

Animal Welfare Forum: Management of Abandoned and Feral Cats

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The following papers were submitted by speakers at the 2003 AVMA Animal Welfare Forum, which was held at the Chicago Marriott Northwest, Hoffman Estates, Illinois. These papers have not undergone peer review; opinions expressed are those of the authors and not necessarily those of the American Veterinary Medical Association.

During the Forum, the 2003 Animal Welfare Award was presented posthumously to Franklin M. Loew, DVM, PhD, DACLAM.

The AVMA Animal Welfare Forum is an annual event planned by the Animal Welfare Committee, under the direction of the Executive Board. For additional information about the Forum or the Animal Welfare Award, please contact the AVMA Communications Division.

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Welcome

Bonnie V. Beaver, DVM, MS, DACVB
AVMA 2003–2004 President-Elect

On behalf of the more than 70,000 members of the American Veterinary Medical Association, it is a privilege for me to welcome you to the 14th annual Animal Welfare Forum. This forum is the highlight of Animal Welfare Week, which promotes public awareness on issues that affect the animals we serve. As a leader in addressing animal welfare, the AVMA considers a broad range of issues. To improve understanding of the various aspects of a current topic, the annual Animal Welfare Forum provides an opportunity to bring the science of these hot issues to the profession, public, and press. This year's topic is the "Management of Abandoned and Feral Cats." As many of you know, I have devoted a great deal of my professional career to studying cat behavior, the human-animal bond, and animal welfare, so it is an honor for me to be able to introduce this topic.

Feral cats evoke hot debates about ecologic impacts, individual cat welfare, human responsibilities, intercat disease transmission, humaneness, con-

trol of zoonoses, and management or dissolution of unowned cat colonies. At the current time, there are no easy answers, and I expect this Forum will raise as many questions as our speakers attempt to answer. We will not always agree, but we will come away with increased knowledge and a renewed commitment to work for the welfare of all the animals with which we share this earth.

As you can see by reviewing the program, our speakers are well-known, respected, and dedicated scientists. They bring the most current knowledge in the area of feral cats, and I personally thank all of them for taking time from their very busy schedules to share their expertise with us today.

There is a saying that goes, "Letting the cat out of the bag is a whole lot easier than putting it back in." That is the purpose of the Animal Welfare Forum. It is time to gain new knowledge, challenge old beliefs, switch paradigms, and examine the management of abandoned and feral cats.



Understanding issues and solutions for unowned, free-roaming cat populations

Margaret R. Slater, DVM, PhD

Free-roaming cats are at the center of an international controversy. To put it bluntly, in some countries, the question has become do we cosset or euthanize unowned cats? Are they to be seen as victims or villains? In the United States, concerns and conflict have penetrated the scientific world as well as the consciousness of the general public. The past 5 years have seen an increase in related peer-reviewed publications, presentations, and letters to the editor as well as articles in newspapers and cat-oriented magazines.

How animals are viewed has changed, and companion animals, in particular, are perceived to be worth

more than their economic value. Animals have been shown to feel pain, fear, and other emotions. This shift in values and attitudes toward animals, together with advances in animal welfare science, has created widespread support for the idea that animals deserve consideration of their well-being and health needs beyond minimal food and shelter. Euthanasia of companion animals because no one wants them is no longer the preferred solution to an overabundance of dogs and cats. This shift in mentality also means that questions are increasingly being asked about how to best control ownerless, free-roaming cat populations. The passion human stakeholders bring to this debate becomes easier to understand when one considers that cats have been the most popular pet in the United States for the past several years.¹

Issues and solutions for dealing with unowned free-roaming cats are not simple, inexpensive, or broadly applicable. Indeed, even the definitions of each cat subpopulation are unclear. Let me begin by defin-

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ing some terms.² A free-roaming cat is the general term for any cat living outdoors at least part of the time. Unowned free-roaming cats include stray socialized cats that are lost or abandoned as well as unsocialized feral cats. For the purposes of this discussion, a feral cat is one that is too frightened of humans to be placed into a typical home as a companion animal. Further complicating our understanding of cat subpopulations is the fact that cats may move from one subpopulation to another during a lifetime. For example, an owned cat that is abandoned and living on her own for a time may become feral. That cat may have kittens that are also feral, or her kittens may be caught before they are 8 weeks old and be socialized, becoming suitable indoor companion animals. Understanding what each scientist means by each term is important when data from different studies are compared. Also, each subpopulation comes from a somewhat different source, and different interventions are required for control of existing cat populations (eg, sterilization) and prevention (eg, identification and education).

A key to comprehending the fervor surrounding free-roaming unowned cats is understanding the difference in people's perceptions of them. Cats serving in the role of companions may be viewed as family members. Cats working to keep rodents under control in barns, stables, and gardens may be valued but only in terms of their ability to perform their job well. Still others perceive cats as nuisances that defecate in gardens, leave pawprints on cars, make noise at night, or carry disease. Each perspective colors the views of scientists, policymakers, and ordinary citizens; gives rise to different solutions to the problem of free-roaming cats; and is accompanied by a different comfort level in implementing each proposed solution.

Historically, cats have been viewed as gods to be worshiped and protected, the devil's tool, or witches' familiars.³ This ambivalence is seen today in the contrast between cats as the most popular companion animal in the United States and much of western Europe⁴ and popular images of them as sneaky, furtive, and indifferent to humans. Cats were, and in some cases still are, believed to be unclean and carriers of disease.

Free-roaming unowned cats, especially feral cats, are considered to be peripheral to our orderly world. They are not owned and therefore have no one to bring them as patients to veterinary clinical settings. They are not subjects of our direct concern, and this makes it easier to view these cats as different from companion animals. This also precludes caring for them as would be appropriate for a family member. In addition, there is the reality that truly feral cats cannot be handled in the same way as socialized cats.

At this point, what should be done with existing unowned cats becomes subject to debate. Is it most humane to trap and euthanize them? What length and quality of life will they enjoy if they are sterilized, vaccinated, and cared for on a daily basis? What are the practical implications of available solutions? In some countries, cats are poisoned, shot, and hunted with dogs. That would not likely be well received in the United States, even if it were legal. Which option is most effective over the short and long term? What

choices prevent public health problems and wildlife predation?

The answers to some of these questions are still unknown. What we do know is that euthanizing on location by use of poisons, guns, and disease introduction is not practical in inhabited areas or where other species might also be killed. Even on islands where geographic area is more manageable, millions of dollars and thousands of hours of work over many years have been needed to eradicate cats.⁵⁻⁷ And all this with a closed cat population. Trap and remove for euthanasia has been practiced in many localities for many years as part of animal control programs. To the best of my knowledge, no location has ever achieved long-term control of free-roaming cats by use of this method. Relocation of unowned cats to sanctuaries is an appealing option; however, there is limited space available, and these cats may not receive proper care nor are they ensured a good quality of life. Sometimes, relocation to a new place where the cats are wanted is an option. But there are risks to the cats in adapting to their new home, and there are not always residents willing to take on more cats.

Trap, neuter, and return as a nonlethal control method has been proposed as a viable option.⁸ In this method, cats are humanely trapped, anesthetized, examined, sterilized, vaccinated, ear-tipped or notched, and returned to their caregivers for daily food, water, shelter, and supervision. On college campuses, several programs have been shown to have been effective.^{9,10} In Massachusetts, a community program included a cat-only shelter, education on rehoming a cat, and low-cost sterilization.² That program has been extremely successful at reducing the number of free-roaming unowned cats to the point where there are no longer cats in some locations on the waterfront, where there were previously numerous cats.¹

The public health implications of free-roaming cats are complex. Public health agencies are charged with protecting the health of the public. This means that they address possible risks and focus on problems for humans. The numbers of humans involved, severity of the health problem, and degree of public concern all influence the importance of a particular disease to public health officials, especially in the competition for scarce resources. The problem for public health officials is further complicated by the fact that the actual magnitude of the risk of many zoonotic diseases potentially carried by free-roaming cats is unknown.

Related public health concerns in the United States frequently center on rabies. In the United States, rabies is maintained almost entirely in wildlife. Most cases of rabies are in skunks, raccoon, bats, and coyotes.¹¹ In 2001, 93% of all rabies cases were in wild animals.¹² Domestic animals are then infected by these species. Cats have become the most common domestic species infected with rabies since the early 1990s, possibly due to less consistent vaccination of cats and their being allowed to roam more freely than dogs.¹²⁻¹⁵ Dogs and cats are nearly always infected with the local terrestrial rabies virus variant.¹⁶ Therefore, dogs and cats are unlikely to play an important role in transmission of bat variant rabies to humans.

Since 1990, 33 human cases of rabies have been reported in the United States. Seven people were infected outside the country, generally with the dog variant.¹² All but 2 of the remaining 26 people were infected with bat variants of the virus. The remaining 2 cases were dog-coyote variants. No human cases of rabies have been associated with cats in recent decades in the United States. Control of rabies in wildlife species has been primarily through oral immunization of free-ranging animals. Programs aimed at long-term, widespread reduction of wildlife populations, possibly infected with rabies, are not recommended and have never been shown to be effective.¹²

In Asia, parts of Latin America, and much of Africa, exposure to infected dogs continues to be the major source of rabies in humans.¹⁷ Widespread vaccination campaigns as well as research on how best to achieve compliance with vaccination have been conducted. While relatively little research has been done on cat populations and control of rabies, studies¹⁸⁻²⁰ of dog populations in a number of countries offer some suggested solutions. Culturally sensitive programs must be designed to effectively control rabies, and the relationships between residents and animals must be understood.^{19,21} The WHO recommended not to pursue dog removal as part of rabies control programs.^{19,20} Instead, vaccination of pets and livestock has been shown to provide a barrier that protects humans from wildlife rabies, and available vaccines are very effective.^{12,16} Vaccination of many free-roaming cats may achieve a herd immunity effect²² and provide an additional barrier between rabid wildlife and humans.

Another important public health concern is bites. While dog bites are more common in the United States, cat bites are more likely to result in rabies postexposure prophylaxis.¹⁴ Cat bites are more likely to be from unowned cats that are provoked.^{15,23,24} Cat bites or scratches are more commonly inflicted on adult women in the summertime; therefore, education, reductions in numbers of stray cats, and avoiding direct contact should reduce risk of cat bites substantially.

Many other potentially zoonotic diseases may be of concern to public health agencies and veterinarians.²⁵ Toxoplasmosis is a disease that is often discussed because cats are the only species known to excrete oocysts in their feces.²⁶ Tests on 33% to 58% of stray cats were positive for antibodies.^{26,27} Thirty-eight percent of domiciled adult cats were seropositive. However, epidemiologic studies^{28,29} of risk factors for toxoplasmosis in humans implicate environmental and food-related factors, not living in a neighborhood with cats. In addition, mechanical transmission of oocysts by other species such as dogs has been documented.³⁰ Discussions of other common zoonoses applicable to free-roaming cats have been published.^{2,25}

Debates about free-roaming cats and wildlife generally focus on 3 major issues. The first is predation on native species by cats. The second is the concept of cats as an introduced species that should not be allowed to remain in the wild. The third is more philosophical in nature: cats are viewed as a domestic species; consequently, it is seen as our responsibility to keep them

safely confined for their protection as well as the protection of other species.

Predation by cats is studied by scat analysis, analysis of samples obtained from the gastrointestinal tract, records of prey brought home, or remains of prey found in the field. Each method has its limitations, and results from 1 study may not be comparable to results from studies that use other methods. This needs to be considered when evaluating and making generalizations about predation by cats.³¹ Cats are opportunistic predators, eating whatever food sources are readily available, including carrion, garbage, and cat food. In general, cats' diets on the mainland comprise approximately 70% mammals.³¹ The remaining components of their diet vary by geographic location and proximity to humans. Birds, reptiles, insects, and garbage are all possible food items for cats.³² Urban cats are likely to have different consumption patterns than cats living in rural or wilderness areas. The prey of cats in cities and towns are likely to be nuisance species, such as rats, mice, starlings, and pigeons, rather than endangered ones.³³

The argument that cats are an introduced species and therefore must be removed to ensure survival of native species is based on several assumptions. The first assumption is that if cats were removed, the habitat would return to its normal state. This is likely not true because cats are often introduced along with rats, birds, and other predators. Ecosystems are complex, and many factors including the control of rats by cats may be involved.³⁴ Furthermore, human alteration of the environment is the primary reason for reduction and extinction of native species.³⁵ Cats are commonly blamed for extinctions despite inappropriate extrapolations, small sample size, and unclear definitions.³⁶⁻³⁸ They have even been blamed for extinctions of species that were never present.⁶

The second assumption is that we must protect native species from introduced species. This argument has been differentially applied.³⁹ Indigenous coyotes, wolves, bears, and cougars who hunt introduced livestock have been killed for decades to protect domestic species.

The last issue is linked to the rights of animals, itself a very vexing idea. By allowing cats to roam, it is believed that we place more value on the needs of the cat than on the lives of the prey the cat might kill. This argument is not based on the number of prey or ecosystem preservation, but on an individual human's perspective of what cats may need to preserve their quality of life. It is at least arguable that cats can enjoy a satisfying quality of life as safely confined companions in modern home life.

In recent years, increasing numbers of people have expressed concern over the well-being of the cats themselves. Free-roaming cats are vulnerable to cars, dogs, coyotes, humans, disease, starvation, and climate. There are difficult questions about an unowned cat's quality of life and the importance of interactions with humans. There are concerns about disease spread between cats as well as between cats and other species. Reliable answers to these questions are as yet unavailable. At present, it appears that cats spread few diseases

to other cats.⁴⁰ Commonly cited diseases and agents that may be spread between cats include feline leukemia, FIV, and various parasites.

Feline leukemia virus and FIV are of concern for unowned and owned cat populations. Large studies have shown that rates of infection are usually about 5% for feral cats, which is not substantially different from rates determined for pet cats.^{10,41-43} Male cats are more likely to have FIV because that virus is spread by biting and fighting. Feral cats (4% to 18%) in the United States appear to be at lower risk for feline coronaviruses than pet cats (59%).⁴² Because coronavirus is primarily transmitted by the fecal-oral route, burying of feces in the environment rather than sharing an indoor litter box may play a role.

Drawing definitive conclusions about parasites in free-roaming unowned cats is difficult because many studies define cat populations in different ways. Studies have also used convenience samples that may not be representative of the general population. In addition, studies have been performed in different countries, which makes generalization difficult. Some work on the feral cat populations in the southern United States has provided data specific to that group. In Florida, 92% of cats in a sterilization program had fleas and 37% had ear mites.⁴⁴ One study⁴⁵ involving 80 feral and 70 pet cats in California found that feral cats had a somewhat higher prevalence of internal parasites but a similar prevalence of feline viral diseases. Therefore, control of infectious disease needs to address risks associated with all cats. Reducing free-roaming cat populations will contribute to the health of cats in general.

Veterinarians have a central role to play in reducing numbers of unowned free-roaming cats. As part of general practice, veterinarians must provide education about the importance of proper health care and identification as well as about selecting a pet that is a good match for the owner.²⁹ Veterinarians must encourage permanent methods of identification such as microchips or tattoos. They should be proactive in identifying behavioral problems that might cause a cat to be exiled to the outdoors or abandoned. Veterinarians should also know available resources in the community that can help rehome cats that cannot be kept and provide a suggested contact for additional sources of companion cats, cat welfare-related organizations, and general cat husbandry. All of these practices will help decrease the likelihood that a cat will become unowned and should be a part of routine veterinary care.

Veterinarians have many opportunities to help reduce existing populations of unowned, free-roaming cats. They may partner with reputable animal shelters, rescue organizations, or feral cat grass-roots organizations. They may start an organization that helps place homeless cats. They may offer seminars and written materials for their clients, the public, and members of local animal protection organizations on basic infectious disease control, health requirements, or behavioral problems associated with cats. Many veterinarians already choose to volunteer their time at a feral cat spay day or work as a surgeon in a spay/neuter clinic.

Successful control of free-roaming unowned cats

within communities requires that a combination of approaches be used. Humane societies and animal care and control agencies need to consider solutions that reach beyond their doorsteps. Grass-roots organizations must increase their visibility and become more professional in their approach. Veterinarians must recognize their key role as the only source of spay and castration surgeries. Veterinarians also have a responsibility to help reduce sources of free-roaming unowned cats by addressing behavioral problems, pet selection, identification, and vaccination. Doing nothing is not a viable alternative when faced with nuisance complaints, public health concerns, and predation as well as concerns about the welfare of the cats themselves. Creative and effective solutions can be developed only by finding common ground and bringing the strengths of each group to bear the problem. A flexible, tailored, and multifaceted approach will be needed to make a difference in the numbers of free-roaming, unowned cats in the United States, a goal that, after all, is widely shared.

⁴LeBaron S, Merrimack River Feline Rescue Society, Newburyport, Mass: Personal communication, 2003.

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Humane strategies for controlling feral cat populations

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What Are Feral Cats?

The domestic cat has increased in popularity as a household pet in recent decades, surpassing the dog to become America's most numerous pet.¹ Despite the enhanced status of cats as human companions, millions of unwanted cats are admitted to animal shelters each year and most of these cats are euthanatized because homes cannot be found for them. Debate about the true impact of free-roaming cats on the environment, on feline welfare, and as a reservoir of feline and zoonotic diseases is ongoing, often emotional, and

fueled largely by a lack of sound scientific data on which to base credible conclusions. Separating the impacts of free-roaming, owned cats from those of unowned cats is also difficult.

Definitions of various cat populations defy universal acceptance and focus variably on ownership status, lifestyle, and degree of socialization. Cats may be defined as free-roaming if they are not confined to a yard or house, a definition based on confinement of the animal rather than ownership or degree of socialization. Strictly speaking, feral cats are defined as those that are untamed and evasive. They are either born in the wild and lack socialization or are abandoned to the wild and become untrusting of humans. Although feral kittens can be tamed into acceptable pets if captured at

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a young age, enormous effort is often required to tame older feral cats. The lines between loosely owned outdoor cats, tame strays, and feral cats are often blurred. Owned cats that wander or become lost may become stray cats. Stray cats that have lived in the wild for an extended time may become feral. Homeless cats may be adopted. Thus, individual cats may occupy different categories at various stages of their lives. For the purposes of this discussion, "feral cat" will be used to denote any unconfined, unowned cat, regardless of its socialization status.

How Many Feral Cats Are There?

The number of feral cats in the United States is unknown but is suspected to approach that of pet cats (73 million in 2000)¹ and contributes substantially to cat overpopulation.² Feeding of homeless cats is a common activity practiced by pet owners and those without pets of their own. In the suburban community of Alachua County, Fla (85,000 households, 216,000 residents), 12% of households acknowledged feeding a mean of 3.6 cats they did not own or approximately 36,000 feral cats.² County residents also owned an estimated 45,000 pet cats. This indicates that feral cats comprise at least 46% of the local cat population. These findings are similar to results of studies performed in Santa Clara County, Calif, where 10% of households fed a mean of 3.4 cats each³; in San Diego County, where 9% of households fed a mean of 2.6 cats each⁴; and in Massachusetts, where 8% of households fed a mean of 3.7 cats each.⁵ Together, these studies found that feral cats comprised at least 36% to 46% of the total cat population. Thus, feeding feral cats is a widespread activity that crosses socioeconomic strata. Almost half of those who feed cats do not own pets,² implying that efforts to involve those who feed cats in control strategies should extend beyond the pet-owning public typically served by veterinarians, animal control agencies, and animal welfare organizations. For purposes of estimating the size of a community's feral cat population, it is reasonable to estimate 0.5 cats/household. County household statistics are available online at www.census.gov.

Although providing food for unowned cats is a common activity, few of those who feed cats take action to sterilize them. Sterilization of pet cats owned by feeders of feral cats was common (90%) in Alachua County, indicating high compliance with veterinary and animal welfare recommendations for neutering of pets not intended for breeding.² This is consistent with previous reports^{2,6} that 82% to 91% of pet cats are sterilized, although not always before producing a litter of kittens. Given the high rate of sterilization among pet cats, feral cats likely represent the single most important source of cat overpopulation (Table 1).

Although large cat colonies on public property, such as parks and institutions, often comprise the most visible and controversial cat populations, most feral cats live in small groups near the homes of people who feed them.⁷ In Alachua County, most cat colonies consist of a small group of 3 to 10 cats and are often described as a female with kittens and an occasional wandering male.⁷ This is consistent with results of a

Table 1—Projected annual contribution of owned versus feral cats to cat overpopulation.

Variable	Owned cats	Feral cats
Percentage female	50%	50%
Sterilization rate	85%	2%
Litters per year	1.5	1.5
Kittens per litter	4.0	4.0
Kittens per cat annually	0.45	2.9
US cat population	73 million	50 million
Kittens born annually	33 million	147 million

national survey⁸ that reported a mean colony size of 4 to 12 cats and a Hawaiian study⁹ that reported that 65% of colonies consisted of 1 to 10 cats. In most cases, cat colonies are located on private property, particularly at the residence or workplace of individuals feeding them.

Caretakers have reported a strong bond with the feral cats they care for, even though they do not consider these cats to be their pets.⁷ This differs from the traditional image of the human-animal bond, as many of these cats cannot be touched or held and do not live indoors with the caretaker. Nevertheless, cooperation of caretakers is imperative if cat population control programs are to be effective.

Public Health

Rabies—Rabies, a disease that is primarily maintained and transmitted by wildlife, is of particular concern to public health officials. Since 1981, rabid cats have outnumbered rabid dogs in the United States, with 270 cases in cats reported in 2001.¹⁰ Although the dog is the primary vector of rabies worldwide, widespread vaccination of dogs and reduction of the stray dog population since the 1940s have greatly reduced the number of cases in dogs in the United States.¹¹ Today, more than 90% of cases of rabies occur in wildlife, primarily in raccoons, skunks, coyotes, foxes, and bats.¹² The most serious current pandemics of rabies in the southeastern and eastern United States were caused by illegal interstate translocation of raccoons and coyotes by the hunting industry.¹³ A total of 36 humans have died of rabies in the United States from 1990 to 2001, and 75% of these cases were associated with bat exposure.¹² Nine cases were associated with the dog/coyote strains of rabies; all but 2 of these exposures were believed to have occurred in foreign countries. Despite continued concern about the role of cats in human rabies exposure, the last case in a human associated with cats in the United States was reported in 1975.¹⁴ According to the CDC, depopulation of wildlife species that harbor rabies is an impractical rabies control tactic because of cost, repopulation, and public opposition.^{11,15} In contrast, vaccination of skunks and raccoons against rabies via trap-vaccinate-release programs and oral baited immunization has proven quite successful for providing long-lasting herd immunity, even when individual animals received only a single dose of vaccine and when only a portion of the population was immunized.¹⁵ Likewise, a single dose of rabies vaccine protected domestic cats against virulent challenge 4 years later.¹⁶ Although an ideal rabies con-

trol program for dogs and cats consists of an initial vaccine followed by boosters 1 year later and every 3 years thereafter,¹⁰ it is likely that even a single vaccine administered at the time of sterilization helps protect feral cats against rabies.

Bites—Although dogs account for 75% of reported animal bites to humans, rabies postexposure prophylaxis is more commonly administered after cat bites.¹⁷⁻¹⁸ Most cat bites are reported to be provoked from stray cats, with adult women more likely to be bitten than children and men.¹⁹⁻²¹ This indicates that cat bites can be reduced by reducing the stray cat population and avoiding direct handling of stray cats. Even when rabies is not involved, cat bite wounds often result in serious infections. They most frequently occur on the hands, and risk of infection is highest with puncture wounds.²¹ Public health recommendations include immediate cleansing of the wound, medical attention, and prophylactic treatment with amoxicillin-clavulanate. Most large-scale feral cat control programs follow guidelines that minimize the risk of cat bites and scratches. These include the use of humane traps for capturing and transporting cats and the administration of injectable anesthetics to cats in their traps so that they are never handled when they are awake.

FeLV, FIV, and feline coronavirus—Large epidemiologic studies indicate that FeLV and FIV are present in approximately 4% of feral cats, which is not substantially different from the infection rate reported for pet cats.²² As expected, male cats are 4 times as likely to carry FIV as female cats, primarily due to bite wounds incurred during territorial disputes. Infection with FeLV occurs at approximately the same rate in males and females, and the virus is most commonly spread from infected queens to their kittens. Interestingly, feral cats are significantly less likely to have antibodies against coronavirus (4% to 18%), the agent of feline infectious peritonitis, than are pet cats (59%).⁴ Coronavirus is primarily transmitted via a fecal-oral route. Feral cats' behavior of burying their feces may reduce the risk of transmission, compared with pet cats sharing a litter box in a multicat household.

Models of FeLV and FIV transmission in free-roaming cat populations indicate that neither virus impacts overall colony size, which is more influenced by environmental carrying capacity.²³ Furthermore, FeLV and FIV may become extinct sterilized in cat populations that have few aggressive interactions.²⁴ In a closed nonbreeding colony of 26 cats monitored over 10 years, all 7 FeLV-infected cats died within 5 years of diagnosis (median age, 7.2 years), resulting in extinction of the infection from the colony.²⁵ The remaining cats became immune as demonstrated by protective virus-neutralizing antibody titers. Median survival of FIV-infected cats was 12.5 years, and survival of uninfected cats was 8.6 years.

The American Association of Feline Practitioners (AAFP) recommends FeLV and FIV testing of all cats but states that a positive test result should not be used as the sole criterion for euthanasia.²⁶ The AAFP further recommends that all positive screening test results undergo confirmation. Because the accuracy of

positive tests decreases when prevalence is low, as is the case for FeLV and FIV, up to 50% of positive test results for feral cats might be expected to be false-positive. Confirmatory testing is often impractical since recommended confirmatory tests require use of a reference laboratory and it may be several days before results are available. The recent advent of FIV vaccination has added an additional complication to testing. The vaccine induces antibodies against FIV that cause false-positive results in the currently licensed FIV tests. Thus, it is problematic to differentiate FIV-infected cats from vaccinated ones.⁶

Testing recommendations for pet cats are difficult to apply to feral cats for several reasons. The cost-to-benefit ratio of testing large numbers of animals to detect small numbers of infections is a common dilemma in herd health programs. Resources for treating feral cats are limited, and many programs have elected to focus on mass sterilization as the primary goal. For these reasons, most large sterilization programs for feral cats do not routinely test for FeLV and FIV, a policy accepted by the American Academy of Family Physicians.²⁷ Even without testing, it is possible that focusing resources on sterilization will have the additional benefit of reducing transmission of FIV (by reducing fighting) and FeLV (by reducing reproduction; Table 2)

Parasitism—Parasitism is the most common transmissible problem of feral cats. In Florida during the summer, 92% of cats presented for sterilization were infested with fleas and 37% had ear mites.²⁸ A study⁴ of 80 feral cats in California revealed that 54% carried intestinal ascarids, compared with only 4% of 70 pet cats. Tapeworms and coccidia were found in 26% and 13% of feral cats, compared with 4% and 0% of pet cats, respectively. More feral cats (20%) were seropositive for *Toxoplasma gondii* than pet cats (3%), which may represent exposure via hunting for feral cats. In another study,²⁹ *Bartonella henselae* was the most common infection identified in 553 (34%) feral cats in Florida. Two organisms formerly grouped under the classification of *Haemobartonella felis*, *Mycoplasma hemominutum* and *M. hemofelis*, were present in 12% and 8% of these cats, respectively. Only 10% of the cats had antibodies indicating exposure to *T. gondii*. These infection rates for *B. henselae*, *Mycoplasma* spp, and

Table 2—Three models of vertical transmission of FeLV in a theoretical population of 2,000 feral cats: model 1, no cats are tested or sterilized; model 2, 50% of cats are tested and sterilized and cats with positive test results (FeLV+) are removed; and model 3, 100% of cats are sterilized without testing or removal.

Variable	Model 1	Model 2	Model 3
Percentage FeLV+	4%	4%	4%
Adults sterilized	0	1,000	2,000
Adults sexually intact	2,000	1,000	0
FeLV+ euthanatized	0	40	0
Adults FeLV+	80	40	80
Kittens born	6,000	3,000	0
Kittens FeLV+	180	90	0
Total FeLV+ cats	260	130	80

These models assume that 4% of feral cats are FeLV+ and that 75% of kittens born to FeLV+ queens will become infected.

T. gondii are not substantially different than those reported for pet cats.

Taken together, reports of transmissible diseases in feral cats indicate that, for many diseases, feral cats do not have a greater impact than free-roaming pet cats. Given that most pet cats are allowed outdoor access, it is difficult to separate the public health impacts (for both humans and cats) of the 2 groups of cats. Regardless, it is clear that widespread vaccination against zoonotic and feline diseases coupled with population reduction via sterilization will address many public health concerns surrounding domestic cats.

Feral Cat Control

Considerable controversy surrounds methods for controlling free-roaming cats, particularly identification of the option that is most practical, effective, and humane. Of primary concern is the welfare of the cats themselves. Some animal welfarists believe that the feral lifestyle is too fraught with potential risk to be acceptable and recommend preemptive euthanasia of cats on the basis of their lack of ownership rather than on evidence of current suffering. Others believe that the quality of life of feral cats should not be judged differently than those of other species existing in a wild state. The recent growth of the "no-kill" movement has caused some leaders to reexamine traditional beliefs that euthanizing large numbers of healthy animals to prevent potential suffering or as a method of population control can be compatible with the values of a humane society.

Although control of feral cats has emerged as one of the most hotly contested issues in animal control and welfare, the reality is that feral cats are mostly ignored by both governmental and private animal control agencies. Individual colonies of "nuisance" cats may be removed, but few agencies have comprehensive programs designed for a sustained reduction in the number of feral cats in their communities. The debate over feral cat control frequently hinges on the relative attributes of 3 approaches: removal of cats for adoption, life-long confinement, or euthanasia versus sterilization of cats followed by return to their colonies. Regardless of the solutions that are chosen, effective public policy dictates that programs focus on the large numbers of cats that inhabit communities and not simply on high-profile and controversial situations. Because the numbers of cats and the costs of dealing with them are great, planning for the best use of scarce resources and a herd health approach are essential.

Removal of cats—Feral cats have been extirpated from several uninhabited islands by means of poisoning, hunting, trapping, and introduction of infectious feline diseases.³⁰ Although effective, logistic barriers and public opposition would make such strategies in populated mainland areas unfeasible. Effective cat control programs must integrate environmental safety, affordability, sustainability, and public aesthetics. Any realistic plan to control feral cats must recognize the magnitude of the feral cat population, the need to engage in continuous control efforts, and the degree of public affection for feral cats.

Advocates for population control by cat removal

frequently cite adoption as a solution for the feral cat problem. While adoption of socialized cats, particularly kittens, is frequently facilitated by feral cat caretakers, it is not a practical large-scale solution. A large proportion of feral cats are simply too wild to be safely and humanely placed indoors with families. Additionally, although the number of homeless cats euthanatized at animal shelters is declining because of increased sterilization of pets, there is still a large imbalance between available homes and the number of cats born each year. Current evidence suggests that approximately 2.5 to 3 million cats are euthanatized annually at animal shelters.³¹ Approximately 75% of these are classified as adoptable but must be destroyed within a few days because there is not enough space to house them. This suggests that a large influx of feral cats removed from the environment would crowd shelters and increase euthanasia of both feral and friendly homeless cats.

Establishment of sanctuaries that confine unadoptable cats for life is another alternative for control of feral cats. However, most sanctuary programs that permanently house feral cats are filled to capacity almost immediately after opening. One of the largest sanctuaries in the country is Best Friends Animal Sanctuary in Utah. Although the sanctuary permanently houses approximately 400 feral cats with special needs, it also operates a trap-neuter-return (TNR) program because the number of feral cats in the community vastly outstrips the capacity of the sanctuary.⁶ The National Humane Education Society (NHES) found that its program to house feral cats in its sanctuary in hopes of taming the cats for adoption ultimately led to a decrease in overall cat adoptions because the cats never became tame.⁴ Instead, the sanctuary was overcrowded with unadoptable cats and closed to new admissions. In remedy, the NHES instituted the Feral Cat Adoption/Relocation Program in which outside agencies were solicited to accept cats for release in appropriate environments in exchange for stipends of up to \$25,000 for 50 cats.

A widely cited example of cat control by removal is ongoing at Bidwell Park in California. The Chico Cat Coalition (CCC) was formed in 1996 to remove approximately a dozen cats that inhabited the environmentally sensitive park. Cats are adopted or placed in a private barn sanctuary. Unexpectedly, the high visibility of the project encouraged more abandonment, and new cats and kittens are found regularly.⁶ In 7 years, the group has removed 633 cats from the park, of which 77% have been adopted. Most remaining cats are unadoptable and occupy the sanctuary, which is closed to cats from other locations. A contract with the city subsidizes the CCC's ongoing efforts to control cats by removal from the park. Although the Bidwell Park example demonstrates that removal of cats may be a solution for selected cat colonies that cannot remain in place, it also demonstrates that removal is not scalable to the capacity necessary for reductions in cat populations on a community-wide basis and is unlikely to be successful unless applied on a continuous basis.

TNR—A growing grass roots movement has promoted control of feral cat populations through steril-

ization. Trap-neuter-return seeks to sterilize large numbers of cats and return them to their colonies. Although the ultimate goal is extinction of the colony due to adoption of friendly cats and natural attrition, it may be more realistic to plan for large reductions in cat populations but not necessarily the eradication of all cats. Some programs are very comprehensive, including extensive veterinary care, colony registration, monitoring, and adoption of tame cats, whereas others focus solely on sterilization. Most programs are privately run by volunteers dependent on donations for operating costs, but municipal animal control agencies are increasingly opting for TNR on the principle that sterilization is ultimately more efficient and cost-effective than repeated extermination. The Animal Services Department of Orange County, Fla, reported reduced numbers of complaints about cats, fewer cat admissions to the shelter, and reduced operating costs following implementation of a free sterilization program for feral cats funded by the county.³¹ Several of the largest animal control agencies and shelters in the country have integrated TNR for feral cats into their overall animal control programs, including Maricopa County Animal Care and Control, Ariz; New York City Center for Animal Care and Control; San Francisco Society for the Prevention of Cruelty to Animals; and the American Society for the Prevention of Cruelty to Animals.

Is TNR effective?—A TNR program at a Florida university was highly successful in reducing the feral cat population during an 11-year period.³² Prior to initiating the program, feral cats were considered by campus authorities to constitute a nuisance. Periodic efforts to trap and remove the cats were made when their numbers prompted complaints about on-site noise and odor, but employees and students openly violated policies against feeding the cats and interfered with trapping efforts by university officials during removal campaigns. The TNR program instituted in 1991 incorporated sterilization, euthanasia of sick animals, and adoption of socialized cats and feral cats that eventually tamed enough to become pets. With the exception of 1 male cat, all 155 original cats were sterilized between 1991 and 1995, and no kittens were known to be born on campus after 1995. Adoptions accounted for 47% of the decrease in the cat population. Most (83%) cats still remaining on site in 2002 had been present for > 6 years. This compares favorably with the finding that only 42% of the pet cat population in the United States is more than 5 years old.³³ Of the cats that disappeared, died, or were euthanized for debilitating conditions, 61% had been present for at least 3 years. Newly arriving sexually intact socialized cats, apparently abandoned, periodically joined the colonies; their presence could have undermined the control program had they not been promptly captured and neutered. Migration of cats between colonies was common, and resident cats did not always prevent the immigration of new members. Overall, each of the 11 colonies on the campus decreased in size, and 3 colonies eventually became extinct. By the end of 2002, only 23 cats remained on campus.

Another study⁷ of 132 unrelated cat colonies in

North Central Florida revealed that most colonies consisted of a small family group of cats located on the caretaker's property. The caretakers were encouraged to present the cats for free sterilization and were provided humane traps for transportation. While 920 cats were present at the beginning of the study, that number was reduced by 26% to 678 a year later, even though not all cats in the colonies had been sterilized by that time. The southern Florida resort community of Ocean Reef turned to large-scale TNR in 1995 after years of cat control by removal failed to reduce the overall population.⁴ The Ocean Reef Community Association constructed a Feral Cat Center, including a clinic and holding area for sick and adoptable cats. From 1995 to 2002, 1,376 feral cats were admitted to the program. Of these, 35% were adopted, 22% died or were euthanized, and 3% were being held at the Center. Only 40% of the cats were returned to their colonies, resulting in a decrease in overall population from approximately 2,000 cats to 500 cats.

Failures of TNR to control cat colonies also exist. A 1-year study³⁴ of TNR programs in 2 southern Florida parks revealed that the presence of highly visible, well-fed cat colonies encouraged illegal abandonment of additional cats. While the original population of 81 cats declined by 20% during the observation year, the arrival of new cats prevented reduction of the colonies and 88 cats were present at the end of the study. Minimal territorial activity by the cats was observed, and aggressive encounters between cats were usually limited to enforcement of feeding order. Interestingly, predation was rarely observed in these fed colonies, and only 2 birds were documented to be caught during the 1-year observation period. This is the only published report of predation by cats in managed colonies and contrasts sharply with previous reports of greater predation by cats in unmanaged colonies and by free-roaming housecats.

These studies indicate that long-term reduction of feral cat numbers is feasible by TNR. However, the extended survival of feral cats following sterilization indicates that natural attrition would result in a slow rate of population decline. Adoption of socialized cats accelerates population reduction. These studies also refute the common belief that established colonies of cats will defend their territory and prevent the immigration of new arrivals. Immigration or abandonment of new cats may occur and could substantially limit the success of TNR if an ongoing surveillance and maintenance program is not effective. Both sanctuary programs and TNR have the potential to enhance abandonment of unwanted pet cats. The high rate of destruction of cats admitted to animal shelters may prevent some cat owners from choosing relinquishment to shelters in favor of release to colonies, in the misguided attempt to "give the cat a chance." Public education promoting responsible pet ownership, increased and earlier sterilization, improved pet retention programs, and expansion of "no-kill" animal sheltering should be promoted to reduce pet abandonment. In addition, sanctuary and TNR programs should be conducted discretely to avoid attracting public attention, other wild animals, and more cats.

Is TNR humane?—Although cats are a highly fecund species capable of producing multiple litters per year in almost any climate, a kitten mortality rate of > 50% prior to maturity contributes to the relative stability of cat populations.³⁵ Trap-neuter-return programs enhance the welfare of the species by preventing the birth of kittens that would be marked for early death in the wild. Data collected on 5,323 feral cats presented for sterilization indicate that while feral cats were homeless, the euthanasia rate for health reasons was quite low (0.4%) and unexpected deaths during sterilization surgery occurred at a low rate (0.3%).³⁶ In another study,³⁷ the body condition of adult feral cats presented for sterilization was generally lean but not emaciated. One year after sterilization, these cats were significantly heavier and had higher body fat, indicating that feral cats, like their tame counterparts, experience enhanced fat accumulation following sterilization. Although TNR may not meet the gold standard of care desired for pet cats, it appears that sterilized feral cats can enjoy an extended period of good quality of life while their population dwindles by adoption or natural attrition. As such, it is not necessary to perform prophylactic euthanasia of feral cats simply because they do not share a human address.

Is TNR legal?—To date, there are no laws at the state or federal levels that regulate TNR of feral cats. Although the Endangered Species Act and the Migratory Bird Treaty Act do not specifically address TNR, it has been suggested that these laws could be used both to promote TNR to reduce environmental impacts of cats³⁸ or to initiate legal action against cat caretakers, veterinarians, and public officials if it can be shown that their involvement with feral cats ultimately leads to the impairment of protected species.³⁹ However, such legal action has not yet occurred, even though TNR programs have been active for more than a decade. In Florida, state law empowers the Fish and Wildlife Commission to remove cats from public lands when cats are shown to menace wildlife but does not prohibit TNR in general.³⁹ Local ordinances are in effect throughout the country that variably prohibit TNR or define requirements for its implementation. In several jurisdictions, TNR is adopted as public policy and is carried out by use of tax revenues.

The Role of Veterinarians in Feral Cat Control

The number of cats euthanatized in animal shelters has decreased from approximately 5.4 million in 1990 to 2.5 to 3 million today.³¹ Concurrently, the number of dead cats found on roads, a marker of the total outdoor cat population including both outdoor pets and feral cats, has decreased by 90% since 1992.⁴⁰ Veterinarians have been instrumental in reducing both of these numbers by educating clients to keep their cats indoors and by sterilizing most pet cats. Today, 82% to 91% of pet cats are sterilized, although not always before producing a litter of kittens. The result of this high sterilization rate is that owned cats produce only 22% of the kittens necessary for zero population growth of cats.⁴¹ Feral cats produce approximately 80%

of the kittens born each year and are the most important source of cat overpopulation (Table 1).

Currently, euthanasia in shelters is the leading cause of death of cats. Many veterinarians, shelter workers, and humane societies have long accepted this as a sad necessity for which there was no humane alternative. More recently, however, some veterinarians have questioned whether the veterinary community would be as complacent if an infectious disease resulted in the same loss of life. As in the case of infectious disease outbreaks, veterinarians have emerged as leaders in novel strategies to end cat overpopulation. More than 1,000 members of the California Veterinary Medical Association sterilized 170,334 feral cats between July 1999 and May 2002 in a \$9.5 million project funded by Maddie's Fund.⁷ Several veterinary schools house programs for feral cat sterilization, serving both their communities and the need for students to gain more surgical experience.

Increasingly, community collaborations have been developed for integrated sterilization, adoption, and pet retention programs to achieve "no-kill" animal control. In these communities, no animals that are adoptable or treatable are euthanatized; only those that are too ill to rehabilitate or that have unmanageable behavioral problems are euthanatized. The cornerstone of these success stories is aggressive sterilization, including programs for feral cats. The unprecedented success of communities as diverse as San Francisco and Tompkins County, NY, in achieving a "no-kill" status has prompted other regions, such as Los Angeles, New York, and the entire state of Utah, to pledge to end the destruction of adoptable cats and dogs within a few years. Large-scale TNR for feral cats is a core strategy in these campaigns.

Regardless of the vantage point from which feral cats are viewed, nearly all stakeholders agree that something should be done to reduce their numbers. The real debate begins when specific strategies are offered to accomplish this goal. Opponents of TNR suggest a 3-pronged approach for removing feral cats from the environment, including adoption, sanctuary, and destruction. Although TNR programs frequently incorporate adoption for friendly cats, the imbalance of available homes, massive size of the feral cat population, and feral nature of the cats make large-scale adoption an unrealistic solution alone. Likewise, care-for-life in sanctuaries is recognized as the most expensive and least efficient method of population management.⁶ Most sanctuary programs that permanently house a large number of feral cats also have an active TNR program because the sanctuaries are filled to capacity. Although TNR opponents list destruction of cats as a last resort, large-scale removal of cats to animal control facilities would likely result in euthanasia of nearly all of the feral cats.

In summary, there are several options available for integrated nonlethal feral cat control, and no single solution is likely to be appropriate for all situations. Adoption is an ideal outcome for socialized cats and should be employed whenever feasible. Placement in sanctuaries or relocation of colonies may be required for unadoptable cats that must be removed from their colony sites because of welfare or environmental con-

cerns. Sterilization and return to the colony is a third alternative and represents the most cost-effective and scalable strategy. Those who care for feral cats often have a strong human-animal bond and will not cooperate with programs that threaten these cats. Engaging cat feeders in solutions for feral cats will undoubtedly be more productive and economical than warring against them.

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Analyzing approaches to feral cat management—one size does not fit all

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How to best solve the diverse issues related to feral cats is a complex question with many facets. Each facet reflects large gaps in our knowledge and understanding. Felid biology; global, regional, and local ecology; human psychology; sociology; economics; and theology are all examples of branches of learning that can contribute knowledge toward finding acceptable solutions to feral cat problems. Unfortunately, our understanding of any one of these disciplines is incomplete, particularly with regard to specific knowledge relevant to feral cats. Making informed decisions is therefore difficult at best.

Discussions about feral cats often become emotionally charged, even when the discussion is among individuals with similar backgrounds. Perceptions based on personal experiences rapidly substitute for missing objective data, and interpretations of options become increasingly monochromatic. Over the years, I have been expounding to students a general rule based on my observations of scientific debate. The "Rule of Inverse Vehemence" states that the vehemence with which proponents of opposing views argue their points is inversely proportional to the quality of data available to support their positions. In other words, highly charged polemic disagreements are often fueled by insufficient, reliable, objectively collected, and properly analyzed data to support a unified position. My graduate student, Dr. Felicia Nutter, had the opportunity to experience discussions held by groups with very different perspectives on feral cat issues during the time she was formulating her graduate studies proposal, and that brought feral cats to my attention as a subject of scientific inquiry. Familiar with my "Rule of Inverse Vehemence," Dr. Nutter proposed that the application of well-established wildlife biology research techniques to the study of feral cats could supply knowledge that may help reduce discord between respected colleagues. She pursued this question, and that is why I am speaking with you today.

A review of the existing literature suggested that the "Rule of Inverse Vehemence" might apply. Although much has been written about feral cats, most reports are based on observations or extrapolations that do not follow well-established rules of scientific inquiry. Diary entries observing a single cat would be extrapolated by simple multiplication into the world or US population of cats—estimations that seriously defied accuracy in our experience. Reliably estimating populations of any animal, even on much smaller scales (counties and municipalities), requires carefully

designed sampling studies. We frequently encountered multiple-fold differences in statistics in the popular press, and there seemed to be a complete willingness to report these spurious numbers in otherwise scientific reports. Although an improvement over observations of a single cat, published scientific studies routinely examined only a single feral cat colony or created a pseudo-metastudy, ignoring major differences in experimental procedure and design. In almost all cases, even well-designed studies were conducted for very short times, limiting the potential for examining annual or, in many cases, even seasonal variations.

Having reviewed the state of our knowledge, more questions arose than we could possibly study well. We hypothesized that variation between colonies could be responsible for much of the discord in published small-scale studies. Therefore, we chose to design our research to examine as large a sample of feral cat colonies as our limited resources could reliably support. A key goal was to better understand the scale of variability we should expect across colonies. Of the many questions of interest, 4 rose to the top of our list as veterinarians and seemed to fit within an integrated study design. These questions included the following: 1) how reliable is our understanding of feral cat reproduction potential, 2) what is the relative zoonotic risk of involvement with feral cats, 3) what is the feasibility of reliably implementing current recommendations for high-end management of feral cat colonies, and 4) how does management of feral cat colonies affect the populations of colonies? What we found and are continuing to find is appropriately being published in detail in the peer-reviewed scientific literature, but I am exploring these same questions during this presentation to illustrate 3 key points: 1) There is still much to learn about feral cats, 2) all feral cat colonies are not equal, and 3) high-intensity management of feral cat colonies can successfully reduce colonies to extinction, but the process requires a long-term commitment of resources and may be appropriate and successful for colonies in some situations but not for others.

What Do We Know About Feral Cat Reproductive Potential?

Data on cat reproductive parameters have been collected by several investigators and generally support the concept that domestic cats are prolific. How prolific is a more complicated question. Females can bear young prior to reaching 1 year of age and can have multiple litters per year.^{1,2} However, the reproductive capacity of female cats and the consequences of unabated reproduction are often extrapolated to very large numbers by use of maximum rather than realistic litter sizes or by completely ignoring kitten mortality.^{2,3}

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Our recent work looked at reproductive parameters of large numbers of naturally breeding feral and free-roaming cats ($n = 2,409$).⁴ We found that although pregnancy could occur in any season as reported by Prescott,⁵ the vast majority (603/625) of pregnancies identified in our study occurred in the spring and summer months. This supports the hypothesis that births are correlated with optimal environmental conditions.¹ Mean number of litters per year for a queen in our studies in which colonies were managed on high planes of nutrition and health management was 1.4, considerably lower than the possible 3.0. Only 2 cats in our study achieved that lofty goal, and in each case, there was 100% mortality of at least 1 of the first 2 litters of the year.

After litters per year, litter size has the most dramatic impact on extrapolations of domestic cat reproductive potential. Mean litter sizes reported in the literature for free-ranging cats range from 2.1 to 5 kittens/litter,⁵⁻¹³ and our study⁵ found mean litter size to be 4.1 ± 1.3 (mean \pm SD) on the basis of fetus number or 3.5 ± 1.2 on the basis of live births. These numbers, of course, do not take into account kitten mortality. Used alone, they would grossly overestimate population growth. In the first 2 years of our colony-based studies, we observed a 3-month kitten mortality rate of 48%, contributing to 75% cumulative kitten mortality at 6 months. This falls within the range of previously reported mortality rates and is not particularly difficult to achieve, considering the wide range of mortality rates reported (up to 90%).^{8,9b} Kitten mortality rates can depend strongly on environmental variables. High variation in mortality rates and causes of kitten mortality among otherwise similar colony sites in our own studies convinced us of the important need to study multiple colonies over more extensive time frames to achieve meaningful estimates of expected kitten mortality. This also emphasizes how challenging it can be to generalize these parameters across colonies existing in different environmental conditions. Juvenile mortality figures in our studies are consistent with previously reported rates^{14,15} for small wild carnivores other than feral cats. This suggests that the feral cat's reproductive potential is not that far removed from other carnivores we work with in the wild. It also tends to support the notion that it is appropriate to assess feral cat reproductive potential by use of methods developed for studying other small wild carnivores and that similar time frames will be required to achieve accurate understanding—basically, a decade or more, not just a few years. This does not mean that I advocate waiting for decades to make decisions about feral cats. Complete understanding of very complex questions rarely occurs, and decisions related to complex questions must often be made with incomplete data. The key is to take into account the level of uncertainty in our current understanding as we evaluate the risks and benefits of different actions.

How Much Zoonotic Risk Do Feral Cats Pose?

Concerns about the potential for feral cats to serve as vectors of human disease are fairly frequently

expressed in editorials and letters to the editor.¹⁶⁻¹⁹ How large is this risk? Certainly potential zoonoses have been associated with feral cat populations,²⁰ but how does the risk of disease compare to risks from human exposure to other animals, owned pet cats for example? Cats may play a role as a reservoir of *Bartonella* infections,²¹ and *Bartonella* infection is reported to be common (28% prevalence) in pet cats across the United States.²² Fleas and possibly ticks play a role in the transmission of *Bartonella* organisms, so it was not too surprising to find in a study²³ of pet cats and feral cats with no flea control management from the same locality that feral cats had a somewhat higher prevalence of the disease (93% feral and 75% pet). The dramatic difference in what we found, compared with previously reported prevalences of *Bartonella* infection, probably points to the need to examine feral cat zoonoses issues locally or at least with careful attention to environmental and ecologic conditions. For example, the vigorous biting insect life of North Carolina is radically different than that found in high chaparral environments in the western United States. Interestingly, in our North Carolina studies in which we admittedly looked at feral cat colonies under very high levels of management, feral cats had similar baseline health status to pet cats, as reflected by hematologic parameters. Although there was documentable evidence of infection or exposure of feral cats to all 7 pathogens we examined, prevalences were similar to and not statistically different from prevalences in owned cats for 5 of the 7 pathogens.²³ It would appear that in situations where trap-neuter-return (TNR) programs can be intensively managed, including vaccination and parasite control, feral cats need not experience a "mean existence" with regard to overall health and need not pose a markedly greater risk of zoonotic disease, compared with owned cats. Clearly this would vary with the environment and the design of management protocols. Remember, variability is an important theme in this presentation.

What Are the Economics of High-End TNR Management?

Though not much research gets done without money, cost analyses and economics do not seem to be a popular avenue of inquiry when looking at the veterinary literature. This is unfortunately true with regard to assessment of feral cat management. The most detailed information available on how to trap feral cats seems to come from instructions provided to participants in TNR programs.²⁴⁻²⁶ There seems to be good agreement among these groups on the use of wire box traps, but details of set strategy are harder to come by. Some useful information on baits is available (smelly is better).²⁷ Unfortunately, trapping details are rarely reported in the wildlife literature for any species, let alone for feral cats. It seems reasonable to urge those researching feral cats to report more detail on this issue as well as on actual costs of maintaining various components of TNR programs. The paucity of information we could retrieve from published work hampered our own budgeting efforts, and we decided to incorporate some analyses of trapping costs into our studies when it could be done without compromising

scientific objectives. The first controversy we looked at returned some surprising results.²⁶ We were concerned about trapping efficiency, a common Achilles heel in wildlife studies. We asked, how much does it cost to catch a cat and does it work better if you invest in baiting unset traps for a time before actually trapping cats? Perhaps because of the nature of the colonies we were trapping (well acclimated to humans and used to being fed in particular locations) and less likely because of our trapping acumen, we had remarkable success trapping feral cats, compared with other wildlife. In 1 study, we trapped 107 cats from 9 colonies with 98% trapping efficiency and 98% of the cats were captured in < 9 trap nights/cat, with no statistical or practical difference between the percentage of cats captured per colony or the trap effort per cat if we prebaited traps for 3 days or simply cold set.²⁸ The cost differences were significant, with prebaited trapping costing nearly double what a cold set strategy cost. Much more work examining the economics of managing feral cats needs to be done and published. Again, what works best and most economically is likely to vary from region to region and habitat to habitat, and certainly by the nature of the colony, but sound economic analyses of components of feral cat management efforts can help guide practical decision-making. High-level TNR management requires the application of substantial resources over a prolonged time to be successful. Planners need to ensure that long-term efforts can be sustained through careful budgeting and fiscal planning.

How Does Management of Colonies Affect Population Dynamics?

Cats are an extremely plastic species capable of adapting to widely variant environments. If for no other reason than this plasticity, extrapolation and generalization about feral cat colonies are dangerous. Considerable variation occurs in every aspect of their existence. What we have found with colonies meeting relatively strict inclusion criteria in a single modestly populated rural county in North Carolina may have little predictive value when applied to colonies in urban settings, wilderness areas, different climates, or even on different management plans. In pilot studies for a longer-term study in progress, we have been looking at 9 and now 12 colonies of feral cats being managed for maximum potential for growth. All colonies receive food and water daily, have shelter available, are treated with an antihelminthic annually, and were vaccinated against rabies and common feline viral diseases when enrolled in the study. Altering specific components of the management plan allowed us to examine the contribution of those components to the population shifts we observe. What have we learned so far?

- Trap-neuter-release programs can stabilize colonies and cause population declines over time when compared with control colonies in which cats are not neutered. All 6 surgically sterilized feral cat colonies initially enrolled in our studies have decreased in population during the first 2 years of study (mean decrease of 36%) and continue to decline. During the same 2 years, the mean

change in population for the 3 control colonies was a 47% increase.

- There is extreme variability in population dynamics between similarly sized colonies despite efforts to control variables by use of restrictive inclusion criteria for enrollment in studies.

The extent of variation between even similar colonies in similar habitats is a key issue that must be dealt with when planning and analyzing results of feral cat studies. That variation must also be considered when attempting to use data from 1 situation to guide management in another. How to best deal with variation depends considerably on the questions being asked, but to ignore it invites failure. Early in our ongoing study, populations in control colonies (unneutered cats) varied more dramatically than did populations in reproductively managed colonies. Though the mean population change for all 3 control colonies during the first 2 years was a gain of 47%, looking at means can give an incomplete picture. In reality, population shifts for individual control colonies during the first 2 years of the study were 31%, 127%, and 283% of original colony size, respectively. All 6 TNR colonies decreased in size relatively uniformly (range, 30% to 89% of original size) during the same period. Clearly, stochastic events can dramatically change population dynamics within individual colonies.

This means that a precise and definitive answer to the most common questions we are asked by people interested in our research will likely remain elusive and very challenging, even after we have a decade of information available on multiple colonies. These questions include, can TNR take a feral cat colony to extinction and how long does it take for a TNR-managed colony to extinguish itself? To date, one of our experimental colonies has already gone extinct and another is approaching extinction. Others have reached relatively low numbers of cats but seem to have stabilized as what might be termed "microcolonies." As we continue our work, it wouldn't be totally unexpected if immigration pushed the population of a TNR colony up again, though this has yet to happen. Fluctuations in colony populations should occur, and such fluctuations are not unique to feral cats. Wildlife biologists are used to this challenge. Working in complex and variable systems with incomplete knowledge is one of the underpinnings of the concept of adaptive management, which is familiar to all wildlife professionals. In many ways, it is also the foundation of decision analysis in relative risk assessment.

Different solutions will fit different situations. For potentially contentious situations in which radically different perspectives must be accommodated, optimizing results requires a willingness to establish goals and strategies by analytically examining the perceived risks of management options as held by all interested parties. It then becomes important to continually assess data to evaluate progress toward goals and make adjustments in management efforts and methods to fit changes in real world dynamics. Trap-neuter-release programs can, under circumstances similar to those we are studying,

bring a feral cat colony to extinction. We have observed that happen. But as to how long will it take, the best answer we can provide at this time is somewhere between 4 or 5 years and more than a decade. Trap-neuter-release programs as currently managed are not likely to be good solutions when acute issues (eg, severe impacts on highly endangered species) can only be addressed by rapid extinction of a feral cat colony.

What Needs to be Done From Here?

As a research scientist, I have to make a plea for more study and more knowledge. However, that will not be enough. There are important questions that our studies will not address. The actual impact of feral cats on wildlife species can be determined only by analysis of carefully collected data. Our experience suggests that impacts will vary dramatically with the wildlife species being examined, the prey base and predator make-up of the ecosystem involved, the feral cat management strategies employed, and other factors. Better and more practical research on trapping of feral cats, including initial bulk trapping and sustained immigration management, would likely benefit feral cat management efforts. Our work is designed to look at a uniform colony type managed with close human contact. The cats in our colonies are not like some other feral cats, which are almost completely wild creatures living far from human contact. Studies similar to ours, but conducted in other environments and with other management variables examined, could help improve our ability to predict the impact of managing feral cat colonies under different conditions.

The most important plea I feel I can make for the future is for the dedicated and experienced individuals involved in feral cat management to recognize that 1 solution probably will not solve all feral cat challenges. Individuals holding different views on feral cat management must find ways to work together in a rational atmosphere of cooperation. A varied array of tools needs to be available to facilitate humane solutions to a highly varied set of problems posed by the amazingly adaptable feral cat. High-level TNR management as currently defined and administered can be one of these tools in certain situations in which time and resources are available.

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Professional, ethical, and legal dilemmas of trap-neuter-release

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Although some have portrayed the current feral and abandoned cat trap-neuter-release (TNR) controversy as pitting cat haters against cat lovers, this is not the case. Those opposing TNR and the proliferation of free-roaming cats consider domestic cats to be important and valuable companion animals to the pet-owning public and their families. What opponents of TNR object to are cats in the wrong places doing destructive and undesirable things.

The domestic cat evolved from African and European wild ancestors (*Felis silvestris*) into what is now considered a separate species (*Felis catus*). Natural predators, cats came to this country with European immigrants several centuries ago.¹ For this reason, cats are variously and correctly identified as nonnative, exotic, introduced, alien, foreign, or invasive species. Invasive species are defined as "species (animals, plants, microbes, etc) alien or nonnative to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm, or harm to human health."² Discussions regarding the impacts and welfare of free-roaming cats should be viewed with these facts in mind.

Substantial numbers of groups and individuals believe that programs variously identified as trap, test, neuter, vaccinate, and release (TTNVR), feral cat altering programs (FCAP), and TNR are the key to reducing the burgeoning numbers of free-roaming cats in this country. Citing failures of animal-control agencies and traditional removal methods to adequately address problems associated with unconfined cats, TNR advocates and their supporters have become more active and visible during the past decade. Although TNR advocates and opponents share a common belief that neutering programs and education of cat owners and advocates are paramount to effectively dealing with unconfined cats, they have areas of philosophic and practical disagreement. Veterinarians are faced with professional, ethical, and legal dilemmas and responsibilities when considering potential solutions to the free-roaming cat problem.

Professional Dilemmas

Other associations' perspectives—The veterinary community should carefully consider the recommendations of other professional organizations that have a vested interest, as well as technical expertise, in potential solutions to the problem of free-roaming cats.

Although well meaning, many advocates of TNR lack professional training in the biological, ecologic, and wildlife sciences. Consequently, they may misunderstand, minimize, or choose to ignore documented

concerns regarding the ecologic, domestic animal and public health, legal, humane, and social nuisance impacts of feral cats, including those in TNR programs.

Professional and lay organizations have been concerned with the impacts of abandoned and feral cats for many years. They have established committees, reviewed pertinent data, and formalized position statements recognizing *F. catus* as a nonnative, midsized predator.

For example, The Wildlife Society, founded in 1937, is the wildlife manager's professional equivalent of the AVMA. They publish 2 peer-reviewed scientific journals, have state affiliations, administer a board-certification program, hold annual meetings, and serve as the professional organization for more than 9,000 members. Their special expertise is the health of the environment and maintenance of our nation's wildlife resources.

The Wildlife Society has spent more than 2 years developing its policy No. 25 on feral and free-ranging cats,³ and this policy clearly identifies the problems associated with these alien predators. The society's policy includes support for "passage and enforcement of local and state ordinances prohibiting the public feeding of feral cats, especially on public lands, and release of unwanted pet or feral cats into the wild."³ It also indicates opposition to "passage of any local or state ordinances that legalize the maintenance of 'managed' (ie, TNR) free-ranging cat colonies."³

Many other organizations have developed similar policies, including the following: the International Association of Fish and Wildlife Agencies, the Association of Avian Veterinarians, the American Association of Wildlife Veterinarians, the Council of State & Territorial Epidemiologists/National Association of State Public Health Veterinarians, the American Bird Conservancy, The Humane Society of the United States, the American Ornithologists' Union, People for the Ethical Treatment of Animals, the National Audubon Society, and various state wildlife federations and commissions.

Veterinarians should carefully review the well-considered and strong foundations upon which these organizations formulated their policies on free-roaming cats and TNR. Just as the veterinary profession merits respect when addressing issues of animal health and disease, the advice of other professionals should also be heeded when questions fall into their areas of expertise.

Committee on Environmental Issues—One of the charges to the AVMA's Committee on Environmental Issues (CEI) is to "provide information to the membership to enable informed decisions about environmental issues in their communities."⁴ With this in mind, the

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CEI has spent considerable time examining the impacts and options for dealing with abandoned and feral cats. The CEI has concluded the following:

- Free-roaming cats (*F catus*) are present worldwide and are considered an exotic or nonnative species in all habitats in which they exist.
- Free-roaming cats have had well-documented and substantial impacts on local wildlife populations and are an important cause of the decline of neotropical migrants.
- Free-roaming cats can exert substantial detrimental predatory effects on native birds and small mammals in local ecosystems.
- Maintenance of free-roaming cat colonies does not eliminate predation on native birds and small mammals by feral cats.
- Managed cat colonies do not solve the problems of cat overpopulation and suffering, wildlife predation, or zoonotic disease transmission.
- Cats as pets have a long association with humans and responsible cat owners should be encouraged to continue caring for the cats under their control.
- Veterinarians are uniquely positioned to offer recommendations and counseling on indoor living as part of a feline preventive healthcare program. By offering this service, veterinarians can potentially improve the welfare of cats.

On the basis of this information, the CEI also does the following:

- Strongly supports and encourages humane elimination of feral cat colonies.
- Strongly supports reducing the numbers of stray cats through humane capture (with placement in homes where appropriate) by local health departments, humane societies, and animal control agencies.
- Supports passage and enforcement of local and state ordinances prohibiting public feeding of free-roaming cats, especially on public lands, and release of unwanted pet or feral cats into the wild.
- Strongly supports educational programs and materials that call for pet cats to be kept indoors, in outdoor enclosures, or on a leash.
- Supports programs to educate and encourage pet owners to neuter or spay their cats and encourages pet adoption programs to require that potential owners spay or neuter their pets.
- Supports development and dissemination of sound, helpful information on what cat owners can do to minimize predation by free-roaming cats.
- Supports working with the conservation and animal welfare communities to educate the public about the negative impact of free-roaming cats on native wildlife, including birds, small mammals, reptiles, amphibians, fish, and endangered species.
- Supports community efforts to develop local ordinances that require mandatory spay or neuter of all cats over 6 months old unless the owner purchases an annual intact permit, breeders permit, or both; require all cats to be licensed and appropriately vaccinated against rabies; and discourage cat owners from allowing their cats to roam at large.

- Supports educational efforts to encourage the agricultural community to keep farm cat numbers at low, manageable levels and use alternative, environmentally safe rodent control methods.
- Encourages researchers to continue their study of the impacts of free-roaming cats on native wildlife populations.
- Opposes passage of local or state ordinances that legalize the maintenance of managed (ie, TNR) cat colonies.

AVMA positions, policies, and guidelines—The current AVMA position statement on Abandoned and Feral Cats,⁴ which was approved by its Executive Board in 1996, neither endorses nor opposes managed cat colonies. Unfortunately, this position often has been misinterpreted and misrepresented by both those advocating for and opposing TNR.

Furthermore, I believe there are inconsistencies between this position and other published AVMA positions and guidelines. Examples include the AVMA's Policy on Animal Welfare and Animal Rights,⁵ which includes references to proper housing, management, nutrition, disease prevention and treatment, and responsible care; its Position on Dog and Cat Population Control,⁶ which recommends adherence to animal control principles of licensing and permanent identification, strict enforcement of animal control laws, and development of more comprehensive laws; its support for carefully controlled use of random-source cats for research, testing, and education⁷; its concept paper on Environmental Responsibility⁸; its Model Rabies Control Ordinance⁹; its definition of the veterinarian-client-patient relationship; and its Guidelines for Veterinary Prescription Drugs,¹⁰ which includes recommendations for labeling and record keeping. To embrace TNR seems to compromise a number of professional principles, perhaps in an effort to appease or avoid conflict with proponents of managed cat colonies.

Ethical Dilemmas

Surveys—Veterinarians and the public frequently rely upon surveys to obtain useful information about respondents' perspectives on and experience with various issues. Although members of the public may obtain this information from a variety of sources, veterinarians are more often exposed to survey data obtained via scientific studies and presented in peer-reviewed journals. Lacking time to thoroughly investigate methods used to obtain and publish data, both veterinarians and the public must rely on the intellectual honesty of those obtaining and presenting this information.

When data from surveys are evaluated, it is important to consider study design. How were questions developed? To whom and how was the survey distributed (ie, was distribution truly random)? Was background material presented with the survey and what information did that background material contain? Could the wording of questions or background information provided have influenced responses of the participants?

Asking these questions has caused me some angst with respect to a recent survey conducted by a TNR advocacy group.¹¹ Results of that survey indicate that

77% of its respondents opposed the trapping and euthanasia of healthy feral and abandoned cats; 94% supported changing existing community laws prohibiting people from feeding, neutering, and managing cat colonies; and 89% favored TNR programs and management of cat colonies. Intended to "determine the level of knowledge about and support for nonlethal population control of feral cats, specifically TNR," the 5-question survey was completed by nearly 25,000 respondents who were described as individuals with "interests in environmental, animal welfare, health, and human services issues" as well as a "cross-section of the general public."¹¹ Although the description of respondents appears to represent a valid sample, a further inquiry revealed that the survey's format and distribution may have created bias. According to those conducting the survey, it was mailed to "selected caring friends" and accompanied by background information about the advocacy group's ongoing efforts to address the problem of abandoned and feral cats through the use of TNR. My review of the accompanying background information revealed that it contained no information about the possible negative ecologic impacts, animal and human health concerns, legal issues, or societal impositions that have been associated with managed colonies.

Moving beyond impassioned debate—During the past several years, as debate regarding abandoned and feral cats has become more heated, concerns have emerged regarding the extent to which some activists will go to promote their cause. Those supporting trap and removal of abandoned and feral cats, rather than TNR, have reported verbal abuse, personal threats, disruption of public forums, and interference with the conduction of their businesses.¹² Although such behaviors may not be typical of most proponents of TNR, the fact that they have occurred is cause for concern. Neither proponents nor opponents of TNR should promote or accept these types of activities as we search for workable solutions.

Medical and surgical practices—One technique commonly applied in TNR programs is removal of an ear tip at the time a colony member or candidate is neutered and prior to the cat's release. The intent is to identify the cat as a colony member and prevent transfer of the cat to an animal control facility should it be retrapped. An ear-tipped cat is not necessarily associated with an approved or unapproved colony, nor does ear tipping definitively identify a cat or confirm its reproductive or vaccination status. I have been told that some cat owners will ask to have the ears of their own cats tipped to avoid having to comply with animal control statutes. Veterinarians who refuse to perform the procedure on owned cats may be faced with having their clients take their business elsewhere. Such requests place practitioners in uncomfortable ethical and financial positions and should be vigorously condemned by those supporting TNR.

Large, privately funded TNR programs have also, in my view, placed veterinarians in a position that pits ethical concerns against financial gain. Neutering and rebandoning feral cats without so much as a rabies

vaccine (recognizing the broader ongoing debate attendant to vaccination in general) raises ethical issues. In California, it appears that as many as 90,000 cats neutered under TNR programs were deliberately rebandoned without immunization against rabies or other diseases.¹³ Although TNR programs may reimburse veterinarians for providing spay/neuter services, we must be wary of accepting financial reimbursement for actions that raise professional and ethical concerns.

Disease Concerns

A whole host of disease-related concerns are raised by TNR and abandoned and feral cats in general. It is widely recognized within the veterinary community that species-specific as well as zoonotic diseases are harbored by free-roaming cats. Although I will not belabor the consequences of external and internal parasites (particularly toxoplasmosis), cat scratch fever, FeLV and FIV, or a myriad of other feline-harbored diseases, I do believe that brief consideration of rabies is appropriate.

Minimization of rabies as a risk by some proponents of TNR concerns me. The media handbook¹⁴ of 1 advocacy group states that "fear of rabies far outweighs any real threat from this disease in the U.S." and that "studies have shown that feral cats are generally in good health and condition and pose no threat to human health." Attempts have also been made to minimize rabies risks for cats and humans by citing the small number of human deaths reported by the CDC during a 12-year period and stating that vaccinated outdoor cats pose no risk of contracting or spreading this disease. Despite cats being the most frequently reported rabid domestic animal in the United States, proponents of TNR rarely address the fatal nature of untreated human rabies infections, nor do they readily acknowledge that nearly all TNR colonies contain unvaccinated cats or previously immunized cats whose immunity against rabies is diminished or has disappeared. Cat caretakers are also not advised that they should report all bites and scratches induced by free-roaming cats to appropriate health authorities. The media handbook fails in its responsibility to the public to convey critical public health messages and is inconsistent with recommendations outlined in the Compendium of Animal Rabies Prevention and Control.¹⁵

In New Hampshire < 10 years ago, exposures to a kitten of unknown origin that was subsequently diagnosed with rabies led to the treatment of an estimated 665 individuals and expenses of more than \$1.5 million for investigation, laboratory testing, and rabies immunoglobulin and vaccines.¹⁶

In 2003, there were numerous rabies alerts resulting from free-roaming cats determined to have positive results of rabies tests. In Florida, parks have been closed, widespread rabies alerts issued, and individuals have been required to be treated as a result of diagnoses of rabies in feral cats. Between 1988 and August 2003, 208 cats with laboratory-confirmed rabies diagnoses were identified in Florida alone.¹⁷

When asked to provide scientific evidence sufficient to contradict the Florida Rabies Advisory Committee's position¹ that "the concept of managing free-roaming/feral cats is not tenable on public health grounds

because of the persistent threat posed to communities from injury and disease," supporters of TNR focus on the paucity of cat-induced human rabies in the United States and the fact that most rabies cases are reported as developing in wildlife. Although definitive identification of immunized cats is often impossible, TNR proponents have described them as immune barriers between infected wildlife and humans.

These perspectives are misleading and fail to adequately address rabies concerns. They ignore the financial, psychologic, and health implications of potential rabies exposures involving free-roaming cats. Not all cats under TNR management are vaccinated or appropriately revaccinated against rabies. Because most vaccinated cats in TNR programs are not definitively identified, concern for public health precludes the assumption that they do not pose a risk.

In October 2003, 4 individuals were attacked by a free-roaming cat on the campus of Kennasau State University in Georgia and had to undergo treatment.¹⁸ Rabies risks are real. To minimize those risks, particularly as veterinarians, is alarming and irresponsible.

Legal Dilemmas

An important consideration for veterinarians and others involved in TNR programs is the legal ramifications of their participation. Professional wildlife biologists and a smaller cadre of veterinarians working with wildlife have expressed related concerns for some time. In a well-researched and -written report¹⁹ to the US Fish and Wildlife Service, the attorney authors describe a number of concerns that could impact participation in TNR programs. The report reviews the magnitude of free-roaming cat populations in the United States and Florida, the negative environmental impacts of free-roaming cats, and strategies for dealing with free-roaming cats and presents detailed information regarding the legality of various management approaches. Federal wildlife laws (ie, the Endangered Species Act and Migratory Bird Treaty Act), Florida state wildlife protection and animal cruelty laws, and local ordinances are discussed in detail.

Some TNR advocates are working diligently to persuade municipal, county, and state authorities to alter or overturn long-standing animal control ordinances that may preclude the operation of managed colonies. Advocacy groups often provide guidance for individuals interested in influencing related public policy processes. Veterinarians and the public must be cautious in supporting changes to carefully conceived and long-standing animal care and control laws and should not allow basic epidemiologic and public health principles to be compromised.

The CEI has expressed its concern regarding potential legal liability for veterinarians and other allied professionals who opt to participate in TNR programs to the AVMA-PLIT. In response,^b the PLIT informed the CEI that because violations or alleged violations of the Endangered Species Act or Migratory Bird Treaty Act are essentially criminal acts, no coverage exists under the AVMA-PLIT-sponsored insurance program for claims that might arise from allegations of violations of those acts. The trust was unable to com-

ment on the potential for veterinarians to be found guilty of violations of these statutes or regulations or for them to be fined for such violations.

Conclusions

As the veterinary profession and the public attempt to deal with the problem of free-roaming cats, some things seem obvious. Both proponents of TNR and its detractors acknowledge that there are too many free-roaming cats in this country. Both sides actively support neutering as part of a comprehensive approach to reducing pet overpopulation. Both (generally) admit that neither TNR nor trap-neuter-remove will solve the problem without extensive education and assistance from the public. Trap-neuter-release proponents who minimize the negative ecologic impacts of feral cats by citing the negative impacts of habitat degradation (eg, urbanization) are, in my opinion, ignoring reality.

Trap-neuter-release proponents object strongly to euthanatizing apparently healthy cats. Opponents of TNR prefer alternatives but see euthanasia as more humane and therefore preferable to reabandonment (mean life spans for cats kept indoors tend to exceed those of feral/free-roaming cats by a factor of 4 to 6). Euthanasia is a legitimate tool of our profession. By definition, it is humane. In the interests of animal and public welfare, the profession and public generally find euthanasia to be acceptable under many circumstances. Foreign animal disease introductions, domestic and wild animal disease emergencies, and unwanted exotic or nonnative species introductions may all warrant the use of euthanasia. Sometimes it is better that some healthy animals die in light of the excessively negative impacts of their continuing to live.

The public, aided by veterinarians, has expended great effort in developing animal control ordinances and laws. Free-roaming dog colonies have not been condoned and neither should free-roaming cat colonies. Arguing that cats warrant preferential treatment ignores the damage they cause and the risks they pose.

Despite models or interpretations by skilled statisticians, the following points seem irrefutable:

- A TNR cat cannot reproduce. However, it remains an ecologic threat to native species, is a potential reservoir of animal and human disease, and may be a social nuisance.
- A trapped, neutered, and removed cat also cannot reproduce. However, once removed, ecologic damage, animal and human disease risk, and social impositions are greatly reduced or eliminated.
- Ultimately, a combination of a vigorous trap and removal program; stronger and more effective licensing, identification, and confinement laws (including improved enforcement); and a massive, ongoing public education program that promotes responsible pet ownership and the necessity of keeping cats properly confined will go a long way toward reducing the number of free-roaming cats in our country.

Whether adopted; placed in a confining sanctuary; judiciously used in research, training, or education; or euthanatized, removal and not return seems the most

responsible course of action. Our nation has greatly benefited from antilittering campaigns and actions. We must similarly seek to make it politically incorrect and socially unacceptable to engage in biological littering resulting from irresponsible cat ownership and promotion of TNR programs.

Veterinarians, with help from organizations like The Wildlife Society and the American Bird Conservancy and its "Cats Indoors!" program, should join hands on a nationwide campaign to educate the public as to the importance of keeping their cats confined. Just as client education brochures inform on health-related issues, factual, objective information presented in a similar fashion can advise as to why cats should be confined for the sake of the cat, the environment, other animals, and the public. The "Cats Indoors!" concept should be promoted by professional veterinary organizations, in veterinary curricula, in elementary and high schools, in pet shops, among cat fanciers, and by humane groups.

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.

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Trap-neuter-release programs: the reality and the impacts

Linda Winter, BS

American Bird Conservancy (ABC), conservationists, and wildlife biologists are often accused of making domestic cats (*Felis catus*) the scapegoat for bird population declines and ignoring the "real" causes of bird mortality, such as habitat loss and fragmentation, pesticides, pollution, window strikes, and collisions with communication towers. In fact, through the Bird Conservation Alliance,¹

ABC is working with a broad coalition of conservation groups as well as state and federal wildlife agencies in North, Central, and South America to address all issues related to bird mortality. However, as remaining wildlife habitat becomes fragmented and isolated by human development, domestic cat predation on native birds, especially rare and endangered species, has become an important factor in bird mortality that cannot be ignored.

How many birds do pet, stray, and feral cats kill each year in the United States? Exact numbers are not

From Director, *Cats Indoors!* Campaign, American Bird Conservancy, 1834 Jefferson Pl NW, Washington, DC 20036.

known, but on the basis of their 4-year study and those of others, Coleman et al² estimated that free-roaming cats kill at least 8 million birds/y in rural Wisconsin and that nationwide rural cats probably kill hundreds of millions of birds each year. Suburban and urban cats add to that toll. In their ongoing, but unpublished, identifications of cat prey items in Wisconsin, including stomach contents, scat analyses, observations of kills, and prey remains, 19.6% of 1,976 animals captured by 78 free-ranging cats were birds.³

Numerous cat predation studies show that birds can comprise between 0% and 100% of a cat's prey, depending on the individual cat, its location, time of year, and availability of prey.³ For example, in a study⁴ of feral cat stomach contents in Sacramento Valley, Calif, birds comprised 25% by volume for the year but varied from just a trace in October to 70% in June. A study⁵ by The Mammal Society in England found that a minimum of 44 species of wild birds comprised 24% of the prey that cats brought to their owners. In a study⁶ of pet cats in an English village, birds comprised 35% of the prey brought home. Studies of prey items that pet cats bring home reveal only the bare minimum of what those cats actually kill. Animals killed by cats but consumed or left elsewhere, animals that escaped the cat but died later because of trauma or secondary infection, or young animals that starved to death or died of exposure because cats killed 1 or both parents are not counted in such studies. Moreover, eggs eaten by cats are not detectable in the digestive system, and because of the lack of feathers, nestlings are not detectable in scat analyses. In addition, cat predation studies do not indicate impacts on wildlife populations—only what cats killed at that particular time and location. Given the wide variety of animals killed by cats, what cat predation studies do indicate is that cats are opportunistic hunters.

Rural outdoor cats kill larger numbers and varieties of birds than cats in suburban or urban areas.² Scientific studies⁷ have also documented that declawing cats, putting bells on their collars, or keeping them well fed do not prevent them from killing animals. Adamac⁸ showed that hunger and hunting behavior are controlled by different portions of a cat's brain. In her study of pet cats in Wichita, Kan, Fiore⁶ found that 83% of cats enrolled in the study killed birds. In all but 1 case in which feathers were found in scat, the owner was unaware that their cat had ingested a bird. This appears to refute Patronek's⁹ assertion that "cats tend to bring prey home." In fact, most volunteers reported that their cats did not bring prey to them. Instead, owners observed the cats with the bird or found remains in the house or other locations. Cats often kill but do not eat their prey, so studies analyzing scat or stomach contents alone would underreport the number of birds killed by cats.

The American Pet Products Manufacturers Association's 2003/2004 National Pet Owner Survey¹⁰ estimates that there are 77.7 million pet cats in the United States. A 1997 nationwide random telephone survey¹¹ indicated that 66% of cat owners let their cats outdoors some or all of the time. No one knows how many stray and feral cats there are, but estimates range

from 60 to 100 million. Conservationists and wildlife biologists in the United States are concerned about domestic cat predation on native wildlife because *Felis catus* is not native to North America, occurs here in large concentrated numbers, and kills common as well as rare species. Our job is to keep common species common and to prevent rare species from becoming extinct. As the famous conservationist Aldo Leopold¹² stated, "the last word in ignorance is the person who says of an animal or plant: 'what good is it?' If the biota, in the course of eons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts. To keep every cog and wheel is the first precaution of intelligent thinking."

Cat Predation Impacts on the Mainland

In his review of cat predation studies up to 1988, Fitzgerald¹³ stated that "any continental population of birds that could not withstand predation by cats would have been extirpated long ago." His statement ignores the fact that the status of a species can change over time. Sixteen years later, after additional habitat loss and new scientific studies, scientists now list invasive species, including cats, as the second most serious threat to declining and rare wildlife.^{14,15} The domestic cat is included in the Invasive Species Specialist Group's list of 100 of the worst alien invasive species.¹⁶ Recent studies indicate that cat predation can impact populations of birds in isolated habitats, especially species that are rare or specialized in their habitat requirements. Species that nest or feed on or near the ground are especially vulnerable to cat predation, regardless of whether they exist on islands or the mainland. Although the science suggests otherwise, advocates of trap-neuter-release (TNR) often state that well-fed cats do not kill wildlife or they only kill pest species such as house mice (*Mus musculus*). This claim was tested in 2 grassland parks in the East Bay Regional Park District in California: 1 area where more than 25 cats were being fed daily and 1 area without cats.¹⁷ Feeding animals in these parks is illegal. Almost twice as many birds were seen in the area without cats, compared with the area with cats. Breeding birds were seen more often in the area without cats. California Quail (*Callipepla californicus*) and California Thrasher (*Toxostoma redivivum*) were present in the area without cats but absent in the area with cats. California Thrasher is listed on ABC's Green List because its population is declining.¹⁸ In addition, more than 85% of native western harvest mice (*Reithrodontomys megalotis*) and deer mice (*Peromyscus* sp) were trapped in the area without cats, whereas 79% of house mice, an exotic pest species, were trapped in the park with cats. The researchers concluded that "cats at artificially high densities, sustained by supplemental feeding, reduced the abundance of native rodent and bird populations, changed the rodent species composition, and may have facilitated the expansion of the house mouse into new areas. Thus we recommend that the feeding of cats in parks should be strictly prohibited."¹⁷

In a study of relationships between coyotes (*Canis latrans*), midsized predators such as cats, and scrub-dwelling birds, cat owners living along the rims of

steep-sided canyons in San Diego were asked to collect all of the prey their cats brought home.¹⁹ These canyons are isolated pockets of habitat with species that may not exist elsewhere. Cat owners reported that as a mean, each outdoor cat that hunted returned 24 rodents, 15 birds, and 17 lizards to the residence each year. Depending on the size of the canyon, there may be tens to hundreds of outdoor cats with access to each canyon. In comparison, the canyons often harbor only 1 or 2 pairs of native predators such as coyote or gray fox (*Urocyon cinereoargenteus*). The researchers estimated that cats surrounding a moderately sized canyon return approximately 840 rodents, 525 birds, and 595 lizards to residences each year. Existing population sizes of some birds do not exceed 10 individuals in small to moderately sized canyons, so even modest increases in predation pressure from midsized predators, in conjunction with other habitat fragmentation effects, may quickly drive native prey species (especially rare ones) to extinction. The study¹⁹ also found that in small canyons where the coyote was absent, there was an increase in midsized predators, such as cats, raccoons (*Procyon lotor*), and opossum (*Didelphus virginiana*), and a drastic decline in diversity (and in some cases elimination) of scrub-breeding birds. However, in the larger canyons where coyotes were still present, the scrub-breeding birds were also present. Coyotes are known to eat cats and other midsized predators.

Cat Predation Impacts on Islands

The devastating impacts domestic cats can have on island bird populations are well known. Jackson²⁰ estimated that cats are primarily responsible for the extinction of 33 species of birds worldwide. Veitch²¹ attributed cat predation as primarily responsible for the extinction of 8 island bird species, including Stephen's Island Wren (*Traversia lyalli*), Chatham Island Fernbird (*Bowdleria rufescens*), and Aukland Island Merganser (*Mergus australis*), and the eradication of 41 bird species from New Zealand islands alone. He also noted that "the subsequent eradication of cats from several islands in the New Zealand region has allowed birds to increase in both numbers and species diversity."²¹ Moors and Atkinson²² state that "probably no other alien predator has had such an universally damaging effect on seabirds."

In a recent study,²³ wildlife biologists investigated the effects of domestic cat predation on 3 small nesting colonies of Wedge-tailed Shearwater (*Puffinus pacificus*) at Malaekahana State Recreation Area on Oahu, Hawaii, where stray cats were fed by the public. These seabird colonies were compared with a large Shearwater colony at nearby Mokuauia Island State Seabird Sanctuary, where cats were absent. During the study, feral cats were fed daily at Malaekahana at a site that was located only 30 m from the closest Shearwater nesting colony. Many more burrows produced chicks at Mokuauia (62%) than at Malaekahana (20%). At Malaekahana, reproductive success was 0% at the colony closest to the cat feeding site and almost all breeding adult Shearwaters in that colony were killed. Populations of long-lived seabirds such as Shearwaters, which do not breed until they are ≥ 5 years old and

produce only 1 egg/y, are highly sensitive to the loss of breeding adults. Depending on how old the chick is when a parent bird is killed, the chick may die of starvation because 1 parent cannot keep up with the chick's feeding demands.

Cat predation impacts on island bird populations are not limited to ground-nesting seabirds. The federally endangered Palila (*Loxiodes bailleui*), a Hawaiian Honeycreeper, is threatened by feral cats in its protected, but limited, habitat of mamane and mamane-naio forest at 6,000 to 9,000 feet on Mauna Kea. Wildlife biologists have been monitoring the Palila population and have found that since 1998, 8% to 11% of monitored Palila nests were depredated annually by cats.²⁴ This level of cat predation inhibits efforts to restore the Palila population.

TNR—The Reality

Articles have recently appeared in the *Journal of the American Veterinary Medical Association* on intensive TNR efforts with unlimited spay/neuter services available to volunteers. These efforts were conducted on private property or on college campuses with small numbers of cats in each colony. However, data collected in these studies are problematic because they rely on anecdotal recollections of cat feeders of the numbers of cats in the colonies before and after TNR. In a survey²⁵ of 101 cat feeders in north central Florida, the total surveyed cat population was reportedly 920 before participation in TNR and 678 after TNR. However, the total number of cats ($n = 920$) minus deaths (151), disappearances (149), and adoptions (238) and plus births (498) and immigrations (103) equals 983, not 678. The authors wrote, "the fact that the numbers do not add up is attributable to fluctuations in colony members and the fact that these numbers were estimates based on the recollections of individual caretakers. These numbers should not be interpreted as precise data based on accurate record keeping."²⁵

Examples abound²⁶ of larger cat colonies maintained for 10 or more years in public parks, on public beaches, on college campuses and military bases—some with sensitive species present—and in areas adjacent to critical wildlife habitat, despite the AVMA's recommendations in its 1996 position statement on "Abandoned and Feral Cats" that states, in part, "the colony should be restricted to a well-defined relatively safe area, and not on lands managed for wildlife or other natural resources (eg, state parks, wildlife refuges, etc)."

Florida—Advocates of TNR claim that managed cat colonies decrease in size and are even eliminated in just a few years through attrition. This assertion was tested through photographic and observational capture-recapture techniques in 2 Miami-Dade County, Fla, parks: A.D. Barnes Park and Crandon Marina.²⁷ The A.D. Barnes Park is a popular bird watching site, especially during spring and fall migration. Crandon Marina contains a protected coastal beach area that has been designated as nesting grounds for the Least Tern (*Sterna antillarum*), a species in serious decline. During the study, 37 cats were observed at A.D. Barnes Park and 91 cats were observed at Crandon Marina. Although kit-

tens were abandoned at both colonies (22 kittens at A.D. Barnes Park and 14 kittens at Crandon Marina), they were not included in the capture-recapture analysis. The number of original colony members decreased over time in both colonies. However, illegal dumping of unwanted cats and the attraction of stray cats to the abundant food offset reductions in cat numbers caused by death and adoption. Furthermore, the overall population of the colony increased at A.D. Barnes Park and remained static at Crandon Marina. Consistent with other scientific studies^{28,29,c} that show cats in colonies are not territorial, the existing cats did not keep new cats from joining the colony or from food. Although it was not the purpose of the study to determine cat predation effects on native wildlife, well-fed cats were observed stalking and killing birds protected by the Migratory Bird Treaty Act, including a Common Yellowthroat (*Geothlypis trichas*) and other native wildlife. Other animals were also observed eating the abundant cat food, including a stray dog (*Canis familiaris*), raccoon, and spotted skunk (*Spirogale putorius*). Subsidizing these predators may increase predation pressure on native wildlife, and the proximity brought about through communal feeding may increase risk of disease transmission within and across species. Castillo and Clarke²⁷ concluded, "our study suggests that this method is not an effective means to control the population of unwanted cats and confirms that the establishment of cat colonies on public lands encourages illegal dumping and creates an attractive nuisance."

Clarke and Pacin³⁰ compared 2 TNR groups operating in south Florida. The Cat Network is a volunteer-based group whose members have been practicing TNR in the Miami-Dade County area, including public parks such as Greynolds Park, for years. Because the group does not actively maintain records, it is not possible to determine with accuracy how many cats and colonies are managed by Cat Network volunteers. During a 10-month period in 1999, 2,009 certificates for spay/neuter surgeries were returned to the Cat Network by veterinarians. Although this may have reduced stray and feral cat reproduction, without systematic collection of data, it is impossible to determine whether the Cat Network had reduced the size of its colonies over time. However, the certificates did reveal that few of these cats were vaccinated against diseases other than rabies.

Greynolds Park was once famous for its heron rookery and as an important stopover site for migratory songbirds. Dalrymple^d conducted a bird survey from 1997 to 1998 and found that upland bird species counts had significantly declined in the park since 1987, when he had last conducted a similar survey. Although the causes of the decline are uncertain, stray and feral cats likely contributed. Dalrymple^d saw few feral cats in Greynolds Park in 1987 but observed 30 to 50 cats in the park each day in 1998. Raccoons were also seen eating at numerous feeding stations throughout the park. Raccoons are the wildlife most commonly found to be rabid in the eastern United States, and cats are the domestic species most commonly found to be rabid by the CDC.³¹ Rabies has been confirmed in cats and raccoons in Florida.

After ignoring the cat overpopulation problem for

years and over the objections of members of the Cat Network, Commissioners in Miami-Dade County strengthened and enforced laws, making it illegal to feed or abandon animals in parks and authorizing park staff to undertake humane removal of nuisance animals. In Greynolds Park, a public education campaign called "Be a Park Pal" was initiated and park staff sponsored adoption days for cats removed from the park. Approximately 20 to 25 unadoptable cats have been placed in an enclosure away from natural resource areas. Organized feeding has stopped, the cat population has been reduced to an innocuous level, and park staff monitor and remove occasional newly abandoned cats as needed.^e

Another TNR group that Clarke and Pacin³⁰ studied is the well-funded and well-organized Ocean Reef Cat Club (ORCAT) at Ocean Reef Club residential resort on North Key Largo, Fla. Beginning in 1989, ORCAT volunteers reportedly trapped and had sterilized approximately 200 cats/y for 5 years. However, the cat population grew larger. More intense efforts were needed, which led to the community association-sponsored Feral Cat Center in 1995 with an annual budget of \$100,000 and paid staff. As of 1997, the cat population was considered stabilized at about 1,000. The ORCAT's employees maintain a detailed history of each cat within the colony. By June 1999, ORCAT had reduced the cat colony to approximately 500 cats. These cats are fed in approximately 40 subgroups throughout the property. Even with considerable resources and efforts to reduce this stray and feral cat population, 500 cats is still a large population. This effort is also not representative of most TNR operations. Adjacent to the Ocean Reef Club is the Dagny Johnson Key Largo Hammock Botanical State Park, and across the road is the Crocodile Lake National Wildlife Refuge. These areas provide the last remaining habitat for the highly endangered Key Largo woodrat (*Neotoma floridana smalli*) and Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*). Despite this protected habitat, the woodrat population has plummeted from an estimated 6,500 woodrats in 1988 to fewer than 80 today.^{33,f} Stick nests characteristic of the woodrats, which may be used for several generations and become as large as 4 feet high and 6 to 8 feet in diameter, can no longer be found. Cats have been observed roaming through the park. Cats are being trapped and removed from the National Wildlife Refuge, and efforts are underway to captive breed woodrats in the hope that they can later be released back at the site.

In addition to the Key Largo woodrat and Key Largo cotton mouse, domestic cats are threatening other rare species in Florida, including the Florida Scrub Jay (*Aphelocoma coerulescens*), subspecies of beach mice (*Peromyscus polionotus* ssp), Lower Keys Marsh Rabbit (*Sylvilagus palustris hefneri*), Roseate Tern (*Sterna dougallii*), and Silver Rice Rat (*Oryzomys palustris natator*). Only 100 to 300 Lower Keys Marsh Rabbits exist today. A 1999 study³⁴ found that free-roaming cats were responsible for 53% of the deaths of these rabbits in 1 year, and scientists predict the species could be extinct in a few decades at this rate of

predation. Populations of beach mice are already at risk because of habitat loss, disease, and loss of genetic diversity. Domestic cat predation has applied additional pressure to these fragile populations. Found only in the southeastern United States, beach mice are important for maintaining native grasses that help stabilize dunes. Six of 8 beach mice subspecies are federal- and state-listed as endangered or threatened, and 1 is extinct. Scientists consider predation to be the most important factor now affecting beach mouse survival. A cat colony had a negative effect on a population of Choctawhatchee beach mouse (*Peromyscus polionotus allophtys*) near Grayton Beach State Park. During a radiotelemetry study,⁸ 8 of 14 radio-collared mice were lost in the first 2 days. One radio was tracked and located in the digestive tract of a cat. Another radio was found in cat feces near the campground. At the time, there were at least 2 nearby feeding stations where large amounts of cat food were regularly dropped.

Brevard, Palm Beach, Volusia, Gilchrist, and Okaloosa counties in Florida have amended their ordinances to make TNR legal.³⁵ Orange County's Animal Control Department provides spay/neuter services for those who register their cat colonies. After 3 years of legalized TNR and \$100,000 of taxpayer funds to help pay for it in Brevard County, the free-roaming cat population had grown so out of control that a Feral Cat Advisory Committee was formed to make recommendations on how to solve the problem. Cat colonies are common along the Space Coast and even exist in parks with designated endangered sea turtle nesting sites. Domestic cats kill sea turtle hatchlings.³⁶ Despite reams of documents and hours of meetings and discussions, Brevard's Feral Cat Advisory Committee was not able to reach an agreement and disbanded without making formal recommendations. Federal and state wildlife biologists were not consulted when county commissioners passed ordinances allowing TNR. Therefore, on May 30, 2003, the Florida Fish and Wildlife Conservation Commission (FWC) unanimously passed a policy to "protect native wildlife from predation, disease, and other impacts presented by feral and free-ranging cats."³⁷ Under the policy, TNR will not be allowed on lands managed by the FWC, and it indicates their strong opposition to programs and policies that allow release, feeding, or protection of cats on public lands that support wildlife habitat. This policy received broad support from conservation groups, federal and state agencies, and wildlife rehabilitators. A petition filed against the FWC claiming that it had not conducted adequate research, failed to allow sufficient time for public comment, and did not consider more humane alternatives in the drafting of its policy was dismissed by an administrative law judge on August 29, 2003.

California—Most of California's threatened or endangered birds and land mammals are vulnerable to domestic cat predation.³⁸ Although loss and fragmentation of habitat are the main causes of these wildlife population declines, large numbers of pet, stray, and feral cats roaming the remaining habitat impose addi-

tional stress on remnant wildlife populations. Some counties have amended their ordinances to legalize maintenance of cat colonies if volunteers register their colonies with animal control. In 1994, San Mateo County exempted from the "ownership" definition people who register as caretakers of feral cat colonies and "who trap or make a reasonable effort to trap all feral cats over the age of 8 weeks in his/her care, and has them spayed or neutered."³⁹ Santa Cruz⁴⁰ and Santa Clara⁴¹ Counties also approved ordinances legalizing domestic cat colonies. Environmental reviews were not conducted before these ordinances were passed. Maddie's Fund gave a \$9.5 million grant to the California Veterinary Medical Association (CVMA) to reimburse more than 1,000 veterinarians who spayed or neutered 170,334 cats for release. The CVMA did not consult with the California Fish and Game Commission on this project, nor were cat feeders advised to avoid releasing cats in sensitive wildlife areas.

California Quail, a species that nests, feeds, and runs on the ground, have resided in San Francisco's Golden Gate Park since the late 1800s.⁴² Quail chicks are flightless for 10 days after hatching and stay on the ground for a month before beginning to roost in trees at night. Twenty-five years ago, cats in San Francisco's Golden Gate Park were routinely removed and California Quail, White-crowned Sparrows (*Zonotrichia leucophrys*), and native brush rabbits (*Sylvilagus bachmani*) were numerous. However, in the early 1990s, advocates of TNR objected to euthanasia of stray and feral cats trapped in the park and requested that the cats be managed by TNR instead. Ornithologists at the California Academy of Sciences and the City College of San Francisco noticed that the decline in wild bird species directly paralleled a rise in the population of feral cats.^{43,44} After 12 years of TNR, there are still at least 7 active feeding stations in Golden Gate Park and only a handful of Quail have survived.⁴⁵ The brush rabbit has been extirpated.

Hawaii—Hawaii is considered the endangered species capitol of the world, with more endangered plant and animal species per square mile than any other place on the planet. By the late 18th century, at least 45 species of endemic birds had become extinct.⁴⁶ Cats were probably brought to the islands in the late 1700s. Given the mild climate, cats can breed year-round in Hawaii, with 3 litters/y of 4 to 6 kittens/litter. Rabies does not exist on the islands, and there are no wild predators of cats, such as coyotes, to help keep the free-roaming cat population in check. Although domestic cats are not the only threat to endemic Hawaiian birds, they are an important factor, even in higher elevations away from lands occupied by humans.

Approximately 21% of Oahu's households have cats, totaling approximately 150,000 pet felids.⁴⁷ Oahu's Cat Protection Law of 1995 mandates that all outdoor cats 6 months or older be sterilized and wear identification, and the Hawaiian Humane Society (HHS) offers a low-cost spay/neuter program. Abandoning any animal is also illegal. A TNR program was begun in Hawaii in

1993 and was supported by the HHS and the Hawaii Cat Foundation. In 2002, HHS performed 2,609 free sterilization surgeries for cats in managed colonies. From 1993 to 2002, 19,786 cats were sterilized for release on Oahu.⁴⁶ There are more than 2,000 cat caregivers registered with the HHS feral cat program on that island. Despite these efforts, the HHS annually euthanatizes more than 11,000 cats on Oahu.¹

Managed cat colonies occur in many places in Hawaii where stray and feral cats have congregated, including public parks, beaches, and sites adjacent to sensitive wildlife habitat, such as seabird nesting colonies. In 1999, researchers found that a Wedge-tailed Shearwater colony at Waiehu on Maui near a managed cat colony lost 23 adult birds to cats during a 10-day period. A Shearwater colony at Hookipa lost 59 adult birds and 27 burrow-fledged chicks to cats. At a small Shearwater colony east of Kuau, 6 adult birds were killed by cats, causing the total loss of all chicks at 5 burrows. At Pauwalu, remains of Bulwer's Petrel (*Bulweria bulwerii*) chicks were found near a cat colony during each of 3 years and there was no evidence that any chicks had successfully fledged from the colony during this time. According to researcher Duvall,⁴¹ "small colonies (of seabirds) were vulnerable to total failure and larger colonies to losses of returning adults and late-stage chicks and adults. Comparison of cat-free Molokini islet illustrated cat predation has a sustained negative impact on established Maui native seabird colonies, expansion of colonies, and colonization of new areas by native seabirds."

Cat Removal Does Work

Proponents of TNR maintain that trapping and permanent removal does not work and that more cats will come to fill the void left by cats that were trapped. The following examples show that trap and removal does work if the source of food is also removed.

Virginia—In 1993 at Riverside Park, Va, cats were being fed around picnic tables where families came to enjoy a view of the Potomac River. By law and policy, pets, including cats, must be kept under physical restraint at all times in areas administered by the National Park Service. Staff from the National Park Service told feeders the cats had to be removed. Amid public protest from cat feeders and a lawsuit, 28 adult cats and 3 kittens were trapped and taken to Fairfax County Animal Control. The lawsuit was dismissed as moot in September 1994, and no cats were euthanatized.⁴⁷ Cats are no longer found on that site. However, I have personally observed a large rat hole marking the site of the former cat feeding station. It appears that both cats and rats were being fed.

California—Cat removal has also worked well in Bidwell Park in Chico, Calif. In 1997, several hundred stray and feral cats roamed the park and the park's historic California Quail population had been decimated. Alta Cal Audubon Society and others asked the city's Park and Playground Commission to take action. The Commission began to enforce the state's antiabandonment law and the city's antilitter law. A citation was issued to 1 cat feeder for deliberately violating these laws, and he was ordered to do 80 hours of community

service by helping to trap and remove cats from the park, which the community supported. Although TNR advocates asked that a TNR program be started in the park, the Commissioners refused. In response, the Chico Cat Coalition (CCC) was formed to rescue the cats. Since February 1998, the CCC has trapped and removed more than 638 cats and kittens, found homes or foster homes for more than 510 of them, and returned 11 cats to their owners. Forty cats died, 8 of which were euthanatized. Approximately 71 cats not suitable for adoption are living out their lives in the comfort of a fully enclosed barn with free access to an outdoor enclosure on private property.⁴⁸ The City of Chico pays for spay/neuter services. California Quail are once again seen in the park, and it is unusual to see a stray cat. The CCC and the Park Commissioners appear to have found a humane solution for both cats and native wildlife.

Morro Rock Ecological Reserve is a popular area with a spectacular view of Morro Bay and nesting Peregrine Falcons (*Falco peregrinus*), a species protected by federal law. Despite policies and regulations prohibiting abandonment and feeding of domestic animals in state parks, a large group of stray and feral cats had been fed in the parking lot daily for years. Over the objections of a local cat rescue group, approximately 50 cats were trapped in the park and taken to the local humane society between 1995 and 1997. Some cats had to be removed twice because individuals would go to the humane society, buy the cats back, and release them at the Rock. According to observations by local birders, Canyon Wrens (*Catherpes mexicanus*) had all but disappeared at the Rock but are now common. The presence of the cat colony caused many cat owners to dump unwanted cats there. Since the cats were removed and the feeding stopped, cat abandonment and feeding are no longer problems at the park.⁴⁹

In 1997, a group of stray cats abandoned by Alameda Naval Air Station personnel were being fed near a colony of California Least Tern (*Sterna antillarum browni*), a federally listed endangered species. Cats are known to prey on Least Tern, and it was illegal to feed cats on the base.⁴⁸ Groups advocating TNR protested the Navy's effort to trap and remove the cats and asked that feeding cats on the base be legalized. However, the Navy continued to trap and remove cats and other predators as required under the Endangered Species Act, and this effort paid off. Prior to removing predators, there were only a few nesting pairs of terns; however, by the summer of 2001, an estimated 275 nests fledged approximately 320 chicks.⁹ This area is now managed by the US Fish and Wildlife Service as a National Wildlife Refuge.

The East Bay Regional Park District manages 96,000 acres with 14 state or federally listed threatened or endangered species and at least 27 species of special state concern. Rare ground-nesting birds found in the East Bay Regional Park District, such as California Clapper Rail (*Rallus longirostris obsoletus*), California Least Tern, and Western Snowy Plover (*Charadrius alexandrinus nivosus*), are especially vulnerable to cat predation. Abandoning cats and feeding them and their offspring have been substantial problems in some of the district's parks, despite laws prohibiting these activities. Huge public controversies erupted and were highlight-

ed by media whenever the district removed cats from the parks by humane trap and removal or by lethal control. To resolve this issue, in 1999, the district proposed the "Feral and Abandoned Volunteer Program," which would allow cat colony advocates who signed a liability waiver and agreed to adhere to volunteer guidelines to trap and permanently remove cats on EBRPD lands. Although 10 volunteers signed the waiver, only 1 actually removed cats. The volunteer program has since been disbanded, and park staff is successfully trapping and removing cats from the parks.⁹

Ohio—Advocates of TNR believe that the general public does not support large-scale trap and remove programs and that they are cost-prohibitive. However, in response to complaints from citizens about numerous stray and feral cats, the Akron City Council passed an ordinance on March 25, 2002, prohibiting domestic cats from running at large. As of August 31, 2003, a total of 2,495 stray and feral cats had been trapped by citizens as well as by 4 wardens on an on-call basis and taken to Summit County Animal Control. Of those cats, 530 were redeemed or adopted and 1,965 were euthanatized because they were feral, injured, or diseased. The cost to the City of Akron was \$26,546. If the public did not support this program, far fewer cats would have been trapped because private citizens did most of the trapping.⁷

Mexican islands—Collaborative efforts by the Mexican Natural Resources Ministry, conservation groups, and island residents have resulted in successful removal of domestic cats and all other exotic species from 15 Mexican islands at a cost of < \$1 million.⁸ Fishermen commonly brought cats onto the islands as a way to control native rodents attracted to their homes, but the cats were later abandoned. Unfortunately, shearwaters and other seabirds that nest in burrows in the ground became easy prey for these cats.

On Natividad Island, researchers determined⁴⁹ that domestic cat predation was the main threat to the Black-vented Shearwater (*Puffinus opisthomelas*). Natividad is the breeding ground for more than 95% of this species' world population, and shearwaters were estimated to comprise 90% of feral cats' diets on the island. After 25 feral cats were removed from Natividad, mortality of Black-vented Shearwater decreased dramatically, from 1,012 dead birds/mon to only 88 dead birds/mon. This rate of mortality is typical and sustainable by the shearwater population.

Better Alternatives

The ABC believes that trap and removal programs can be effective in eliminating stray and feral cat populations and that they are the only acceptable option for public parks, beaches, and other areas managed for wildlife. Cat sanctuaries, such as those run by Best Friends in Utah, Rikki's Refuge in Virginia, the Humane Society of Ocean City in NJ, the CCC in California, the Delaware Humane Association in Delaware, and the Habitat for Cats Sanctuary in Massachusetts, keep cats sheltered, safe, and well fed; provide access to routine veterinary care; protect wildlife; and reduce health risks for cats and people. The ABC strongly supports sanctuaries for stray and

feral cats as an alternative to TNR that is more humane to both cats and wildlife.

Veterinarians Can Make a Difference

The first step in controlling free-roaming cat overpopulation starts with educating the public on responsible pet ownership. In 1997, ABC initiated a citizen education campaign called "Cats Indoors!" to encourage cat owners to keep their cats indoors and to support humane, permanent removal of cats from wildlife areas. Campaign materials include a brochure, posters, fact sheets, an educator's guide for grades kindergarten through 6, print and radio public service announcements, and computer-aided slide presentations.⁵⁰ The AVMA also strongly encourages owners of domestic cats in urban and suburban areas to keep their cats indoors.⁵¹ As a primary source of information for cat owners, veterinarians should take every opportunity to encourage responsible ownership of their feline patients.

In conclusion, for solutions to the free-roaming cat overpopulation problem to be viable, they must do the following: protect native wildlife, especially vulnerable species; be humane to native wildlife as well as cats; protect human health; comply with federal, state, and local laws; effectively reduce the free-roaming cat population; and be scientifically defensible. In the opinion of the ABC, TNR as presently practiced has not met these objectives.

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The welfare of feral cats and wildlife

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There are an estimated 60 to 100 million feral and abandoned cats in the United States. By any measure, this is an important welfare issue, and the many bodies of free-roaming cats visible along roadsides across the country are mute testimony to the tragedy of their unhappy lives. Many people of goodwill want to see this situation improved. Some believe that feeding feral cats; trapping, neutering, and releasing them; and allowing them to live in colonies is 1 answer to the overpopulation problem. Others believe that, on the whole, such programs are most often unsuccessful at sharply reducing and eventually eliminating feral cat populations. In my opinion, attempting to maintain cats in colonies only compounds the problem by causing massive killing and crippling of native wildlife, jeopardizing biodiversity, undermining traditional animal control, enabling irresponsible people to abandon cats, and sending mixed messages about the veterinary profession's commitment to serve the welfare of all species, including cats and wildlife.

The Welfare of Wildlife

Free-roaming and feral cats yearly kill hundreds of millions, perhaps as many as a billion, native North American birds, mammals, reptiles, amphibians, and fish.^{1,2} The Lindsay Museum of Walnut Creek, Calif, a full-service wildlife rehabilitation facility, received 5,669 small mammals, birds, and reptiles between January 1 and September 14, 2003. Of these, 24% (1,050) of birds, 12% (143) of mammals, and 15% (11) of reptiles were presented because of cat-related injuries or conditions.³ These animals were brought in alive and do not include those that died or were not found. When raptors and pelagic birds are removed, accession figures reveal that 30.3% (1,015/3,353) of birds were admitted because of cat-related problems. This includes 36 species, many of which are songbirds or locally rare, sensitive, or migratory species; all are supposed to be protected by law from illegal take (Table 1). These figures are from 1 wildlife rehabilitation facility, which serves half of 1 small county in California, for < 9 months.

A recent survey conducted in southern Michigan indicated that free-ranging cats killed from 0.7 to 1.4 birds/wk.³ Twenty-three species (12.5% of all breeding species) were involved, including 2 species of conservation concern.³ The authors of that study³ estimated that cats would kill between 16,000 and 47,000 birds during the breeding season in their 3 study areas and concluded that cat predation "plays an important role in fluctuations of bird populations."

It is in cats' nature to hunt.^{4,7} It is part of their telos, a term coined by Aristotle that means "a function, a set of activities intrinsic to an animal, evolu-

Table 1—Data used to calculate the percentage of cat-related accessions to the Lindsay Museum of Walnut Creek, Calif, for all species and for susceptible birds (ie, nonraptors and pelagic birds).^a

Species	No. of birds accessioned from Jan 1–Oct 14, 2003	No. of cat-related accessions	%
All birds	4,409	1,050	24
All mammals	1,187	143	12
All reptiles	73	11	15
Blackbirds	58	6	10
Bluebirds	5	2	40
Bushits	49	17	35
Chickadees	24	7	29
Cowbirds	40	7	18
Crows	107	7	7
Doves	720	234	33
Finches	685	209	31
Flickers	9	2	22
Flycatchers	4	0	0
Goldfinches	130	23	18
Grosbeaks	6	0	0
Hummingbirds	209	35	17
Jays	313	104	33
Juncos	18	13	72
Killdeer	14	1	7
Kingbirds	1	1	100
Larks	1	1	100
Magpies	6	1	17
Meadowlarks	5	2	40
Mockingbirds	175	59	34
Nuthatches	6	5	83
Orioles	10	5	50
Phoebes	46	10	22
Band-tailed pigeons	19	2	11
Poorwills	2	0	0
Quails	88	19	22
Robins	202	71	36
Sapsuckers	2	1	50
Shrikes	4	1	25
Siskins	1	0	0
Sparrows	30	19	63
Tanagers	4	2	50
Thrushes	36	16	44
Titmice	17	8	47
Towhees	183	96	52
Vireos	2	0	0
Warblers	15	3	20
Waxwings	49	12	24
Woodpeckers	49	11	22
Wrens	9	3	33
Total susceptible birds	3,353	1,015	30.3

tionarily determined and genetically imprinted."⁸ No reasonable refutation of this exists in the literature. Even trap-neuter-return (TNR) advocates admit "that a sizable problem exists" with regard to the killing of wildlife, but offer no plan for mitigation.⁹ Providing abundant food for outdoor cats, even overfeeding, does not stop this natural hunting behavior.^{4,10,11,b}

From the Marine Wildlife Veterinary Care and Research Center, 1451 Shaffer Rd, Santa Cruz, CA 95060.

As presented by Winter,¹¹ the negative effects on wildlife populations can be extensive, devastating, and prolonged. Negative effects are particularly severe on islands, in parks where habitats have been fragmented (urban and suburban areas), and for endangered and ground-dwelling species.^{6,12-14} In a study¹⁵ of 2 California parks, feral cats selected native species of rodents and birds over introduced (pest) species. In locations where regularly fed feral cat colonies existed, native birds were markedly less abundant and less likely to nest, and ground-foraging species such as California quail and thrasher were entirely absent.^{15c} Native rodents were less abundant, and house mice were more abundant.⁶ This makes evolutionary sense in that species of European origin, such as Norway rats, house mice, starlings, and English sparrows, have had many thousands of years to coevolve with *Felis silvestris* and *Felis catus*, whereas North American species have had only several decades to perhaps 200 years.

Feral cats also indirectly kill native predators by removing their food base.¹⁶ Because they are subsidized, feral cats can exist even when prey species have been reduced to far below carrying capacity.^{6,7} In some areas of Wisconsin, feral cats outnumber all native mesopredators combined.

Cats' victims (native species) have evolved in and belong in North America and provide ecosystem services.^{13,17,18} The loss of these animals reduces biodiversity, even in somewhat degraded ecosystems.^{17,18} Loss of their ecosystem services has implications for such basic life processes as insect population dynamics, soil fertility and stability, pollination, and seed dispersal. Removal of cats from native and even degraded ecosystems has no negative and only positive ecologic consequences.

Wild animals are not only killed by cats but are also maimed, mauled, dismembered, ripped apart, and gutted while still alive, and if they survive the encounter, they often die of sepsis because of the virulent nature of the oral flora of cats. Veterinarians working in the area of avian and wildlife rehabilitation see this problem frequently.^{4d} Wild animals experience pain and suffer too. On the basis of compassion alone (for those who can ignore the impersonal nature of wildlife mortality figures and disruption of ecologic processes), the suffering of wildlife must be weighed against the perceived welfare of feral cats.

It is pointless to debate every potential disease and parasite of cats and situation in which they might affect wildlife. Clearly the potential for transmission of diseases and parasites from dense aggregations of feral cats to wildlife exists. Some diseases carried by feral cats are negatively impacting sensitive and endangered wildlife populations. The Alala, or Hawaiian crow, and southern sea otter are being seriously affected by systemic and central nervous system disease caused by toxoplasmosis linked to cat feces.^{19,20} In a recent publication, we showed that toxoplasmosis was the primary cause of death for 23% of the threatened southern sea otters ($n = 105$) we examined during a 3-year period and that it contributed to the death of many others.²¹ There is also reason to believe that feral cats may serve as a source of FeLV for cougars and Florida panthers.^{22f}

The following passage from *Animal Rights and Human Morality*⁸ represents an ethical viewpoint: "I would not adopt as a universal principle always favoring the 'higher' animal—for example, if the choice came down to a quick death for the higher animal versus a slow, lingering death for the lower animal, one should presumably choose the death of the higher animal."

The first law of medicine is "primum non nocere," or "above all, do no harm." How do we square this most basic law, and the now popular phrase "veterinary medicine is for all species," with this situation? Feral cats and the programs that foster their free-ranging existence do not serve the welfare of individual wild animals or wildlife populations, can cause an alteration of basic biological processes, and have serious potential negative impacts on biodiversity and recovery of endangered and sensitive species¹² in many landscapes.

The Welfare of Feral Cats

In my opinion, TNR really stands for trap, neuter, and reabandon, and that is how I will define TNR for the purposes of these proceedings. Abandonment of animals cannot be morally justified and is illegal under state humane laws.²³ The California Penal Code goes on to say it is illegal to fail to provide animals with shelter, water, food, and protection from weather.²⁴ Such conditions often occur at TNR sites. If it is illegal to abandon a cat once, how can it be legal to do it a second time? How can veterinarians justify being party to abandonment, an illegal act of animal cruelty?

Part of the cat's telos is its desire for affection and human companionship and its semidependence on human care and provision. Veterinarians and animal shelter workers in particular know how important human touch and companionship are to a cat. Cats that lose their owners are often bereft and suffer what appears to be depression. Practicing veterinarians often see sick or injured cats begin to heal and thrive when petted and interacted with more frequently.

Some TNR programs do not distinguish between truly feral cats and lost or stray pet cats. Photos are not taken, and cats are not held for owner identification and reunion with their families. In the world of TNR, unless a stray cat has a collar or is microchipped, it is very difficult to distinguish from a truly feral animal. Once trapped, neutered, and marked, these lost cats are much less likely to ever be found and returned to their owners or adopted. Trap, neuter, and reabandonment is a cruel fate for many former pet cats.

People for the Ethical Treatment of Animals (PETA) has called TNR "subsidized abandonment" and states that "feral cats do not die of 'old age.' They are poisoned, shot, tortured by cruel people, attacked by other animals, or hit by cars, or they die of exposure, starvation, or...contagious diseases.... In one feral cat colony, half of 32 cats were shot by a man who claimed that they were attacking his children. Cats in another colony were shot with darts. A loose dog killed several cats in another colony. Ferals often scratch their ears bloody, driven crazy by pain and itching of ear mites and accompanying infections. Others die of blood loss or anemia from worms and fleas. Urinary tract infections, which frequently lead to blockage in male cats,

cause extremely painful, lingering death if not treated. Untreated upper respiratory infections leave eyes and noses so caked with mucus that animals can barely see or breathe."²⁵

Many feral cats live short, brutal lives. Figures vary, but the AVMA has used the figure of 2 years as opposed to 10 for the mean lifespan of owned cats²⁶; others estimate that feral cats live approximately half as long as owned cats.²⁷ Mortality rates for feral cats can be up to 80%/y.²⁷ Feral cats suffer considerably higher rates of injury and disease.^{26,27} Many feral cats succumb to vehicle trauma, predation, disease, or severe weather.²⁷ Winter¹¹ has presented a number of examples of the dangerous and unsanitary conditions found at feral cat feeding sites. Clearly these conditions and outcomes are not serving the welfare of feral cats.

TNR Sends Mixed Messages About the Veterinary Profession

Is veterinary medicine for all species? The AVMA's Long Range Plan, Goal 1, Objective 6 states in part, "emphasize the concept that veterinarians have a positive influence on the health and well being of all living creatures...." Trap-neuter-return appears to be advantageous to only 1 species (cats) and disadvantageous to many dozens, perhaps hundreds, of other species (Table 1). What kind of ethical message and world view does veterinary support for TNR and feral cat colonies send?

Many wildlife biologists, ecologists, conservation agencies, and bird and mammal lovers strongly oppose TNR and feral cat colonies.^{28,29} Most avian and wildlife veterinarians strongly oppose TNR and feral cat colonies.^{29,30} What message does veterinary support for TNR send to millions of conservationists and the veterinarians who provide care for birds, native species, and their ecosystems?

The conditions under which feral cats are handled in TNR programs and the level of veterinary care provided may be lower than prevailing local practice standards. In large-scale TNR operations, dozens of cats may be dropped off in the morning for spays and neuters.³¹ A history is almost never available, and examination of the cat in the trap is necessarily brief and from a distance. No owner or client is present. How is it possible for a veterinarian-client-patient relationship to exist as required under federal laws regarding the use of veterinary drugs and under the Model Veterinary Practice Act and other AVMA policies and positions if there is no client and no lasting relationship? Neutering is an elective surgery, not an emergency procedure. If a valid veterinarian-client-patient relationship is not necessary for an elective surgery, why is it necessary for clients seeking popular medications? Practitioners who worry about the impact of Pet Med Express should give serious thought to how TNR will effect public perceptions about the value of veterinary services.

Veterinarians involved in TNR programs have told us that in large-scale spay clinics in Florida, cats are spayed for \$12 to \$17 in drugs and supplies.³¹ If this is so and widely known to cat advocates, how must they then look at veterinarians who charge \$70, the amount the California Veterinary Medical Association

(CVMA) reimbursed its members,³² or \$100 to \$150 as is charged in many practices. Consumers, particularly those who read Consumer Reports and are already suspicious of veterinarians, may be left wondering.

Is the \$17 spay done in a sterile theatre with a separate instrument pack? Is ketamine the sole anesthetic? Is postoperative pain relief considered? Is there any substantive postoperative care or surgical follow-up? Are medication and instructions given at the time of examination and spay followed? Vaccinations may or may not be given, but if given, is there any follow-up? If not, this is not in keeping with recommendations in the AVMA's Model Veterinary Practice Act. Is this professionally acceptable or appropriate? How can the veterinary profession provide high-quality medical care for some cats and yet provide and support a much lower standard of care for others? If 2 different levels of care are professionally acceptable standards of practice, how can you deny a client the low-cost version if they know it is available?

Some TNR advocates argue that vaccination is not a good return on investment³¹ and that resources should instead be directed toward spaying and neutering. Ninety thousand feral cats were released into California without vaccinating them for rabies, despite bat and skunk rabies being endemic within this state. This was justified on the basis of local practice standards,³² but the cats in question were not going to homes where they might have some insulation from wildlife rabies carriers or other feral cats. In the face of CVMA support for TNR, only 1 county health veterinarian in California insisted that all TNR cats in his county be vaccinated against rabies. Hopefully, recent cases of rabies in feral cats in Florida and at Kennasau State University in Georgia,³³ which resulted in human exposures, will cause this stance to be reconsidered.

Diseases and parasites affecting feral cats can have human health implications. Pregnant women; people receiving chemotherapy for immunologic diseases and organ transplants; and those with HIV, AIDS, or other immunologic problems are at increased risk of clinical disease if exposed to toxoplasmosis. Maintaining feral cats where they can deposit cat feces in national, state, county, or city public parks; on campuses; and around schools and hospitals constitutes a public health risk.^{34,35} In 1994, 5 Florida children were hospitalized with encephalitis that was associated with cat scratch fever.³⁵ The daycare center at the University of Hawaii in Manoa was closed for 2 weeks in 2002 because of concerns about potential transmission of murine typhus (*Rickettsia typhi*) and flea (*Ctenocephalides felis*) infestations afflicting 84 children and faculty.³⁶ The fleas were from a feral cat colony that has grown from 100 to over 1,000 cats, despite a TNR effort.³⁶ Some of the obvious sanitary, vermin, and parasite problems associated with concentrations of feral cats have been presented by Winter,¹¹ but wherever cats are concentrated and under minimal care and control, their diseases and parasites are likely to be more abundant. What does support of TNR say about the veterinary profession's commitment to public health in light of the fact that many public health veterinarians strongly oppose TNR?^{29,37}

Although most veterinarians donate their skills and attendant costs to spay feral and abandoned animals, substantial funds have been made available recently to subsidize TNR programs. Maddie's Fund provided the CVMA with \$13 million over 3 years to support TNR efforts.³² Practitioners who were or became members of the CVMA in aggregate received \$12 million, were paid \$70/spay and \$50/castration, and were not required to vaccinate cats or provide other health services (more than 90,000 cats did not receive rabies vaccinations).³² The CVMA retained \$1 million for arranging and promoting the program.³² Although money can be a powerful motivator, we do not believe that greed is central to this issue but rather that a large number of veterinarians have been led to believe that TNR is humane and relatively harmless and will help control feral cat populations. I do not believe this is so.

If TNR does not provide high-quality health care for cats; undermines the veterinarian-client-patient relationship; undermines support for high-quality veterinary practice; or shows the veterinary profession as environmentally insensitive, not supportive of biodiversity and conservation, or less than vigilant about public health, then in my opinion, TNR serves neither our profession nor the welfare of feral cats, wildlife, or the public.

TNR Does Not Work Under Most Prevailing Circumstances

Each situation and location where feral cat populations exist and where TNR has been tried is different. Geography and groundcover vary from open and easy to access (campuses and some parks) to steep, broken, and densely vegetated. Feral cats in some locations are semitame and allow approach and handling, and in other locations, they are extremely fearful and flee at the site of people. How "success" (reduction in cat numbers) is defined also varies. The fact that many TNR groups fail or refuse to keep adequate records¹¹ does not help resolve the issue of success or failure.

Although some TNR programs have succeeded in slowing the growth of feral cat populations and sometimes the number of cats has declined over several years, in most locations where TNR has been tried, it fails to substantially or quickly reduce cat numbers and almost never eliminates feral cat populations.^{11,38,39} After bad experiences with TNR at both the Mayport Naval Station and Norfolk Naval Shipyard, the US Navy banned TNR from lands under its control. Winter¹¹ has provided examples of other failures. Even at the original Palo Alto location where TNR was first tried,³⁹ cat numbers have been unstable and cats have had to be periodically removed to reduce the population to an acceptable level. I believe it is misleading to claim that TNR works in locations where cats are permanently removed periodically for adoption or other reasons. I have personally seen multiple feral cat colonies on state property and park lands and in a number of sensitive habitats on private lands in California where various levels of TNR (from casual to serious efforts) have gone on for many years. None of these efforts, by themselves, eliminated the feral cat population.

Simple population modeling and hands-on experience reveal that TNR is likely to succeed only when numbers of feral cats are small to begin with (30 to 40 or less); when the colony is closed (no immigration) or nearly so; where essentially all female cats in the area can be captured and neutered; where all the terrain is accessible (so pockets of untrapped animals do not remain); and where capture and neutering efforts are early, intense, and prolonged.^{38,39,40} These circumstances seldom prevail long enough for cat colonies to be eliminated. Exceptions happen when unexpected lethal events occur, such as the mass dog mauling that led to the elimination of 1 study colony.⁶ I do not believe that any of us would argue that this is a desirable scenario. In some situations where TNR has been described as successful, cats were all semidomesticated and approachable. Ironically, cats like these are the most likely to be adoptable and to succeed in an enclosed sanctuary. Other feral cat colonies reported to have disappeared under TNR programs were actually moved by their caretakers to other locations.

The largest TNR program in the nation, which neutered and reabandoned 180,000 cats, is not expected, even by its proponents, to reduce the number of feral cats in California.³² Despite articles claiming success,⁴⁰ a follow-up study⁴¹ on one of the largest and most active TNR programs in California has revealed no demonstrable effects at the population level after nearly a decade of effort. The coastal sage scrublands of San Diego County, where this work took place, are among the most imperiled habitats in the world with one of the largest assemblages of endangered animals anywhere. I could find no evidence that this program was carried out with any sensitivity to its potential impacts on wildlife. An ecologic study¹⁰ in these same areas of San Diego County indicated that owned, free-ranging cats bring home 24 rodents, 15 birds, and 17 lizards to their owner's residence yearly and leave an unknown number of other wildlife dead or dying.

Trap-neuter-return's failures are, in part, attributable to its being based on several false assumptions, including the following: rates of abandonment and immigration are relatively low; cats at existing sites will exclude others (in reality, the presence of food attracts others)¹¹; feral cats will stay where you put them (you cannot herd cats, well fed or not); all cats can be caught; and populations of cats in colonies will behave in general as if they were isolated and in a closed system. Modeling to guide some TNR efforts that incorporate these assumptions has led to unrealistic conclusions.⁴² Suppression of feral cat numbers is possible with great effort, but for the same reasons, it is difficult to exterminate rats and cats on islands by use of lethal means and it is vastly more difficult to accomplish this by use of nonlethal means in open systems. Finally, planning for TNR has almost universally failed to appreciate the reproductive potential of cats (Malthusian Index of 3, similar to that of the rabbit) and the very early onset of breeding in some females.

Since TNR is not sustainable, does not generally reduce feral cat populations in a reasonable period of time (5 years or fewer) in most circumstances where it is used, and almost never results in the elimination of

feral cat colonies, I do not believe it serves the welfare of cats or wildlife.

TNR May Be Illegal and Veterinarians Are Not Above the Law

If well-meaning individual veterinarians or associations found themselves the subject of misdemeanor or felony lawsuits, it would be most unfortunate. The comments in the following section are offered in the interest of avoiding such situations.

It is against the law to take protected species of wildlife, which is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect."⁴¹ Because cats can and do kill, harass, harm, pursue, and wound endangered species, people who reabandon cats, maintain feral cats, or both and the veterinarians who knowingly provide services (an oral contract exists or in some cases a fee is paid) for animals destined to be so abandoned appear to be in potential violation of the Endangered Species Act (ESA).⁴² Under the ESA, citizen suits are allowed and "any person may commence a civil suit...to enjoin any person...who is alleged to be in violation."⁴²

Wild animals and their right to exist are protected under other state and federal laws. The Migratory Bird Treaty Act makes it a misdemeanor or felony to kill or take "any migratory bird."⁴³ The act states that "any person, association, partnership or corporation who shall violate any provision...shall be deemed guilty of a misdemeanor...fined not more than \$15,000 or be imprisoned not more than 6 months, or both."⁴⁴

Most states also have their own endangered species laws (eg, California Endangered Species Act), and in all states, the taking of native species is prohibited, except as allowed under hunting and fishing regulations, which are commonly referred to as game laws. Relatively few species killed by cats can be legally taken for any purpose. Recent actions by several game and fish commissions suggest that states may be starting to take a more aggressive approach to TNR. From a wildlife agency perspective, the release of non-native predators is just as illegal as poisoning or poaching wildlife or bulldozing their habitat.

The federal Migratory Bird Treaty Act and ESA laws are strict liability laws, which means there is no affirmative defense allowed.⁴² Telling the judge that "you didn't mean to," "didn't know," or "it wasn't as bad as they say" is not an acceptable defense. Repeated or knowing offenses can be tried as felonies in civil and criminal courts. Veterinarians who have been informed in their professional communications and journals and who admit they are aware that illegal taking may occur (what veterinarian can argue he does not know that cats kill birds?) are open to felony prosecution. Even acts that inadvertently take wildlife protected under the federal law, as occurred when veterinarians inadequately disposed of barbiturate-laden carcasses, have resulted in successful prosecution under ESA.⁴⁵

Activities judged to be illegal that result in the taking of wildlife can result not only in legal prosecution, fines, and penalties but also in restoration costs that are often accessed under both state and federal laws. These financial penalties are designed not only to deter future

violations but also to assist species recovery or provide habitat for the species affected. Oil spills and other illegal acts that kill hundreds to thousands of birds often result in legal costs, fines, penalties, and restoration packages in the tens of millions of dollars. To prevail in court, it has not been necessary to have all the animals' bodies for evidence as models and estimates are used to calculate losses and needs for restoration. Trap-neuter-return programs that release thousands of cats to prey on native wildlife, if adjudicated, could result in similar financial consequences.

As noted, in addition to breaking wildlife protection laws, TNR may result in acts considered illegal under some state humane statutes. Repeated misdemeanors or a felony committed by a veterinarian in many states is sufficient reason for review, suspension of licensure, or both. The AVMA PLIT has been informally asked by the Committee on Environmental Issues what sort of liability they see associated with TNR, and their informal reply has been that insurance does not cover acts deemed to be illegal.¹ Our interpretation is that practitioners should not expect their malpractice insurance to cover their legal costs. Given the widespread participation of veterinarians in TNR, I believe that many practitioners may not understand that their activities may place them in legal jeopardy.

TNR as an Enabler

Trap-neuter-return creates an attractive nuisance and has been hypothesized to act as a classic enabler, encouraging people to abandon cats instead of taking them to animal shelters.^{11,46} It should not be surprising that some people, believing that their cat will get veterinary attention, be neutered, and be provided with food and water, choose abandonment over paying fees to relinquish the cat to animal control. Trap-neuter-return advocates admit that posted locations where TNR programs are being conducted regularly experience substantial and repeated influxes of cats.³¹ Thus, TNR actually appears to undermine its stated goal of protecting the welfare of cats and fails to educate people as to their legal and moral responsibilities.

Many feeders of cats will not keep records, are not committed to population control, or are not willing or able to aggressively maintain a vigilant TNR effort. How much of a fig leaf does TNR provide for people who just want to have lots of cats?

Some people are compelled to own and care for excessive numbers of cats. This psychologic illness is referred to as "collectors psychosis."⁴⁷ How is the person who must save 25 to 30 cats in their home different from the person who sees themselves as the savior of 25 to 30 cats in a park? Some "cat people" may be "collectors," and it is possible that TNR is enabling and supporting some people who need psychologic counseling and assistance.

Rollin⁸ says that "we also do not wish to prolong a life that is in gross or hideous violation of the creature's telos, even if the creature is conscious and not suffering." One can argue whether a feral existence is a gross or hideous violation of a cat's telos, but it may not be the life for which cats have been genetically programmed or evolved.

The perspective of PETA is, "because of the huge

number of feral cats and the severe shortage of good homes, the difficulty of socialization, and the dangers lurking where most feral cats live, it may be necessary and the most compassionate choice to euthanize feral cats. You can ask your veterinarian to do this, or if your local shelter uses an injection of pentobarbital, take the cats there. Please do not allow the prospect of euthanasia to deter you from trapping cats. If you leave them where they are, they will almost certainly die a painful death. A painless injection is far kinder than any fate that feral cats will meet if left to survive on their own.²⁵ If even ardent animal rights groups and philosophers can accept euthanasia as part of feral cat control, why can't those advocating for TNR accept it?

If and when TNR programs enable illegal, inhumane, irresponsible, and unhealthy behavior, they do not serve the welfare of feral cats, wildlife, or society.

Where Do We Go From Here? What Can We Do About Feral Cats?

Barrows⁵⁰ has stated that we probably all support the "T" and "N" parts of TNR, but we strongly disagree on the details of the "R" part. Our success in controlling populations of feral cats and reducing the suffering of these cats and of wildlife depends on redoubling our collective efforts. We must be practical and strategic in the use of the tools available to us and ensure that all of these tools are used appropriately. We must embrace comprehensive and long-term solutions that manage people in addition to feral cats.

We must do more to prevent abandonment.⁴⁹ 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. Until there is broad recognition of this and real social stigma and penalties are attached, we will continue to have a feral cat problem in this country.⁴⁹ We must educate feeders of cats that keeping large numbers of cats outdoors for years on end is cruel to cats and wildlife, possibly illegal, and unacceptable.

Mandatory spay/neuter laws, if strictly enforced, have the potential to reduce the population of feral cats in many areas. Marin County in California is an example of a community where cats and kittens are sometimes imported from adjacent counties to fill the need for adoptees. In many counties, however, existing pet ownership laws are not enforced or penalties for non-compliance are less than the cost of compliance and thereby ignored.

We must all be more generous and supportive of adoption and fostering programs. The fostering of cats and kittens until they are either healthy or tame enough to be adopted or until local animal shelters have sufficient room for them can spare cats from euthanasia. My family and I have found this to be particularly rewarding. We were able to tame and find homes for 6 feral kittens this year. Even adult and young adult feral cats can be tamed. We have 4 adult cats now, all of whom were feral at one time, and during the past 17 years, we have had 11 such cats. If animal control agencies are to deal effectively with feral cats, they must have the resources they need. This means funding and gratis or low-cost professional ser-

vices. Efforts to undermine animal control programs that do not use TNR as their primary means to manage feral cats must cease.

Just as it is becoming clear in many parts of the United States that "no-kill" shelters are not sustainable,⁵¹ we must acknowledge that TNR has limited applicability. We must accept that euthanasia will remain part of animal control activities for at least the near future and that some cats may indeed have to be humanely killed if other efforts at placement fail. Cats would be better served if we could all agree to support serious and comprehensive efforts to sharply reduce their populations. If cat advocacy groups expect support for limited TNR from those who typically oppose it, they should in turn be supportive of all feral cat animal control efforts, even those that do not focus exclusively on TNR.

Recently, another option has become available: enclosed sanctuaries where cats can live out their lives protected from weather and most injury. Large and well-known cat sanctuaries exist in Delaware, Massachusetts, New Jersey, New Mexico, Utah, Virginia, and several places in California. Others are being built and operated by individuals and organizations on small and moderate scales similar to other sanctuaries, as described by Winter.¹¹ This is happening simply because people sense it is the right thing to do. Hopefully, we can all agree this is 1 thing that truly serves the welfare of both cats and wildlife.

Gandhi stated that "the advancement of a civilization can be seen in the way it treats its animals." In my view, trap, neuter, and reabandonment of cats is not the measure of a healthy or mature society. A balanced and multidimensional approach to management of feral cats that is practical, legal, sustainable, effective, and compassionate and that embraces stewardship and responsibility for all species is the measure of a mature society.

⁴⁹Anderson N, Lindsay Museum, Walnut Creek, Calif: Personal communication, 2003.

⁵⁰Jessup DA, California Department of Fish and Game, Sacramento, Calif: Personal observation, 2003.

⁵¹Hawkins CC. *Impact of a subsidized exotic predator on native biota: effect of house cats (Felis catus) on California birds and rodents*. PhD dissertation, Texas A & M University, College Station, Tex, 1998.

⁴Murray D, Avian and Exotic Clinic, Monterey, Calif: unpublished data, 2003.

⁴⁹AVMA Executive Board, *AVMA long-range plan: improving animal and human health, goal 1, objective 6*. AVMA, Schaumburg, Ill, 2003.

¹Cunningham EM, Florida Fish and Wildlife Conservation Commission, Tallahassee, Fla: Personal communication, 2003.

⁴⁸Stoskopf MK, North Carolina State University, Raleigh, NC: Personal communication, 2003.

⁵¹Foley J, University of California, Davis, Calif: Personal communication, 2003.

⁵Beasley V, University of Illinois, Urbana, Ill: Personal communication, 2003.

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