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Feral Cat Management

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INTRODUCTION

The domestic cat has increased in popularity as a household pet in recent decades, surpassing the dog to become America's most numerous pet. However, despite the enhanced status of cats as human companions, millions of unwanted cats are admitted to animal shelters each year, and the vast majority of these are euthanatized because homes cannot be found. Debate about the true impact of free-roaming cats on the environment, on feline health, and as a reservoir of both feline and zoonotic diseases is ongoing, often emotional, and fueled largely by a lack of sound scientific data on which to form credible conclusions. It is also difficult to separate the impacts of owned cats from those of unowned ones. Of primary concern is the welfare of the cats themselves.

Definitions of various cat populations defy universal acceptance, focusing variably on ownership status, lifestyle, and level 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 socialization status. Strictly speaking, feral cats are defined as untamed and evasive. They are either born in the wild and lack socialization or are returned to the wild and become untrusting of humans. Although feral kittens can be tamed into acceptable pets if captured at a very young age, enormous effort is often required to tame older feral cats. Stray cats may be defined as homeless cats that remain socialized and friendly toward humans. The lines between loosely owned outdoor cats, stray cats, and feral cats are often blurred. Owned outdoor 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. Thus, individual cats may be included in different categories at various stages of their lives. For the purposes of this discussion, the term "feral cat" will be used to denote any unconfined, unowned cat, regardless of its socialization status.

CHARACTERISTICS OF FERAL CATS

Interactions with Humans

The number of feral cats in the United States is unknown, but is suspected to rival that of pet cats (73 million in 2000) and to contribute substantially to cat overpopulation (Levy et al. 2003b). Feeding of homeless cats is a common activity practiced by both pet owners and those without pets of their own. In the suburban southern community of Alachua County, Florida, 1 in 8 households acknowledged feeding an average of 3.6 cats they did not own, or approximately 36,000 feral cats (Levy et al. 2003b). County residents also owned an estimated 45,000 pet cats. This indicates that feral cats comprise at least 46 percent of the local cat population, but does not include feral cats that are not fed by residents. These findings are similar to studies performed in Santa Clara County, where 10 percent of households fed an average of 3.4 cats each (Johnson et al., 1994), in San Diego County, where 8.9 percent of households fed an average of 2.6 cats each (Johnson et al., 2002), and in Massachusetts, where 7.9 percent of households fed an average of 3.7 cats each (Manning and Rowan, 1992). These studies also concluded that feral cats comprised at least 36–41 percent of the total cat population. Feeding of feral cats is a widespread activity that crosses many socioeconomic strata. Almost half of cat feeders do

not own pets, implying that attempts to involve cat feeders in control strategies should extend beyond the pet-owning public typically served by veterinarians, animal control agencies, and animal welfare organizations (Levy et al. 2003b). For purposes of estimating the size of a community's feral cat population, it is reasonable to estimate 0.5 cats per household. County household data are available at www.census.gov.

Although provision of food for unowned cats is a common activity, few cat feeders take further action to have the cats sterilized. Sterilization of pet cats owned by feeders of feral cats was common (90.1 percent) in Alachua County, indicating high compliance with veterinary and animal welfare recommendations for neutering of pets not intended for breeding (Levy et al., 2003b). This is consistent with previous reports that 82–91 percent of pet cats were sterilized, although not always before producing a litter of kittens (Johnson et al. 1994, Johnson et al. accessed 2002, Manning et al. 1992). Given the high rate of sterilization among pet cats, unowned cats may represent the single most important source of cat overpopulation.

In Alachua County, most (61 percent) cat colonies consist of a small group of 3–10 cats, and are usually described as a female with kittens and an occasional wandering male (Centonze and Levy 2002). This is consistent with results of a national survey (Clifton 1992) that reported a mean colony size of 4–12 cats, and a Hawaii study (Zasloff and Hart 1998), which reported that 65 percent of the colonies consisted of 1–10 cats. In most cases, cat colonies are located on private property, particularly at the feeder's residence or workplace. Although large cat colonies on public property, such as parks and institutions, often comprise the most visible and controversial cat populations, it appears that the vast majority of feral cats associated with humans live in small groups near their feeder's homes.

Caretakers report a strong bond with the feral cats they care for, even though they do not consider these cats to be their pets (Centonze and Levy 2002). This is different than the traditional image of the human-animal bond, as many of the cats cannot be touched or held and do not live indoors with the caretaker. Nevertheless, the cooperation of caretakers is imperative if cat population control programs are to be effective.

Physical Characteristics

Data collected from feral cats undergoing sterilization provide information about their physical condition, but might not accurately reflect all groups of feral cats, such as young kittens or cats not associated with caretakers. In Florida and California, approximately 57 percent of more than 20,000 cats admitted for sterilization were females (Scott, Levy, Crawford 2002). This contrasts with findings of feral cats in the field. Cats caught on Marion Island (n = 857) near South Africa were equally distributed between males and females, and those caught on Macquarie Island (n = 246) near Australia included more males than females (56 vs. 44 percent, respectively). Cats in central Rome (n = 301) included fewer males than females (44 vs. 56 percent, respectively), whereas 55 percent of feral cats on an urban Florida university campus (n = 155) were males (Scott, Levy, Crawford 2002). The frequent finding of equal to higher numbers of males in populations observed in the field versus the predominance of females referred for neutering suggests that females may be easier to capture or that caretakers may preferentially select females for neutering.

In Florida, the first pregnancies of the breeding season appear in January (Scott, Levy, Crawford 2002). This is consistent with the first occurrence of the minimum day length required to induce estrus in cats at this latitude. Later in the spring, almost half of the female cats evaluated are pregnant. A second smaller peak in the summer suggests second pregnancies during the same breeding season for some females, or first pregnancies for late-born kittens from the previous year. A similar pattern was observed in cats in southern California (Figure 23.1). On the basis of a mean gestation period of 65 days and the pregnancy rate of 19 percent found in Florida cats, each adult female cat is projected to produce a mean of 1.1 litters per year. This estimate assumes that pregnant cats are no more or less likely to be trapped than nonpregnant cats, and is consistent with previous findings that feral cats can produce multiple litters during each breeding season. Depending on geographic location, annual pregnancy rates in feral cats have been reported to range from 0.98 to 2.0 and to produce 4 to 5 fetuses per litter (Scott, Levy, Crawford 2002). Pyometra is diagnosed in 0.4 percent of female cats presented for spaying in Florida (Scott, Levy, Crawford 2002).

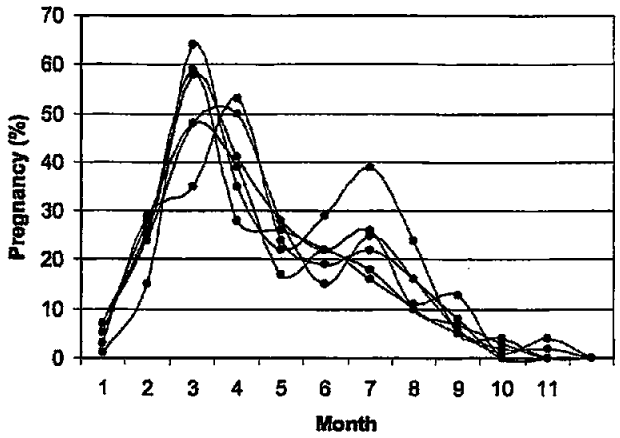


Figure 23.1. Pregnancy is highly seasonal in cats and is correlated with day length. Data collected from more than 12,000 feral cats presented for sterilization in San Diego, California, during 1995—2000 demonstrate synchronization of pregnancies early each year, followed by a second, smaller peak of pregnancies in the summer.

The frequency (2 percent) and clinical findings of cryptorchid cats are similar to those reported for pet cats undergoing castration (Scott, Levy, Crawford 2002). Most cats have unilaterally retained testicles that occur with equal frequency on the left and right sides, and equally in inguinal and abdominal locations. Bilaterally retained testicles were more likely to be found in the abdomen than in the inguinal region. The scrotum of bilaterally cryptorchid males may resemble that of castrated cats, so procedures should be established for confirmation of the true reproductive status, such as examination for penile barbs or exploratory laparotomy. Although retained testicles are usually infertile, they are still capable of secreting testosterone, which contributes to objectionable territorial behavior, aggression, and urine odor. Thus, it is inappropriate to leave retained testicles in place.

A study of adult feral cats found that the cats were generally lean, but not emaciated at the time of sterilization (Scott, Levy, Gorman, Newell 2002). One year later cats were significantly fatter than they were at the time of neutering, indicating that feral cats, like their tame counterparts experience enhanced fat accumulation following neutering. Only 0.4 percent of feral cats presented for sterilization were euthanatized for humane reasons in Florida (Scott, Levy, Crawford 2002).

Infectious Diseases

The threat that feral cats pose to both feline and human public health is a topic of much debate. Rabies is of particular concern to public health officials. Although the dog is the primary vector of rabies world-wide, widespread vaccination of dogs and reduction of the stray dog population since the 1940s have greatly reduced the number of canine cases in the United States. Today, more than 90 percent of rabies cases occur in wildlife, primarily in raccoons, skunks, coyotes, foxes, and bats. Since 1981, rabid cats have outnumbered rabid dogs in the United States, with 249 feline cases reported in 2000 (Jenkins et al., 2002). Although dogs account for three-quarters of reported animal bites to humans, rabies post-exposure prophylaxis is more commonly administered as a result of cat bites (Moore et al., 2000, Hensley 1998). Most cat bites are reported to be provoked from stray cats, with adult women more likely to be bitten than children and men (Hensley 1998, Patrick and O'Rourke 1998, Wright 1990). This is in contrast to dog bites, which are more likely to occur when unprovoked pet dogs bite children. This suggests that human exposure to rabies can be limited by reducing and immunizing the stray cat population and by avoiding direct handling of stray cats. Despite continued concern about the role of cats in human rabies exposure, no human cases have been associated with cats since 1975 in the United States (Veterinary Public Health Notes 1975). Even when rabies is not involved, cat bite wounds are often serious. They most frequently occur on the hands, and risk of infection is highest when puncture wounds occur (Dire 1992). Public health recommendations include immediate cleansing of the wound, medical attention, and prophylactic treatment with amoxicillin-clavulanate.

The American Association of Feline Practitioners (AAFP) recommends FeLV and FIV testing of all cats, but that a positive test result should not be used as the sole criteria for euthanasia (Levy et al. 2001). The AAFP further recommends that all positive screening test results undergo confirmation. Large epidemiological studies indicate that FeLV and FIV are present in approximately 4 percent of feral cats, which is not substantially different that the infection rate reported for pet cats (Lee et al. 2002). As expected, male cats are four times more likely to carry FIV than female cats, due to biting as the primary mode of transmission. FeLV, which is most commonly spread from infected queens to their kittens, occurs at approximately the same rate in males and females. Testing recommendations for pet cats are difficult to apply to feral cats for several reasons. Of primary importance is the cost-benefit ratio of testing a large number of cats in order to detect the small percentage of seroreactors. Resources for treating feral cats are limited, and many programs have decided to focus on mass sterilization as the primary goal. Because the accuracy of positive test results decreases when prevalence is low, as is the case for FeLV and FIV, more than 50 percent of positive test results in feral cats would be expected to be false-positives. 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, due to false-positive results in the currently available tests for FIV antibodies induced by the vaccine. For these reasons, and because sterilization reduces the behaviors most associated with viral transmission, most large sterilization programs for feral cats do not routinely test for FeLV and FIV.

Parasitism is the most common infectious problem of feral cats. In Florida during the summer, 92 percent of cats presented for sterilization were infested with fleas, and 37 percent had ear mites (Akucewuch et al. 2002). A study of 80 feral cats in California revealed that 54 percent carried intestinal ascarids, compared with only 4 percent of 70 pet cats (Levy et al. 1999). Tapeworms and coccidia were found in 26 percent and 13 percent of feral cats, compared with 4 percent and 0 percent of pet cats, respectively. The same study identified a higher rate of seropositivity for *Toxoplasma gondii* in feral cats (20 percent) compared with pet cats (3 percent), which may represent exposure via hunting in feral cats. Interestingly, feral cats were significantly less likely to have antibodies against coronavirus, the source of feline infectious peritonitis, (4 percent) than were pet cats (59 percent). Coronavirus is primarily transmitted via a fecal-oral route. The behavior of feral cats of burying their feces may reduce the risk of transmission compared to pet cats sharing a litter box in a multi-cat household. FeLV (0–1 percent) and FIV (3–5 percent) were uncommon in both groups of cats. *Bartonella henselae* (34 percent) was the most common infection identified in 553 feral cats in Florida (Luria et al. 2003). Two organisms formerly grouped under the classification of *Haemobartonella felis*, *Mycoplasma hemominutum* and *M. hemofelis*, were present in 12 percent and 8 percent of cats, respectively. Other infections included coronavirus (18 percent), *T. gondii* (10 percent), FIV (5 percent), and FeLV (3 percent). Male cats were significantly more likely to be infected with FIV and mycoplasmas than were female cats. Similar infection prevalences have been reported for pet pats.

Control of Feral Cats

The control of feral cats has emerged as one of the most controversial issues in animal control and welfare. Historically, feral cats have been largely ignored by both governmental and humane agencies. Specific cats that are declared a nuisance may be removed, but few agencies have comprehensive programs designed to decrease the number of feral cats in their communities.

Although the humane movement has yet to establish minimum acceptable standards of living for pet cats or cats in shelters, some believe that feral lifestyle is too fraught with risk and discomfort to be acceptable. Others believe that the quality of life of feral cats should be judged no differently than those of other species existing in a "wild" state. The growth of the "No Kill" movement has caused some animal welfare leaders to re-examine traditional beliefs that killing 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.

Feral cats have been extirpated from several small uninhabited islands as a result of decades of intensive control measures including poisoning, hunting, trap-

ping, and introduction of infectious feline diseases (Levy et al. 2003b). Despite the success of eradication campaigns on geographically isolated islands, logistic barriers and opposition from resident citizens would likely make application of such lethal strategies in populated mainland areas unfeasible. Cat control programs in populated areas must incorporate safety considerations for nontarget animals and humans, be affordable for participating municipal agencies or charitable organizations, include plans to curtail continuous cat immigration and reproduction, and be aesthetically acceptable to the public. Clearly, 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 significance of the public's affection for feral cats. The most successful examples of enduring community-wide animal control have incorporated high-profile nonlethal feral cat control programs into integrated plans to reduce animal overpopulation.

TRAP-NEUTER-RETURN

A growing grass roots movement has promoted control of feral cat populations through sterilization. Trap-Neuter-Return (TNR) seeks to sterilize large numbers of cats and return them to their colonies. Some programs are quite elaborate, including extensive veterinary care, colony registration, monitoring, and adoption of tame cats, whereas others focus solely on sterilization. Whereas most programs are small, privately run volunteer groups dependent on donations for operating costs, a few are operated with public funds by municipal animal control agencies on the premise that sterilization is ultimately more efficient and cost-effective than extermination. The Animal Services Department of Orange County, Florida, reported decreased complaints about cats, decreased cat admissions to the shelter, and decreased operating costs following development of a free sterilization program for feral cats funded by the county. Alley Cat Allies, a national organization advocating TNR for control of feral cats, counts more than 8,000 programs and individuals in its database. Accompanying growing awareness of feral cats is increased controversy about their impacts, welfare, and place in society.

Increasingly, veterinarians are asked to participate in nonlethal control of feral cats, frequently by providing free and low-cost veterinary services. The concept of TNR as a method for cat population control is described by the American Veterinary Medical Association (AVMA 1996), and endorsed by many humane organizations (Centonze and Levy 2002). More than 1,000 members of the California Veterinary Medical Association sterilized approximately 168,000 cats between July 1999 and May 2002 in a $12 million project funded by Maddie's Fund.

A TNR program at a Florida university was highly successful in reducing the feral cat population during an 11–year period (Levy et al. 2003a). Before the initiation of the program, feral cats were considered by campus authorities to constitute a nuisance. Periodic trap and removal efforts were made when excessive cat 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 neutering, euthanasia of sick animals, and adoption of socialized cats and feral cats that eventually became tame enough to become pets. With the exception of 1 male cat, all original study cats were neutered between 1991 and 1995, and no kittens were known to be born on campus after 1995. As a result of deaths, disappearances, and adoptions, the known maximum cat population (68 cats in 1996) gradually decreased to 23 cats, the lowest number for the entire recording period. A majority of the cats were found as kittens, and most of those were feral cats born on site. Adoptions accounted for 47 percent of the decrease in the cat population, even among feral cats. It has been reported that feral cats become less aggressive toward each other and more friendly toward their feeders following neutering, and this may have encouraged adoption of previously feral cats. Cats were often transferred to private homes only after several years of feral status. Despite widespread concern about the welfare of feral cats, many of the animals survived for a number of years. Most cats (83 percent) still remaining on site at the end of the observation period had been present for > 6 years. This compares favorably with the mean lifespan of 7.1 years reported for pet cats, particularly as almost half of the cats were first observed as adults of unknown age (Nassar 1984). Most cats (61 percent) that disappeared, died, or were euthana-

tized for debilitating conditions had been present for at least 3 years. In general, the cats were in adequate physical condition and only 4 percent were euthanatized for humane reasons. 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.

These results 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 be expected to result in a slow rate of population decline. Adoption of socialized cats accelerates population reduction. These results also refuted an oft-cited claim that an established colony of cats will defend its territory and prevent the immigration of new arrivals. Immigration or abandonment of new cats in sterilized colonies may be a frequent event, and feral cats do not appear to have sufficient territorial activity to prevent new arrivals from permanently joining colonies. These new arrivals could substantially limit the success of TNR if an ongoing surveillance and maintenance program is not effective.

Failures of TNR to control cat colonies also exist. A 1-year study of TNR programs in 2 southern Florida parks revealed that the presence of well-fed cat colonies encouraged illegal abandonment of additional cats (Castillo 2001). While the original population of 81 cats declined 20 percent during 1 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.

Veterinary Procedures for Feral Cats

There are many approaches to delivering veterinary care to feral cats. This discussion focuses on techniques for large-scale sterilization with the goal of reducing the feral cat population (Fig. 23.2).

Safety First

One of the dominant concerns about working with feral cats is safety. Feral cats have an uncanny ability to escape during handling, and can inflict serious injury during recapture attempts. A loose cat can thoroughly damage a clinic in its frantic efforts to escape. It is recommended that anyone who works with stray animals, including feral cats, receive prophylactic rabies immunizations. Gloves should be worn at all times to reduce exposure to body secretions from cats. The most common health risks for individuals working with feral cats are bites and scratches. Even semi-tame cats may bite defensively if they are startled, as in the attempt to place a cat in a carrier for transportation. For these reasons, it is imperative that safe cat handling techniques be developed and enforced. Not only does this guarantee the safety of personnel, but it also prevents the unfortunate situation in which public health officials require the euthanasia of biting cats for rabies examination. The safest method for handling feral cats is to admit them only in wire humane traps. The traps are escape-proof, and anesthetic is easily injected through the wire mesh. The traps should not be opened until the cats are recumbent. At the completion of surgery, the cats are returned to their traps before awakening. With this system, cats are never handled awake. Handling systems that involve transferring cats from one container to another or opening a container to restrain a cat only invite escapes and injuries. If cats must be housed for several days, they may be released into a secure cage. Special feral cat boxes can be pur-

Figure 23.2. Some large-scale clinics specializing in feral cat surgery are capable of sterilizing more than 150 cats in a single day. Photo by Julie Levy.

chased which have "portholes" that may be latched closed after the cat has hidden in the box. These boxes allow safe movement of the cat to other areas. If a feral cat escapes from its cage, the safest method of capture is with a net on a pole. Attempts to catch a feral cat by hand, or with a blanket are extremely dangerous for personnel. Rabies poles are very dangerous for cats and only serve to cause more panic.

Admissions

Caretakers of feral cats should be informed in advance where to obtain a trap and how to safely capture and transport a cat. It is advisable to accept all cats, even friendly ones, in traps exclusively, because confinement and transport can frighten any cat, leading to escape or injury. Release forms should be used to assure that the cats are believed to be unowned and that the caretakers are aware of the risks of anesthesia and surgery in cats of unknown health conditions. An agreement should be reached at the time of admission about how to proceed if unanticipated health problems are detected once the cat is anesthetized. Caretakers should be advised not to leave food in the traps, but it must be recognized that food is required to bait the traps, and that some cats may have eaten within a few hours of surgery. A practical system for identifying the cats is to place 2 identical numbered stickers on the trap at admission. One of the stickers is placed on the cat when it is removed from the trap. This allows cats to be matched back to their traps following surgery.

Anesthesia

Injectable anesthetics are preferred for feral cats because they can be administered to cats still in their traps and there are no waste gases (Figure 23.3). A cocktail of tiletamine and zolazepam (Telazol) (1 500-mg vial) reconstituted with ketamine (100 mg/ml, 4 ml) and large animal xylazine (100 mg/ml, 1 ml) instead of water is just one of many that have been used in feral cats (Williams et al. 2002). "TKX" has several advantages for large-scale cat anesthesia. A small injection volume (0.25 ml for average adult cats, 0.15 ml for kittens) can be administered "intracat" through the wire of the trap, eliminating the need to handle conscious cats. Time to recumbency is generally 3–5 minutes, and vomiting is uncommon. General anesthesia is adequate for abdominal surgery. The xylazine component of the cocktail is reversed with yohimbine administered intravenously at the same volume as the TKX. The major disadvantages of TKX include hypothermia, prolonged recovery time, and poor postoperative analgesia. Cats generally return to sternal position within two hours, but frequently are not fully recovered from anesthesia until the following morning. Faster recovery times may be achieved by using a lower dose of TKX for immobilization and then using gas anesthesia by mask to obtain a surgical plane. TKX has been used on more than 15,000 feral cats with a remarkable safety record. Considering that these are often unthrifty, parasitized animals of unknown background, highly stressed, and unsuited for preanesthetic examination, the observed rate of 3 deaths per 1,000 cats compares favorably with reports of anesthetic death rates of pet animals in private practices (Williams et al. 2002). A cocktail of medetomidine, ketamine, and buprenorphine has also been used in feral cats (Cistola et al. 2002). "MKB" offers the advantages of improved blood pressure and oxygenation compared to TKX, rapid recovery following reversal with atipamezole, and good analgesia, but some cats experience rough recoveries and marked hyperthermia with this combination.

Surgical Preparation and Surgery

Upon recumbency, cats are removed from their traps and identified. If antibiotics are used, they

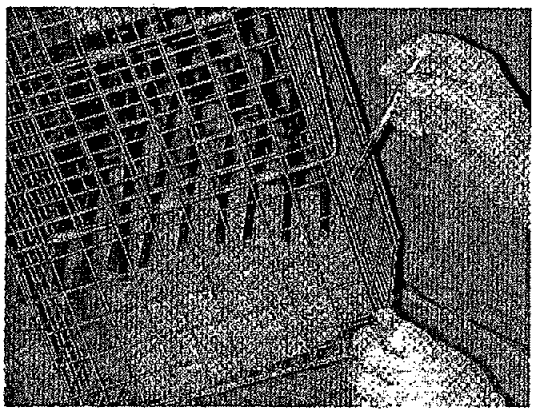
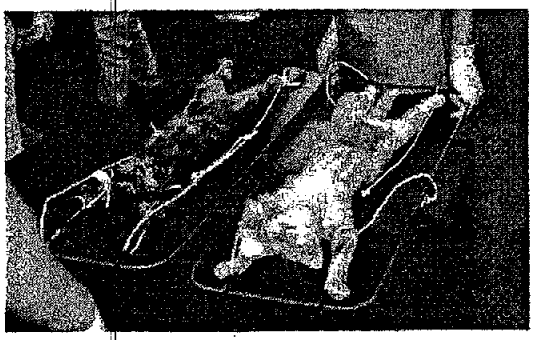


Figure 23.3. Commercially available humane traps accompanied by a metal comb facilitate safe hands-free restraint of feral cats during injection of anesthetic drugs. Photo by Karen Scott.

should be administered prior to surgery for the optimal prophylactic effect. The eyes should be lubricated with plain ophthalmic ointment. Cats have been reported to suffer anaphylaxis associated with ophthalmic ointment containing antibiotic as an uncommon idiosyncratic reaction. Since anaphylaxis would be difficult to recognize and treat in anesthetized cats, it is recommended to avoid antibiotic-containing eye lubricants. Tying females to "spay boards" facilitates preparation and moving of cats between stations (Fig. 23.4). Routine preparation for aseptic surgery is performed. Ideally, the pace of the clinic should be controlled so that there is always a cat ready to be spayed, and veterinarians never have a lull in surgery.

Cats may be spayed by either a midline or left flank approach (Dorn 1975, Krzaczynski 1974). The flank approach offers slightly increased surgical efficiency and reduced risk of evisceration should an incisional complication occur following release. It is ideal for lactating cats, but cats with advanced pregnancy are more easily spayed via a midline approach. The flank incision can also be monitored easily by the caretaker following release to the colony. Flank incisions have been described from both the left and right approaches. An area approximately 8 cm square is aseptically prepared, using the greater trochanter as the landmark for the dorsocaudal corner of the square. Following draping of the area, the surgical site is identified lying approximately midway between the dorsum and the ventrum and approximately 3–4 cm cranial to the greater trochanter. A 1–2 cm skin incision is made either vertically or horizontally. The body wall is tented with forceps and entered using blunt dissection with scissors or forceps. Sharp dissection of the muscle wall should be minimized to avoid bleeding. The spleen may underlie the incision on the left side, and care should be taken to avoid laceration of the organ when the abdomen is entered from the left. The uterine horn lies just beneath the body wall and is retrieved with a spay hook. From this point forard, the spay is performed similarly to the midıe approach. If the incision is properly placed, it possible to remove both ovaries and as much of e body of the uterus as with the standard proceıre. The body wall is closed with a single ›sorbable suture, as is the subcutaneous tissue. In ral cats, the skin is best closed with a buried ıture. The major disadvantage of the flank spay is e inability to explore the abdomen in the event of tra-operative complications or to confirm previıs ovariohysterectomy.



A

B

Figure 23.4. Cats can be tied to Plexiglas spay boards for (a) surgical preparation and (b) movement around the clinic. Photos by Julie Levy

Because of the sheer number of feral cats and the high euthanasia rate of cats at shelters, it is difficult to rationalize not sterilizing pregnant cats. Releasing a pregnant cat or confining it in a foster home to have kittens only adds unnecessarily to cat overpopulation and suffering. Once trapped, many cats are extremely difficult to trap a second time. For this reason, lactating cats should also be sterilized when trapped and returned to their colonies as quickly as possible. Because cats will be released to their colony soon after surgery, incisions should be as small as possible and skin sutures should not be used.

Ear Tipping

Feral cats may interact with a variety of caretakers, veterinarians, and animal control personnel during

their lives, so it is important that a universal method of identifying sterilized animals is adhered to. Ear tipping is the only fully reliable method and is recognized internationally (Cuffe et al. 1983). With this procedure, a hemostat is clamped across the distal centimeter of the pinna, and the tip is removed by cutting straight across with scissors (Figure 23.5a). Using scissors results in less hemorrhage than use of a surgical blade. If the ear is tipped before surgery, the hemostat may be left in place until the cat is returned to its trap. Tipping is preferred over notching, because notches may be confused with irregular pinnae caused by fight wounds, frostbite, and ear mites, whereas the tipped ear creates an unmistakable characteristic silhouette (Figure 23.5b). Tattoos and microchips may be used to identify individual cats, but this must be done in addition to ear tipping, because neither method can be read without handling the cat. If tattoos are used, it is important to sterilize the equipment between each cat to avoid the inadvertent transmission of blood-borne infectious diseases. This can be problematic in large-scale operations that are processing many cats at a time. Several types of tags and buttons designed for use in the ears of mice and rabbits have been used in cats, but these are associated with a high rate of loss and infection. Some caretakers and veterinarians have objected to ear tipping as an unnecessary and disfiguring practice. Ear tipping is performed painlessly under anesthesia and is much less invasive than the accompanying sterilization procedure. It allows the identification of sterilized cats in the field so that they do not face the trauma of unnecessary transport and surgery again. It is the standard of practice accepted by animal welfare organizations and feral cat advocacy groups in the best interest of the cats. The presence of a tipped ear does not appear to affect the adoptability of cats in the future.

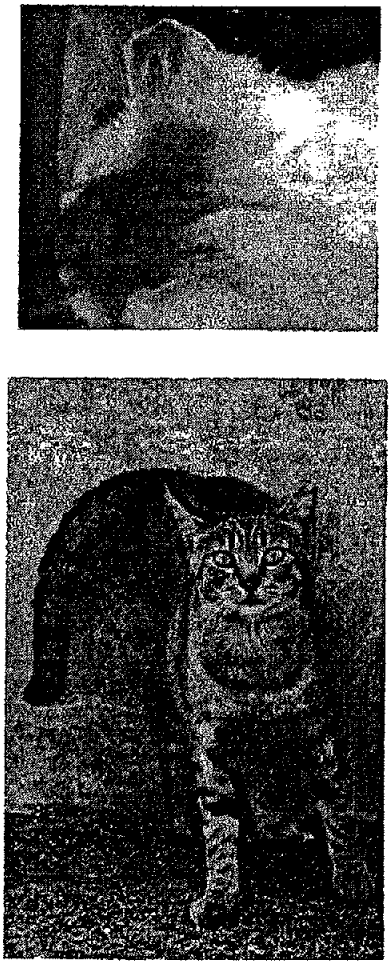


Figure 23.5. The internationally recognized identification mark of a sterilized feral cat is "ear tipping," in which the distal centimeter of an ear tip is removed while the cat is under anesthesia for sterilization (a). Cutting the tip straight across leaves a characteristic silhouette recognizable without having to handle the cat (b). Photos by Julie Levy (a) and John Newton (b).

Vaccination

The AAFP recommends providing core vaccines (rabies, panleukopenia, herpesvirus, and calicivirus) to all cats (2000 Report). Non-core vaccines, such as FeLV, are recommended only for cats at risk of exposure. Since feral cats are exposed to a variety of other cats with unknown FeLV or FIV status, they would be considered at risk. However, these guidelines were developed for pet cats, not feral cats, so decisions about which vaccines to use and which cats to vaccinate should be made based on perceived cost-benefit ratios and program resources. Rabies occurs in wildlife throughout the continental United States, and feral cats may form an interface between wildlife reservoirs and humans. For this reason, rabies vaccines should be administered to all cats undergoing TNR.

Not only does this provide increased safety for the cats and their caretakers, but it also makes TNR programs more acceptable to public health officials. A rabies product with three years duration of immunity should be used, even if it is the cat's first vaccine. Many cats are difficult to retrap for booster vaccines, but a single rabies vaccine has been shown to protect cats against virulent challenge for more than three years (Soulebot et al. 1981). Some programs admit only cats three months of age and older so that the rabies vaccine is recognized by local authorities as valid. The canary pox-vectored rabies vaccine is approved for kittens as young as 8 weeks of age, but is currently labeled only for one year duration of immunity. Kittens should be vaccinated against panleukopenia, herpesvirus, and calicivirus, because of their high susceptibility and the life-threatening effects of infection in young cats. Feral cats are frequently unavailable for booster vaccines, but still benefit from a single immunization. Live-virus vaccines should be used because they confer greater immunity following a single immunization than inactivated vaccines. Whereas panleukopenia, herpesvirus, and calicivirus vaccines would also ideally be administered to adult cats, mature cats are more naturally resistant than kittens to these viruses. Program resources may dictate whether all adult cats are vaccinated against these infections. The effect of a single FeLV vaccine is unknown, and most TNR programs do not include FeLV vaccines in their programs. The first vaccine against FIV was introduced in 2002. This vaccine causes false positive FIV test results in vaccinated cats, so its use has complicated FIV testing in cats from unknown backgrounds. Similar to FeLV vaccines, the benefit of a single immunization against FIV is unknown, and this vaccine is not widely used in feral cats.

Parasite Control

Feral cats are frequently returned to their original multi-cat environment, and the advantage of a single treatment for parasites at the time of sterilization is uncertain. Parasiticides can be mixed in food for ongoing treatment of parasitism, but this is usually not practical on a large scale. Kittens are most severely affected by parasites and are likely to benefit more from treatment than are adult cats. Depopulating parasites in kittens, even transiently, may reduce the physical stress cats experience following weaning. Adult cats are more naturally resistant to parasitism and are less likely to develop severe complications such as flea anemia, diarrhea, and weight loss. Because feral cats should only be handled after they are anesthetized, treatment of parasites at the time of sterilization is limited to topical and injectable products. Imidacloprid, selamectin, and fipronil may be applied topically for flea control. Heavily infested cats can be sprayed with a cat-safe flea spray prior to surgery. Ivermectin (0.2 mg/kg SC) may decrease roundworms, hookworms, and ear mites. Selamectin can be applied topically to anesthetized cats and is effective against roundworms, hookworms, ear mites, and fleas. Selamectin should be avoided in young debilitated kittens, as neurological side effects have been reported in this group. Single-dose ear mite treatments, such as otic milbemycin and extended action ivermectin, are ideal for feral cats that cannot be treated following recovery from anesthesia.

Recovery

If xylazine has been used for anesthesia, recovery can be hastened by administration of yohimbine. Prior to awakening, cats should be returned to their traps to recover in a quiet warm place and monitored until fully awake. All cats should be left in their traps overnight following surgery. If fully recovered the next day, they may be released to their colony. Although feral cats presented for sterilization are homeless, their general body condition is usually adequate, and the euthanasia rate for humane reasons is quite low. Fatal complications associated with surgery occur in feral cats at approximately the same rate as reported for pet cats undergoing anesthesia and surgery. Even though complications are uncommon, procedures should be in place for the management of surgical and medical emergencies. It is also helpful for veterinarians and cat caretakers to establish in advance protocols for unexpected findings such as cryptorchidism, pyometra, illnesses, and injuries.

CONCLUSION

Populations of feral cats exist throughout the world and are a large source of cat overpopulation. Concern about their impacts on the environment and public health, as well as consideration of the welfare of the cats themselves, has led to

various efforts to reduce their numbers. TNR has emerged as one viable alternative for nonlethal cat control capable of reducing cat populations over the long term.

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