








Intersectoral articulation for population management strategies of free-roaming colony cats in Curitiba, Brazil

A articulação intersetorial para estratégias de manejo populacional de gatos de vida livre em colônia em Curitiba, Brasil

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ABSTRACT

Colony, free-roaming, or feral cats are classifications of domestic cats capable of living and reproducing in the wild. Managing these populations is fundamental to controlling zoonoses, especially sporotrichosis, and must be structured on a legal, ethical, and animal welfare basis. This study is part of a research project to develop a protocol for controlling sporotrichosis in free-roaming cats and reports on ethical population control interventions in a cat colony. It also examines the intersectoral coordination between the Federal University of Paraná Collective Veterinary Center (MVC-UFPR Center), representing the first sector of the economy, the Paranaense Energy Company (COPEL), representing the second sector, and an independent protectors group, representing the third sector. Three trap, neuter, and return (TNR) actions were carried out between May and October 2023, trapping 16 animals, neutering 12, returning 9, and adopting four animals. A SWOT analysis evaluated the intersectoral coordination efforts' strengths, weaknesses, opportunities, and threats for free-roaming cat population management. The shared commitment of stakeholders emerged as a strength, while the lack of regular meetings and bureaucratic hurdles were identified as weaknesses. Opportunities for improvement include enhancing collaboration and increasing the frequency of actions. However, the lack of public policy addressing feline population management poses a significant threat.

Keywords: TNR. Collective Veterinary Medicine. Zoonosis control. Sporotrichosis. Animal welfare.

RESUMO

Gatos de colônia, gatos de vida livre ou gatos ferais são classificações de gatos domésticos, capazes de viver e se reproduzir em vida livre. O manejo dessas populações é fundamental para o controle de zoonoses, em especial a esporotricose, e deve ser estruturado em bases legais, éticas e na ciência do bem-estar animal. Este estudo faz parte de uma pesquisa que visa desenvolver um protocolo para o controle da esporotricose em gatos de vida livre e relata intervenções éticas de controle populacional em uma colônia de gatos. Ele também examina a coordenação intersetorial entre o Centro de Medicina Veterinária do Coletivo da Universidade Federal do Paraná (Centro MVC - UFPR), representando o primeiro setor da economia, a Companhia Paranaense de Energia (COPEL), representando o segundo setor, e um grupo de protetoras independentes, o terceiro setor. Três ações de captura, esterilização e devolução (CED) foram realizadas entre maio e outubro de 2023, resultando na captura de 16 animais, esterilização de 12, devolução de nove e adoção de três animais. Foi conduzida uma análise SWOT para avaliar os pontos fortes, pontos fracos, oportunidades e ameaças dos esforços de coordenação intersetorial para o controle da população de gatos de vida livre. O interesse das partes em implementar estratégias de gestão populacional de gatos de vida livre foi identificado como um ponto forte; como fraquezas, foram identificadas a falta de reuniões para alinhamento entre partes e a morosidade do processo devido às burocracias envolvidas; como oportunidades, a possibilidade de intensificar a colaboração e o aumento da frequência das ações; e como ameaças, a ausência de políticas públicas voltadas para o controle da população de felinos.

Palavras-chave: CED. Medicina Veterinária do Coletivo. Controle de zoonoses. Esporotricose. Bem-estar animal.

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Introduction

Colony, free-roaming, or feral cats pose a significant challenge in urban areas due to their ability to live and reproduce in the wild, exhibiting complex social structures and territorial behaviors. These animals, classified as domestic cats, often exhibit reactive behaviors due to limited interaction with humans throughout their lives (Bastos et al., 2019; Dutcher et al., 2021; Slater, 2005). Management of these populations is critical to controlling zoonotic diseases (Allen et al., 2017; Doherty et al., 2017), particularly sporotrichosis, disease in expansion in Curitiba, and must be based on legal, ethical, and animal welfare principles.

Trap-Neuter-Return (TNR) is emerging as a critical population control strategy to minimize the proliferation of free-roaming cat populations (Swarbrick & Rand, 2018). Given the prolific reproductive nature of cats, with a single unaltered female capable of producing numerous offspring (Bastos et al., 2019; Carvalho, 2018; Mello, 2021), TNR plays a critical role in curbing population growth and ensuring humane treatment (Slater, 2005). Through TNR initiatives, animals are trapped, sterilized, and returned to their habitats after anesthesia recovery, promoting animal welfare and population control (Levy et al., 2003).

The regulatory framework for animal management in Brazil emphasizes ethical practices and the protection of flora and fauna. Mandated by the Brazilian Constitution of 1988 (Brasil, 2016), this framework prohibits actions that compromise ecological functions, cause species extinction, or subject animals to cruelty. Federal laws, such as Federal Law 9.605 of 1998 (Brasil, 1998) and Federal Law 13.426 of 2017 (Brasil, 2017), reinforce these principles by establishing sanctions for environmentally

harmful behaviors and implementing birth control policies for dogs and cats, respectively. Specifically, Federal Law 14.228 of 2021 (Brasil, 2021) prohibits the euthanasia of dogs and cats by zoonosis control agencies, except in certain circumstances. In addition, Curitiba Municipal Law No. 16.037 of 2022 (Curitiba, 2022) sanctions the mistreatment of animals, further emphasizing the importance of ethical practices in animal management.

SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis serves as a valuable tool for strategic planning in various industries (Fernandes, 2015; Namugenyi et al., 2019), including veterinary medicine, where the analysis informs strategic decisions regarding clinic management, educational programs, and other aspects (Huebner & Flessa, 2022; Orpin, 2015; Stärk & Nevel, 2009). While intersectoral coordination is essential for effective population management, current approaches in Brazil often lack sufficient collaboration between sectors (Dominici, 2017).

This study, part of an effort to develop a protocol for managing sporotrichosis in free-roaming cats, reports on ethical population management interventions in a cat colony. It also examines the intersectoral coordination between the Federal University of Paraná Collective Veterinary Center (MVC-UFPR Center), representing the academic sector, the Paraná Energy Company (COPEL), representing the private sector, and independent animal welfare organizations, representing the nonprofit sector. The SWOT analysis will evaluate the strengths, weaknesses, opportunities, and threats associated with these actions and collaborations to guide future interventions and improve population management strategies.

Materials and Methods

Location and actors involved

The article describes the management of a colony of free-roaming cats on private land in Curitiba. The colony in question was identified in March 2023, with the help of a group of animal protectors, at a distribution unit of COPEL, the company responsible for energy transmission in Parana.

The land occupied by the colony has a perimeter of about 420 meters and an area of about 11,000 square meters. It is an area of uneven ground, completely covered with vegetation, with loose stones and channels for the flow of electric cables. These channels form an extensive underground network that has become an animal refuge. The colony is in one of Curitiba's most populated neighborhoods, Santa Quitéria, a predominantly residential area with about 13,400 inhabitants (Instituto Brasileiro de Geografia e Estatística, 2016).

An assessment of the situation was made by gathering information about the case from animal caretakers and by observing the approximate number of animals at the site, the level of sociability of those animals, and the carrying capacity. Through observation, we estimated that there were 30 wild animals in the colony. A virtual meeting was then held between COPEL and the MVC-UFPR Center. This meeting defined the participation of the three institutions and their roles: COPEL was responsible for facilitating access to the site where the animals would be kept and for the environmental management of the site, keeping the grass cut and the ground clean; the animal protectors for feeding the animals daily, organizing the captures, transporting the animals on the actions and sending them to temporary or permanent homes when necessary. The MVC-UFPR Center was responsible for the clinical and surgical care, sterilization of the captured animals, and donation of food from the Zero Hunger Project, which, in partnership with the PremieRpet Institute, makes it possible to feed dogs and cats in vulnerable situations (Figure 1).

Actions and Standard Operating Procedures (SOPs)

The proposed TNR actions aimed to reduce the reproductive activity of free-roaming cats, minimize risks

to human health, low levels of animal welfare, and animal mortality due to the lack of basic resources, and promote a reduction in the rate of animal renewal in a free-roaming cat colony located on private land owned by COPEL in Curitiba, Paraná. To enhance action planning, standard operating procedures (SOPs) for TNR were established based on Gough & Hamrell's (2009) methodology, which is still being applied and improved.

During the capture, transport, and resting period at the MVC-UFPR Center, drop-traps were strategically covered to simulate burrows, and attractive food was carefully placed inside to entice the animals. These drop-traps were randomly deployed in the area colonized by the animals and kept covered until the preanesthetic medication (PAM) was applied. The attractive food tends to run out in the evening.

The animals were carefully transported in enclosed and quiet vehicles, within their own covered capture cages, along an approximately 11km route between the colony and the MVC-UFPR Center. Upon arrival at the MVC-UFPR Center, they were placed in a peaceful and controlled environment for at least an hour. In order to reduce stress, a synthetic pheromone, Feliway Classic Spray®, was administered (Vitale, 2018). If necessary, the animals were given PAM inside the traps or in a squeeze cage. Once they became drowsy and

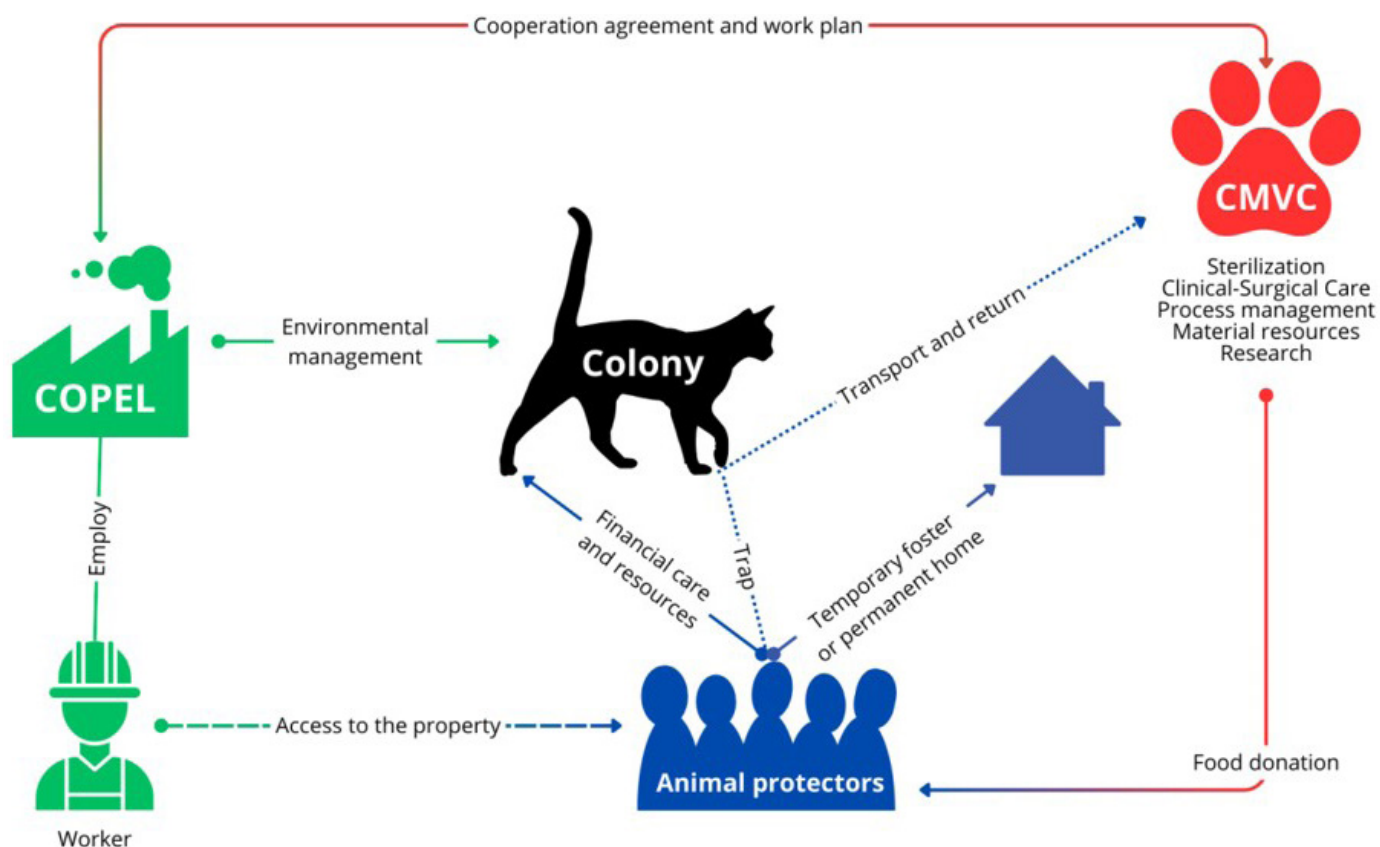


Figure 1 – Articulation for the population management strategy involving TNR for free-roaming colony cats, as per actions in Curitiba, Brazil, from March to October 2023.

relaxed, they were transferred to the surgical preparation room, where they underwent a clinical assessment, gender identification, and trichotomy.

The anesthetic protocol varied between actions. For the first action, the preanesthetic medication (PAM) consisted of dexmedetomidine (5 mcg/kg), methadone (0.3 mg/kg), and ketamine (2 mg/kg). The second action involved administering 1.25 ml of dexmedetomidine and 1.25 ml of methadone to the dehydrated contents of one bottle of Zoletil® 50. The pharmacological concentration included tiletamine (2 mg/kg), zolazepam (2 mg/kg), dexmedetomidine (10 mcg/kg), and methadone (0.2 mg/kg), which were administered at a dose of 0.04 ml/kg for pharmacological restraint of the animals. This combination was chosen based on the longer duration of tiletamine, which is present in Zoletil, compared to ketamine (Branson, 2003). Due to the unavailability of tiletamine during the first study, a medication change was necessary. Anesthesia was induced and maintained using intravenous propofol. The induction involved administering 2 mg/kg over 2 min, followed by maintenance with a 0.3 mg/kg bolus as needed. Male subjects received intratesticular lidocaine at a dose of 3 mg/kg divided between the testicles. Female subjects received the same drug when their ovaries were externalized at a dose of 3 mg/kg diluted in two parts of 0.9% saline solution, following the method described by Grubb & Lobprise (2020).

The surgical procedures performed on the animals were an orchietomy for males and a minimally invasive ovariectomy (OH) for females. To ensure the team's safety, personal protective equipment such as long-sleeved aprons, goggles, masks, and gloves were used when handling animals with skin lesions. Samples were collected for cytology examination to identify the species of the *Sporothrix* complex. The skin lesions were covered with gauze and adhesive plaster to minimize the risks of handling patients with suspected sporotrichosis.

During anesthetic unconsciousness, all animals underwent a procedure in which their ear tips were removed trapezoidal. Protocols were established to ensure that males' left and females' right ears were standardized (Bastos et al., 2019). In cases where animals tested positive for sporotrichosis, both ear-tips were removed. All neutered animals were administered post-operative medication with Shotapen®, an injectable preparation combining benzylpenicillin procaine, benzylpenicillin benzathine, dihydrostreptomycin, and meloxicam and dipyrone. The surgical wounds of the females were covered with bandages.

After the animals were cleared for return, they were transported back to the colony. Subsequently, the transport boxes were placed open in the field. Some animals utilize the boxes as a hiding place until the animal protectors depart from the colony, while others seize the opportunity to escape. Following TNR, the animals are monitored by animal protectors.

Application of the SWOT matrix

SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis can be a valuable tool for strategic planning and decision-making (Allen et al., 2017; Doherty et al., 2017), particularly in the context of One Health. One Health emphasizes the interdependence of human, animal, and environmental health, making SWOT analysis effective for comprehensively assessing and addressing health-related challenges. The approach is widely used in veterinary medicine for strategic planning of interventions, clinic management, and program evaluation. Its benefits have been highlighted by Stärk & Nevel (2009), Huebner & Flessa (2022), and Orpin (2015). This approach facilitates informed decision-making and interdisciplinary collaboration, improving health outcomes across species boundaries.

Each intervention was assessed using a SWOT matrix as a central tool for project analysis and management (Muhlbauer, 2019). Data collection was facilitated by meetings during the interventions, highlighting the indispensable role of intersectoral collaboration between institutions. In addition, various criteria were analyzed to assess the organizational capacity for intersectoral coordination using the SWOT matrix. These included group involvement in action integration, responsiveness to needs, timely completion of tasks within proposed timelines, and a proactive approach to challenges encountered. These assessments help improve intersectoral collaboration and optimize human and veterinary healthcare project outcomes.

Results and Discussion

Implementing TNR as a feline population management strategy in the COPEL cat colony involved coordinated efforts between the MVC-UFPR Center, animal protectors, and COPEL employees. A technical cooperation agreement was signed, which clarified the obligations agreed between the parts and dealt with the management of the budgetary and property resources, human resources, term and validity, intellectual rights, closure, termination, publication, measurement of results, protection of personal data, omitted cases and, finally, conciliation and jurisdiction. The work plan made COPEL responsible for facilitating access, the

environmental maintenance of the land with free-roaming cats and providing the necessary inputs to carry out the planned actions. It also determined the responsibility of the MVC-UFPR Center for the other actions: sterilization, clinical-surgical care, process management, material resources, and research.

On May 8, 2023, eight drop-trap cages were randomly deployed in the colony, baited with attractive food. On the night of May 9, the traps were set up to capture the animals, and by the following morning, nine animals were captured. Among them were three kittens under 45 days old who were not sterilized due to their young age. These kittens were promptly released to animal protectors. The group also included three young males approximately 90 days old, one of which had rectal prolapse, as well as two adult lactating females and a male exhibiting skin wounds indicative of sporotrichosis. As part of the TNR process, the captured animals were neutered, underwent registration, identified with subcutaneous microchips and ear tips, following the developed SOPs.

All animals, except for the three dispensed kittens and one young cat that suffered irreversible cardiac and respiratory arrest before surgery, underwent sterilization. During sterilization, the young cat with rectal prolapse underwent a reduction procedure and was referred to the hospital, where it died the following day. Regarding the animal requiring sporotrichosis diagnosis, worn teeth and an accumulation of tartar were observed during anesthetic unconsciousness, suggesting advanced age. Skin lesion samples were taken for subsequent mycological culture, resulting in a positive diagnosis, leading the animal to be isolated for treatment in a veterinary clinic. As a result of the first action, nine animals were captured. Of these, five were neutered, two died, three were kept in temporary homes due to their young age, one was hospitalized for treatment of sporotrichosis, and three were returned to the colony.

On the night of September 28th, eight traps were set up with attractive food. By the following morning, six animals were captured in five cages, of which three were young females, one of which had skin lesions; two adult males, one clinically healthy and one with skin lesions;

and a young, healthy cat, with the tip of its left ear cut off, indicating that it had been neutered in the first action; it was fed, transferred to a transport box and awaited the sterilization period of the other animals for release in the same place. All three cats had their pregnancy terminated during the OH procedure. These were early pregnancies identified during surgery and resulted in the abortion of 11 fetuses. For sterilizing the animals with skin lesions, the team followed the established protocol, and on mycological culture, the animals were not diagnosed with sporotrichosis. As a result of the second action, six animals were captured. Five were neutered, and one was recaptured.

On October 20, 2023, the identical animal protectors carried out the third capture in the same colony. The capture methodology was repeated, and no adaptation period to the cages was provided. Eight traps were set with attractive food in the colony on the night of October 19, but only one adult male animal was captured. The animal was neutered but had no visual or permanent identification to confirm its reproductive status. The patient's reproductive condition was only discovered after pre-anesthetic medication was administered. As a result, the animal was microchipped and had the tip of its left ear cut off while unconscious. To utilize the available personal and surgical resources, the animal protector brought the two kittens who were exempted from surgery during the first action because of their young age to undergo the procedure. The third animal was adopted and did not get sterilized. As a result of the third action, one animal was captured, but it had already been neutered, registered, identified, and returned. Two other animals were neutered, identified, and returned to their keepers.

The actions captured 16 animals, 53.3% of the estimated number of cats in the colony. Of these, one died prior to surgery, one was recaptured, one was adopted and did not undergo sterilization, and one was sterilized, resulting in 12 neutered animals. One animal was diagnosed with sporotrichosis, treated, and subsequently adopted. In addition, the three puppies originally captured were adopted, two of them by one of the guardians. Nine animals were returned to the colony after being neutered, identified, and microchipped (Table 1).

Table 1 – Information on animals participating in the actions, trap-neuter-release colony cat population management in Curitiba, Brazil, from March to October 2023

DATE	10/05/2023		29/09/2023		20/10/2023		TOTAL
	Male	Female	Male	Female	Male	Female	
No. of animals captured	6	3	3	3	1	0	16
No. of animals neutered	3	2	2	3	1	1	12
No. of animals with sporotrichosis	1	0	0	0	0	0	01
No. of animals kept with animal protectors	1	0	0	0	1	0	06

In the endeavor to manage feline populations effectively, a SWOT analysis reveals several critical factors to consider. Applying the SWOT matrix to the actions, it can be seen that strengths include successfully capturing a significant number of animals. Furthermore, the recapture of an animal implies some stability within the colony. In addition, capturing and sterilizing at least one animal greatly assists population control efforts. Appropriate care for animals in distress demonstrates a compassionate approach to animal welfare. Furthermore, capturing pregnant females allows for ethical interventions to protect animal welfare. Finally, registering and identifying neutered animals without visible markings is advantageous for tracking and monitoring. As weaknesses to address, the placement of capture traps without adaptation time underscores the importance of coordination and planning between stakeholders. Moreover, the absence of pre-surgical examinations necessitates ad hoc responses to unforeseen circumstances during procedures. As for opportunities, implementing a more robust anesthesia protocol has improved surgical outcomes. Similarly, the use and adaptation of Standard Operating Procedures (SOPs) offer the potential to streamline processes. In addition, promoting the adoption of animals can alleviate population pressure on the colony. As for threats, handling animals with zoonotic diseases poses risks to both human and animal health. Similarly, managing free-roaming animals presents

challenges in terms of safety and logistics. Additionally, the possibility of abandoned animals further complicates population control initiatives (Figure 2).

Regarding animal protectors who act as colony caretakers, it has been observed that they are typically middle-aged women who care for pets, which is consistent with the findings of Zasloff & Hart (1998). It is important to note that implementation of Feline Population Management strategies for free-roaming cats requires a motivated group of volunteers and sustained funding (Roberston, 2008).

When assessing the results of intersectoral coordination, a notable strength is the shared commitment of stakeholders to implementing population management strategies for feral cats. However, weaknesses have been identified, including the lack of regular meetings, resulting in operational failures such as insufficient time to adjust trap cages in subsequent actions and lengthy processes due to bureaucratic hurdles. Looking forward, there is an opportunity to enhance collaboration and increase the frequency of actions through better alignment. However, a significant threat exists due to the lack of public policy addressing feline population management, especially regarding organized colonies of free-roaming animals (Figure 3).

When implementing TNR procedures for feline population management, ensuring the traceability and identification of captured animals is crucial. This is achieved through

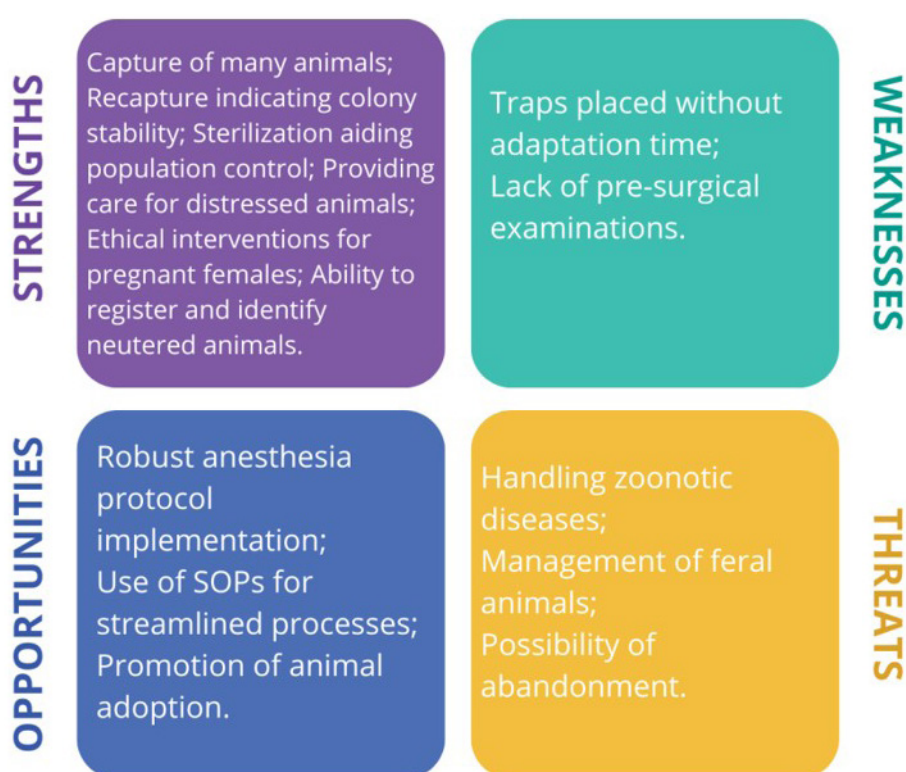


Figure 2 – Strengths, weaknesses, opportunities, and threats matrix to evaluate the actions within the trap-neuter-release strategy for population management of free-roaming colony cats in Curitiba, Brazil, March to October 2023.

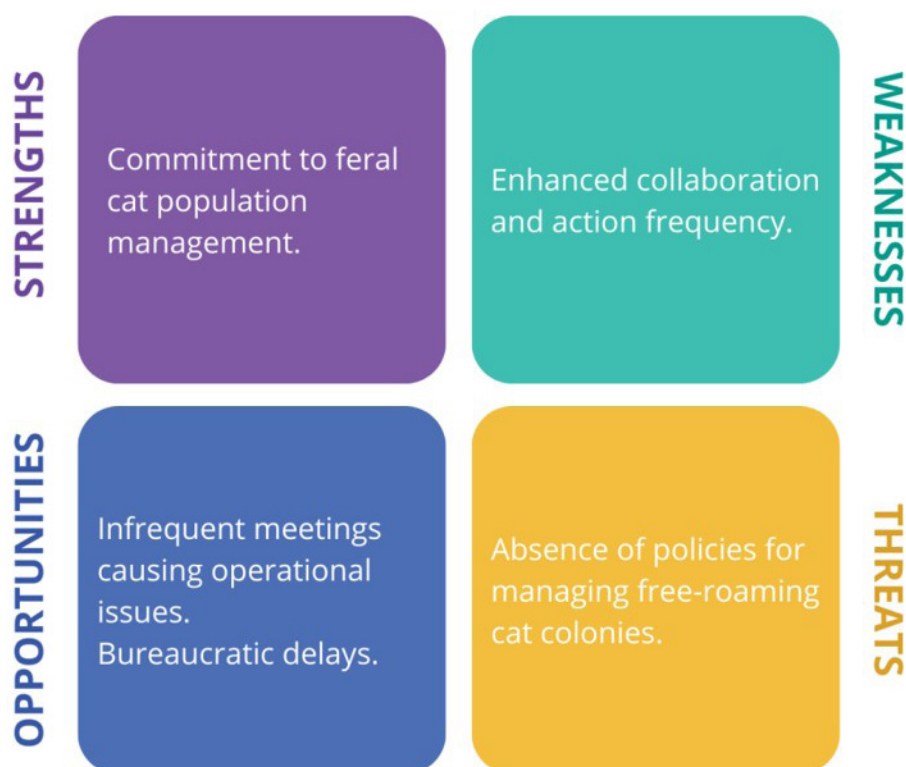


Figure 3 – Strengths, weaknesses, opportunities, and threats matrix to evaluate the intersectoral within the trap-neuter-release strategy for population management of free-roaming colony cats in Curitiba, Brazil, March to October 2023.

subcutaneous microchips and ear-tip marking, which allows the animals to be registered and recognized as TNR participants from a distance (Carvalho et al., 2019).

It is worth noting that the lack of visual or permanent identification on some neutered animals raises concerns regarding their reproductive status. This observation emphasizes the importance of using ear-tip cutting as a sign of castration, a crucial aspect of practical population management efforts.

Trap-Neuter-Return (TNR) aims to neuter a sufficient number of free-roaming cats to reduce reproduction and consequently reduce populations over time. Studies show that implementing an aggressive adoption program can accelerate population decline and that sterilization is only effective when accompanied by the permanent removal of large numbers of cats (Levy et al., 2003). In the study colony where cat population management strategies were implemented, 53.3% of the estimated animals were trapped and 40% neutered and removed from the colony, including those that died or were adopted, for 20% of the estimated number of animals. A demographic modeling study suggests that 71% and 94% of free-roaming cats must be sterilized to reduce cat populations effectively (Foley et al., 2005). These findings underscore the importance of ongoing colony management efforts to stabilize the cat population.

The complexities of neutered free-roaming cats, particularly the lack of pre-surgical examinations, raise various ethical

considerations. For example, during surgical procedures, three cats underwent pregnancy termination to prevent potential complications for both the pregnant female and her offspring. This decision, although difficult, aimed to mitigate risks and promote animal welfare, as highlighted by Raffae (2015). Additionally, Nutter et al. (2004) conducted studies that highlight the high mortality rates of feral cat kittens. This emphasizes the importance of population management strategies to improve animal welfare. The effects of the lack of prior examination could also be seen in the young cat that was presented with cardiorespiratory arrest in the first case. Necropsy revealed congested lungs, foamy fluid in the trachea, and fluid accumulation in the pericardial space, findings consistent with pneumonia.

In the Brazilian context, legislative frameworks aim to protect animal welfare and promote responsible pet ownership. Population control of free-roaming animals must align with various laws, including the 1988 Constitution, Article 225 (Brasil, 2016), which safeguards fauna and flora, penalizing cruelty and promoting ecological balance. Federal laws, such as Federal Law 9.605 of 1998 (Brasil, 1998) and Federal Law 13.426 of 2017 (Brasil, 2017), emphasize the importance of animal welfare in birth control measures and penalize acts of abuse or mistreatment. Municipal regulations, like Municipal Law No. 16.037 of 2022 in Curitiba (Curitiba, 2022), further enforce animal abuse and

mistreatment sanctions. However, despite the existing legal framework, there is a noticeable lack of specific policies addressing Feline Population Management, particularly concerning free-roaming animals organized in colonies.

Conclusion

Although improvements are needed in intersectoral coordination aimed at managing free-roaming cats, the partnership has been very positive and has impacted the lives of the colony's animals. Working together allows each part

to take responsibility for an area of competence, facilitating the progress of actions and boosting long-term results.

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethics Statement

The study was conducted with the approval of the Animal Use Ethics Committee of the Federal University of Paraná (UFPR) under protocol number 026/2023.

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