many local jurisdictions have enacted ordinances requiring sterilization of all dogs and cats within their jurisdiction, or upon adoption from a shelter. Breeders with a valid permit are usually exempted, which may entail an additional fee (Smith 2009). These ordinances have been less successful than originally envisioned because in some jurisdictions people who adopt an animal may pay a "neuter deposit" fee that is redeemable later upon submission of proof that the animal was indeed sterilized. Compliance with this requirement is low, probably no more than 50% (Smith 2009). Many adopters never attempt to redeem the deposit.

Enforcement. Compliance with dog regulations depends on the type of policy imposed, with stricter and more consistent restrictions resulting in fewer violations (Kellner et al. 2017). The researchers suggest that to maximize compliance with leash laws, consistent policies may be more effective than leash laws that vary over time, and dog owners may be more compliant if cat owners are also required to license and leash their pets. What's fair is fair. Additionally, it may be beneficial to increase enforcement at peak times for all trails, and at all times on trails where violations are more likely.

Dangerous animals. The true incidence of animal bites is unknown, because most bites are minor (an estimated 80%) or unreported (Garcia 1997). Anchorage is no exception. However, national figures are instructive. Dog bites account for 80-90% of reported animal bites in the U.S., or 1% of injury-related emergency department visits annually (Stephanopoulos et al. 2004, Ellis and Ellis 2014). The dog is usually known to the victim, often living in the household, and most bite victims are children.

Cat bites are the second most common type of mammalian bite, accounting for about 5-15% of all bites (Stephanopoulos et al. 2004). Others have estimated a higher bite rate for cats, approaching 20% of all mammalian bites (Patronek and Slavinski 2009, Harper 2018). A study of 11 geographically diverse urban emergency departments observed 75% of all animal bites were from dogs (an additional 5% were from police dogs) and 13% were from cats (Steele et al. 2007). Dogs are more likely to bite children, and cats are more likely to bite adults. Including scratches serious enough to be treated by a doctor, the injury rate attributable to cats may increase to 25% (Matter and Arbeitsgemeinschaft 1998). And the relative proportion is likely to have increased in the 20 years since that estimate because cats now outnumber dogs.

Cat bites and scratches are more likely to become infected than dog bites; 80% of cat bites versus 5% of dog bites become infected (Kim undated). Six percent of patients treated for cat bites ultimately require hospitalization, compared to 1% of dog bite victims (Stephanopoulos et al. 2004). Bites to the hand are more likely to become seriously infected. Babovic et al. (2014) found 30% of patients with cat bites to the hand were hospitalized, and the average length of stay was 3.2 days.

Injuries inflicted by pets may ultimately hurt people in less predictable ways. For example, depression was found in a high proportion of patients treated for cat bites (41%) and dog bites (29%) using a large electronic database (Hanauer et al. 2013). The probability of being diagnosed with depression at some point, if treated for a cat bite, was twice as high for women than men. This may be because women are more likely to own a cat, but no known causative link has been proposed to explain the association.

In a follow-up study using a general population, Flegr and Hodny (2016) confirmed the association with cat bites but found depression in women was five times more likely to be associated with cat scratching than biting, with the possible causal factor being infection by the bacteria that causes cat-scratch disease.

Public health. Dogs were the primary domestic carrier of rabies until the 1970s, when nearly universal vaccination programs and leash laws began to be promulgated and enforced in the United States and Canada. That hasn't happened with cats (Weise 2013). Approximately 250 rabid cats are reported in the U.S. annually, and the CDC estimates that 16% of people who undergo rabies treatment are exposed to the virus from cats. Human deaths from rabies are rare in the U.S., with only two or three per year, and no deaths have been linked to cats in decades. Yet increasing numbers of feral cats, many of them in urban and suburban TNR "colonies," has heightened the risk to public health.

Veterinarians working for the Centers for Disease Control and Prevention (CDC), including the chief of its rabies office, believe that TNR programs are ineffective at controlling feral cat populations or reducing public health concerns for rabies and other zoonotic diseases (Weise 2013, Roebling et al. 2014). The CDC has also warned people of new data suggesting that cat-scratch disease is more dangerous than most people realize (Kim 2016). About 40% of cats carry the bacterium that causes the illness at some point in their lives, and free-ranging cats may be more likely to be infected. The American Association of Wildlife Veterinarians also supports banning and eliminating feral cat "colonies" on public lands managed for natural resources and discouraging "colonies" on private lands (AAWV 1996).

Predictably, avid proponents of feral cats and TNR have attacked Roebling and her co-authors, insisting that the CDC itself has no official policy on TNR (Best Friends Animal Society 2013, Holm 2015, Wolf 2016). However, in 2017 the CDC website recommended that food and water not be provided outdoors for pets (CDC 2017*a*), and the CDC still recommends that cats and ferrets be kept indoors (CDC 2017*a*, 2019). In other words, the CDC does not support outdoor cat "colonies."

Costs. The cost of animal control varies from jurisdiction to jurisdiction and depends partly on the size of the pet population, regulations, and level of enforcement. While it may not be productive to compare costs between jurisdictions, several attempts have been made to compare the relative cost of TNR versus removal.

John Dunham and Associates, Inc. (2010) estimated the cost of eradicating feral cats nationwide at about $15,749,145,000 versus $13,999,240,000 for trapping, neutering, vaccinating and releasing every cat.

That analysis, prepared for an organization that supports TNR, was flawed in numerous ways. The analysis assumed that the cost of trapping cats would be the same whether the cats were euthanized or released. However, released cats are often re-trapped, which adds to the cost,

and providing food to maintain feral cat "colonies" would cost much more for a program whose goal was to maintain the cat population than one in which the cats were being systematically removed. Dunham's analysis estimated that sheltering, food and supplies while impounded, and unspecified medical tests would require 50% of the cost of trapping and euthanizing the cats. However, it is unlikely that programs intended to eradicate or substantially reduce feral cat populations would require keeping the cats in captivity for an extended period. The costs for sheltering and food and supplies were not included in the TNR alternative. Dunham assumed a best-case scenario wherein veterinarians and community volunteers would offer their services for free for TNR, but didn't make a similar assumption for the "trap and euthanize" alternative.

The analysis completely failed to account for two significant factors. It didn't include adoption, which is a critical adjunct of TNR as practiced in the U.S. A "trap and euthanize" program would also benefit from the adoption of stray pets and kittens that were or could be easily socialized. And Dunham's analysis appears to have assumed that all feral cats would be dealt with in one fell swoop. In other words, reproduction and immigration were not factored in. In the real world, new strays, abandoned cats, and trap-shy feral cats are constantly adding kittens to the population. But dead cats don't reproduce.

According to a far more objective analysis – comparing the costs to manage an urban cat population in Oahu, Hawaii – TNR would be twice as expensive as euthanasia (Lohr et al. 2013). More importantly, the analysis found that in a real-world scenario, which included a realistic estimate for the annual influx of abandoned cats, TNR was unable to reduce the cat population to zero over the 30-year span of the modeling experiment.

Another analysis estimated that the initial effort to trap, neuter and release could cost over $100 per cat. Washington, D.C., is planning to spend $1.5 million to count its cats to help improve efforts to manage the population, including the widespread use of TNR (Domonoske 2018). And TNR has hidden costs. Cat "colonies", even if maintained by dedicated volunteers, must be fed, partly for humane reasons but also because feeding attracts new arrivals that must be treated. Wild animals and other invasive species like rats and mice can eat the bulk of the food left at outdoor cat-feeding stations (Hawkins et al. 2004, Theimer et al. 2015, Leikam and Kerekes 2018).

Less acknowledged (and completely overlooked by Dunham's analysis) is the cost of maintaining large numbers of stray and feral cats on human health and wildlife. An analysis of the cost of alien and invasive species in the U.S. conducted in 2005, when cat populations were approximately two-thirds as high as current estimates, calculated the annual value of wild birds killed by feral cats (i.e., not including those killed by pet cats) to be approximately $17 billion, only slightly less than the economic cost of rats (Pimentel et al. 2005). The analysis didn't subtract the value of small mammals, amphibians and reptiles killed by cats. Nor did it factor in the human health impacts of toxoplasmosis and other cat-related diseases. The same analysis concluded that the economic cost of feral and pet dogs was $620 million annually, including treatment of dog bites and human fatalities.

Removal vs. TNR. Whether a community removes (i.e., euthanizes or confines) stray and feral cats that cannot be adopted or employs TNR is a hotly debated issue. Adding to the anecdotal evidence that TNR doesn't work, researchers who have modeled various methods of controlling feral cats have also concluded TNR is unlikely to be effective in real-world situations. In this section, the "removal" strategy includes adoption whenever possible before a free-ranging cat is euthanized or permanently confined. TNR programs also attempt to adopt out

cats whenever possible; however, the market for kittens and sociable stray cats can easily be swamped.

McCarthy et al. (2013) modeled three methods of feral cat control – removal, TNR and TVHR (trap-vasectomy-hysterectomy-release) – with five rates of annual capture success. Unlike TNR, in which males are castrated, in TVHR vasectomy is used because it doesn't alter a male cat's sexual drive or social status, so cats maintain their position in the breeding hierarchy and may better prevent immigration of other males and compete for female attention. Female cats with hysterectomies continue to attract males and compete with intact females. Unlike TNR, TVHR doesn't increase kitten and adult survival rates. Increasing survival, of course, counteracts the primary objective of population control. Simulations were run for 4,000 days (about 12 years) beginning with a hypothetical population of about 200 cats (the model started with 40 male and 40 female cats and was allowed to increase for 2,000 days before any intervention). Under these conditions, TVHR performed better than both TNR and removal at reducing population size at all capture rates between 10% and 90%. At no capture rate was TNR more effective than TVHR or removal, and only at annual capture rates greater than 90% was removal more effective than TVHR. The simulation showed that TNR could be counterproductive, increasing the size of the population under some scenarios. However, all of this is moot for one reason. The simulations did not include immigration from adjacent areas or abandoned cats; thus, they are not applicable to what would actually happen in the real world.

Schmidt et al. (2009) included immigration rates in their model. They simulated population changes under both TNR and removal (as well as a 50:50 combination of TNR and removal) at 25%, 50%, and 75% capture rates for individual cats, with 0%, 25% and 50% immigration rates, over a 25-year period. They found that population decreases were comparable for removal, TNR and a 50:50 combination for all treatment rates only when there was no immigration. However, at 25% and 50% immigration rates, the population decreases were higher when cats were removed. For best results, immigration must be prevented and over 50% of the cat population must be captured and treated each year to reduce free-ranging cat populations. Schmidt et al. (2009) found that treatment effort increased as implementation rates increased, and removal required a higher treatment rate than TNR. However, "treatment" in their study did not include cats recaptured during the TNR effort, a common phenomenon that would be expected to add considerably to the number of cats baited to and released from live traps, which is a broader definition of "treatment" that may better encapsulate the effort and cost of the two methods.

Anderson et al. (2004) compared TNR reductions in fecundity rates for female cats by 10%, 25%, 50%, and 75% with reductions in survival rates by the same amounts. A successful removal strategy required reducing both juvenile and adult cat survival by more than 50%. A 75% reduction in survival (i.e., 75% removal) would reduce the population by half every year. TNR was unable to reduce the hypothetical populations at the highest rate (75%) used by the model because TNR reduces fecundity, not survival.

Miller et al. (2014) concocted a hypothetical population of 200 feral cats in an area of about 25 urban square blocks surrounded by a neighborhood four times larger to simulate movement into the study area. They incorporated the problem of abandoned cats by adding four six-month-old kittens to the population every six months. The model accounted for dispersal and survival rates for large urban, small urban and rural communities. At six-month intervals the cat populations were subjected to treatment levels ranging between 10% and 50% of the untreated population, and each scenario was run for 50 years. A high treatment rate (40% every six months) led to rapid population decline and elimination by 10-15 years in isolated large and

small urban environments for both removal and TNR methods. However, immigration and abandonment at the levels tested made elimination impossible; after about five years the population managed under TNR leveled off at about 100 cats while the population in which cats were removed leveled off at about 30 cats. Removing at least 30% of the remaining population every six months resulted in consistent decline, while TNR required capturing and neutering 40% of the untreated population every six months to achieve similar results. Temporary contraception fared even worse than TNR. Even low levels of immigration significantly reduce the effectiveness of any management intervention.

Lohr et al. (2012) simulated population effects for feral cats on Oahu Island, Hawaii, over a 30-year-period for TNR and removal and compared the costs of both programs. The ecological carrying capacity of Oahu was assumed to be 25,000 feral cats based on field experience. Because the ideal removal program would eradicate feral cats in the shortest possible time, and kittens are constantly being added to the population, they assumed that more than 30,000 cats would have to be removed in one year. To test for the effects of abandonment (no other form of immigration is possible on an island), they added 0%, 1%, 2%, 5%, or 10% of the initial population to the island's simulated population each year. With no abandonment the feral cats could hypothetically be eradicated in the first year; however, with abandonment rates of 1% or more the population would rebound to about 25,000 cats within 6-10 years. At the highest abandonment rate (10%), if removal is repeated every five years the population would fluctuate from about 5,000 after trapping to about 30,000 at the peak of the upswing. The TNR simulation assumed that 15% of adult cats each year (based on historical records) and 40% of kittens would be sterilized. At that rate, assuming no abandonment, the initial population of 25,000 feral cats would be reduced almost to zero in 30 years; however, if the abandonment rate was 1% or higher, the population would never be eradicated. Removal was the cheapest way to reduce the number of cats regardless of the abandonment rate. At all abandonment rates tested, where removal needed to be repeated every five years, the cost over a 30-year-period was less than half that of TNR.

Loyd and DeVore (2010) used a decision analysis network to compare the efficacy of five management scenarios: do nothing, removal, TNR (without adoption), TNR (with adoption of kittens), and TNR (with medical testing, vaccination and monitoring). For medium to large feral cat populations the optimal method was removal. According to their analysis, TNR would be effective only in isolated populations of less than 50 cats.

Cat populations have three segments: owned, unowned, and sheltered. Flockhart and Coe (2018) make the case that management of cat density must consider all three segments because human intervention determines, to a large extent, the transitions from one segment to another and each segment contributes differently to the total cat population. They developed a model that closely matches population estimates of cats in urban areas that were based on expert opinion and empirical data. Using the model, the researchers hope to provide information that can fine-tune cat management options because they consider multiple interventions concurrently that are tailored to a specific urban area.

For example, the model predicted that the number of shelter cats should decrease with increasing sterilization rates across all three segments, confirming conventional belief that universal sterilization will reduce the likelihood that shelters are overcrowded. Surprisingly, the model predicted that increasing the sterilization rate of owned cats should increase the number of unowned cats. The researchers believed this trade-off arose because lost, sterilized cats have a higher recovery rate and returning owned cats assures that that segment of the population stays near carrying capacity, which reduces the number of unowned cats that are

adopted off the street. Even more surprisingly, the model predicted that increasing the sterilization rate of unowned cats (the primary objective of TNR) should increase the number of unowned cats. In part, this may be due to the enhanced survival rate of sterile cats, but the number of unowned cats also depended on the number of free-roaming kittens becoming feral and the abandonment and relinquishment of owned cats.

The list of actions Flockhart and Coe provide as examples of potential interventions warrant their own bullet points.

Actions focused on owned cats:

- Subsidized spay-neuter programs
- Campaigns to reduce the proportion of owned cats give outdoor access
- Techniques that increase relinquishment over abandonment

Actions focused on cats in shelters:

- Assure that all cats moving through shelters are sterilized
- Assure that animal adopters are optimally matched with adoptable pets to reduce subsequent relinquishment rates
- Techniques to increase reuniting lost animals with their owners

Actions focused on unowned cats:

- Consider the relative impacts of euthanasia of free-roaming cats compared to feral cats given that capture rates are density dependent

The authors believe that increasing the potential number of interventions targeted at the three different segments of the cat population may identify less divisive management strategies that reach their objectives (e.g., fewer free-roaming and shelter cats) by considering both humane interventions and the environmental impacts of outdoor cats. They warn that the uncoordinated actions of different stakeholder groups could be counter-productive, collectively take more time, and ultimately cost more money.

The debate over the two main methods of feral cat control – removal vs. TNR – focuses on survival (i.e., removal, which might be largely lethal control) or fecundity (i.e., TNR or a similar program). The number of feral cats in a "colony" has been shown to increase due to higher immigration and lower emigration rates, in addition to increasing kitten survival (Gunther et al. 2011). Multiple studies have shown that decreasing a population's survival rate is more effective than decreasing fecundity in reducing the number of feral cats (Anderson et al. 2004, McCarthy et al. 2013). Management actions that reduce fecundity in excess of 70% of the fertile population would need to be maintained annually to cause a population decrease in a cat population managed by TNR methods (Anderson et al. 2004, Foley et al. 2005, Budke and Slater 2009, Lessa and Bergallo 2012).

It is noteworthy that no unbiased modeling studies have found TNR to be more effective than removal, particularly in real-world scenarios where the treated population is regularly augmented through reproduction, immigration or abandonment. Similarly, anecdotal evidence and literature reviews have found no examples of TNR eradicating a population of feral cats larger than a small colony (Longcore et al. 2009). Although TNR advocates often claim success, their assessments generally rely on subjective or anecdotal records, and their measures of success are primarily a reduction in the number of cats brought into shelters or euthanasia rates (Houser 2015). These reductions, because they do not necessarily signify a decline in the number of free-roaming cats, do little to help wild birds and mammals.

Nevertheless, there is a growing body of scientific literature that purports to demonstrate the effectiveness of TNR over other methods of feral cat management.

Two authors in particular, Daniel Spehar and Peter Wolf, seem to be trying to flood the zone with ill-conceived, poorly designed, blatantly biased, incomplete, and misleading articles in scientific journals. Spehar and Wolf (2017) examined a TNR program in Newburyport, Massachusetts, that they claim had "achieved its original goal of 100% sterilization of resident cats and zero kitten births." This was a post-hoc evaluation of a 25-year project conducted by volunteers. No one conducted an initial cat census, the project area was small and surrounded by thousands of other feral and stray cats, and the authors relied on estimates of feral cat numbers by a variety of "colony" caretakers. Incredibly, the authors stated at least 20 times in their article that critical information was lacking in their analysis, in particular cat population estimates. Not surprisingly, feral and stray cats were still being found in their project area eight years after the "last" cat died, and volunteers still maintained a feeding station and were receiving calls about free-ranging cats in the project area when the article was being written. The volunteers claimed that these were "indoor-outdoor" cats, an argument accepted without question by Spehar and Wolf (2017).

Spehar and Wolf (2018) wrote another misleading article describing a TNR program in a Chicago neighborhood. This time all the data – 10 years of feral cat sightings – was compiled by one volunteer caretaker. However, only one "colony" was monitored for the complete 10 years and 8 of the 20 colonies were monitored for less than half the duration of the study. Colony counts were conducted "on an annual basis" or while jogging through the neighborhood and talking to other feral cat caretakers. But the cats weren't counted unless seen by the original volunteer. The volunteer was still finding feral cat feeding stations in the study area after the study ended. Also, the study area wasn't as large as the volunteer assumed (i.e., 1 mi^2), and Spehar and Wolf (2018) concluded the area was 1 km^2, but the actual area, based on a map provided on the volunteer's website, was about 0.86 km^2, or about one-third of the original estimate and substantially smaller than that published by Spehar and Wolf. It's difficult to convince a scientist that a study is legitimate if no one can agree on the boundaries or size of the study area. Like the previous study, the volunteer didn't count "indoor-outdoor" cats. Most of the reduction in the feral cat population was accomplished by adoption. In the end, the final count used to determine the project's success included only ear-tipped cats; the volunteer had no idea how many unmarked cats inhabited the study area or whether their numbers were increasing or decreasing.

In their third collaboration, Spehar and Wolf (2019) come to the self-congratulatory conclusion that TNR, which aims to save cats by re-abandoning them in place, resulted in "greater feline intake," increased live-release rate, and "euthanasia reductions" based on the data compiled by six animal shelters. Of course it did. Under TNR there are more cats, and cat owners can abandon their pets (or turn them over to a shelter) knowing that they will not be euthanized but released and fed outside instead.

More recently, Boone et al. (2019) evaluated the outcomes of a variety of feral cat management strategies including no action, removal, culling and TNR. All of the actions had high and low intensity iterations. A casual glance at their conclusions and graphs would lead one to agree that TNR was by far the most successful strategy. But Boone et al. (2019) stacked the deck.

For the low- and high-intensity culling strategies, their model removed 25% or 50% of the feral cats and then allowed the population to return to its carrying capacity, with 200 untreated cats

populating the hypothetical surrounding neighborhood. The authors, of course, knew that previous models have predicted that culling requires a 50% removal rate on at least an annual basis to work. In contrast, the low-intensity TNR program sterilized 25% of the untreated cats **every 6 months** and the high-intensity TNR sterilized 75%(!!) every 6 months for an effective treatment rate of 80% of the population. Of course the authors knew that other modeling has predicted that TNR programs might work if they remove roughly 75% or more of the untreated cats on an ongoing basis. By far the best success in reducing the population was achieved by "removing" cats. For the purposes of the model, it isn't clear how "removing" 25% or 50% of the cats is any different than "culling" 25% or 50% of the cats until you notice that they "removed" that many untreated cats every 6 months, but didn't "cull" the hypothetical population again until it returned to carrying capacity. Why would a modeling exercise that purported to compare three strategies use vastly different treatment rates for each strategy? The modeling exercise published by Boone et al. (2019) was unabashedly intended to tip the scales in favor of TNR.

Shame on the two scientific journals – Animals and Frontiers of Veterinary Science – that accepted these four articles with little or no editorial oversight or objective peer review.

Vantassel (2013) probably wasn't the first to point out the central paradox of TNR. Both TNR and removal rely on trapping to capture cats. How then is it cheaper or more efficient to trap, neuter and return cats than to simply trap and remove them from the population? Generally speaking, a program that intends to reduce the number of feral cats must capture and sterilize 70-75% or capture and remove 50% of the population. Most of the population reductions that TNR proponents claim to have achieved in the short term can be attributed to their removal of cats, primarily by adoption but also through transfers to shelters, death in or enroute to temporary confinement, or euthanasia of sick and injured cats. Thus, the "long-term" success reported for a TNR program in Florida was clearly due to removing about 50% or more of the free-roaming cats from the population in almost every one of the 23 years (Kreisler et al. 2019) and not by neutering and returning cats to the streets.

All of the subsequent quasi-scientific justifications cited by TNR proponents – claims such as neutered "colony" cats exclude new cats and removing cats only creates a "vacuum" effect that increases feral cat populations – are simply unproven excuses (Longcore et al. 2009). Little or no evidence exists that sterilization markedly reduces territorial behavior, ranging behavior for either sex, or the degree of home range overlap among individuals, at least for cats sterilized as adults (Guttilla and Stapp 2010).

One consistent criticism of removal vs. TNR is that removal has only been successful at eradicating cat populations on remote islands, where there is no supplemental source of cats coming from dispersal or abandonment. However, islands share one characteristic with at least some urban areas: relative isolation. A city like Anchorage is an urban island surrounded by natural habitat (populated by native predators) that is somewhat inhospitable to feral cats. Thus, immigration from surrounding communities is far less likely. Absent immigration, the problem boils down to irresponsible cat owners who abandon their pets or allow them to roam and breed, as well as semi-owners who habitually feed stray and feral cats.

Not only is TNR ineffective on any practical scale, it diverts attention from more important issues. Failing to reduce numbers of pet and feral cats that kill billions of wild animals is both unethical and environmentally shortsighted (Jessup 2004, Anonymous 2016, Waters 2013, Schofield 2018). When naïve or irresponsible cat owners are led to believe that cats are "natural" predators, that cats don't kill very many wild animals, or that someone else will care for their cat after it is abandoned, that "allows" them to release their cats outdoors with a clear

conscience and exacerbates the problem of too many free-ranging cats (Castillo and Clarke 2003, Jessup 2004, Urseny 2012, St. George 2014).

There is also the issue of wasting limited resources. Barrows (2004) put this most succinctly: "If a fraction of the millions of dollars being expended to neuter, reabandon, and feed cats was directed toward enhancing education and supporting more effective animal control ordinances and their enforcement, we would be much farther down the road toward effectively reducing the problem of free-roaming cats than we are today."

In a comprehensive review of TNR literature that included empirical measures of success, Crawford et al. (2019) concluded that TNR is unlikely to solve the problems created by stray and feral cats in most cases and is unethical on animal welfare grounds. The authors found that targeted adoption, early-age desexing, community education, and responsible pet ownership have greater promise to minimize euthanasia, reduce numbers rapidly, and address other identified issues.

TNR advocates and feral cat defenders also make ethical and moral arguments; however, these typically downplay, or ignore altogether, the significant environmental and human health impacts of feral cats (e.g., Lauber et al. 2007, Friends of Animals 2007, Marks 2013, Lindsay 2013, Lynn 2015, Lauerman 2016). In fact, it is possible to write a 33-page philosophical treatise defending the rights of feral cats and the moral justification of TNR without mentioning birds once (Abbate 2018). Abbate and Fischer (2019) insist that it is "demeaning" to call an animal an invasive species. It is also possible for a veterinarian to argue that his cats should be allowed to roam freely even though he advises his clients not to allow their cats to do so because his so-called "barn cats" don't eat birds at the neighbor's birdfeeder (Becker 2012), as far as he knows. Feral cat advocates have gone so far as to argue that "even if cats pose a real threat to bird species," because humans have created an environment "that is highly advantageous to cats," killing the cats would only leave a void that "is quickly refilled by members of that species" (Anderson and Vaniotis 2008). So much for individual responsibility and environmental stewardship.

Recommendations of experts

A variety of international, national and state agencies, professional societies, and non-governmental organizations have offered expert advice on managing cats and other free-ranging pet populations.

American Association of Feline Practitioners. The AAFP has a unique perspective on cat care. It emphasizes that an indoor-outdoor lifestyle, in a safe environment, is the best option for pet cats because it allows them to perform their normal behaviors such as hunting and stalking (AAFP 2016*a*). This position statement appears to be a clarification of an earlier AAFP position on free-roaming cats. In its earlier position statement the AAFP encouraged state and local governments to required keeping owned cats indoors, in an outdoor enclosure, or on an attended leash (AAFP 2013). Thus, the "indoor-outdoor" reference in the position statement appears to mean permanently confined or leashed; however, the AAFP tolerates outdoor cat "colonies," if licensed. Other recommendations include:

- All cats should have both permanent (e.g., microchip) and visible (e.g., tag) identification so they may be returned to their owners if they become lost or stolen (AAFP 2007).
- Cats should be sterilized early, at 6-14 weeks of age, before they are capable of breeding (AAFP 2010).

The welfare of free-roaming, abandoned and feral cats is significantly diminished compared with pet cats, and they pose significant threats to human health and wildlife (AAFP 2013). To combat the growing numbers of these cats:

- The AAFP strongly supports reducing numbers of unowned cats through humane capture.
- State and local governments should require that all cats obtained from humane organizations, shelters, and wholesale and retail pet suppliers be sterilized.
- Privately owned cats should also be required to be sterilized prior to sale or adoption if not intended for breeding.
- State and local governments should prohibit the abandonment of cats.
- Managed cat colonies should not be established on public lands (except by lawful permit) or in areas where cats pose a threat to protected wildlife or a significant risk of disease to wildlife or the public.

American Veterinary Medical Association. The AVMA does not support laws that mandate sterilization of privately owned pets because it may contribute to owners avoiding licensing, rabies vaccination, and veterinary care for their pets (AVMA 2019*c*).

- However, it supports licensing all dogs and cats, microchipping, and prohibiting the sale or adoption of intact dogs and cats by shelters or humane organizations.
- Young cats and dogs should be sterilized by four months of age.
- Unlike the AAFP, the AVMA recommends keeping pet cats in an enriched indoor environment, in an outdoor enclosure, or exercising leash-acclimated cats to minimize the risks to the cat, wildlife, humans and the environment (AVMA 2019*b*).
- The AVMA provides a model ordinance for dog and cat control (AVMA 2019*d*).

The AVMA also has a policy on free-roaming, abandoned, and feral cats (AVMA 2019*e*).

- It recommends educating the public on the risks posed by these cats, including adverse affects on wildlife, ecosystems, and public health, as well as risks to the welfare of the cats.
- It strongly supports reducing and controlling the number of these cats through humane capture.
- It encourages sterilization of all adopted cats, microchip identification of all owned cats and cats in managed colonies, prohibiting public feeding of intact, free-roaming and feral cats, and prevention of managed cat colonies in wildlife-sensitive ecosystems.
- The AVMA prefers non-lethal control; however, the goal of colony management should be continual reduction and eventual elimination through attrition. For colonies not achieving those goals, the AVMA does not oppose humane euthanasia.

Interestingly, during the drafting of the AVMA's policy, the AAFP strenuously objected to the recommendation to humanely euthanize colonies of feral cats on the grounds that euthanasia hasn't proven effective in reducing cat populations either and because the AAFP anticipated adverse public reaction to the AVMA guidelines if they included this provision (AAFP 2016*b*). The AVMA left the provision in because the majority of members voted in favor of it, primarily because the issue was far broader than simply cat welfare.

Association of Avian Veterinarians. The AAV is comprised of veterinarians, veterinary technicians, veterinary students, and allied professionals that work in private practice,

colleges and universities, zoos, government and industry. According to the organization's website, many members are considered global leaders in avian conservation and wild bird health. One of the organization's key objectives is preserving and protecting birds in the wild, in their native habitats. The AAV's position statement (AAV undated) on feral cats resolves to:

- Support community efforts to develop local ordinances that a) require mandatory spay/neuter of all cats over six months of age unless the owner purchases an annual intact permit and/or breeders permit; b) require all cats to be licensed and vaccinated against rabies; and c) discourage cat owners from allowing their cats to roam at large.
- Support reducing the numbers of stray cats through humane capture (with placement in homes where appropriate) by local health departments, humane societies, and animal control officers.
- Support actions by government wildlife agencies, public health agencies, and public and private organizations to ban or eliminate cat colonies on public lands in a humane manner and discourage feral cat colonies on private lands.
- Work with veterinary educational institutions and other professional organizations – as well as within the AAV – to promote awareness, education, and research aimed at reducing the number of owned and stray free-roaming cats.

California Veterinary Medical Association. The CVMA (2017) "strongly supports reducing the number of unowned, free-roaming, abandoned and feral cats through humane capture (with placement in homes where appropriate) by local health departments, humane societies and animal control agencies. It also recommends that:

- All free-roaming abandoned and feral cats that are not in managed colonies should be removed from the environment and treated in the same manner as other abandoned and stray animals in accordance with local and state ordinances.
- Prohibit sale or adoption of intact cats by humane organizations and animal control.
- Require licensing, rabies vaccination, and permanent identification by micro-chipping all pet cats.
- Encourage that owned cats be kept indoors, in an outdoor enclosure, or confined to the property in a rural area.
- Prohibit public feeding of intact free-roaming abandoned and feral cats.
- Prevent establishment of managed cat colonies in sensitive wildlife habitats.
- Encourage public education that reduces abandonment of pet cats and eliminates public feeding of unowned and free-roaming feral cats.

The CVMA "neither endorses nor opposes appropriately managed cat colony programs" because "the reduction in the total number of free-roaming cats these programs will affect is insignificant." Managed colonies "should be considered an interim solution" and "the first step toward reducing the size of the colony through attrition." Should managed cat colonies be established, "natural or artificial restrictive barriers should be employed to protect both cats and native wildlife."

Canadian Veterinary Medical Association. Espousing overall goals of fewer free-roaming cats, better health care for such cats, and improved return rates of owned cats, the CVMA (2014) recommends:

- Community subsidized spay/neuter and TNR programs.
- TNR programs must include signs of success, including colony stabilization and an ongoing decline in cat numbers, especially kittens, and should not be located in wildlife

refuges or breeding areas, near habitats of threatened or endangered species, or in other ecologically sensitive areas.
- Culturally sensitive public education on responsible cat ownership.
- Both permanent and visible identification of cats.
- Sterilization.
- Capture and humane euthanasia may be necessary to preclude suffering.

Unlike the other veterinary associations in this section, the Canadian Veterinary Medical Association appears to downplay cat predation on wild animals, noting that "cats represent only one of many pressures on wildlife" and "it is important to recognize that urban and suburban settings, parks and islands are not the same, with each location having a distinct set of challenges."

Australian Veterinary Association. No other continent has experienced the full impact of free-roaming cats like Australia, where feral cats inhabit 99.8% of the land area (Legge et al. 2017) for an average density of one feral cat for every 1.5 square miles (Wahlquist 2017), where the average Australian cat kills 7 animals each day (Dilonardo 2018) and pet and free-roaming cats kill 377 million birds (99% of them native birds) annually (more than 1 million/day; Woinarski et al. 2017). To compound the problem, Australia has more threatened and endangered species than any other continent and cats threaten many of them with extinction.

It shouldn't be surprising that the AVA (2016) takes an uncompromising position on feral cats.

- Control methods should be humane and effective in the long term.
- Control methods should minimize risk to non-target species.
- Physical capture methods are preferred [to shooting or poisoning] in urban areas to allow impounding and recognition of domestic cats with owner identification.
- Owned cats should be permanently identified with microchips (preferred), tattoos, tags, or collars.
- Owned cats should be sterilized before puberty to minimize unplanned breeding, roaming and fighting; however, mandatory programs have not significantly reduced overpopulation so voluntary sterilization should be encouraged through education and financial incentives such as a reduction in registration fees.
- Owned cats should be contained or subject to a curfew to protect the cat from accidents and infectious diseases, to prevent predation on wildlife, and to reduce community nuisances; however, contained cats require appropriate environmental enrichment.
- Unowned cats should be kept for at least 7 days prior to being made available for re-homing, or be euthanized. Unowned cats that are severely ill, very anxious, or stressed should be immediately euthanized.
- TNR programs have not been effective under Australian conditions, primarily because the cats often do not have a good level of care once released, continue to hunt and kill wildlife, and can be a significant public nuisance.
- Effective control requires coordination between researchers, state and territory jurisdictions and government agencies.
- Public education on responsible pet ownership is essential.
- All cat breeders should be licensed, registered and adhere to relevant state or territory codes of practice.
- There is a pressing need for more funds for research, more control and management, and more innovative, effective and humane methods of control and eradication of feral cats.

National Association of State Public Health Veterinarians. While the benefits of pet cats are acknowledged, free-roaming unowned and feral cats can be detrimental to public and environmental health. Therefore, the NASPHV (1996) believes that:

- Local health departments, humane societies, and animal control groups should take action to reduce the numbers of stray animals to minimize the impact of abandoned and/or feral cats.
- Managed cat "colonies" may foster irresponsible cat ownership and will promote the practice of allowing pet cats to roam free.
- Timely neutering, regular veterinary care and keeping pet cats indoors should be encouraged.

International Wildlife Rehabilitation Council. The IWRC is a professional organization of rehabilitators, rescuers, veterinarians, researchers, and educators (IWRC 2018). Wildlife rehabilitators witness the results of dog and cat attacks on wild animals; thus, the IWRC makes the following recommendations (IWRC 2014):

- License cat and dog breeders to aid in population control.
- Owners should neuter non-breeding cats and dogs.
- Programs are needed to educate cat and dog owners and the general public about impacts and what can be done to reduce them.
- Cats should be kept indoors. If allowed outdoors they should wear collars with devices designed to prevent hunting. Cats should not be allowed to roam and be supervised at all times when outdoors.
- Dogs should be kept confined when unsupervised. When outside they should be walked on a leash unless in an area where any impacts on wildlife can be reduced or eliminated. No dog should be allowed to roam freely.
- Dogs and cats should be vaccinated and treated for worms.
- Pets should be fed properly to reduce potential predation.
- Supports humane removal of feral cat and dog populations, including feral cat colonies, through the rehabilitation and adoption of suitable animals into domestic environments and humane euthanasia of animals that cannot be rehabilitated and re-homed.

Association of Reptilian and Amphibian Veterinarians. Cats kill many amphibians and reptiles (Hernandez et al. 2018). Anchorage has no native reptiles, but wood frogs (*Rana sylvaticus*) are common. This professional organization's position statement on feral and free-roaming domestic cats (ARAV 2016) supports the following actions:

- Encourage pet owners to keep owned cats indoors and spayed/neutered for the health of both the cats and the natural environment.
- Reduce the numbers of stray and feral cats through humane measures.
- Remove free-roaming and feral cats from conservation lands or ecologically sensitive areas.
- Promote education of the general public and animal care professionals regarding the detrimental effects that free-ranging and feral cats can have on local wildlife populations, including reptiles and amphibians.

Centers for Disease Control and Prevention. To prevent outbreaks of zoonotic diseases like rabies the CDC website recommended that food and water not be provided outdoors for pets (CDC 2017*a*) and that cats and ferrets be kept indoors (CDC 2017*a*, 2019).

Several non-veterinary organizations have recommended policies and actions to reduce the number of stray and feral cats. As the AAFP and AVMA acknowledged, free-ranging cats pose significant adverse impacts to wild animals, particularly birds, and ecosystems. According to the U.S. Fish and Wildlife Service, cats kill nearly four times as many birds as other, common, human-caused mortalities, including collisions with windows, vehicles, transmission lines and wind turbines, poison, electrocutions, and oil pits (USFWS 2016). Only habitat loss poses a greater risk to bird populations in the U.S., and its direct and indirect impacts are both cumulative and difficult to assess.

Nowhere in the U.S. is the problem of free-ranging cats more acute than in Florida and Hawaii, which have established task forces to address the issue.

Feral Cat Issue Team (FCIT, Florida). Any effort to control feral cats should include measures to reduce the flow of new cats into the wild. Eradication through trapping and euthanasia is unfortunate, but necessary, as well as an effective and humane way of reducing numbers of feral cats and controlling cats in situations where they pose an imminent threat to wildlife, although this may be unpopular with some of the public (FCIT 2003). TNR and cat "colonies" are unsatisfactory solutions to cat overpopulation and do nothing to reduce the impact of cats on wildlife.

The FCIT recommended that local governments:

- Provide incentives for sterilizing cats.
- Enact and enforce leash laws for cats as well as dogs.
- Prohibit abandonment of cats and feeding of stray cats, including "colony" cats in public parks.
- Limit the number of cats that may be owned or cared for at any one time.

Feral Cat Task Force (Kaua'i, Hawaii). This task force included representatives from humane organizations, as well as land managers and scientists. All members agreed there were too many feral, stray and abandoned cats on the island (Adler 2014). A stray cat was defined as any cat living or roaming off an owner's property or without permission to be on public or another person's private property.

The task force recommended strengthening the island's cat-licensing ordinance as follows:

- Enforce penalties for owners of stray cats that are captured away from their own properties or on properties where permission has not been granted.
- Fund Kaua'i Humane Society to appoint additional humane officers to seize and impound feral, abandoned, and stray cats as well as issue citations for appropriate violations.
- Impose stiff fines for cat abandonment.
- Prohibit cats on county properties.
- Licensed cat owners should be required to obtain written permission of property owners if cats are allowed onto the properties of others. If cats are found on other properties without written permission, they should be considered stray cats. Private property owners should be allowed to revoke their permission with a 10-day notice.
- All cats allowed outdoors should be sterilized.
- Stray cats should be trapped and returned to their identifiable owners. Owners should be subject to escalating penalties if/when future incidents occur.

- Five years after the cat ordinance is amended, all cat colonies must be located on private property, completely fenced, registered, certified, and monitored. Caretaking of TNRM (TNR with the addition of monitoring) colonies will be conducted by private individuals and not reliant on County funding.
- Cats in areas without registered colonies should be removed by trapping.
- Redefine cat owners to include colony caretakers.
- Implement a public education program.

Stewardship Centre for British Columbia. This organization was created to provide science-based environmental information to help people sustain healthy ecosystems voluntarily (Pearson and Blair 2013). It advises against adopting a TNR program because they do little to reduce and rarely stabilize populations. To reduce domestic and feral cat predation it recommends the following:

For cat owners

- Keep domestic cats indoors or on leashes.
- Neutering.
- Attach bells, electronic sound devices or bibs to collars to reduce hunting success.
- Keep cats out of bird feeding areas, including near bird feeders where seed is on the ground.
- Never abandon a cat.
- Don't feed stray cats.
- Keep only neutered female barn cats.

For municipalities

- Initiate a public education program.
- Require cat licenses and microchips or ID tags.
- Support free or subsidized spay-neuter clinics.
- Ban free-range cats.
- Trap feral cats and remove them from the population.
- Ban outdoor feeding of pets.

The Wildlife Society. The Wildlife Society (TWS), the largest professional organization of wildlife managers and scientists, comes at the issue of domestic cats primarily through concern for the significant impacts of invasive species, including cats, on wild animal populations. Its position statement on invasive and feral species encourages "the enactment, expansion, and enforcement of laws and regulations focused on eradicating and controlling the spread of invasive and feral species" (TWS 2016*a*).

In a more detailed issue statement, the TWS outlined its policy on feral and free-ranging cats (TWS 2016*b*):

- Support and encourage the humane elimination of feral cat populations through adoption into indoor-only homes and humane euthanasia of unadoptable cats.
- Support the passage and enforcement of local and state laws prohibiting the feeding of feral cats, especially on public lands, and the release of unwanted pet or feral cats into the wild.
- Oppose the passage of any local or state laws that legalize the maintenance of "managed" (trap-neuter-release) free-ranging cat "colonies."
- Support informational and educational programs and materials that explain a) the negative effects of outdoor cats and ask pet owners to keep cats indoors, in outdoor

enclosures, or on a leash; b) encourage pet adoption programs and pet owners to sterilize their cats; and c) offer advice on what individual cat owners can do to minimize predation by free-ranging cats and to minimize potential disease transmission to humans, wildlife, and other cats and domestic animals.

American Bird Conservatory (ABC). The ABC has taken a lead in the effort to decrease human-subsidized cat predation through its Cats Indoors program (ABC 2018*a*). The program's focus is mainly informational; however, several recommendations and examples support citizen-led initiatives to better control cats (ABC 2018*b*), such as:

- Compile statistics from the local animal shelter, including complaints about cats.
- Document public health problems that relate to cats.
- Licensing laws will make it possible to hold cat owners accountable for problems caused by their cats. Licenses are also a valuable tool for rabies control.
- Differential licensing, where fees are higher for unsterilized pets, promotes spaying and neutering.
- Require microchips in addition to ID tags because cats can slip out of collars.
- Neuter all cats over six months of age.
- Limit the number of cats an individual can own.
- Fine owners who allow their cat to roam on another person's property without permission. Laws requiring that cats be confined to their owner's property or physically restrained when off-premises are the most effective way for communities to ensure that cats receive the protection and care they deserve.

International Union for Conservation of Nature. The IUCN is "the global authority on the status of the natural world and the measures needed to safeguard it." The organization's "red list of threatened species" is the world's most comprehensive information source for the conservation status of wild animals and plants (IUCN 2018). A critical component of conserving nature is identifying and controlling invasive species. The IUCN's Invasive Species Specialist Group (ISSG), an international network of scientific and policy experts established in 1994 (ISSG 2008), has compiled a list of the world's 100 worst invasive exotic species (ISSG 2018). Domestic cats are on the list, along with house mice, black rats, European rabbits, European starlings, common carp, brown tree snakes, Dutch elm disease, purple loosestrife, and the mosquito species that spread West Nile virus, dengue fever and malaria.

Hillsborough Animal Health Foundation. The Hillsborough Animal Health Foundation is the rare humane organization that has crafted a compromise solution that recognizes both the problem with TNR and the goal of not killing cats or wild animals (HAHF undated). Designed by veterinarians in accordance with the AVMA feral cat recommendations, their plan is to trap-evaluate-neuter-vaccinate-adopt-contain (TENVAC) free-roaming cats. Their TENVAC program recommends that state and local agencies adopt and enforce laws that:

- Prohibit sale or adoption of intact cats by humane organizations and animal control,
- Require licensing, rabies vaccination, and microchipping of all cats,
- Encourage that owned cats be kept indoors, in an outdoor enclosure, or on a leash, and
- Prohibit public feeding of free-roaming abandoned and feral cats.

A no-kill, no-release solution requires facilities for cats that cannot be adopted. HAHF recommends that sanctuaries for feral cats be properly designed and maintained. High quality care is imperative and overcrowding must be avoided. Because Hillsborough County has allowed TNR in the past, a compromise solution allows registered caretakers to continue to

maintain outdoor "colonies" (Layton and Thompson 2013). However, in addition to sterilization, rabies vaccination, and testing negative for FIV and feline leukemia:

- All cats must be microchipped and registered to an owner or organization, and treated annually for internal parasites.
- Cat "colonies" cannot be maintained within 8,000 feet of schools, human food sources (e.g., groceries, restaurants), daycare centers, hospitals, or any public parkland or environmentally sensitive area.
- All managed "colonies" shall have the permission of all adjacent landowners and any property owners within 1,000 feet of the "colony" location.
- "Colonies" must be closely monitored. No new cats or kittens may be allowed to join the "colony" (all must be immediately removed and adopted, fostered or contained).
- All feeding must be completed while the caregiver is present and then ALL food [their emphasis] must be removed, along with all visible fecal matter and food remains.
- All managed "colonies" must be licensed, new "colonies" are strictly forbidden, and the managed colony program shall be phased out over a 5-year period.

HAHF's feral/stray cat management plan includes examples and cost estimates for approved cat facilities, noting that responsible pet ownership is not cheap. It is expected that the cost per cat in sanctuaries will be $200/year; however, volunteers, private fundraising and sponsorships could offset government costs (Layton and Thompson 2013).

HAHF has a remarkably clear vision of both public expectations and enlightened feral cat management. The management plan concludes with "It is impossible to expect county residents to understand the importance of Responsible Pet Ownership if the animal control policy for feral cats is to simply dump them outside!" Every recommendation in the plan is designed to contain feral cats as quickly as possible, to prohibit outdoor feeding of newly abandoned or stray cats, and to make it socially unacceptable to release cats into the wild.

Predictably, even a good compromise is too much for some TNR proponents. Perhaps the most zealous activist, Wolf (2012) insists that TENVAC is unfeasible because one cannot expect feral cat advocates to pay for cat sanctuaries or stop feeding cats outdoors. Wolf implies that the sole reason that the "full-service, full-price" veterinarians drafted Hillsborough's feral cat management plan is to gain an unfair pecuniary advantage over local clinics that offer discounts on neutering (paid for by TNR-related grants and donations from humane organizations, the pet food industry, and individuals). On his Vox Felina blog, Wolf provided a list of veterinarians who belong to the HAHF and recommended boycotting them.

Despite the wide range of professional interests, all of the aforementioned organizations largely agree on recommendations to manage pet cats more like dogs are currently managed, and to significantly reduce or eliminate populations of feral cats.

Alley Cat Allies. Alley Cat Allies and many other humane organizations large and small, from the Humane Society of the United States to several local, Anchorage-area groups take a completely different tack from the HAHF by advocating the antithesis of the recommendations listed above. They prefer "no-kill" policies for pets taken to shelters and free-ranging cats. With a "no-kill" goal it is difficult to find homes for all cats, particularly feral cats, so these groups have taken to releasing cats into the wild as a solution.

Alley Cat Allies is perhaps the biggest advocate of TNR. TNR is its signature program and the organization has pitched the practice as "the future of animal control" in many communities through its website, community workshops, and by other means (Alley Cat Allies undated *a*).

Some humane organizations, notably People for the Ethical Treatment of Animals (PETA), do not support TNR (Mullins 2016). Alley Cat Allies (2010) challenged PETA to a catfight over the issue, employing the remarkably tone-deaf argument that "it is in no animal's best interest to be killed." Tell that to the birds. More recently PETA (2019) has tried to straddle the fence by not opposing TNR if "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." If anyone knows of such a place, please let me know.

CONCLUSIONS

"A man may be fined $10 for killing a songbird,
but he may keep any number of cats..."
Edward Howe Forbush, 1916

Dogs and cats are not treated equally

If this is not yet abundantly clear, turn back to the executive summary for a long list of examples.

Anchorage has too many feral and stray cats

In 2017 Anchorage had an estimated 68,300 pet dogs and 74,600 pet cats according to the AVMA calculator used by Anchorage Animal Care and Control. A conservative estimate of the number of stray and feral cats is about 30,000. Thus, Anchorage has over 104,000 cats.

Because cats are much less restricted than dogs by pet owners, state and local law, and enforcement actions, Anchorage has a large and growing population of free-ranging cats. Public attitudes and expectations – including failure to sterilize a pet until it has had at least one litter, feeding feral and stray cats outdoors, believing that prowling cats are "natural" or that cats must hunt and kill to fulfill their purpose or that feral cats are more valuable than the native bird and mammals they kill – combined with inadequate regulations and enforcement of existing laws are a large part of the reason why free-ranging cats are so abundant and detrimental to the environment and human health.

Anchorage's cats kill millions of wild birds and mammals annually

In the 48 contiguous states, cats have been estimated to kill 1.3 to 4 billion wild birds and 6.3 to 22.3 billion wild mammals annually (Loss et al. 2013). Far fewer cats in Canada have been estimated to kill 100-300 million wild birds annually (Blancher 2013). Using the estimated low end of the national kill rates compiled by Loss et al. (2013), Anchorage's cats kill an estimated 1,148,000 birds and 5,975,000 small mammals annually.

What if birds killed over a million cats annually? What if the average dog killed one or more cats every week? Wouldn't cat owners be asking for some relief?

Toxoplasmosis poses a greater risk to public health than rabies

Despite the warnings of veterinarians and doctors and its recent inclusion on the CDC's list of five neglected parasitic infections, toxoplasmosis is not being taken seriously as a threat to public health. Although toxoplasmosis infects, injures and kills more people than rabies, it is largely ignored by state and local public health agencies. Like cat predation on wildlife, the unprecedented growth in cat populations over the past 40-50 years has had unintended consequences for human health. As cat numbers increase, the risk of exposure to *Toxoplasma* oocysts may also increase. Only a vaccine or systematic serologic testing of pregnant women and newborns, for example, followed by treatment, will prevent most congenital toxoplasmosis in North America (Boyer et al. 2011).

A universal, coordinated effort has achieved great success in reducing the risk of rabies in dogs and, to a lesser extent, cats. A similar effort is required for toxoplasmosis. An initial step should be an investigation by the Alaska Division of Public Health.

The precautionary principle requires action to protect public health and wildlife

Without a doubt some people will question the goal and objectives of this report and some of the information included in it. Despite every effort to cite verifiable scientific studies and include a range of public and expert opinions and recommendations, there are estimates in this report that can and probably will be challenged. For example, no one knows exactly how many feral and stray cats roam Anchorage and basing an estimate of the number of birds and small mammals eaten by cats on two other estimates – a national formula for estimating the number of cats combined with an estimate of the number of prey items consumed – is fraught with uncertainty. However, we have to start somewhere (van Heezik 2010). If someone has a better idea of the local impact of cats on wildlife, let them provide their sources, methodology, and best objective estimates.

Meanwhile, it is abundantly clear that dogs and cats are not treated equally in Anchorage. Because there are more cats, probably many more cats, than dogs and because cats are less restricted in their movements and more likely to adversely affect the environment and human health, changes are warranted.

No one denies that cats kill birds and small mammals. Even feral cat advocates who question scientific studies that attempt to quantify the impact are quick to point out the value of cats for controlling or eradicating rats and mice (as if a cat differentiates between a house mouse and a meadow vole). They also attempt to deflect the seriousness of the issue by claiming that cats are "natural" predators and wild animals in their own right, that they only kill the old and weak, that more birds are killed by windows than cats, or that humans shouldn't choose to protect native birds over feral cats.

Feral cats do not present the same magnitude of threat as DDT, cigarette smoke, global climate change or other environmental issues that have been debated for decades. However, feral cat impacts have something in common with these threats – the precautionary principle should be applied. In other words, where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation and health risks (Grayson and Calver 2004).

Calver et al. (2011) applied a four-step guide for implementing the precautionary principle:

- current data documenting wildlife mortality caused by pet cats satisfy the precautionary trigger of scientifically plausible risk;
- the risk of significant declines or local extinctions of threatened wildlife, coupled with uncertainty in establishing population declines in response to pet cats, argue for strong levels of precaution;
- precautionary measures that should be considered include, but are not limited to, restrictions on the maximum number of cats allowed per household, mandatory sterilization and registration of pet cats, curfews, requiring pet cats roaming outdoors to wear collar-mounted predation-deterrents, or compulsory confinement of cats to their owners' premises; and

- the principle's requirement for extensive consultation in implementing precautionary measures should encourage collaborations involving conservation biologists, veterinarians, animal welfare activists, concerned citizens and municipal officers.

Scientists, managers and politicians should survey and collaborate with the public before adapting policies or other actions in accordance with the precautionary principle (Lilith et al. 2006). This report is a step in that direction.

Personal responsibility is key and must be fostered

America doesn't have a problem with pets, its problem is pet owners and people who feed stray and feral pets. The problem arises from a profound scarcity of personal responsibility.

For example, Crowley et al. (2019) found that the perceptions of risk and responsibility among British cat owners were riddled with excuses. According to cat owners, cats' hunting behavior is not a problem because it is a) desirable or b) natural – but if it is a problem it's natural. Some owners were willing to admit that their cat's predation was harmful to wild bird populations, unnecessary or cruel (with the focus on individual suffering and cats playing with their prey), or simply unpleasant (largely because their cat brought the animals into the house). However, even the rare cat owner who expressed some regret for its depredation on wild birds was unconcerned about wild mammals because of a perception that they were "vermin," too numerous to worry about, or already declining in numbers.

Exploring their perceptions of responsibility raised similar issues. Some cat owners believed they have no responsibility to control their cat's hunting behavior because a) they didn't think it was a problem in the first place or b) they claim it would be extremely difficult or impossible. One cat owner advised, if you don't like it "don't get a cat." Other cat owners believed they have some responsibility to control their cat's hunting behavior and were willing to take some action such as using a collar with a bell or keeping the cat indoors at night, but most were not willing to permanently confine their cat. Many of these owners believed that confinement was unnatural and reduced the cat's quality of life. While some admitted worrying about their cat's safety while it was prowling the neighborhood, they felt that the cat's quality of life outweighed the risk. Finally, some cat owners believed that their cat had an insignificant effect on wildlife, but that cat owners shared a collective responsibility because high densities of cats could be detrimental to wildlife populations. Crowley et al. (2019) apparently found no cat owner willing to accept full responsibility for their cat's predation. The investigators did, however, observe in passing that cat owners in the United States appeared to be more willing to keep cats indoors.

If owners do not see their pets' behavior as unusual or problematic, or if they are waiting for all cat owners to act in concert, then they will be less likely to voluntarily assume responsibility for asserting some level of control (Crowley et al. 2019). The most important hurdle in assuming responsibility was the owners' belief that it would be extremely difficult or impossible to control their cats' behavior. Many cat owners throw up their hands in frustration or use it as an excuse not to do anything about it.

Dog owners, while far from perfect, have largely learned to accept the responsibility for their pet. Fostering a greater sense of personal responsibility is a goal held in common by many animal control and pet experts.

Free-roaming pets must be adopted, confined or euthanized

To correct the imbalance, free-roaming cats (and rabbits) must be treated more like free-roaming dogs. In other words, they shouldn't be released into the wild and allowed to roam without supervision. Cats already released into the wild should be removed by adoption, confinement, or euthanization.

The next section of the report uses expert advice to compile a list of management recommendations for rectifying the regulatory imbalance and protecting wildlife and human health. Many of the recommendations focus on confinement, licensing so owners become more responsible, further limiting unplanned breeding, increasing adoption, reducing outdoor feeding stations, public education, better enforcement and legislation, where needed, to facilitate these goals. Crawford et al. (2019) have made an excellent case for these recommendations in Australia.

A municipal program to remove free-roaming cats from the city, because it is more expensive than providing information and passing ordinances, should be the last resort. But it will be necessary. It only takes a few people ignoring or flaunting the rules – and continuing public non-engagement or apathy – to maintain high numbers of free-ranging cats. Most, if not all, of the cost of removal could come from licensing fees. A cat license should not be less expensive than a dog license. Relative size of pets should not be a factor, otherwise the owners of miniature Chihuahuas are already paying too much for a dog license.

Removal, using lethal methods or confinement when cats cannot be adopted out, isn't an easy choice. It will be highly controversial for starters. TNR caretakers and others who feed feral and stray cats, like most pet owners, derive a strong sense of emotional satisfaction and self-worth from caring for the cats (Finkler and Terkel 2011). Like TNR, lethal control alone has never eradicated feral cats from a community. But there are reasons to believe that removal, in conjunction with other methods, can be effective at reducing numbers of feral cats far below current levels.

Note that, despite the claims of TNR and "no kill" proponents (e.g., Schaffner 2017), "removal" is not a euphemism for "kill." Just like the way TNR is practiced, the first step in physically removing free-ranging cats from the environment should be adoption, where feasible and prudent. However, if a free-ranging cat is unsuitable for adoption, then a removal program would euthanize or permanently confine the cat rather than release it back into the wild where it could continue to adversely affect the environment and human health for another decade or more. Cats should not be held by the AACC for a long period if the facility is being flooded with incoming cats.

The municipality has long practiced removal. Most cats taken to the AACC center – about 80% over the past three years – are not euthanized, they are adopted or returned to their owners. While some "no-kill" proponents seek to demonize traditional cat control by calling it "catch-and-kill," a more accurate epithet for Anchorage's animal control effort would be "catch-and-adopt." If the number of free-ranging cats could be reduced by any means short of euthanasia or confinement, we would all benefit. So that is the first priority.

Free-ranging cat (and rabbit) populations can be limited in size by reducing the number of feeding stations and shelter, by reducing the number of fertile cats (and rabbits) in the general population, by licensing and fines which make owners more responsible, and by restricting cats (and rabbits) to the indoors, unless they are restrained by a leash or other containment method.

Anchorage residents seem to have a laissez-faire attitude about outdoor cats. Better enforcement of the leash law, with the added threat of removal (which might mean euthanasia), will increase compliance and reduce the rate of abandonment.

Feral cat advocates will argue that restricting outdoor access and not feeding outdoor cats is inhumane. Tell that to the birds.

While these actions will reduce the free-ranging cat population, removal will also be required. Feral cats have been eradicated on some small islands. Anchorage is not on an island, but the city is an "island" in a biogeographical sense. It's an urban area surrounded on two sides by ocean and on the east by a huge swath of wild country that is inhospitable to cats due to an abundance of wild predators (Ferriera et al. 2011). Thus, immigration is limited. The primary sources of feral cats in Anchorage are abandoned cats and so-called "outdoor" and "indoor-outdoor" cats that become strays, both sources that should be easier to control than immigration from surrounding areas.

TENVAC (trap-evaluate-neuter-vaccinate-adopt-contain) – as practiced in Hillsborough County, Florida, and several other communities – may be preferred to euthanasia. TENVAC is feasible in Alaska where there are no entrenched TNR programs because no one has been allowed to legally establish feral cat "colonies" by permit. Permanent confinement will be more expensive than euthanasia, but if the public demands a "no-kill" solution, then confinement is preferable to doing nothing. Well-publicized campaigns to sterilize and stop abandonment, paired with adoption of strays and a dedicated facility for confining unadoptable cats, have reduced the number of free-ranging cats in some communities.

In other countries, feral cat control agents have used poison baits such as Curiosity (which uses para-aminopropriophenone, or PAPP, in an impervious pellet) and Eradicat (which uses sodium monofluoroacetate, or Compound 1080, injected or inserted as a pellet into a sausage) on islands and on a continent-wide scale in Australia (Gammon 2015, Johnston et al. 2011). The pellet in Curiosity bait is reliably consumed by cats but rejected by many non-target species; however, because poison would almost certainly do collateral damage to wildlife and other pets, there is no need to consider using poisoned baits in Anchorage. The municipality doesn't have to adopt other extreme measures being tested in Australia, such as a grooming trap dubbed the Felixer which employs lasers and sprays a poisonous gel on cat fur, birth control injections, genetic modification, an impenetrable fence, or injecting poison pellets under the skin of prey animals (Gammon 2015, Lysaght 2017, Kachel 2018, Small 2018, O'Brien 2018). But when a cat is captured and the owner cannot be found and it is deemed unadoptable, then the cat should be removed from the outdoors. The decision to use humane euthanasia or confinement as a last resort is only a matter of will.

MANAGEMENT RECOMMENDATIONS

"If a fraction of the millions of dollars being expended to neuter, reabandon, and feed cats was directed toward enhancing education and supporting more effective animal control ordinances and their enforcement, we would be much farther down the road toward effectively reducing the problem of free-roaming cats than we are today."

Paul L. Barrows, DVM, PhD, DACVPM

An effective management plan should include goals, objectives and practical solutions. This report's overarching goal is to make cat care and control more consistent with dog care and control and to address several issues where cats or cat ownership has a different impact from that of dogs.

Objectives

To reduce as much as possible in Anchorage the number of:

- unowned pets
- unplanned litters
- pets in shelters
- pets euthanized
- tons of untreated pet waste
- incidents of infectious zoonotic diseases
- wild animals killed by pets or feral animals

Recommended solutions

To achieve this end, the Municipality of Anchorage should consider implementing the following solutions. I have divided them into broad categories.

Responsible ownership:

- Require a license for all cats. The fee should be the same as that required for dogs, with a lower fee for sterilized animals.
- Broaden the definition of a pet owner or caretaker to include a) anyone providing food or water to a feral, stray or free-roaming dog, cat or rabbit for a period of 15 days or more, and b) anyone who brings a dog, cat or rabbit to a veterinary clinic or animal shelter for an injection or other health care, with or without the intent of releasing the animal back into an outdoor environment.
- Require microchips, in addition to visible ID and rabies tags, for all cats and rabbits not confined to a hutch.
- Ban outdoor feeding of dogs and cats, unless the food is immediately consumed.

Pet acquisition:

- Require pet stores to sell only dogs and cats obtained from shelters. People looking for specific breeds may still purchase these pets from licensed breeders.

- Require that dogs, cats and rabbits be sterilized before they are capable of breeding unless the owner purchases an annual intact permit, breeder's permit, or both. Cats should be sterilized at 6-14 weeks of age in accordance with recommendations of the American Association of Feline Practitioners.
- Limit the number of pets in a household.

Enforcement:

- Enforce the leash law for cats and rabbits.
- Better enforce the license law for dogs and cats with the objective of making animal control self-sufficient. Owners of pets without a visible license should get one free pass, then be fined in addition to the license fee. Owners of pets who have received a license and lost the collar or tag should not be fined if the pet has an up-to-date microchip.
- Email owners annual reminders to renew pet IDs and update microchip information, if necessary.
- Return cats and rabbits to their owners, and hold them accountable for repeat offenses. Owners should be subject to escalating penalties if and when future incidents occur.
- Establish stiff fines for abandoning pets, defined as when a licensed owner moves to a different community or neighborhood (new household at least two miles from the former) and the pet is subsequently recovered in the previous neighborhood with an ID tag or microchip linking that owner to the pet; i.e., it is not a sufficient defense for a licensed owner to claim that the pet couldn't be found when the owner moved or that the pet was transferred to someone else in the previous neighborhood without prior notification.
- Trap and remove cats and rabbits from public lands, particularly illegal cat "colonies."
- Ban cats and rabbits from public lands unless restrained by leash or confined.
- A dog, cat or rabbit found on a private property without written permission of the property owner should be regarded as a stray.
- Increase municipal fines for unlicensed free-ranging cats and rabbits so that they are the same as those for dogs, and enforce those laws.

Animal care and control:

- Increase Anchorage Animal Care and Control (AACC) staff and add at least one enforcement officer whose primary mission is to remove free-ranging cats and rabbits.
- Revise AACC intake and adoption forms to collect data on age, gender, ownership of other pets, motivation and other pertinent circumstances leading to the decision to relinquish or adopt an animal.
- Conduct a scientific survey to better understand pet ownership in Anchorage and to assess the level of support for various animal control programs, including euthanasia and permanent confinement. The survey should provide estimated or relative costs of various methods, as well as their likelihood of success.
- Conduct a scientific estimate of the number of free-ranging dogs, cats and rabbits in the municipality as a baseline for measuring the success of management actions.
- If the public demands a "no-kill" solution to removing free-ranging cats and rabbits, consider encouraging or facilitating a trap-evaluate-neuter-vaccinate-adopt-contain (TENVAC) program by a licensed nonprofit humane organization.

Information and education:

- Promote and encourage adoption before resorting to euthanasia. However, to keep people from "adopting" cats just to "save" them, and to keep cats that are determined to

roam and hunt from continuing to do so, the municipality should adopt a "two strikes and you're euthanized" rule. Any unowned cat brought into the AACC center (1st strike) can only be adopted out once. If the cat is re-captured and returned to the AACC center (2nd strike) and the new owner cannot be found, it should be euthanized.

- Inform and educate the public – on the Animal Control website, in brochures, through social media or by other means – regarding the magnitude of predation by free-ranging cats on birds, the likelihood of attracting bears into neighborhoods by outdoor feeding, the diseases humans can contract from cats, and the inhumane living conditions and short lives of feral cats as opposed to cats kept indoors.

The municipality should also consider asking the State of Alaska to:

- Add feral cats to the list of species that may not be intentionally or negligently fed by humans.
- Prohibit leaving dog or cat food outdoors after a pet has eaten its fill to avoid feeding feral cats, other feral or invasive animals such as mice and rats, and wild animals listed in 5 AAC 92.230.
- Add feral cats to the state's list of invasive species.
- Require cat and ferret owners, like dog owners, to affix metal tags on their pets bearing the number and year of their rabies vaccination certificate.
- Investigate the risks of toxoplasmosis to public health in accordance with 7 AAC 27.020 and, if significant, quarantine potentially infected cats to prevent the spread of the disease to humans (particularly pregnant women and immuno-suppressed individuals), other pets and wild animals.
- Revise AS 03.55.030, the state law that allows anyone to shoot free-ranging dogs that annoy or bite domestic and wild animals (under specified conditions), to include free-ranging cats that harass wildlife.

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Ernest Hemingway

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you meet
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APPENDIX A: Anchorage Animal Care and Control statistics, Anchorage, Alaska (2008-2017).

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total	Mean
CATS												
Impounds	72	44	42	48	29	42	30	26	14	36	383	38
Protective custody[1]	14	35	56	13	25	13	16	21	12	15	220	22
Truck stray[2]	579	455	375	407	387	412	305	338	340	290	3888	389
Office stray[3]	1686	1483	1314	1457	1273	1147	891	783	750	817	11601	1160
All strays	2265	1938	1689	1864	1660	1559	1196	1121	1090	1107	15489	1549
Owner surrendered	1304	1090	1091	937	887	786	485	504	417	520	8021	802
Returned	39	28	21	34	32	32	28	38	30	32	314	31
Owner requested euthanasia[4]	154	159	138	134	104	110	102	83	98	74	1156	116
Dead on arrival	173	178	158	187	184	155	178	163	186	182	1744	174
Total intakes	3848	3294	3037	3030	2737	2542	1857	1793	1661	1784	25583	2558
Total live received	3675	3116	2879	2843	2553	2387	1679	1630	1475	1602	23839	2384
Adopted	1625	1359	1268	1077	1089	1050	816	925	853	969	11031	1103
Claimed	254	222	201	193	205	228	248	243	210	204	2208	221
Owner requested euthanasia[4]	165	165	147	137	101	109	103	88	99	74	1188	119
Died	25	31	27	20	21	27	29	15	27	19	241	24
Missing	1	0	0	1	0	0	0	0	2	0	4	<1
Released to wild	0	0	0	0	0	0	0	0	0	0	0	0
Transferred	0	0	0	0	0	0	0	4	0	0	4	<1
Euthanized	1612	1321	1264	1401	1154	997	480	346	282	320	9177	918
Feral[5]	55	75	46	150	143	199	95	60	52	11	886	89
Dead on arrival	173	178	158	187	184	155	178	163	186	182	1744	174
Total outcomes	3855	3276	3065	3016	2754	2566	1854	1784	1659	1768	25597	2560
DOGS												
Impounds	175	195	148	150	135	120	149	129	104	110	1415	142
Protective custody[1]	63	60	67	61	90	52	49	96	43	77	658	66
Truck stray[2]	665	586	387	385	412	330	402	345	262	292	4066	407
Office stray[3]	1261	1294	1147	1295	1105	882	801	886	865	900	10436	1044
All strays	1926	1880	1534	1680	1517	1212	1203	1231	1127	1192	14502	1451
Owner surrendered	1131	1026	1050	980	915	772	651	629	489	553	8196	820
Returned	86	94	96	96	72	51	67	49	62	67	740	74
Owner requested euthanasia[4]	268	262	264	239	206	225	183	168	174	185	2174	217
Dead on arrival	183	207	150	163	183	163	136	137	120	120	1562	156
Total intakes	3649	3517	3159	3206	2935	2432	2302	2302	1999	2184	27685	2769
Total live received	3466	3310	3009	3043	2752	2269	2166	2165	1879	2064	26123	1612
Adopted	1589	1452	1382	1302	1090	894	842	811	750	740	10852	1085
Claimed	1163	1175	954	1011	975	820	894	1008	851	970	9821	982
Owner requested euthanasia[4]	291	293	283	243	205	232	195	189	174	193	2298	230
Died	14	9	12	3	6	10	5	6	5	8	78	8
Missing	1	1	0	0	1	0	0	0	0	0	3	<1
Released to wild	0	0	0	0	0	0	0	0	0	0	0	0
Transferred	0	0	2	0	0	0	0	0	0	1	3	<1
Euthanized	421	378	378	489	469	320	210	170	103	145	3083	308
Feral[5]	0	0	0	0	0	0	0	0	0	0	0	0
Dead on arrival	183	207	150	163	183	163	136	137	120	120	1562	156
Total outcomes	3662	3515	3161	3211	2929	2439	2291	2321	2003	2177	27709	2771
Dog bites	509	496	460	495	551	482	575	522	500	526	5116	512
Cat bites	74	58	60	76	90	96	93	78	75	89	789	79
VOLUNTEER HOURS												
Dog walking	6510	9093	10419	7970	5666	3285	2610	1886	1454	1284	50177	5018
Cat purring	3370	4906	4946	4151	2648	2640	2386	2052	2086	2136	29185	2919
Total volunteer hours	16469	23673	24946	17464	13298	10647	8800	7941	8478	8083	139799	13980
NOTICE OF VIOLATIONS												
No license (dogs)	494	469	481	454	305	342	461	280	399	308	3993	399
No ID (cats)	0	0	0	7	6	0	0	0	0	0	13	1

[1] "Protective custody" is "An officer shall take an animal not subject to impoundment into protective custody when necessary to preserve the animal's health or safety and humane care and treatment" (AMC 17.25.090).
[2] "Truck stray" is a stray animal picked up by an animal control officer in the field.
[3] "Office stray" is a stray animal brought by a member of the public to the animal control center.
[4] "Owner requested euthanasia" is different for intakes and outcomes each month because not all pets brought in are euthanized that month. The figure under outcomes is for the number euthanized in accordance with owners' requests that month.
[5] "Feral" is a subset of the euthanized outcome. Animal Control considers only unowned animals that display serious anti-social behavior to be feral.

APPENDIX B: Definitions

Adopted: Animal was adopted from Animal Control.

Claimed: Animal was claimed by owner from Animal Control.

Dead on arrival: The animal was deceased when picked up by Animal Control officer or was brought to the Animal Control Center deceased.

Died: Animal died while at Animal Control.

Euthanized: Animal was euthanized at Animal Control, including those at the owner's request.

Feral: Animals (mostly cats) that do not exhibit any social behaviors, are fearful and avoid human contact, and do not demonstrate any social responses to human interaction. Some cats enter a facility and initially exhibit hostile/fearful behaviors but are not feral. A feral cat is generally a cat who lives outdoors and has little or no human contact. While not an exact science, a non-domesticated cat is not adoptable. All feral animals are euthanized. The feral category is a subcategory of Outcomes/Euthanized; it is how many of the animals that were euthanized that were deemed feral.

Impounds: Animal was brought into Animal Control for bite quarantine/ or enforcement investigation.

Missing: Animal who was on the Animal Control inventory cannot be located. It does not occur often, but occasionally animals are stolen from the kennels.

Office stray: A stray animal brought by a member of the public to the Animal Control Center.

Owner requested euthanasia: Euthanasia was requested by owner.

Owner surrendered: Animal was relinquished by owner or caretaker.

Protective custody: "An officer shall take an animal not subject to impoundment into protective custody when necessary to preserve the animal's health or safety and humane care and treatment." – per Title 17, para 17.25.090. According to M. Tierney (personal communication, 2018) this happens when an animal is brought to the Animal Control Center by the Anchorage Police Department or Anchorage Fire Department or an animal control officer is called to assist APD/AFD and pick up the animal in a circumstance that does not involve animal cruelty. (i.e., APD is taking someone into custody for drunk driving that had an animal with them).

Released to wild: Animal was released back into the wild. It is rare to receive an animal that is not domesticated, but Animal Control has received wild animals. (e.g., snowshoe hares).

Returned: Animal was adopted and then returned within 30 days of the adoption.

Transfer: Animal was transferred out of state to a sanctuary. Very rare, but there was a wolf hybrid that was transferred out of state.

Truck stray: A stray animal picked up by an animal control officer in the field.

Author's note

I like cats. I have fond memories of an unowned cat who slept on my green woollen blanket, across my lower legs, on a metal rack in Da Nang nearly 50 years ago. I haven't had an intimate relationship with a cat since leaving Vietnam and mustering out of the Marine Corps. But I admire the way they look and the way they move.

I've owned dogs. The last two, Ande and Cody, grew up with their sisters, my daughters. They were good dogs, the best. Having achieved the pinnacle of dogdom, I feel sure they were reincarnated as cats.

I should also acknowledge the help of my wife and live-in editor. When I mention cats, Lisa's back has started to arch and I fear she may soon start to hiss. So I'm wrapping up almost three year's worth of research into this formidable topic. Now it's time for you to do something.