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Population Of Domestic Animals And Responsible Ownership Of Dogs In The Cantons Of Balsas And Marcabelí, El Oro, Ecuador

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Abstract
The study analyzes the population of dogs and cats in the cantons of Balsas and Marcabelí, in the El Oro province, Ecuador, to understand the distribution patterns, demographic characteristics, and factors associated with responsible pet ownership. Using a quantitative approach, surveys were conducted with pet owners and direct observations in urban and peri- urban areas. It was found that the dog population exceeds that of cats in both cantons, with a higher presence of mixed-breed dogs. Responsible ownership is associated with the type of food and housing, being more frequent in animals that receive prepared food and have adequate shelters. A differentiated geographic distribution between dogs and cats was observed, with dogs showing greater dispersion, while cats tend to concentrate in specific areas. Additionally, the research found that sociodemographic factors and education on animal health influence responsible ownership practices. The study concludes that the implementation of awareness campaigns on responsible ownership, adoption, and sterilization is essential to improving the quality of life for animals and reducing issues such as overpopulation and abandonment in the studied communities
Keywords: *Animal Welfare, Responsible Ownership, Domestic Animals, Public Health.*

INTRODUCTION

According to the World Health Organization (WHO, 2023), zoonotic diseases are those that can be transmitted from animals to humans, and their prevalence tends to increase in populations where knowledge of animal health is limited. The lack of education on animal welfare and zoonoses is closely linked to inadequate pet management practices, leading to conflicts between public health and animal welfare.

The focus of this research is on the variability of knowledge and the implementation of practices regarding the five pillars of animal welfare as established by the World Organization for Animal Health (OIE). These fundamental principles are: freedom from hunger and thirst, freedom from discomfort, freedom from pain, injury, and disease, freedom to express natural behaviors, and freedom from fear and distress.

The value and justification of this study lie in its ability to provide a clear understanding of the dynamics of domestic animal populations in geographically and socioeconomically diverse contexts, such as in the cantons of Balsas and Marcabelí, Ecuador. This analysis is essential for designing effective management and population control strategies, as well as animal welfare strategies that consider local particularities, such as differences in population density, economic activity, and culture.

Responsible pet ownership involves a comprehensive commitment to caring for and protecting animals, ensuring their physical and emotional well-being, as well as promoting harmonious coexistence with humans in their environment. This approach requires owners to provide appropriate veterinary care, proper nutrition, regular exercise, and socialization. Furthermore, responsible pet ownership also includes educating people on the importance of public health and respecting the animal's needs, strengthening the bond between owners and pets and generating mutual benefits (Hugues et al., 2022).

In the Ecuadorian context, responsible pet ownership has significantly evolved in recent years, driven by a set of regulations aimed at ensuring both animal welfare and public health. At the national level, proposed bills have been introduced to regulate pet ownership, establishing clear principles regarding owner responsibilities and penalties for mistreatment or abandonment. The Organic Comprehensive Criminal Code (COIP), in Article 247, classifies pet abuse and abandonment as crimes, imposing penalties that vary depending on the severity of the infraction.

In Ecuador, the ownership and management of domestic animals are determined by socioeconomic, geographical, and cultural factors, which can directly affect their welfare. The domestic animal population plays a vital role in community life, as they not only provide companionship to owners but also significantly influence public health and social well-being (Pulido et al., 2022).

Additionally, Ecuador's environmental legislation plays a key role in the regulation of responsible pet ownership, as it sets standards for the protection of both domestic and wild fauna. In the municipalities of Balsas and Marcabelí, local ordinances have been implemented to regulate pet ownership, requiring the registration, vaccination, and proper care of animals, as well as regulations on breeding. These ordinances aim not only to protect animals but also to protect the community, promoting healthy coexistence and reducing issues related to pet overpopulation. It is essential to guarantee these rights and freedoms not only to ensure the quality of life for animals but also to protect the health of the human population. Studies conducted by Pulido et al. (2022) analyzed pet ownership and management in different regions of the country, identifying socioeconomic, cultural, and geographical factors that influence pet ownership patterns and animal welfare.
Therefore, it is crucial to characterize the population of domestic animals in the cantons of Balsas and Marcabelí, assessing the interaction between the number of animals, ownership conditions, and the impact of these practices on the implementation of animal welfare principles.
This study addresses the issue of domestic animals, specifically dogs and cats, in the cantons of Balsas and Marcabelí, located in the province of El Oro, Ecuador. These cantons present diverse geographic and socioeconomic contexts, offering a unique opportunity to analyze the dynamics of pet ownership and the characteristics of these animals. The main objective of the study is to conduct a comprehensive analysis of the canine and feline populations, considering demographic variables such as breed, size, sex, coat type and color, as well as age.
Animal welfare refers to the harmony between the environment and the animal's response, including the comfort of its surroundings, the quality of treatment, care, nutrition, the knowledge owners have to prevent diseases, and proper handling. Responsible pet ownership is defined as the condition in which a human commits, accepts, and assumes a series of obligations and rights aimed at fulfilling the needs of their pet (Villamar, 2023).
In the cantons of Balsas and Marcabelí, in the province of El Oro, Ecuador, living with pets is an essential part of local culture. However, the lack of information on managing and responsibly keeping these animals creates challenges that could contribute to the transmission of zoonotic diseases (Añazco, 2021).
Studies such as those by Hugues et al. (2022) have shown that education on animal health is key to improving perceptions of zoonoses, thus promoting better pet management. However, the lack of knowledge about animal welfare principles and responsible pet ownership regulations remains a challenge for authorities and the community (Añazco, 2021).
Both cantons present contrasting contexts, which enrich the research. Balsas stands out for its higher population density and more dynamic commercial activity, while Marcabelí is characterized by its predominantly rural infrastructure and agricultural economy. This diversity in social and economic contexts provides a unique opportunity to analyze both the demographic composition of the dog and cat populations and the factors that impact responsible pet ownership. This aspect is essential for addressing problems such as overpopulation and animal abandonment, which require approaches tailored to the specificities of each canton.
The purpose of this research is to characterize the domestic animal population in the cantons of Balsas and Marcabelí in order to assess the impact of these practices on the five principles of animal welfare, promoting responsible practices that benefit both animals and humans. The growing global awareness of animal welfare issues has prompted both local and international communities to recognize the need for improved practices in pet ownership. Public awareness campaigns are crucial in this context, as they educate pet owners and the general public about the importance of responsible pet care. These initiatives are especiallimportant in regions with limited access to information, where misconceptions about animal welfare are prevalent. By fostering a deeper understanding of the ethical treatment of animals and the impact of responsible ownership on both animal and human health, these campaigns contribute to the overall well-being of communities and help bridge existing knowledge gaps. Additionally, fostering collaboration between local authorities, animal welfare organizations, and communities is essential to ensuring the effective implementation of animal welfare policies and to cultivating a more compassionate society towards animals.

METHODS

Study Design

This study employed an observational, descriptive, and cross-sectional approach, incorporating a correlational

component, conducted in the cantons of Balsas and Marcabelí. Through direct observation and the recording of key variables at specific points in time, the study aimed to identify relationships between the characteristics of dogs and cats, whether street or household animals, within each locality.

Study Area

The research was carried out in the cantons of Balsas and Marcabelí, located in the province of El Oro, Ecuador. Balsas, with its higher population density and greater commercial activity, contrasts with Marcabelí, characterized by rural infrastructure and an agricultural economy. These contrasting settings provide an ideal context for analyzing how socioeconomic and geographic factors impact pet ownership and animal welfare in each canton.

Population and Sample

The study population consisted of both domestic and street dogs and cats in the two cantons. A non-probabilistic convenience sampling method was employed, with data collected through surveys administered to pet owners and direct observations in urban and peri-urban areas. A sufficient number of animals from each canton were recorded to ensure adequate representation of the population.

Ethological Data Collection

Data were collected through field observations and surveys of households with pets. A structured instrument was designed to capture information on species, breed, size, sex, coat type and color, estimated age, diet, feeding frequency, housing, and body condition of the animals. Additionally, geographic coordinates were recorded to facilitate the analysis of the spatial distribution of dogs and cats.

Data Analysis

Data analysis was performed using RStudio, utilizing various libraries for Exploratory Data Analysis (EDA). Initial descriptive analysis was conducted using libraries such as dplyr and ggplot2, which provided frequencies and percentages for variables related to animal characteristics, including species, breed, size, sex, coat type, color, and age. To explore relationships between categorical variables, statistical tests such as Fisher's exact test and the chi-square test were applied, depending on the data type. Additionally, a logistic regression model was implemented using the stats library to identify significant factors associated with responsible pet ownership. The geographic distribution of animals was visualized using the leaflet library to create a density map. The tools provided by RStudio and its libraries allowed for a more comprehensive understanding of the patterns of responsible pet ownership and the variables influencing pet ownership in the cantons of Balsas and Marcabelí.

Ethical Considerations

The study was conducted in accordance with ethical principles for research involving animals. No interventions or manipulations were performed on the animals, and data collection was carried out with the consent of the pet owners. All data were treated anonymously and confidentially, ensuring respect for the privacy of the participants.

RESULTS

Characterization of the Population

The analysis results showed that Balsas is home to 62.3% of the street dogs, surpassing Marcabelí with 37.7%."

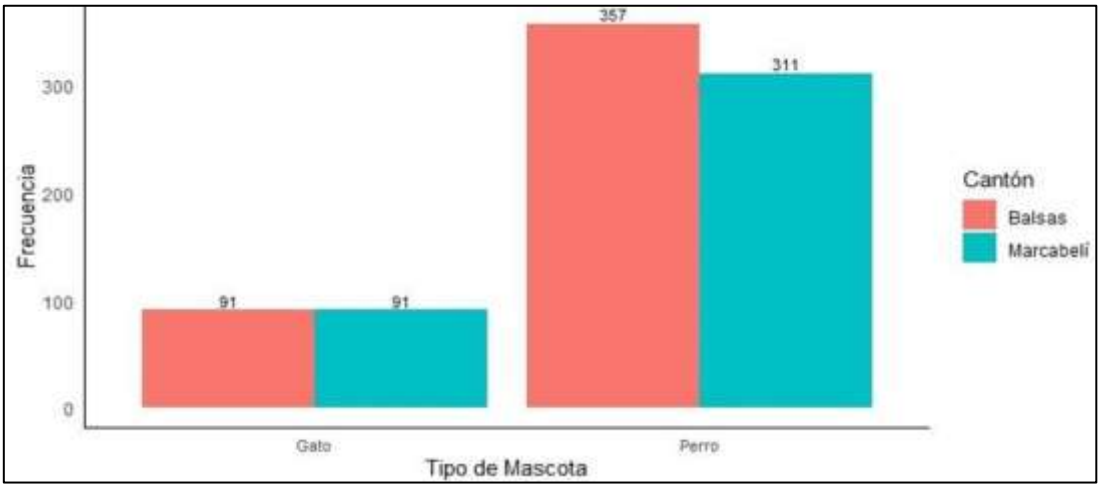
Table 1. Frequency and Percentage of Street Dogs by Canton.

Cantón	Frequency	Percentage (%)
Balsas	38	62,3
Marcabelí	23	37,7

Source: Data extracted from field observations and surveys conducted with households.

As shown in Figure 1, for homeless dogs, the majority belong to the mixed-breed category, with 34 specimens in Balsas and 17 in Marcabelí; other breeds are less common (French Poodle: 3 in Marcabelí; Golden Retriever and 'Small': 1 in Balsas each; 'Other': 2 in Balsas and 3 in Marcabelí). Regarding domestic animals, both cantons have a total of 91 cats, but there is a clear difference in the number of dogs: there are 357 in Balsas and 311 in Marcabelí, indicating that in both localities, the number of dogs significantly exceeds that of cats, with Balsas having slightly more.

Figure 1. Total number of household pets (dogs and cats) by canton



Source: Data extracted from field observations and surveys conducted with households

Table 2 provides a detailed view of the distribution of dog breeds based on their ownership type (street and household dogs) and their location in the cantons of Balsas and Marcabelí. The results show distinctive patterns in the distribution of breeds, both in dogs with responsible ownership and street dogs, which are strongly influenced by sociodemographic characteristics and contextual factors specific to each canton.

In Balsas, the population of mixed-breed dogs is notably higher than that of purebred dogs, with a total of 225 household mixed-breed dogs and 17 street mixed-breed dogs. Among the purebred dogs, the Chihuahua is the most frequent, with 37 household dogs and 1 street dog, followed by the French Poodle with 23 household dogs and 2 street dogs, and the Golden Retriever, which is only found in the household population with 1 specimen. Among the street dogs in Balsas, mixed-breeds dominate (17 dogs), while purebred dogs are scarce, with only 2 French Poodles and 1 dog of another breed.

In Marcabelí, the trend is similar, with 170 household mixed-breed dogs and 34 street mixed- breed dogs, reaffirming that mixed-breed dogs dominate both categories of ownership. Regarding purebred dogs, the French Poodle (with 27 household dogs and 7 street dogs) and the Chihuahua (with 23 household dogs and 1 street dog) stand out again. Although Marcabelí shows a greater diversity of purebred dogs compared to Balsas, mixed-breed dogs remain the most prevalent in both ownership conditions.

These results suggest that responsible ownership, associated with the possession of specific breeds, is more frequent in household dogs. In contrast, street dogs, predominantly mixed- breeds, reflect a lack of control in selection and reproduction, highlighting the absence of proper management of the street dog population. The predominance of mixed-breed dogs in both cantons underscores the urgent need to implement effective public policies focused on sterilization and animal population control, with the goal of mitigating overpopulation and improving the quality of life for both animals and local communities.

Table 2. Distribution of Dog Breeds by Ownership Type and Canton

Canton	Ownership	Pet	Breed	Count
Balsas	Street	Dog	French Poodle	2
Balsas	Street	Dog	Mixed Breed	17
Balsas	Street	Dog	Other	3
Balsas	Household	Dog	European	1
Balsas	Household	Dog	Mixed Breed	84
Balsas	Household	Dog	Other	6
Balsas	Household	Dog	Siamese	1
Balsas	Household	Dog	Chihuahua	37
Balsas	Household	Dog	Chihuahua	1
Balsas	Household	Dog	French Poodle	23
Balsas	Household	Dog	Golden Retriever	1

Balsas	Household	Dog	Siberian Husky	4
Balsas	Household	Dog	Mixed Breed	225
Balsas	Household	Dog	Mixed Breed Other	1
Balsas	Household	Dog	Other	22
Balsas	Household	Dog	Pekingese	5
Balsas	Household	Dog	Pitbull	7
Balsas	Household	Dog	Rottweiler	1
Balsas	Household	Dog	Schnauzer	1
Balsas	Household	Dog	Shih Tzu	4
Marcabelí	Street	Dog	Golden Retriever	1
Marcabelí	Street	Dog	Mixed Breed	34
Marcabelí	Street	Dog	Other	2
Marcabelí	Household	Dog	Pekingese	1
Marcabelí	Household	Dog	Angora	1
Marcabelí	Household	Dog	Mixed Breed	68
Marcabelí	Household	Dog	Other	18
Marcabelí	Household	Dog	Boxer	1
Marcabelí	Household	Dog	Chihuahua	23
Marcabelí	Household	Dog	French Poodle	27
Marcabelí	Household	Dog	French Poodle	1
Marcabelí	Household	Dog	French Poodle Siamese	1
Marcabelí	Household	Dog	Golden Retriever	9
Marcabelí	Household	Dog	Siberian Husky	4
Marcabelí	Household	Dog	Labrador	2
Marcabelí	Household	Dog	Mixed Breed	170
Marcabelí	Household	Dog	Labrador	1
Marcabelí	Household	Dog	Mixed Breed Other	1
Marcabelí	Household	Dog	Other	54
Marcabelí	Household	Dog	Other	1

Source: Data extracted from field observations and surveys conducted with households

In both cantons, household dogs outnumber street dogs in all size categories: in Balsas, 154 household dogs are small, 95 are medium, and 83 are large; the street dogs are distributed with 9 medium, 8 large, and 5 small. In Marcabelí, 135 household dogs are small, 111 are medium, and 81 are large; the street dogs include 18 large, 17 medium, and 3 small. Regarding household cats, in Balsas, small cats predominate (48), followed by medium (31) and large (13); in Marcabelí, medium cats are more common (44), followed by small (36) and large (7).

Table 3. Distribution of Pet Size by Ownership Type and Canton"

Canton	Ownership	Pet	Size	Count
Balsas	Street	Dog	Large	8
Balsas	Street	Dog	Medium	9
Balsas	Street	Dog	Small	5
Balsas	Household	Cat	Large	13
Balsas	Household	Cat	Medium	31
Balsas	Household	Cat	Small	48
Balsas	Household	Dog	Large	83
Balsas	Household	Dog	Medium	94
Balsas	Household	Dog	Medium	1

Balsas	Household	Dog	Small	154
Marcabelí	Street	Dog	Large	18
Marcabelí	Street	Dog	Medium	17
Marcabelí	Street	Dog	Small	3
Marcabelí	Household	Cat	Large	6
Marcabelí	Household	Cat	Large	1
Marcabelí	Household	Cat	Medium	44
Marcabelí	Household	Cat	Small	36
Marcabelí	Household	Dog	Large	80
Marcabelí	Household	Dog	Large	1
Marcabelí	Household	Dog	Medium	111
Marcabelí	Household	Dog	Small	134
Marcabelí	Household	Dog	Small	1

Source: Data extracted from field observations and surveys conducted with households.

In the locality of Balsas, the majority of household dogs are males, with a total of 190, compared to 141 females. Similarly, in the group of street dogs, males also outnumber females, with 15 males and 7 females. On the other hand, in Marcabelí, a similar pattern is observed, with 176 male household dogs and 146 females, while in the case of street dogs, there are 25 males and 11 females, along with 2 of mixed gender. Regarding household cats, in Balsas, there is a greater number of females, totaling 52, compared to 40 males. However, in Marcabelí, a higher number of males is reported, reaching 46, in contrast to 40 females.

Table 4. Distribution of Pet Gender by Ownership Type and Canton

Canton	Ownership	Pet	Gender	Count
Balsas	Street	Dog	Female	7
Balsas	Street	Dog	Male	15
Balsas	Household	Cat	Female	52
Balsas	Household	Cat	Male	40
Balsas	Household	Dog	Female	141
Balsas	Household	Dog	Male	1
Balsas	Household	Dog	Male	190
Marcabelí	Street	Dog	Female	11
Marcabelí	Street	Dog	Male	25
Marcabelí	Street	Dog	Male	2
Marcabelí	Household	Cat	Female	1
Marcabelí	Household	Cat	Female	40
Marcabelí	Household	Cat	Male	46
Marcabelí	Household	Dog	Female	4
Marcabelí	Household	Dog	Female	146
Marcabelí	Household	Dog	Male	1
Marcabelí	Household	Dog	Male	176

Source: Data extracted from field observations and surveys conducted with households.

The most common coat type in dogs and cats from both cantons is short. In the street dog population, in Balsas, short coat is the most predominant with 11 specimens, followed by short and straight with 5, and short and rough with 2. On the other hand, in Marcabelí, short coat is also observed in 10 cases, while the short and straight and short and rough types account for 10 and 7 respectively. Regarding household dogs, short coat is present in 161 individuals in Balsas and 129 in Marcabelí, while short and straight is recorded with 58 and 55 specimens in each place. In the case of cats, short coat is the most abundant with 40 in Balsas and 45 in Marcabelí, followed by short and straight with 34 and 21 respectively. Marcabelí also shows a higher number of silky coats, with 13 examples compared to 2 in Balsas.

Table 5. Distribution of Coat Type in Pets by Ownership Type and Canton.

Canton	Ownership	Pet	Coat Type	Count
Balsas	Street	Dog	Short	11
Balsas	Street	Dog	Short and Rough	2
Balsas	Street	Dog	Short and Straight	5
Balsas	Street	Dog	Long	1
Balsas	Street	Dog	Long and Straight	2
Balsas	Street	Dog	Curly	1
Balsas	Household	Cat	Short	40
Balsas	Household	Cat	Short and Rough	1
Balsas	Household	Cat	Short and Straight	34
Balsas	Household	Cat	Straight	3
Balsas	Household	Cat	Long and Straight	4
Balsas	Household	Cat	Silky	2
Balsas	Household	Dog	Short	161
Balsas	Household	Dog	Short and Rough	8
Balsas	Household	Dog	Short and Straight	58
Balsas	Household	Dog	Long and Curly	10
Marcabelí	Street	Dog	Short	10
Marcabelí	Street	Dog	Short and Rough	7
Marcabelí	Street	Dog	Short and Straight	10
Marcabelí	Street	Dog	Long and Straight	1
Marcabelí	Household	Cat	Short	45
Marcabelí	Household	Cat	Short and Rough	3
Marcabelí	Household	Cat	Short and Straight	21
Marcabelí	Household	Cat	Silky	13
Marcabelí	Household	Dog	Short	129
Marcabelí	Household	Dog	Short and Rough	10
Marcabelí	Household	Dog	Short and Straight	55
Marcabelí	Household	Dog	Long and Curly	14
Marcabelí	Household	Dog	Short	8
Marcabelí	Household	Dog	Short and Rough	5
Marcabelí	Household	Dog	Short and Straight	28
Marcabelí	Household	Dog	Long and Straight	5

Source: Data extracted from field observations and surveys conducted with households.

In the locality of Marcabelí, the following coat colors can be observed in pets: brown (7), caramel (9), and white with brown (5). In Balsas, the most common pet dogs are caramel- colored (75), white (57), black (66), and brown (48). On the other hand, in Marcabelí, dogs of brown (73), black (67), white (69), and caramel (40) colors are also frequent. Regarding household cats, the most predominant coat color is tabby, with 16 in

Balsas and 17 in Marcabelí, followed by gray combined with white (18 in Balsas; 13 in Marcabelí) and black (8; 10). Bicolor cats and caramel-colored ones are also observed, while mixes such as white with black or brown with black are found in smaller quantities.

Table 6. Distribution of Coat Color in Pets by Ownership Type and Canton.

Canton	Ownership	Pet	Coat Color	Count
Balsas	Street	Dog	Tabby	1
Balsas	Street	Dog	Bicolor	2
Balsas	Street	Dog	White	3
Balsas	Street	Dog	White with Brown	2
Balsas	Street	Dog	White with Black	4
Balsas	Street	Dog	Brown	3
Balsas	Street	Dog	Brown with Black	1
Balsas	Street	Dog	Caramel	3
Balsas	Street	Dog	Gray with White	1
Balsas	Street	Dog	Black	1
Balsas	Street	Dog	Salt and Pepper	1
Balsas	Household	Cat	Tabby	16
Balsas	Household	Cat	Bicolor	10
Balsas	Household	Cat	White	7
Balsas	Household	Cat	White with Brown	2
Balsas	Household	Cat	White with Black	8
Balsas	Household	Cat	Brown with Black	2
Balsas	Household	Cat	Caramel	13
Balsas	Household	Cat	Gray with White	18
Balsas	Household	Cat	Black	8
Balsas	Household	Cat	Tricolor	8
Balsas	Household	Dog	Tabby	3
Balsas	Household	Dog	Bicolor	7
Balsas	Household	Dog	White	57
Balsas	Household	Dog	White with Brown	20
Balsas	Household	Dog	White with Black	26
Balsas	Household	Dog	Brown	48
Balsas	Household	Dog	Brown with Black	9
Balsas	Household	Dog	Caramel	75
Balsas	Household	Dog	Chocolate	1
Balsas	Household	Dog	Gray with White	12
Balsas	Household	Dog	Black	66
Balsas	Household	Dog	Salt and Pepper	7
Balsas	Household	Dog	Tricolor	1
Marcabelí	Street	Dog	Gray Tabby	1
Marcabelí	Street	Dog	Bicolor	1
Marcabelí	Street	Dog	White	4

Marcabelí	Street	Dog	White with Brown	5
Marcabelí	Street	Dog	White with Black	4
Marcabelí	Street	Dog	Brown	7
Marcabelí	Street	Dog	Brown with Black	1
Marcabelí	Street	Dog	Caramel	9
Marcabelí	Street	Dog	Black	6
Marcabelí	Household	Cat	Tabby	17
Marcabelí	Household	Cat	Bicolor	7
Marcabelí	Household	Cat	White	9
Marcabelí	Household	Cat	White with Brown	4
Marcabelí	Household	Cat	White with Black	9
Marcabelí	Household	Cat	Brown	3
Marcabelí	Household	Cat	Brown with Black	1
Marcabelí	Household	Cat	Caramel	7
Marcabelí	Household	Cat	Gray with White	13
Marcabelí	Household	Cat	Black	10
Marcabelí	Household	Cat	Tricolor	7
Marcabelí	Household	Dog	Bicolor	11
Marcabelí	Household	Dog	White	69
Marcabelí	Household	Dog	White with Brown	17
Marcabelí	Household	Dog	White with Black	24
Marcabelí	Household	Dog	Brown	73
Marcabelí	Household	Dog	Brown with Black	12
Marcabelí	Household	Dog	Caramel	40
Marcabelí	Household	Dog	Chocolate	1
Marcabelí	Household	Dog	Gray with White	4
Marcabelí	Household	Dog	Black	67
Marcabelí	Household	Dog	Salt and Pepper	7

Source: Data extracted from field observations and surveys conducted with households.

The majority of dogs and cats living in households are between 1 and 5 years old, with a total of 207 dogs in each canton and 51 cats in Balsas, while Marcabelí records 47. In the group of puppies aged between 3 and 12 months, there are 53 dogs and 29 cats in Balsas, and 39 dogs and 24 cats in Marcabelí. Among the animals older than 5 years, there are 78 dogs in Marcabelí and 55 in Balsas, while cats of this age are few: 8 in Marcabelí and 6 in Balsas. In the group of animals younger than 3 months, there are 17 dogs and 6 cats in Balsas, and 4 dogs and 8 cats in Marcabelí. Among the street animals, the majority are adults, with 29 in Marcabelí and 17 in Balsas; puppies are scarce.

Table 7. Distribution of Coat Color in Pets by Age and Canton

Canton	Ownership	Pet	Age	Count
Balsas	Street	Dog	< 3 months	1
Balsas	Street	Dog	3-12 months	4
Balsas	Street	Dog	1-5 years	17

Balsas	Household	Cat	< 3 months	6
Balsas	Household	Cat	3-12 months	29

Balsas	Household	Cat	1-5 years	51
Balsas	Household	Cat	> 5 years	6
Balsas	Household	Dog	< 3 months	17
Balsas	Household	Dog	3-12 months	53
Balsas	Household	Dog	1-5 years	207
Balsas	Household	Dog	> 5 years	55
Marcabelí	Street	Dog	< 3 months	1
Marcabelí	Street	Dog	3-12 months	3
Marcabelí	Street	Dog	1-5 years	29
Marcabelí	Street	Dog	> 5 years	5
Marcabelí	Household	Cat	< 3 months	8
Marcabelí	Household	Cat	3-12 months	24
Marcabelí	Household	Cat	1-5 years	47
Marcabelí	Household	Cat	> 5 years	8
Marcabelí	Household	Dog	< 3 months	4
Marcabelí	Household	Dog	3-12 months	39
Marcabelí	Household	Dog	1-5 years	207
Marcabelí	Household	Dog	> 5 years	78

Source: Data extracted from field observations and surveys conducted with households.

Analyzing the Relationship Between Pet Ownership and Variables of Breed, Size, Gender, Coat Type, and Color, Age in the Cantons of Balsas and Marcabelí

Pet ownership shows a clear relationship with the type of animal ($p = 1.17 \times 10^{-6}$), as well as with its size and gender ($p < 2.2 \times 10^{-16}$), suggesting that these characteristics affect how pets are cared for. On the other hand, no correlation was found between ownership and breed ($p = 0.712$), indicating that breed does not play a role in pet ownership.

Table 8. Association Between Ownership and Pet Characteristics According to Fisher's Test.

Variable	P-Value	Alternative Hypothesis	Interpretation
Pet	1,17E-03	Odds ratio ≠ 1	Significant association between Ownership and Pet ($p < 0.05$)
Breed	0.712	Two-sided	No evidence of an association between Ownership and Breed ($p > 0.05$)
Size	< 2.2e-16	Two-sided	Highly significant association between Ownership and Size ($p < 0.05$)
Gender	< 2.2e-16	Two-sided	Highly significant association between Ownership and Gender ($p < 0.05$)

Source: Data extracted from field observations and surveys conducted with households.

The chi-square analysis revealed a significant relationship between ownership and coat type ($X^2 = 74.893$, $p = 0.02149$), as well as between ownership and age ($X^2 = 20.043$, $p = 0.02949$). This implies that these factors influence how pets are cared for. On the other hand, no relationship was found between ownership and coat color ($X^2 = 43.024$, $p = 0.1669$), suggesting that color is not a determining factor in pet ownership.

Table 9. Association Between Ownership and Pet Characteristics According to the Chi-Square Test.

Variable	X^2 (Chi-Square)	P-Value	Interpretation
Coat Type	74.893	0.02149	Significant association between Ownership and Coat Type ($p < 0.05$)
Coat Color	43.024	0.1669	No evidence of an association between Ownership and Coat Color ($p > 0.05$)
Age	20.043	0.02949	Significant association between Ownership and Age ($p < 0.05$)

Source: Data extracted from field observations and surveys conducted with households.

Evaluate the Factors Associated with Responsible Pet Ownership of Household Dogs and Cats in the Cantons of Balsas and Marcabelí.

The Logistic Regression Model in Table 10 identifies key factors that influence responsible pet ownership. Feeding and housing types are the most significant factors. Feeding with prepared food shows a strong positive relationship with responsible ownership ($p = 0.00026$), suggesting that owners who provide proper food are more committed to animal welfare. The type of housing, such as shelters and other suitable spaces ($p = 0.0002$ and $p = 0.0023$), is also significantly related to more responsible pet ownership. Exclusive housing has a marginally significant relationship ($p = 0.049$), indicating that a private space for the pet promotes better

Table 10. Logistic Regression Model on Factors Associated with Pet Ownership.

Variable	Estimate	Std. Error	z value	Pr(>|z|)	Significance
(Intercept)	-540,5	383,88	-1,41	0,159	
Feeding Type (Prepared food)	1,37	0,37	3,64	0,00026	***
Feeding Type (Scraps)	17,81	2666,64	0,007	0,994	
Feeding Frequency (3 times)	-0,27	0,41	-0,65	0,512	
Feeding Frequency (4 times)	-1,07	0,61	-1,75	0,08	.
Latitude	24,31	14,15	1,71	0,085	.
Longitude	-7,89	5,38	-1,46	0,142	
Supplement (Yes)	0,38	0,24	1,57	0,116	
Exclusive Housing (Yes)	0,55	0,28	1,96	0,049	*
Housing Type (SHELTER)	1,42	0,38	3,7	0,0002	***
Housing Type (OTHER)	1,17	0,38	3,03	0,0023	**
Housing Place (FREE) Body Condition (Ideal weight)	-0,63 1,09	0,25 1,05	-2,5 1,04	0,012 0,298	*
Body Condition (Overweight)	0,97	1,11	0,86	0,384	

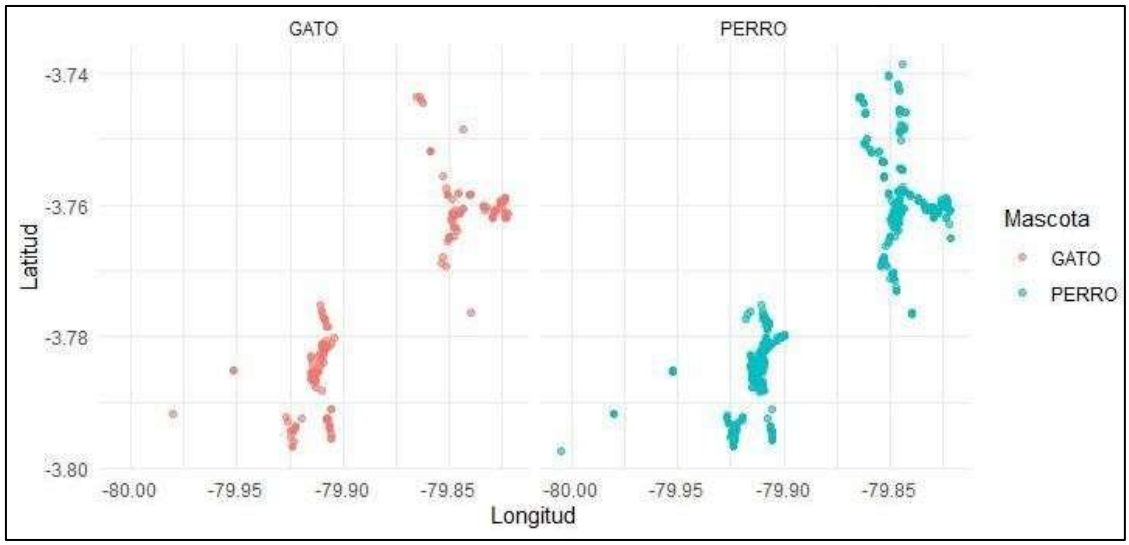
The distribution of responsible pet ownership by location and pet type shows how ownership patterns vary between dogs and cats in the cantons of Balsas and Marcabelí. This figure clearly illustrates that responsible pet ownership is strongly influenced by geographical location and the type of animal.

In urban areas, dog ownership is more prominent compared to cats, suggesting that dogs, due to their social and active nature, adapt better to these environments. On the other hand, cats, with their more independent and territorial behavior, tend to concentrate in more densely populated residential areas where they have access to shelters and food sources.

In rural areas, such as in Marcabelí, there is a more equitable distribution of pet ownership between dogs and cats, although there is a slight preference for dogs. This could be related to agricultural activities, which provide a larger space for dogs to move around and maintain their mobility, while cats remain in more specific and confined areas.

This distribution reflects not only the behavioral characteristics of each species but also how socio-economic, cultural, and infrastructure factors in each canton influence how owners take on the responsibility of pet ownership.

Figure 2. Distribution of Responsible Pet Ownership by Location and Pet Type.



Source: Data extracted from field observations and surveys conducted with households.

DISCUSSION

The study revealed that the majority of the animals are in young and early adult ages, suggesting a constant renewal of the population. Additionally, medium and large-sized dogs were more common, with mostly short coats, which could be related to potential morbidity causes in the study population and environmental conditions.

From a geospatial perspective, cats showed a more concentrated distribution, while dogs exhibited a dispersed pattern, indicating differences in their mobility and permanence in urban and rural environments. Statistically, significant associations were found between ownership and physical characteristics such as size, gender, and coat type, while breed and coat color were not determining factors.

The results of this study highlight the importance of understanding the factors influencing responsible ownership and the presence of street animals in different contexts. The prevalence of male and mixed-breed dogs may be related to a lower sterilization rate or differences in social perceptions regarding animal reproduction. The fact that size and coat type are associated with ownership suggests that certain physical characteristics may influence the likelihood of an animal being kept in a home or ending up on the streets. Additionally, the differentiated spatial distribution between dogs and cats could be linked to the higher mobility of dogs and the tendency of cats to remain in specific areas. These findings reinforce the need to implement awareness, sterilization, and adoption programs to improve the quality of life for domestic animals and reduce overpopulation and abandonment.

The results obtained in this study align with previous research that has documented that dogs tend to outnumber cats in rural and urban communities, where dog ownership is more frequent (Arluke & Rowan,

2020; Arruda et al., 2022; do Vale et al., 2021). Additionally, similar studies have found that size and gender are variables that can influence the likelihood of adoption and the permanence of animals in homes (Powell et al., 2021; Hawes et al., 2020; Cain et al., 2020), while breed and coat color do not always determine responsible ownership (Barrios et al., 2023; Menor-Campos, 2024; Slavney et al., 2021; Mears, 2024; Bradshaw, 2021). However, some research in urban contexts has indicated that the presence of specific breeds may be influenced by adoption trends or by the availability of population control programs (Abdulkarim et al., 2021; Carvelli et al., 2020; Prata, 2020). The differences in spatial distribution observed in this study have also been reported in other locations, where cats tend to concentrate in urban areas, while dogs can be found in both populated areas and peripheral zones (Kays et al., 2020; Candela et al., 2022; Bennett et al., 2021; Jaroš, 2021; Dunford et al., 2024).

The findings of this study strengthen the need to understand the factors influencing dog and cat ownership and distribution. Previous research has highlighted that the overpopulation of street dogs is often related to limited access to sterilization services and a lack of awareness about responsible ownership (Dimitrova, 2022; Lezama-García et al., 2025; Papavasili et al., 2023). Studies in various regions have identified that pet adoption may be conditioned by cultural, economic, and resource availability factors (McDowall et al., 2023), which explains the differences in the population composition of dogs and cats across different cantons. These results are also consistent with research suggesting that cats, due to their more independent behavior, tend to concentrate in urban areas where they can access shelters and food more easily (Vitale, 2022), while dogs tend to have higher mobility and territorial dispersion (Capellà & Gaunet, 2020).

One of the main limitations of the study is that it did not include variables related to owners' perceptions and practices regarding responsible pet ownership, which could have provided more detailed information on the factors influencing the permanence of animals in homes or their abandonment. Additionally, the information collected was based on specific observations and records, so aspects such as access to veterinary services, food, or the level of interaction of animals with the community were not considered. Another aspect to consider is that the study focused on two specific cantons, so the findings may not be fully generalizable to other regions with different dynamics in pet ownership.

Despite its limitations, this research provides valuable information on the distribution and characteristics of the dog population and, to a lesser extent, cats in local contexts, providing a basis for decision-making regarding animal welfare and pet population management. The findings can be used to design more effective strategies for population control, adoption, and education on responsible ownership in similar communities. Furthermore, the study emphasizes the importance of considering sociodemographic and spatial factors when formulating public policies aimed at reducing abandonment and improving the quality of life for domestic animals. These results can serve as a reference for future research aimed at further understanding the factors that influence the relationship between people and their pets, promoting a more comprehensive approach to managing domestic fauna.

CONCLUSIONS

The results obtained in this study provide a comprehensive analysis of pet ownership patterns in the cantons of Balsas and Marcabelí, highlighting the prevalence of mixed-breed dogs in both responsible ownership situations and street conditions. This finding suggests that mixed- breed dogs, due to the lack of proper reproductive control, represent a significant proportion in both conditions, highlighting the lack of effective measures to regulate the animal population in the studied areas.

Regarding purebred dogs, their presence is mainly associated with responsible ownership, particularly among household dogs, with breeds such as Chihuahua and French Poodle standing out. This pattern underscores the relationship between owning specific breeds and the owners' commitment to animal welfare, emphasizing the importance of education and public policies aimed at the responsible management of pets.

Although Balsas has a higher population density and commercial activity, the street dogs in this canton are predominantly mixed-breeds. In contrast, Marcabelí shows a greater diversity of purebred dogs in the household population, although mixed-breeds still dominate among street animals.

This study highlights that sociodemographic factors, along with the characteristics of urban and rural environments, have a considerable impact on responsible ownership practices and animal population management. The findings emphasize the urgent need to implement awareness programs on animal welfare and responsible ownership, as well as sterilization and control policies to mitigate overpopulation,

abandonment, and the risks associated with zoonotic diseases. In this regard, policies must be adapted to local particularities to ensure sustainable management of the dog and cat population, promoting a balanced coexistence between humans and animals in the different contexts studied.

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