



REVIEW ARTICLE

A review of feral cat control

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Animal overpopulation including feral cats is an important global problem. There are many stakeholders involved in the feral cat debate over 'what to do about the problem', including those who consider them a nuisance, the public at risk from zoonotic disease, people who are concerned about the welfare of feral cats, those concerned with wildlife impacts, and the cats themselves. How best to control this population is controversial and has ranged from culling, relocation, and more recently 'trap neuter return' (TNR) methods. Data support the success of TNR in reducing cat populations, but to have a large impact it will have to be adopted on a far greater scale than it is currently practised. Non-surgical contraception is a realistic future goal. Because the feral cat problem was created by humans, concerted educational efforts on responsible pet ownership and the intrinsic value of animals is an integral part of a solution.

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Cats have been closely linked to the evolution of human society for thousands of years. In ancient Egypt cats were associated with the goddess Bast or Bastet (2890–2686 Before Common Era [BCE]) and were revered and protected ('Bastet' *Encyclopedia Mythica* from Encyclopedia Mythica Online. <<http://www.pantheon.org/articles/b/bstet.html>>); the practise of mummification was extended to them and tombs containing thousands of cats have been discovered. There is evidence of co-existence between cats and humans dating back to 6000 BCE in Cypress where cat and human remains have been discovered buried together. In ancient times cats were considered useful for controlling vermin and protecting grain. Cats have also been seen in a negative light by other cultures because of their perceived association with satan, evil and witchcraft; however, since the 19th century, most of these negative connotations have been replaced with a more favorable attitude toward this species. There are an estimated 200 million cats (*Felis catus*) kept as pets worldwide and in many countries including the USA, the

UK and China, pet cats outnumber pet dogs (Bernstein 2005).

In addition to 'pet cats' which are owned, there is another population of cats referred to as feral cats. The definition of a feral cat varies considerably and they have often been referred to as stray cats (an owned cat that has become lost, or one abandoned by its owner), barn cats, alley cats, 'escaped domestic cats gone wild', cats that reproduce in the wild and free-roaming cats that do, or do not rely on humans for food and shelter. One proposed definition is 'a cat that cannot be handled, is unsocialized (with humans), and not suitable for placement in a home as a pet' (Slater 2005). Levy and Crawford (2004) describe a feral cat as any unconfined, unowned cat regardless of its socialization status. Feral cats are not confined and roam freely. A colony is defined as a group of three or more sexually mature animals living and feeding in close proximity to one another (Slater 2005). Feral cats or colonies can further be described based on 'ownership'. Some are completely independent of humans and some are provided with food and shelter on a regular basis by 'caretakers'. A colony is referred to as 'managed' if it is controlled by trap, neuter, and return (TNR) programs (see later under methods for controlling feral cat populations).

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Where do feral cats come from?

The source of feral cats likely varies depending on the location but they may come from existing feral cats and/or from intact lost and abandoned cats that have become unsocialized. In addition, cats may have been introduced into a locale deliberately for control of vermin. Therefore, it is quite clear that humans are responsible for the growing numbers of feral cats. In many countries and in particular the USA pet overpopulation is a growing problem and is a result of people, albeit a minority, regarding animals as disposable resulting in abandonment. In addition, some owners allow their cats to breed freely, or to have kittens prior to sterilizing them. Both of these attitudes contribute to the growing number of feral cats.

It is difficult to estimate the number of feral cats. Several surveys in the USA showed that up to 22% of households feed outdoor cats that they do not own (Levy et al 2003b, Slater 2005). Patronek (1998) suggested that the number of feral cats was between 25 and 60 million. According to Jessup (2004) the USA may be dealing with 60–100 million feral and abandoned cats. Slater (2005) estimates it to be between one-third to one-half of the owned population; the current (2007) estimate of pet cat numbers in the USA is 90 million which would give a figure between 30 and 45 million for feral cats.

Cats have a high reproductive capacity and it is estimated that free-roaming cats can produce a litter of 1–6 kittens 1.6 times per year (Nutter et al 2004b). Cats are sexually mature by 5 to 6 months of age, therefore, even with high mortality rates (Nutter et al 2004b) cat numbers can be sustained. A consistent source of adequate food, which may be obtained from hunting or be provided by caretakers, is essential for a colony to remain in one location. Other factors including shelter and competition with other species also play a role in the stability of a colony (Liberg et al 2000).

Feral cat issues are a worldwide problem and are found in any place that people have traveled or inhabited.

Feral cat issues

The main issues surrounding feral cats can be categorized as follows:

- Public health and zoonotic disease
- Spread of disease to other species

- Spread of disease to pet cats
- Public nuisance
- Predation of wildlife, extinction of native species, disruption of ecosystems
- The welfare of the cats themselves

Who are the stakeholders in the feral cat debate?

The number of interested parties is substantial in the ongoing feral cat debate; any balanced and unbiased discussion must consider the public who consider them a nuisance, the public at risk from zoonotic disease, the people who are concerned for feral cats, preyed wildlife, the 'pro-wildlife anti-cat' groups, and the cats themselves. The debate is frequently emotional in both the pro-cat and anti-cat camps and until recently there have been few scientific studies on which to base many of the arguments.

Public health and zoonosis issues

There is concern about the possibility of cats transmitting diseases to humans, but in reviewing the literature there is little information on the actual frequency of zoonotic diseases in which cats can be implicated. Transmission of disease to humans will vary between countries and climatic regions and also depend on the health status of the human population. Without doubt rabies is the disease of most concern as once clinical signs appear in humans survival is very rare. Successful treatment of one patient in the USA has recently been reported but the facilities and financial support that were required in that case are unlikely to be available in many poorer countries (Willoughby et al 2005).

In most of Europe and the USA, wildlife (eg, raccoons, bats, and skunks) is the most important source of rabies whereas in Asia and Africa dogs are the primary vector of rabies and the biggest threat to humans; dogs have been the focus of the World Health Organization's rabies control program. In the USA the last reported case of rabies in a human that could be linked to a cat was in 1975. (Data from the Center for Disease Control www.cdc.gov. Accessed March 23, 2007.) In 2003, there was a concern that cats could spread sudden acute respiratory syndrome (SARS) and mass culling of cats was temporarily implemented in Singapore. However, based on lack of scientific evidence and intervention by animal welfare organizations this decision was later reversed.

Fatal human plague (*Yersinia pestis*) has been traced to cat exposure in the western United States (Gage et al 2000). Toxoplasmosis (*Toxoplasma gondii*) is a common protozoal disease of cats that can be transmitted to humans. It is usually self-limiting or subclinical in healthy people but can cause serious illness in immuno-compromised humans (eg, AIDS patients). Infected mothers can transmit the infection to their fetus and children may develop chorioretinitis and cerebral defects (Vutova et al 2002). The disease may be contracted by contact with contaminated soil, food and water and is not always associated with direct cat contact. In one study there was no difference in the prevalence of infection between pet cats and feral cats nor those kept indoors versus outdoors (DeFeo et al 2002). The prevalence of *Toxoplasma gondii* based on IgG and IgM antibody testing in feral cats in North Central Florida was lower (<10%) (Luria et al 2004) than in pet cats in Ohio (48%; Dubey et al 2002) and Colorado (19.7%; Hill et al 2000). *Bartonella henselae* is the cause of cat scratch fever and is prevalent in both owned and feral cats, with infection rates varying between geographical regions; this disease most often becomes clinical in the face of immunosuppression and does require a direct bite or scratch for transmission. Other cat-related zoonotic diseases include typhus like diseases (*Rickettsia felis* and *typhi*), Rocky Mountain spotted fever (*Rickettsia*) and Q fever (*C. burnetti*) which are transmitted by the cat flea. *Giardia* species, *Cryptosporidium* species and *Toxocara cati* are also associated with cats.

The H5N1 virus, the cause of highly pathogenic avian influenza (HPAI) is an important emerging pathogen and has potential for pandemic spread. Infection of cats has been confirmed in Germany and Asia (data from the Center for Disease Control www.cdc.gov (accessed March 23 2007), The Food and Agricultural Organization of the United Nations, www.foa.org, and the World Health Organisation, www.who.int/en). Cats can be infected by close contact with affected birds (eating infected carcasses, fecal exposure) but cat to cat transmission is also possible. Infected cats theoretically pose an exposure threat to pet owners although contact with a large amount of virus is required, and cats (and other mammals) only shed small amounts of virus compared to birds. The World Health Organisation state that there is no evidence that cats play a role in the transmission cycle of H5N1 and no human cases have been linked with exposure to diseased cats.

Overall it would appear that feral cats do not have a greater impact on transmissible diseases than free-roaming pet cats (Nutter et al 2004a).

Spread of disease to other species

Toxoplasma gondii has been implicated in the death of southern sea otters in California (Kreuder et al 2003), but as discussed later, feral cats are not the only contributors to the protozoal load that enters freshwater outflows. Efforts to reintroduce the Hawaiian Alala bird were hampered by *Toxoplasma gondii* (Work et al 2000). Equine protozoal myeloencephalitis is a serious neurological disease of horses caused by *Sarcocystis neurona* and both feral and owned cats can be naturally infected and act as one of the many intermediate hosts (Stanek et al 2003).

Feline leukemia virus (FeLV) and feline immunodeficiency virus (FIV) are present in both owned and feral cats and can impact adversely on their health. As discussed above owned and feral cats may be infected with many other infectious organisms that are of concern for the cat and for humans. Overall, cats in managed colonies have a similar prevalence rate of infection as pet cats (Luria et al 2004).

Public nuisance

Complaints about feral cats include the noise they make, especially intact male cats at night, fecal contamination and their presence around restaurants, cafes and other public places. One study in California (Dabritz et al 2006) comprised of approximately 9000 cats in total concluded that they deposited 77.6 tonnes per year of fecal material outdoors but estimated that feral cats were only responsible for less than 30% of this, the rest coming from owned cats that were allowed to roam. People who own cats are less likely to complain about feral cats or be concerned about potential water pollution (Dabritz et al 2006), however, this does not negate the issue.

Predation of wildlife, extinction of native species, disruption of ecosystems

Of all the issues surrounding feral cats the discussion of their impact on wildlife is the one that is most controversial and hotly debated and polarized into 'pro-cat' and 'pro-wildlife' camps. Unfortunately, many of the arguments on both sides

are based on emotion and not on scientific fact leading to conflict when in fact common ground can be found. It is argued that because cats are a domestic species or non-native (introduced) species they should be removed from the environment or prevented from hunting wildlife by confinement indoors or in enclosures. This attitude takes the stance that non-native species are harmful and of lesser value than native species which 'must be protected' and is a normative judgment (Tantillo 2006). However, in reality farm animals are usually non-native (eg, sheep) and are protected from coyotes, mountain lions and foxes, usually by elimination of the predators, which are native species. It has been stated that by allowing cats to hunt wildlife one is placing more value on the life of the cat than the prey species. This is an ethical argument and depends on personal beliefs of the relative importance of different animals. Without doubt wild animals can experience pain and suffering and many may endure injury and painful deaths when hunted by feral cats.

One must not forget that much of the pressure on wildlife is by urban and industrial development causing loss of suitable habitats, and by pollution therefore one sole factor (eg, feral cats) is unlikely to be responsible. Feral cats can impact wildlife by predation, competition for food or by spread of disease. The importance of each factor is likely to vary widely in different locations depending on the availability of different prey species, sources of other food (from garbage or from caretakers), other predators and other pressures such as loss of habitat. It can be difficult to document what cats eat and studies have tried to elucidate this by looking at fecal samples and examining partially eaten prey at different locations. Fitzgerald and Turner (2000) state that mammals are the primary prey of cats, with birds comprising about 20% of their diet. Reptiles can be an important source of food for some cats, depending on the geographical location. Some studies have been taken out of context and have led to headlines such as 'cats kill millions of small mammals and birds' (Harrison 1992). Jessup (2004) states that 'feral cats cause massive killing and crippling of native wildlife and jeopardize biodiversity'. In urban environments endangered species are rare and in fact cats may be useful for controlling other introduced species which are considered pests, for example, rats. Cats have often been blamed for a decline in a native species yet the impact of other predators such as rats, weasels, stoats, ferrets and the mongoose are largely ignored. The situation may be very different between well managed colonies

and unmanaged colonies. Observation of a managed colony revealed minimal predation of birds (Castillo and Clarke 2003).

It has been proposed that if feral cats are removed then the whole situation is resolved and the ecosystem returns to 'normal', or at least to 'pre-cat' conditions. However, this is a very complex situation and requires an understanding of prey, mesopredator and superpredator relationships. Many 'assumed' relationships have turned out to be false when studied carefully. Where birds, rats and cat coexist it has been shown that if cats are removed, there is a sharp increase in the number of rats resulting in almost total loss of the bird population (Courchamp et al 1999), and more recently this has been supported by complex mathematical modeling (Fan et al 2005) where the authors conclude that 'in a prey–mesopredator–superpredator trophic food web, eradication of introduced superpredators such as feral domestic cats is not always the best solution to protect endemic insular prey. The presence of a superpredator may have a beneficial effect in such systems'. In Macquarie Island (between Tasmania and Antarctica) feral cats were eradicated as they were thought to be a threat to what is a national heritage area and home for seabirds. The result was an explosion of the rabbit and rat population and a destruction of the landscape. Now a plan is in place to eradicate rabbits but this could lead to further loss of biodiversity and imbalance and the outcome is unpredictable.

Welfare of feral cats

When considering the well being of feral cats we need to look at both their health and their need for interaction at least to some extent with humans. In many cases caretakers do provide care for colonies of feral cats (Centonze and Levy 2002) by offering food and shelter, basic veterinary care and participating in trap, neuter, and return (TNR) programs. The human–animal bond can be strong in many of these situations and the caretakers cite sympathy and ethical concerns as the main reasons for looking after the cats. Many devote considerable time and sums of money to help these animals (Centonze and Levy 2002).

Body condition scores for feral cats indicate that they are often lean (Scott et al 2002a, b) but emaciated cats are sometimes seen (author's personal experience). Neutering of feral cats improves body score and is also said to improve their health, make them less likely to roam and to become friendlier.

In one survey of feral cats, 75% of kittens died or disappeared within 6 months of birth with trauma (from stray dogs, motor vehicle accidents) being a common cause of death (Nutter et al 2004b). However, reasons for attrition must vary depending on geographical locations and factors such as weather and human population density. Some authors have stated that the mortality rate of feral cats is high and the life expectancy is less than 5 years with causes of death ranging from disease, poisoning, car accidents and attack from other animals (Clarke and Pacin 2002) which equates with a poor quality of life. In summary the welfare of feral cats can vary markedly. In some managed colonies it can be good but in other situations it can be extremely poor. Some people consider destruction of feral cats more humane than allowing them to live with a poor quality of life. As we can see, when considering feral cats, one solution does not fit all situations because all situations are different (Stoskopf and Nutter 2004).

Over the past 20 years there has been an increase in concern for feral cats – both by those who are sympathetic to the cats themselves and those concerned with the real or perceived problems they cause related to wildlife, public health and the health of other animals. There is common agreement that the goal is to reduce the feral cat population but there is much debate and conflict over how this is best achieved.

Feral cat control/solutions

The methods for controlling the feral cat population can be listed as follows:

- Do nothing/‘wait and see’
- Destroy on site
- Trap, remove and euthanase
- Trap and relocate
- Trap, neuter and return (TNR)
- Non-surgical contraception
- Controlling the source of cats

Methods must be effective, practical and humane, so the question is, ‘are there solutions that benefit all stakeholders?’

The ‘do nothing’ approach is an unwise one as history has shown that nature will not ‘take its course and fix the problem’. With the increase in sensitivity toward animals by the majority of the public and pressure on local authorities to act on the problem, doing nothing is no longer acceptable.

Euthanasia

As previously discussed, some people are of the opinion that the life of a feral cat is full of risks and, therefore, not acceptable on welfare grounds, leading to recommendations that the feral cats are ‘pre-emptively’ euthanased before they suffer. However, this often involves destruction of healthy animals, and is not based on their health status at the time of euthanasia. This ‘solution’ brings up the important question of ‘is it ethically acceptable to destroy healthy animals?’ Double standards often exist; wild animals may experience poor welfare and painful deaths yet no one recommends culling them because they ‘might suffer’. The question of ending the life of healthy animals is a far reaching ethical question as humans do kill healthy animals for food and pest control. This current discussion will focus on the plight of the feral cat.

Destroy on site

If destruction is the chosen policy there are important issues to address:

1. Are the techniques used humane?
2. Does it reduce the population?

If poisons are used, cats can suffer a painful and slow death and other species may also be inadvertently poisoned and there is always the risk of human exposure; this is an unacceptable practise and must be condemned. Poisons that have been used include anticoagulants and sodium monofluoroacetate (Compound 1080) (Sherley 2004).

In locations that are not geographically isolated, elimination of cats in one location often results in cats from other locations moving in to take advantage of the space and food sources. Even in isolated areas such as Marion Island eradication of a small (2500) cat population took many years (Nogales et al 2004; www.feralcat.com/sarah2.html). In that situation cats were originally introduced to the island to control house mice but were later blamed for a decrease in the bird population. It took a combination of introduction of feline panleukopenia virus, trapping, hunting and poisoning over 15 years to eradicate the cats. This clearly demonstrates that these techniques are not viable on a large scale basis and are ethically unacceptable. Many other examples of the inefficiency and potential adverse effects of ‘kill on site’ programs are described by Slater (2005).

Destruction of feral cats is becoming increasingly unpopular with the public. For example, in some European cities feral cats are now protected (www.romancats.de) and sanctuaries such as the Torre Argentina Roman cat sanctuary have been set up. It is clear that more humane, ethically acceptable and effective methods are needed.

Trap, remove and euthanase

This process is more humane than the methods used to destroy animals on site. Cats are trapped in humane traps; these are purpose built traps that cats enter to obtain food thereby tripping a gate – no harm comes to the cat as long as traps are checked every 24 h. Cats may be heavily sedated then euthanased with an overdose of barbiturate. However; other less humane techniques including intraperitoneal injection of barbiturate and carbon monoxide gassing are reported. Unless the program is intense and new cats are continually removed, this method is unlikely to succeed for the same reasons as outlined previously.

Trap, remove/relocate

In some cases very young kittens and socialized adults may be adoptable, but this is limited by the availability of suitable homes. Relocation may be the most viable option if a feral cat colony is truly threatening an endangered native species. Some feral cats are relocated to other properties, for example, farms. Another alternative is placement in cat sanctuaries where cats often spend the rest of their lives. These are expensive to run well and can only care for a small percentage of feral cats. Relocation may be useful in addition to other approaches but does not work as a sole technique for dealing with cat overpopulation.

Trap, neuter and return/release (TNR)

Using matrix population models, Andersen et al (2004) calculated that the population of free-roaming cats could be controlled if 50% were euthanased per year, or 75% were sterilized; but stated that euthanasia would be more effective. The validity of the findings in that publication needs to be verified by actual documentation of the outcome of both methods. The authors did not address the issue of the acceptance by the public of euthanasia or the fact that in some countries feral cats are now protected from indiscriminate euthanasia. Foley et al (2005) analyzed feral

cat data in San Diego (California, USA) and Alachua County (Florida, USA) between 1992 and 2004. Using mathematical models to describe population dynamics they stated that monitoring of cat colonies is possible using easily collected data and predicted this data could contribute to modifications of programs and improved future success. A quote from their paper is very pertinent – ‘statistical assessment of the impact of TNR programs on population size is critical to help gain credibility for such programs’.

The goal of TNR programs is to stabilize or reduce a local population by sterilization. It is assumed that because cats are returned to their original site, other cats are less likely to move in to populate a vacated space and there will be natural attrition of the returned sterilized cats. However, it is documented that cats, especially males, move between colonies (Levy et al 2003a). The local population can be reduced more rapidly if young kittens are removed permanently and adopted. This approach accomplishes population control but can allow a sensible number of cats to remain which are often essential for pest control in urban environments. TNR offers the public an opportunity to improve the welfare of feral cats. The visibility of humane solutions to an animal related problem can educate the public on our responsibilities to animals and also allow them to learn about animal behavior and permit some social interaction.

Jessup (2004) claims that maintaining cats in managed colonies compounds feral cat ‘problems’ including the destruction of wildlife and encourages people to abandon cats at the colony sites. His definition of TNR is trap, neuter and *re-abandon*. He states that as abandonment is illegal (under state laws in the USA) trap, neuter and return programs cannot be morally justified. He also claims that some caretakers fail to provide adequate food, water and shelter at TNR sites and, therefore, are committing an act of animal cruelty. However, there is an emerging body of scientific evidence documenting the positive outcome of TNR programs around the world, but within the United States TNR programs are not allowed by law in some municipalities.

In general, TNR involves the humane trapping of cats, sterilization (by a veterinarian), permanent identification of sterilization status (the tip of one ear is removed); vaccination for rabies (in countries where this disease occurs) and release back to the original trapping location. In many cases, other care is provided such as deworming, application of anti-flea medication and vaccination

against feline panleukopenia, rhinotracheitis, calici virus and feline leukemia. Because feral cats are not amenable to nursing, very sick and injured cats are euthanased. Benefits of sterilization (other than population control) include improved body condition (Scott et al 2002b), more interaction with caretakers and decreased roaming and fighting by male cats. Well studied techniques for anesthesia of feral cats are safe and result in minimal mortality (Williams et al 2002, Cistola et al 2004). Newer anesthetic protocols are being developed that focus on postoperative analgesia and a quicker return to normal function (author's unpublished data).

There is some debate as to where and when TNR began but it is known to have been conducted in South Africa and Denmark over 20 years ago and is now well established in the UK, Canada, the Netherlands and the USA as well as many other countries. Some of the earliest scientific reports of its success originated in the UK (Neville and Remfry 1984).

In Florida (USA) TNR was found to be more cost effective and efficient than extermination and resulted in fewer 'nuisance' complaints about cats and fewer admissions to the local animal shelter (Hughes et al 2002). Another success in Florida was the implementation of a TNR program on a university campus which resulted in a significant reduction in cat numbers (from 156 to 23) over 11 years (Levy et al 2003a). The colony initially had 156 cats and over a 5 year period 155 were sterilized. Almost half the cats were adopted and no known births occurred on the campus 5 years after the program began. A few cats disappeared and some sick animals were euthanased. Follow-up studies indicated that the remaining cats had been present for over 6 years suggesting that the welfare and longevity of feral cats can be good under some circumstances.

Provision of free sterilization clinics to a group of caretakers looking after 132 colonies with a total of 920 cats (again in Florida) reduced the population by 26% within a year (Centonze and Levy 2002).

A recent publication describes 10 years of experience with TNR in Rome, Italy (Natoli et al 2006). Since 1991, Italy has had a 'no-kill' policy for the control of feral cats. These authors reported a general decrease in cat numbers after spay/neuter programs were implemented in the city, but their efforts were partly thwarted by the arrival of new cats both by migration into the city and from the abandonment of pet cats within the city. They conclude that a TNR program must be combined

with education of pet owners about early sterilization and abandonment of pets.

Failures of TNR programs are also reported. In one instance, TNR efforts were negated by the abandonment of cats at the highly visible colony (Castillo and Clarke 2003) – it is assumed that owners may drop cats off at these site in the hope that they will be looked after rather than taking them to shelters where they may be euthanased. Again this emphasizes the great need for education and teaching the public that animals are sentient beings and deserve to be cared for. The message must be that owning a pet is a life-long commitment.

In conclusion, there is scientific evidence that TNR under certain conditions can control the feral cat population, and is a viable, humane alternative to other methods previously used. It requires a large group of motivated volunteers which must include veterinarians. Continued and increased funding (by private welfare organizations and by municipal and government agencies) are essential for long-term success. The time and financial costs of trapping cats have been estimated (Nutter et al 2004c), and a TNR program named operation CatNip in Florida (http://vmc.vetmed.ufl.edu/Operation_Catnip.aspx) is estimated to cost US \$17/cat. Endorsement by government, animal welfare organizations and local authorities is also essential. Education of pet owners is required to prevent abandonment and breeding of owned cats that can thwart TNR efforts.

Non-surgical contraception

Some control techniques such as mass euthanasia are costly, time consuming and ethically unpleasant. TNR is labor intensive and costly and involves anesthesia and surgery with the potential for complications and postoperative pain. A humane approach to animal control involves using a vaccine to block fertility, often by preventing fertilization of ova. This approach, using SpayVac (Spayvac-for-wildlife, Inc) has been successful in deer and seals. Issues such as efficacy, delivery method, safety to the target species, side-effects and possible effects on other species in the same environment must be considered and are complex (Purswell and Kolster 2006). This approach is gaining acceptance both politically and by those concerned for the welfare of feral cats. Recent trials in research cats revealed that although antibodies to the zona pellucida were made and high titers achieved, which would be considered to be immunocontraceptive in other species,

zona pellucida vaccines did not prevent pregnancy in females treated at 8–12 weeks of age (Gorman et al 2002). More recent work involving immunization against gonadotropin-releasing hormone (GnRH) in male cats has been more successful (Levy et al 2004).

The Alliance for Contraception in Cats and Dogs (www.acc-d.org) is searching for a drug, vaccine, or implant that is safe, inexpensive, and capable of rendering a cat permanently sterile after a one-time procedure. Until such a holy grail of sterilization is developed other control measures should be aggressively followed.

Decreasing the source of cats

Abandoned and lost pet cats that have been allowed to roam freely can enter the feral cat population and are a common cause for TNR failures. Abandonment is a blatant failure of human responsibility and represents anti-social and immoral behavior. In many instances it is also illegal, or should be made so, but enforcement is difficult and prosecution rare as it is difficult to prove most cases. If written into legislation, laws against abandonment must be carefully couched with no loopholes so that established TNR programs remain legal, and to allow new ones to become established.

Permanent identification, preferably with a microchip would enable lost cats to be reunited with their owners. The numbers of lost pet cats could be reduced by encouraging owners to keep cats indoors; this is a common theme of many advisory bodies including the American Association of Feline Practitioners (Richards 2004), and the American Veterinary Medical Association (www.avma.org/issues/policy/animal_welfare/feral_cats.asp). Some would argue that this denies the cat one of its five freedoms – that of exhibiting normal behavior by hunting and roaming. However, indoor living is more likely to ensure that the other ‘freedoms’ such as the freedom from thirst and hunger, discomfort, pain, injury, disease, fear and distress are provided. If the term utilitarian is interpreted as meaning that ‘actions are right if they are useful or for the benefit of a majority’, and taking into account all the stakeholders in the feral cat issue, then keeping cats indoors does seem a sensible solution.

A concerted effort to educate the public about responsible pet ownership should emphasize the benefits of early sterilization, provide information on cat behavior, and outline the financial and time commitment required to provide for a cat for its

entire life. Low-cost sterilization clinics should be available for people with low incomes. To prevent abandonment there should be help for re-homing cats if an owner can no longer look after their pet. Teaching that animals are sentient beings and deserving of humane care can start early in childhood and continue into adulthood. The National Association for Humane and Environmental Education (www.nahee.org), which is affiliated with the Humane Society of the United States is one example; this organization offers ‘adopt a classroom’ opportunities and provides teaching materials, grants and professional workshops for teachers so that children can learn about overpopulation issues and humane attitudes toward animals.

The future

Pet overpopulation is a global problem and must be addressed. The scientific literature on feral cats is increasing and is essential for modifying and improving current control methods. Widespread non-surgical contraception is a realistic future goal but until that time, TNR programs and education are pivotal to a successful reduction in numbers.

Conclusion

Feral cats are a result of human actions; we caused the problem and we should be responsible for a solution. Reducing the feral cat population is possible with continued efforts aimed at sterilization, research on contraception and education. In countries where veterinary services are limited, education alone is a worthwhile pursuit.

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