Dog population Assessment in five towns in the Metropolitan area of Santiago and Valparaíso regions in Chile

Surveys conducted in March 2020 and report submitted in July 2020

Designed, conducted, and report written by the MEIA-team

Background

HSI's dog and cat welfare work in Chile began in 2011 with the goal of implementing a pilot program that would offer affordable and accessible veterinary services to the pet-owning communities east of the city of Santiago and along the coast, south of the city. In addition to improving the welfare of dogs and cats in communities with difficult access to veterinary services, the program aimed to prevent neglect and abandonment by providing spay/neuter and wellness services (vaccinations, tumor removal, wound clean-up and stitching, etc.) to keep pets with their families. With a small annual budget since its inception, the program has reached over **30,043** dogs and cats.

The program launched with one veterinary consultant and, due to a limited budget, no additional help was brought on until eight years later. In 2019, two part-time consultants were hired to assist with clinic data collection, running and organizing the campaigns and all aspects of program coordination, including more robust government collaboration.

Given the limited funding, HSI focused on growing the program organically, identifying local stakeholders and groups to do the on-the-ground logistics of organizing a spay/neuter and wellness campaign to take place once a month, or as often as feasible, in their city. Community buy-in allowed us to secure an important level of financial sustainability early on, and our effort to highlight the knowledge and professionalism of local veterinarians meant that the program could continue, if needed and to some degree, without an external funding source.

Members of the communities in which HSI works perceive the spay/neuter and wellness campaigns that takes place in their cities as efforts largely put together by a local group with the help of a veterinary team from Santiago. HSI's focus is on building capacity and trust in local groups to ensure long-term sustainability of the program.

It is important to note that cats constitute 33 % of the total animals receiving HSI services during field clinics (dogs 67%).

Contents

Acknowledgement

We would like to congratulate the Chile Companion Animals and Engagement (CA&E) team for successfully implementing their first dog population survey in the country as well as all the volunteers who have tirelessly supported our efforts and ensured that data was collected accurately and on time.

HSI Dog Management Program in Chile background and objectives

The below overview, Chart 1 summarizes the number of field clinics that have been conducted by town, providing an idea of how active/present HSI has been in the towns between 2015 and 2019. However, it does not indicate how many dogs and cats were sterilized in total or per clinic (data available upon request).

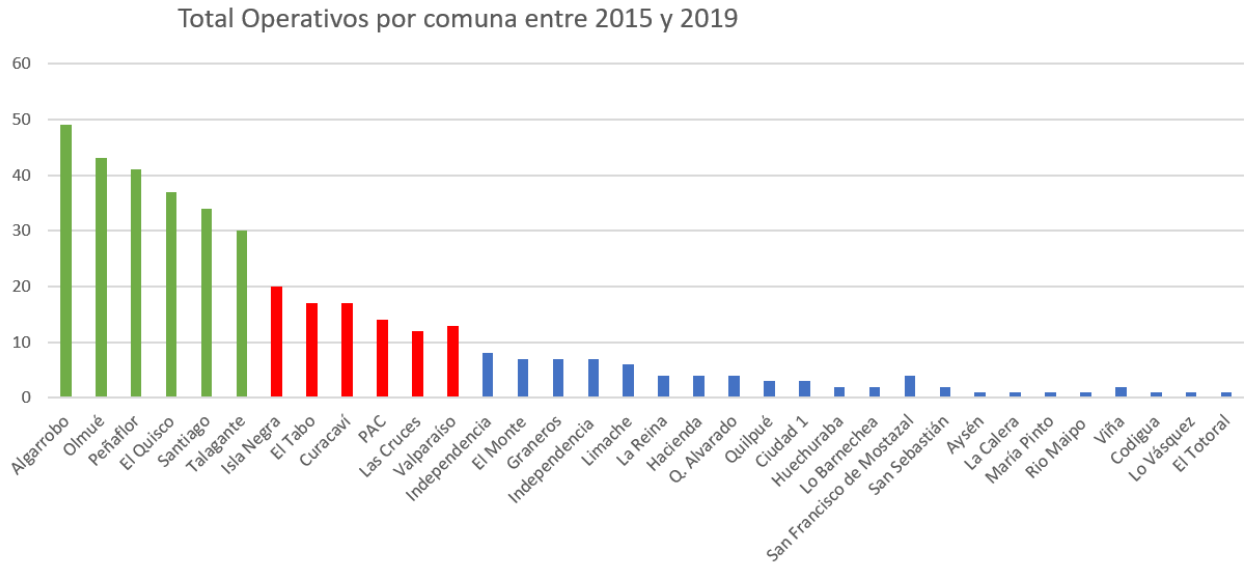


Chart 1: Clinic locations over the past four years were clustered into three groups: 1. The first group of six locations (green) each held between 30 and 49 clinics; 2. The second group of six locations (red) each held between 10 and 15 clinics; 3. The third group of 23 locations (blue) held less than 10 clinics each.

The main goal of the program is to provide affordable/ accessible veterinary services to towns, which have a need for (but limited access to) veterinary services. Spay/Neuter and general wellness field clinics (vaccines, tumor removal/treatment, cleaning and stitching of wounds, mange treatment etc.) are held mainly on weekends. The national government of Chile has a responsible pet ownership program (Programa de Tenencia Responsible de Animales Compañia, PTRAC: attached to their environmental education and protection program) which provides financial support to municipalities and organizations conducting sterilization and general wellness clinics. The level of financing and scope of this National Program has varied over the years since its inception in 2014. HSI is not able to apply for government funding given that the organization is not legally registered in Chile. HSI has collaborated with various branches of the Chilean

government to the extent possible. For instance, HSI partnered with the Ministry of Health to implement a spay/neuter and deworming project in Puerto Aysen, in the extreme south of the country, in an area known for high incidence of hydatid disease cases in humans. The organization also participated in round table discussions and as of late, approached the PTRAC to support their efforts after a report on the performance of the government's spay/neuter program came back unfavorable. Taking advantage of the MEIA's team visit to Chile, a meeting was arranged with the National Coordinator of the PTRAC who expressed an urgent interest in cooperation with HSI for survey implementation and in making PTRAC more evidence-based. After the survey, it was planned to meet the Undersecretary in charge to explain HSI's evidence-based approach and global reach, however due to the COVID-19 outbreak the meeting was unfortunately cancelled. Email conversations between the CA&E Latin America team and the Ministry followed, and other areas of collaboration have emerged.

Metrics

The data gathered was used to generate a variety of metrics that are necessary to track future impact, understand current realities and needs and identify areas of opportunity.

KAP survey metrics:

Dog and cat density in each town: By dividing the recorded dogs and cats by the households surveyed, a per household dog/cat density (dogs/HH and cats/HH) is obtained. Multiplied by the households in the town (last census data is from 2017) we estimated the dog and cat population of the towns surveyed.

Age structure: The age structure of a population reflects the level of turnover and indicates how "stable" a population is. A relatively low turnover (dogs are spread across the age groups from young to senior) will support humane efforts since sterilized and vaccinated dogs remain longer in the population, rather than being replaced by intact and unvaccinated dogs.

Dog ownership practices and attitudes: We recorded different questions pertaining to dog keeping practices and animal welfare, as well as attitudes toward rabies vaccinations, sterilizations and the acquisition and raising dogs.

Street dog survey metrics:

Data gathered during transect surveys were used to generate a variety of metrics, which can in turn be used to track the impact and progress of the project. These included:

Index of dog density: This metric was obtained by dividing the number of dogs counted on each transect by the length of the transect and is expressed as "dogs / km". Note: This metric does not account for incomplete detection, but still provides a relative indicator of underlying dog density that can be used to quantify change over time or patterns of dog density over space.

Age structure: By recording whether each dog sighted was a puppy (< 6 mo. of age) or adult, a simple estimate of population age structure was obtained.

Body condition score and skin conditions: A simple index of dog condition and health status was obtained by rating the body condition of each dog using a simplified veterinary scale (C1 – C5, with C1 corresponding to a malnourished condition and C5 corresponding to an over-nourished condition). In addition, visually obvious skin maladies (i.e., mange) were recorded where observed.

Survey Design and Sampling Framework

This document describes survey work that was conducted by HSI in urban areas of five towns in two regions in Chile: the metropolitan areas of Santiago and Valparaíso. The results generate a baseline assessment as well as an evaluation of the impact that has been achieved so far in these towns (in those that HSI has held sterilization and wellness clinics in the past). This report is intended to highlight the main design features of the surveys and its most useful results.

Survey Design

This survey had to serve both purposes of a baseline and evaluation survey. Using the information available and provided, locations were stratified into different categories based on two criteria, 1) geographical location (Inland or Coastal) and, 2) number of S/N/wellness clinics done by HSI in the last 5 years (Table 1).

Peñaflor and El Monte were pre-selected by the program team as two inland cities that are similar in geography and size, and different in that the HSI team has conducted multiple spay/neuter/wellness visits to Penaflor and only a few to El Monte. Algarrobo, Curacavi, Isla Negra and San Sebastian were randomly selected from the list provided by the program manager. Due to manpower limitations, we did not survey Curacavi and based on the most recent census (2017) Isla Negra belongs to the Commune El Quisco (coastal) and San Sebastian is part of the Commune Cartagena (coastal), hence we surveyed El Quisco and Cartagena. For all towns and cities surveys were conducted in urban areas.

Table 1: Towns and communities HSI has held clinics in (Based on provided information).

Category	City name	Camps (HSI)	Location	Selected for Survey
A	Algarrobo	49	Coastal	X
	Olmué	43	Inland	
	Peñaflor	41	Inland	X
	El Quisco	37	Coastal	X
	Santiago	34	Inland	
	Talagante	30	Inland	
B	Isla Negra	20	Coastal	
	El Tabo	17	Coastal	
	Curacavi	17	Inland	
	PAC	14		
	Las Cruces	12	Coastal	

	Valparaiso	13	Coastal	
C	Independencia	8		
	El Monte	7	Inland	X
	Graneros	7	Inland	
	Independencia	7		
	Limache	6	Inland	
	La Reina	4	Inland	
	Hacienda	4	Inland	
	Q. Alvarado	4		
	Quilpue	3	Inland	
	Ciudad 1	3		
	Huechuraba	2	Inland	
	Lo Barnechea	2	Inland	
	San Francisco de Mostazal	4	Inland	
	San Sabastian	2	Coastal	X
	Aysen	1		
	La Calera	1	Inland	
	Maria Pinto	1	Inland	
	Rio Maipo	1	Inland	
	Vina del mar	2	Coastal	
	Codigua	1	Inland	
	Lo Vasquez	1	Inland	
	El Totoral	1	Inland	
	Graneros	1	Inland	

KAP (Knowledge, Attitude and Practices) sampling and protocol

Sampling

Household surveys were conducted using a systematic random sampling method (stratified random sampling) to sample a portion of the total households in the area. Systematic random sampling in comparison to simple random sampling is less susceptible to researcher error. Stratified random sampling is a variant of random sampling that produces a more efficient return of representative, replicated data in environments that vary systematically over space in one or more critical respects. A short, informal review of stratified-random sampling can be viewed at https://en.wikipedia.org/wiki/ Stratified sampling, with more rigorous treatments available in Sutherland (2006) (pgs. 43 – 51) and Thompson (2002). There are many published studies that have used stratified random sampling for population studies; a few examples can be viewed in Sniff and Skoog (1964), Link and Sauer (1997), and Potvin et al. (2005). In short, this technique requires that the study area be divided into units, and that each unit be assigned to distinct

categories, or strata, based on one or more factors that might influence dog density and distribution. Units to be sampled are then randomly selected within each stratum, and data from those samples are used to characterize the remainder of the units in that same stratum.

The total number of households to be interviewed was set to 400 for each town (confidence interval of 95% with an acceptable margin of error at 5%). However, two of the coastal towns did not reach the target number because the proportion of vacation homes was too high on the survey routes. Survey routes were naively selected by the MEIA team to prevent biased selection and ensure a cross sectional sampling of the towns. Routes were similar for both street surveys and KAP surveys.

Survey Protocol

To explore knowledge, attitude, and practices regarding owned and street dogs we designed a household questionnaire. The cross-sectional survey was conducted using the smartphone app Epicollect5, which contained a prepared survey form. Households were surveyed by a team of two trained surveyors using questionnaires about 15-25 mins in length. Questionnaires included or excluded questions depending on whether the household owned a dog or not and whether they owned a cat. Inclusion criteria for households were:

1. The person being interviewed had to be over 18 years old and a resident at the address
2. In the case of dog ownership, the interviewee had to be the main caretaker or at least well informed about the dog or dogs in the household

Participants were asked to confirm their consent to be part of the study and had the option to opt-out before the interview started and at any time during the interview. Once questionnaires were completed, the completed forms were saved and uploaded to a cloud-based database by the surveyor.

To remain consistent throughout the survey either the left or right side of the street was surveyed, and households were selected following an interval of every third household. In case nobody was available at the selected household, the household after was surveyed instead. If the household was occupied by a person who rented the place for vacation it was recorded as such in the form and the next household was interviewed instead.

Roaming dog survey design and protocol

Survey Design

We designed one survey route in each town (prior to visiting so as to remain unbiased). The blue line (Image 1) is the monitoring route, drawn in Google Maps using the “draw a driving route” function. This ensures that the routes are unbiased and neither areas with a lot or fewer dogs are targeted or avoided. The flag icon indicates the survey start point and the house icon marks the end point of the survey. The black line is an add-on route for the KAP survey.

Image 1: Street survey route (blue) and the additional KAP survey route (black) for Peñaflor; KAP surveys were conducted on both blue and black routes.

Survey Method and Protocol

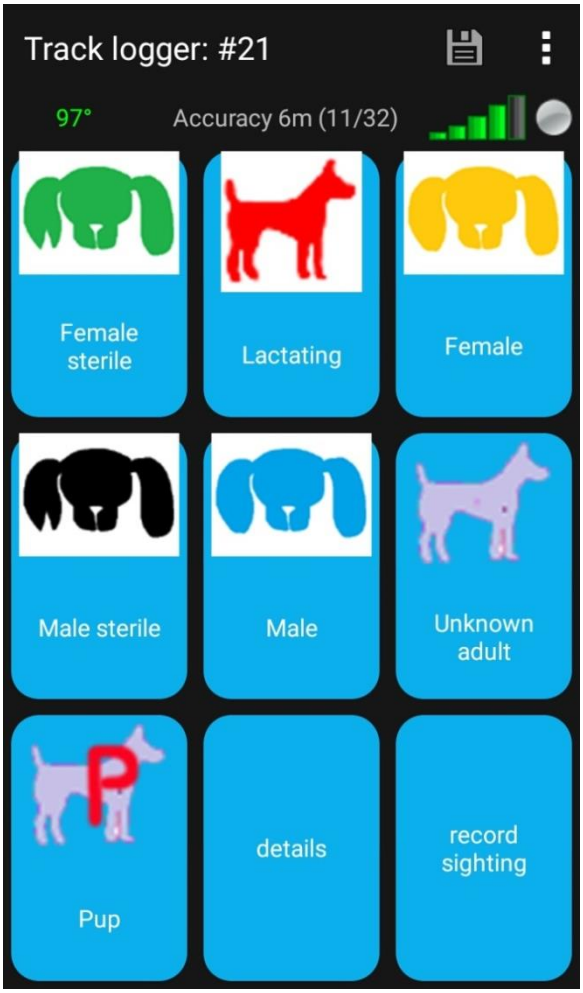
To generate an estimate of dogs per street kilometer we created set routes, also called index or standard routes, in Google Maps along residential roads and highways but avoiding express ways (dogs tend to avoid these roads). Routes were marked with a starting (flag) and end point (house) (as in Image 1). For easy access, the routes were saved as KML files and stored in Google My Places, which can be accessed by smartphone (online and offline).

Following the dog counting protocols, the surveyor recorded all the roaming dogs visible on both sides of the survey route. A survey team, consisting of a driver and an observer in a car (or by foot), conducted the surveys early in the morning. The observer used both the Google Maps app and the OSM Tracker app on a mobile phone. OSM tracker is an application that enables the observer to record a dog sighting and relevant specifics about a dog (female, male or unknown adult, sterile/notched female or sterile/notched male, pup, lactating) as well as record whether the dog had a collar (or other sign of ownership) and welfare indicators such as skin problems and body condition scores (BCS1 to BCS5)), which are saved together with GPS coordinates of the sighted dog. OSM Tracker produces a track record of all sighted dogs and their specifics along the route which was followed during the survey. The data was subsequently downloaded and stored in an Access database for analysis. The survey routes in all towns accept Penāflor (due to the Covid-19 outbreak) were surveyed on two consecutive days by the same survey team to

observe daily variation in dog populations. If daily variation exceeded 10% the survey track would be repeated.

Dogs are recorded in the mobile application OSM Tracker by tapping the relevant dog icons that were pre-set for the survey. The icons are designed in a distinctive way to avoid confusions among the dogs' categories (see below). OSM Tracker requires no internet or phone signal at the time of recording and it receives GPS connection quickly once initiated. The App records each dog's location and details as entered by the operator.

Image 2 & 3. Dog counting layout screen for OSM Tracker application



Detailed Findings

Dog and Cat population density, population estimates and composition

Dog populations in every country consist of different sub-populations or states (ecological term). We looked specifically at 1) Street dogs, 2) Owned dogs and 3) Roaming owned dogs. The third category is difficult to quantify but can be estimated from the survey responses regarding dog owner behaviour and pet keeping culture. We explore each of these sub-populations in the following chapters using the results from both the KAP and street surveys.

Owned Dog and Cat Populations

We spoke with 2,212 households of which we interviewed a total of 1,651 (541 households either declined or were not permanent residents (e.g. rented the house for holidays)): a response rate of 74.6%. The sample size (400) was calculated to produce results with a 95% confidence level, however we reduced this sample size for towns with high numbers of vacation homes (see Table 2). **We estimate an owned dog population and owned cat population for all five towns (Table 2).**

Dog ownership was very similar across the five towns (Table 2) with about two-thirds of households owning a dog. Cat ownership varied a lot more from under a third to over 42% of households owning a cat (Table 2).

By dividing the recorded owned dogs/cats by the dog/cat owning households, a per owning household dog/cat density (dogs/DOHH and cats/COHH) is obtained. Multiplied by the proportion of households owning dogs/cats in the town (last census data is from 2017) we estimate the dog and cat population of the towns surveyed (Table 2). Cartagena had the most dogs and cats per households compared to other surveyed areas. Observations during the survey would also support this as well as the street survey results (and an unofficial count of roaming cats) discussed in the following chapter.

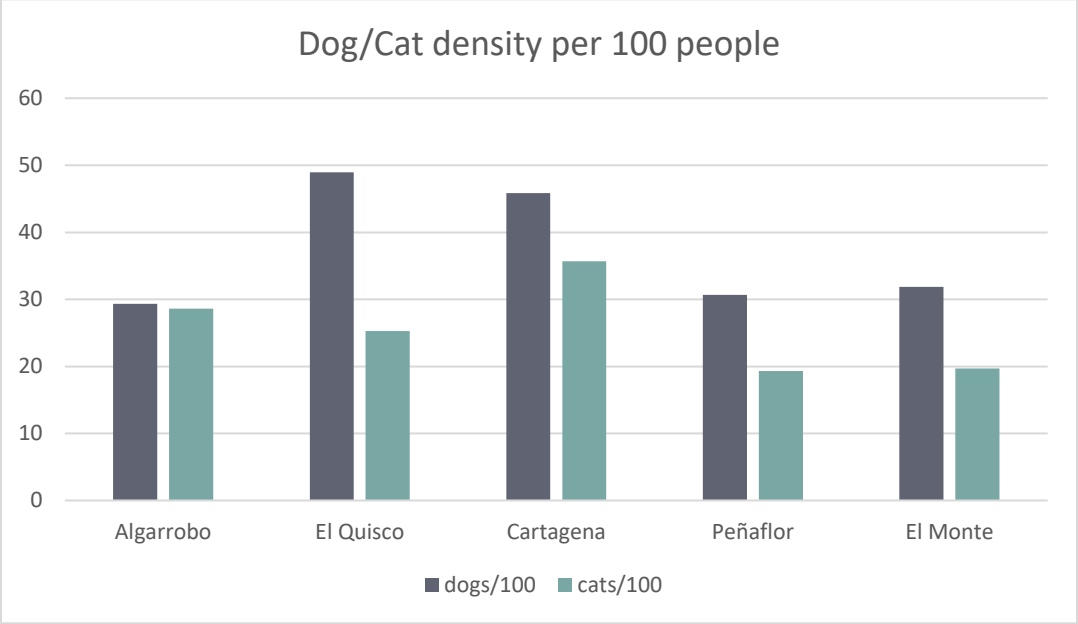
Table 2: Owned dog and cat population estimates. (HH=Household; DOHH=Dog Owning Household; COHH=Cat Owning Household)

Town Name	HH sample size	Total HH (Census 2017)	HH owning a Dog	HH owning a Cat	Dogs recorded	Cats recorded
Algarrobo	222	4306	134	82	209	204
El Monte	401	9275	261	122	489	306
El Quisco	285	6049	181	91	368	190
Peñaflor	437	25030	286	136	478	304
Cartagena	306	7613	207	131	419	326
	Dogs/HH	**Cats/HH**	**Dogs/DOHH**	**% DOHH**	**Est Dog Population**	**Est Cat Population**
Algarrobo	0.94	0.92	1.56	60.36	4054	3957
El Monte	1.22	0.76	1.87	65.84	11440	7078

El Quisco	1.29	0.67	2.03	63.51	7811	4033
Peñaflor	1.09	0.70	1.67	66.13	27665	17412
Cartagena	1.37	1.07	2.02	67.65	10424	8111

If we look at the dog and cat density in relation to total human population (Census 2017) rather than absolute numbers, we can see that El Quisco and Cartagena have in fact a higher density of dogs per people (Chart 2). For Algarrobo, [1]as a more developed coastal holiday-town, the number of dogs/100 people is similar to the towns closer to Santiago, however the cat density is closer to the other coastal towns. El Monte and Peñaflor, almost neighbours geographically and similar in set-up, have an almost identical density of cats and dogs per 100 people. El Quisco and Cartagena are both coastal and have a much higher proportions of resident dwellers compared to coastal Algarrobo, which might explain why more dogs are present on the street during the survey period (see next section), which is right after the summer vacation time.

Chart 2: Dog and cat density across the surveyed towns



Free Roaming Street Dog Population (Owned and unowned dogs on the street)

Free roaming street dog density varied significantly between the towns during the survey hours between 6.15am and 8am. Below is a table summarizing the number of free roaming dogs recorded as well as the

[1] See Government publication on socioeconomic level of these areas (CASEN 2015) if necessary https://www.google.cl/url?sa=t&source=web&rct=j&url=http://observatorio.ministeriodesarrollosocial.gob.cl/indicadores/docs/region/Valparaiso.pdf&ved=2ahUKEwj90ZzmkIXsAhWKLLkGHeIZB3EQFjAEegQICxAI&usg=AOvVaw2YHsZ0Ac-Yu96-RrI6CoNX

average number of free roaming dogs per km using a detectability estimate of 0.44 (generated through Sight/Re-sight experiments in other countries and cities) we estimate a total free roaming street dog population for each town (Table 3).

Table 3: Free roaming street survey results and summary

City/Town Name	Total street length	Total free roaming street dogs counted	Track length (KM)	Dogs/Km	% Dog with Collar	Estimated Total Free Roaming Street Dog Population
Algarrobo	201.7	31.0	18.5	1.7	4.7	768
El Quisco	252.3	82.0	21.9	3.7	0.4	2147
Cartagena	144.2	199.0	19.4	10.3	4.3	3362
Peñaflor	184.1	118.0	21.0	5.6	3.5	2545
El Monte	86.3	118.5	18.3	6.5	4.2	1270

During all surveys (n=9) we only saw one lactating female and few puppies were observed on the streets. This indicates a relatively low reproductive activity of street dogs at the time (season). The composition and welfare indicators were similar across all towns, however we recorded one dog with skin issues in each of the coastal towns but not in the inland towns (El Monte and Peñaflor). We recorded zero dogs that were either emaciated (BCS1 or BCS2) and zero overweight dogs (BCS4 or BCS5). Both indicate that the roaming dog population across the towns had an observed good welfare and that there was no difference between coastal and inland towns.

Owned Dogs Allowed Roaming on the Streets - Confinement Practices

From the street survey, dogs who were wearing a collar, bandana, or other sign of ownership were recorded in similar proportions across the towns, with the exception of one survey in El Quisco that recorded only a single individual. These results are however inconsistent with the reports of household survey respondents where the proportion of owned dogs allowed to roam differs significantly between towns (see next section). When we use the percentage of owned dogs reported to being allowed to roam during the morning hours (6 am-12 pm) we estimate that the below number are roaming on the streets during those hours.

- → **Algarrobo 2937**
- → **El Quisco 2811**
- → **Cartagena 2422**
- → **Peñaflor 9002**
- → **El Monte 5766**

As previously mentioned, roaming dogs on the street will be a mixture of various sub-populations: those that live on the street (stray/abandoned and community dogs) and roaming owned dogs. For a long time street dogs have been viewed as dogs without any direct relationship with humans except garbage scavenging and/or the occasional non-directed feeding. However, increasingly more research shows that street dogs primarily depend on provided food rather than garbage, reflect the human population they live with, and that roaming dogs can belong to various sub-populations of dogs including those owned. This means that the human-dog relationship and human behaviour (individually and as a community) affect and govern the entire dog population regardless of whether the dogs live on the street or in homes. Currently we do not have a method that will provide us, on a large scale, with exact estimates of the sub-populations of roaming dogs. Instead, we try to understand how frequently and at what times dog owners let their dogs roam. To triangulate the responses and establish whether owners accurately answer confinement questions we ask about it in different ways (e.g. 'When do you allow your dog to roam?' and 'Where is your dog currently?', which is summarized below.

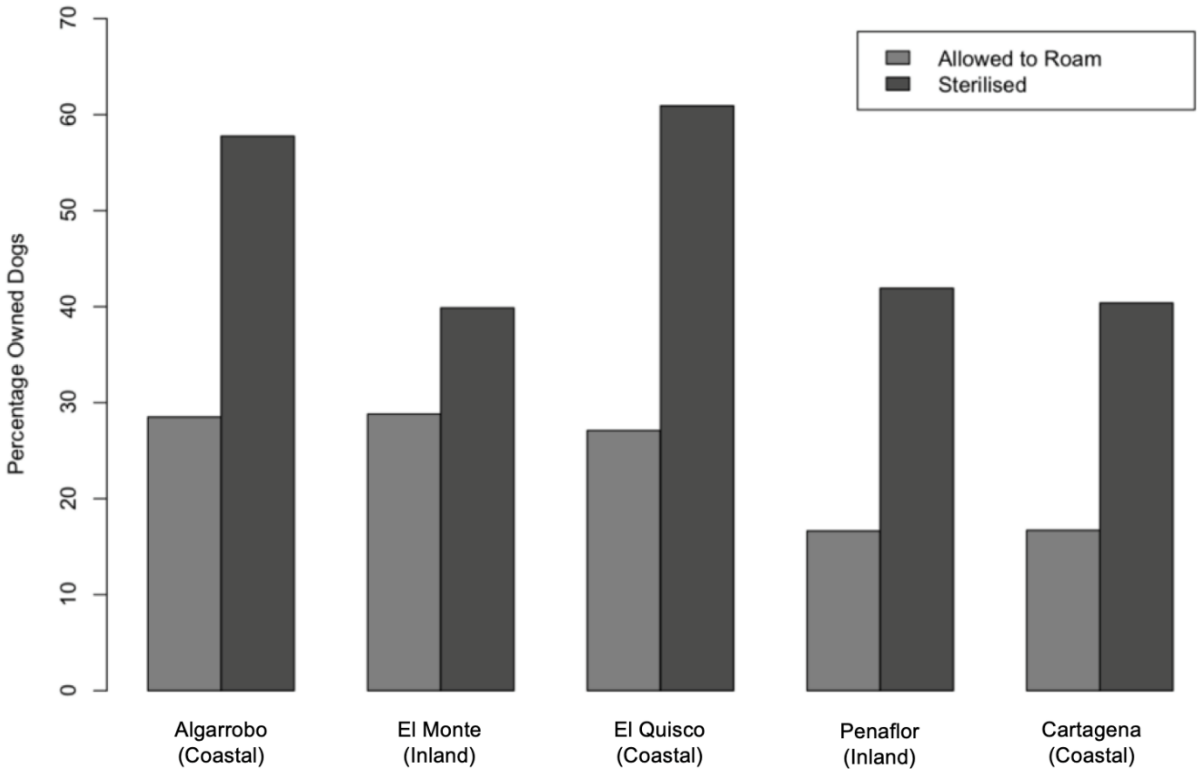
Overall, most dogs were not allowed to roam at any time, however a significant proportion of the population was able to roam at specific times during a 24-hour day. Roaming times varied between towns and households with peaks in the morning and evening (Table 4). We recorded the highest number of households letting their dog(s) roam in El Monte (28.85%), Algarrobo (28.5%) and El Quisco (27.1%), which translates to almost a third of the owned dog population roaming the streets at some point during the day. Most people let their dogs roam either only in the morning hours or in the morning and evening hours. It indicates that the morning is the best time to count roaming dogs and that surveys should start around 7am or 8am, when people wake up.

Table 4: Percentage of households letting their dog out over during a 24-hour period

City/Town Name	**Early mornings - before 6 am**	**Mornings - between 6 am - 12 pm**	**Afternoon - between 12 pm - 5 pm**	**Evening - between 5 pm - 10 pm**	**Night - after 10 pm**	**Morning (6am-12pm) and Evening (5pm-10pm)**	**Never**	**Total roaming at some point**
Algarrobo	0.97	13.04	1.45	0.97	3.86	8.21	71.50	28.50
El Monte	1.03	7.41	1.23	6.58	3.91	8.64	71.19	28.81
El Quisco	0.00	7.86	5.96	3.52	0.00	9.76	72.90	27.11
Peñaflor	0.21	2.08	0.21	4.78	1.46	7.90	83.37	16.63
Cartagena	0.48	1.45	1.94	1.45	2.18	9.20	83.29	16.70

There appears to be no relationship between the percentage of dogs sterilized and percentage allowed to be free at some hours of the day (roam at some point) across the different towns (Chart 3).

Chart 3: Percentages of dogs sterilized versus those allowed to roam across the surveyed towns



There is also no statistical association between the gender of the dog and the location of the dog at time of the interview (X^2 = 0.001, df = 1, p-value = 0.974). However, there is a statistical association between the gender and being allowed to roam at some point (X^2= 5.936, df = 1, p-value = 0.015). There were slightly more male dogs allowed to roam at some point (Table 5) but there was no difference between the gender of the dogs who roamed at the time of the survey.

Table 5: Association of sex with whether dogs are allowed to roam

Gender	Never Allowed Free	Allowed Free	% Allowed Free

Female	754	194	20.5
Male	754	254	25.2

We also looked at whether the sterilization status of dogs determined if they were roaming at the time of the interview and whether they were allowed to roam at some point. There was no statistical association between the sterilization status of the dogs and whether they were roaming at the time of the interview (X^2= 1.458, df = 1, p-value = 0.227) or at all (X^2= 1.932, df = 1, p-value = 0.164).

Dogs reported as being sterilized by an HSI clinic were not less likely to be allowed to roam at some point compared to dogs sterilized by others (X^2= 0.537, df = 1, p-value = 0.464) (Table 6). However, the proportion of dogs sterilized by HSI is too small to draw strong conclusions.

Table 6: Association of sterilization agent with whether dogs are allowed to roam; total number of dogs reported

By whom	Never Allowed Free	Allowed Free	% Allowed Free
Sterilised by HSI	30	11	26.8
Sterilised by others	641	168	20.8

The proportion of dogs wearing a sign of ownership is shown below. The highest number of dogs wearing a sign of ownership was recorded in coastal Algarrobo; the inland towns and coastal Cartagena reported much lower proportions of dogs wearing a sign of ownership.

- → Algarrobo 51.69%
- → El Quisco 47.15%
- → Cartagena 32.69%
- → Peñaflor 32.85%
- → El Monte 33.47%

Dogs wearing a sign of ownership (e.g. collar) were less likely to be roaming at the time of the interview (X^2 = 13.319, df = 1, p-value = 0.0002) and less likely to roam at some point (X^2= 10.071, df = 1, p-value = 0.0015). Dogs with a sign of ownership from coastal towns (Algarrobo, El Quisco, Cartagena) are less likely to be allowed to roam compared to those without, while in inland towns (El Monte, Peñaflor) this relationship does not appear to be significant (Table 7).

Table 7: Association of ownership signs and roaming allowance by town

City/Town Name	Never Free	Allowed Free	% Allowed Free
ALGARROBO			
Sign of Ownership	85	22	20.56
No Sign of Ownership	63	37	37.00
X-squared = 6.072, df = 1, p-value = 0.01373			
EL MONTE			
Sign of Ownership	112	52	31.71
No Sign of Ownership	232	88	27.50
X-squared = 0.74017, df = 1, p-value = 0.3896			
EL QUISCO			
Sign of Ownership	137	38	21.71
No Sign of Ownership	132	62	31.96
X-squared = 4.3828, df = 1, p-value = 0.0363			
PEÑAFLOR			
Sign of Ownership	139	22	13.66
No Sign of Ownership	262	58	18.13
X-squared = 1.232, df = 1, p-value = 0.267			
CARTAGENA			
Sign of Ownership	135	9	6.25
No Sign of Ownership	209	60	22.30
X-squared = 16.238, df = 1, p-value = 5.586e-05			

When survey respondents were asked why they think pet owners in their neighbourhood let their dogs roam freely, many indicated that it was a habit of the owners and some even reported that they believed it was something that the dogs needed to have good welfare (Table 8).

Table 8: Responses to 'Why do you think people in your neighbourhood let their dogs roam on the street?'

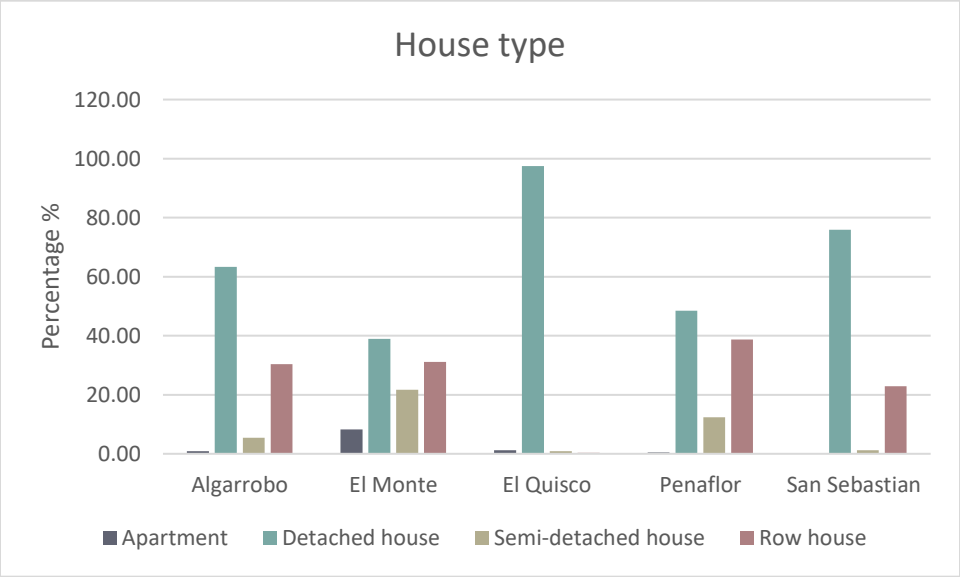
City/Town Name	People are too lazy to walk their dogs (%)	People are used to let their dogs roam/habit of letting their dogs roam (%)	Dogs need to roam to be happy/have good welfare (%)	I don't know (%)
Algarrobo	10.45	59.20	13.43	16.92
El Quisco	37.67	31.98	7.32	23.04
Cartagena	21.81	57.35	10.05	10.78
Peñaflor	11.25	45.22	14.01	29.51
El Monte	29.73	41.16	9.77	19.33

Detailed Household Questionnaire findings

Survey participation and household characteristics

Interviewees were more likely to be female (almost two-thirds in all towns, with the exception of El Quisco which recorded 44.72% male). The largest age group, around half, in all towns was over 55 years of age, with an approximately equally distribution across the other age ranges (see Appendix for more details). Housing types varied across towns but detached houses were dominant in interviews in all towns (Chart 4).

Chart 4: Housing types by town

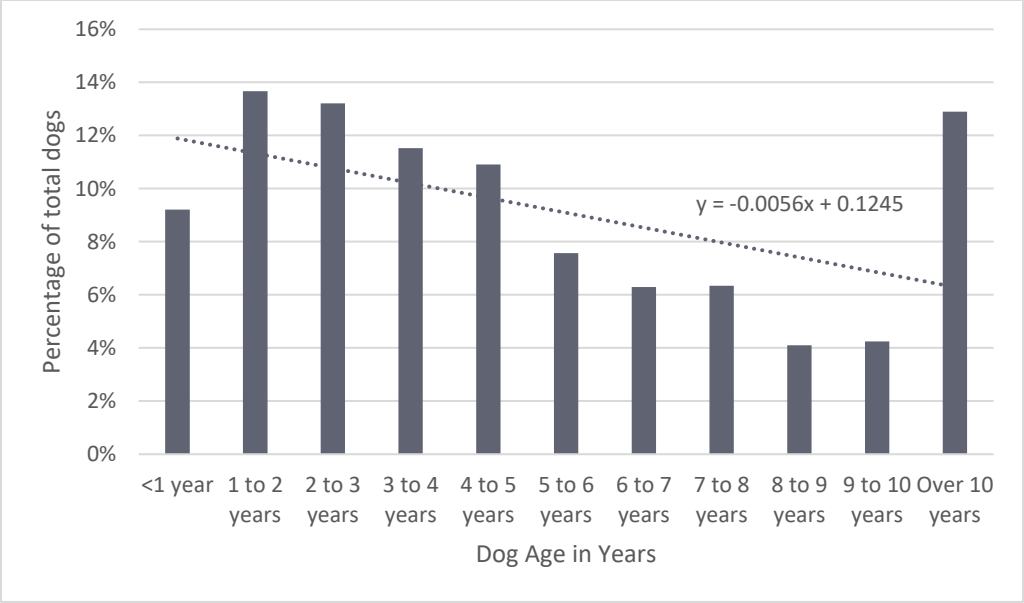


Owned dog demography, health, and reproductive indices

Just over half of the owned dogs recorded (1956) were male (51.5%). Only El Quisco and Cartagena showed a larger proportion of female dogs, 53.1% and 52.3% respectively, compared to the other towns and the female:male ratio difference between towns is statistically significant (X^2=11.27, df=4, p=0.0237).

The age histogram (Chart 5) shows most dogs are young, however many dogs are also senior: 27% of the dog population was 7 years or older. This is significant as it represents a low turnover (dogs become seniors and live longer) of the dog population. A low turnover is good for humane dog population management approaches since high proportions of sterilized and vaccinated dogs can be sustained with much smaller financial investments.

Chart 5: Percentage of dogs by age



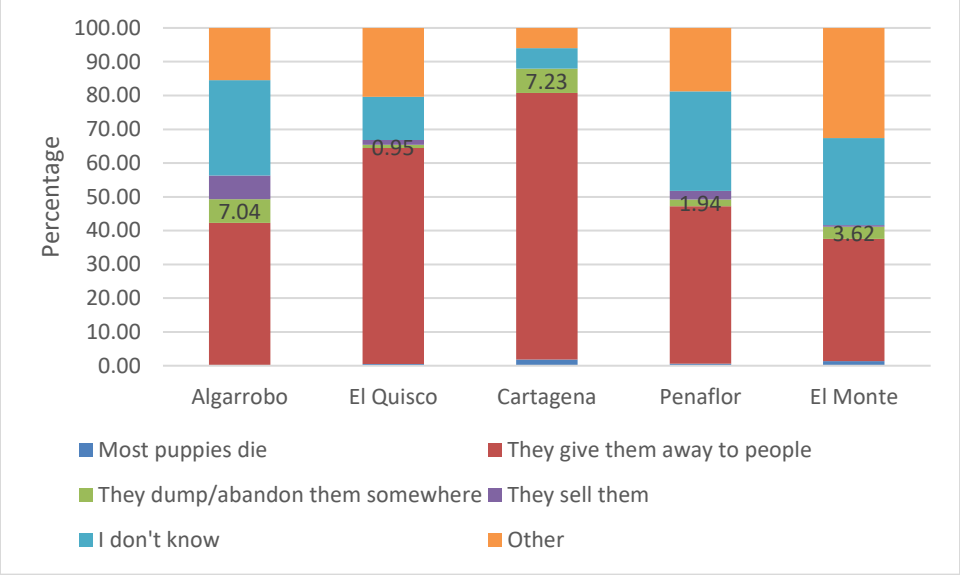
About two third of female dogs had never had a litter at the time of the interview and most female dogs that had had a litter in the past had only had one (Table 9).

Table 9: Percentage responses to 'How many times has she had puppies in her life?' by town

City/Town Name	**0**	**1**	**2**	**3**	**4**	**More than 5**	**Don't Know**
Algarrobo	70.83	15.28	6.94	4.17	0.00	0.00	2.78
El Quisco	69.57	17.35	3.57	1.02	0.51	2.04	0.00
Cartagena	75.51	13.30	4.43	3.45	2.46	0.49	0.00
Penaflor	68.83	18.61	3.90	1.73	0.87	0.87	5.19
El Monte	75.86	17.87	6.28	3.38	0.00	0.97	1.93

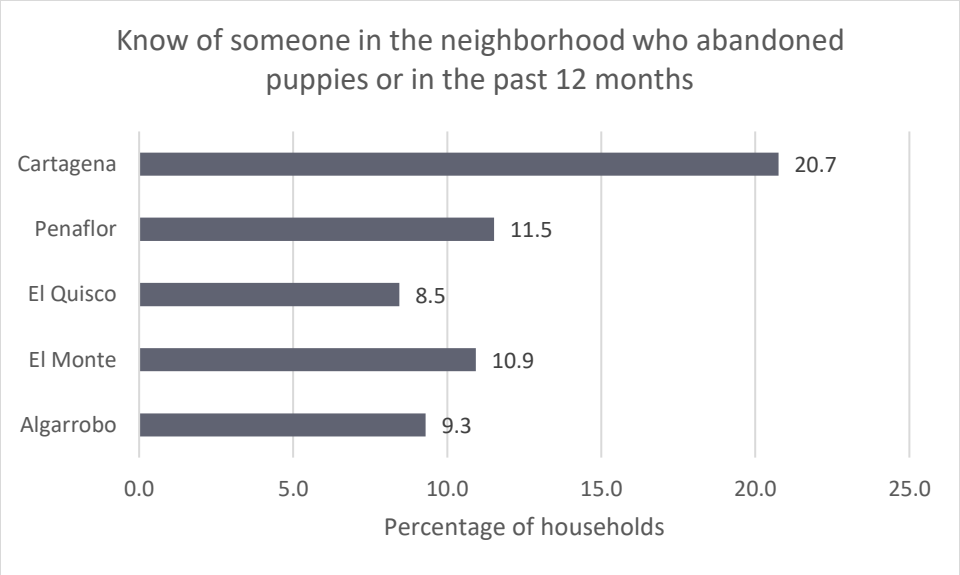
To explore the fate of the puppies born to owned females, we asked what interviewees and their neighbours do with their puppies. While it is common to give them away, it appears to be somewhat common to abandon puppies also, especially in Algarrobo and Cartagena but also to some extent in El Monte (Chart 6). The large proportion of respondents who chose to answer "I don't know" and "Other" could also be an indication that they did not feel comfortable reporting what they do with puppies born in their households.

Chart 6: Responses to 'What do you and other people in your neighborhood usually do with puppies?' by town



However, when specifically asked if they knew of someone in their neighbourhood who had abandoned puppies or dogs in the past 12 months, more respondents were aware of people who abandoned dogs than claimed to do so themselves. In Cartagena, with the largest street dog population (see Table 3), almost twice as many participants reported to know of abandonment (Chart 7). There was no clear difference between coastal and inland towns.

Chart 7: Percentages of respondents who knew of puppy abandonment in the past puppies in the past 12 months by town



Sterilization rates were generally low but especially in the inland areas and Cartagena (Table 10). The biggest impact in towns that had HSI sterilization clinics was in Algarrobo with 9.24% of owned dogs reported to be sterilized by HSI. Peñaflor has been a long-term program-town, however HSI sterilization efforts were only recognized for 5.00% of the owned dogs. The main reason over half of pet owners did not sterilize their dogs was that they considered it not necessary, leaving a lot of potential for education campaigns.

Compared to sterilization, higher percentages were reported for vaccinated dogs against rabies[2] (73.57%), however similarly low percentages were vaccinated by HSI (2.30%) (*Table 10*). A high percentage of respondents reported that their dog had seen a veterinarian in the past 12 months:

- → Algarrobo 81.55%
- → El Quisco 59.24%
- → Cartagena 70.49%
- → Peñaflor 76.09%
- → El Monte 66.46%

Table 10: Sterilization status and sterilization organisation of owned dogs by town

City/Town Name	**Is this dog sterilized? (%)**				**By whom was the dog sterilized? (%)**			
	No	I do not know	Yes		Government Veterinary Hospital	I do not know	HSI vet	Private Veterinarian
Algarrobo	42.23	0.00	57.77		39.50	5.88	9.24	45.38
El Quisco	38.75	0.81	60.43		48.43	6.28	0.45	44.84
Cartagena	59.32	0.48	40.19		57.83	4.82	3.01	34.34

[2] Vaccination against rabies is a legal requirement in Chile

Peñaflor	57.59	0.83	41.58		23.50	7.00	5.00	64.50
El Monte	60.00	0.21	39.79		54.45	3.14	7.33	35.08
	Was this dog vaccinated against rabies in the last 12 months?				**By whom was the dog vaccinated against rabies?**			
	No	I do not know	Yes		Free vaccination campaign	I do not know	HSI vet	Private Veterinarian
Algarrobo	17.87	0.97	81.16		37.50	0.00	4.17	58.33
El Quisco	23.85	3.25	72.90		43.12	0.74	0.00	56.13
Cartagena	25.18	1.94	72.88		57.00	1.33	0.67	41.00
Peñaflor	21.21	4.37	74.43		19.27	6.15	4.19	70.39
El Monte	31.28	2.26	66.46		42.11	0.00	2.48	55.42

Dog owners were relatively knowledgeable on the importance of taking dogs to the vet for yearly exams and high proportions of dogs in Algarrobo, Cartagena and Peñaflor (overall average 78.82%) saw a veterinarian in the past 12 months. However, much fewer dogs in El Quisco and El Monte saw a veterinarian in the previous 12 months (see above paragraph).

Sterilization status of owned cats and willingness to pay for spay/neuter

Cats are a common and popular pet in Chile. Sterilization status of owned cats was varied but cats were likely to be sterilized if other catswere sterilized in the household. As summarised in Table 11, a large proportion (as high as 74.39% in Algarrobo) of households had their cats sterilized. There does not appear to be a difference between the coastal and inland towns, although El Monte showed fewer sterilizations by household (49.18%) than in the other towns.

Table 11: Sterilization status of cats per household by town

City/Town Name	**None (%)**	**Yes, all (%)**
Algarrobo (coastal)	18.29	74.39
El Quisco (coastal)	18.68	72.53
Cartagena (coastal)	24.43	60.31
Peñaflor (inland)	22.06	65.44
El Monte (inland)	49.18	42.62

Only a very small proportion of cat owning households reported to be unwilling to sterilize their intact cats (6.08%), however a significant proportion (38.64%) would only sterilize their cats if it were offered for free (Table 12).

Table 12: Responses to 'Would you be willing to sterilize the cat(s) and if so, how much would you be happy to pay?' by town

City/Town Name	No (%)	Only if it is free (%)
Algarrobo (coastal)	4.9	39.0
El Quisco (coastal)	6.2	35.4
Cartagena (coastal)	5.3	48.9
El Monte (inland)	5.7	41.8
Peñaflor (inland)	8.3	28.1

Quality of the relationship with street dogs and abandonment in coastal areas

When observing of dogs in parks and the manner in which free roaming dogs and people move around each other, there seems very little conflict. Dogs cool down in municipal buildings next to people waiting to attend a meeting, dogs greet strangers (the researchers) not only in play but also by leaning onto strangers in parks. Water bowls (often home-made and attached to trees, fences or similar) can be found throughout various parts of the towns. When asked whether participants feed street dogs, most responded that they do not, yet a nearly a third (27.14% average) reported that they feed street dogs to some extent. The number of participants who reported daily feeding was on average 14.14% (see Table 13).

Water provision is an indicator which we have come across repeatedly in our surveys around the world as a 'level of care' for owned dogs, and the same is true for street dogs. While many people acknowledge that dogs need food and provide either food or leftovers, the provision of water to street dogs is a step ahead and shows a more positive and improved relationship between the communities and their respective street dog populations. Many people provided water to street dogs (Table 14) across all five towns, ranging from 9.6 % in Peñaflor to 27.3% in El Monte. There was no clear difference between coastal and inland towns.

Table 13: Responses to 'Do you regularly feed dogs on the street or in public places?' by town

City/Town Name	No, Never (%)	Sometimes (%)	Every Day (%)	Several times a month (%)	Yes, I have multiple groups of dogs who I feed (%)	Once a week (%)
Algarrobo	60.8	20.7	15.8	1.4	1.4	0.0
El Quisco	57.2	30.2	9.8	2.1	0.0	0.7
Cartagena	41.4	35.5	19.4	3.0	0.3	0.3
Peñaflor	59.3	27.9	10.1	1.1	0.2	1.4
El Monte	61.5	21.4	15.6	1.5	0.0	0.0

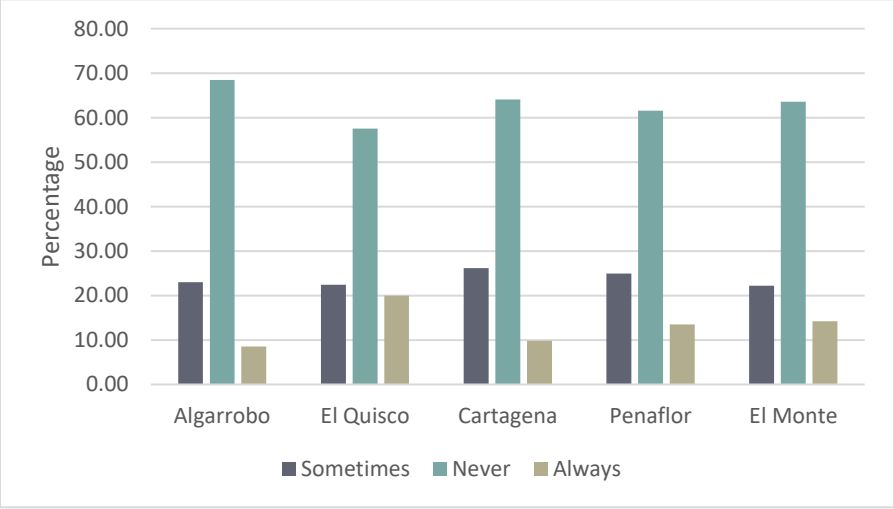
Table 14: Responses to 'Do you regularly provide water to dogs on the street or in public places?' by town

City/Town Name	Yes, in bowls on the streets (%)	Yes, where I feed dogs (e.g. park, public places etc.) (%)	Yes, where I work (%)	Total (%)
Algarrobo	5.9	6.3	4.5	16.7
El Quisco	9.5	9.1	0.7	19.3
Cartagena	15.4	3.6	3.0	22.0
Peñaflor	5.0	3.9	0.7	9.6
El Monte	23.8	1.5	2.0	27.3

In general, people did not report that they feel threatened by the street dogs in their towns (Chart 8), but there were over 20% of people in each town, who sometimes (per week) feel threatened by street dogs. When asked (unprompted answers) what they feel is most concerning about living with street dogs, dog bites were by far the largest concern followed by concerns for hygiene. Proportion of households reporting dog bites being their main concern:

- → Algarrobo 29.28%
- → El Quisco 35.09%
- → Cartagena 25.82%
- → Peñaflor 37.61%
- → El Monte 43.50%

Chart 8: Responses to 'How frequently (over a week) would you say you feel threatened by street dogs you meet on the streets/public spaces/parks etc.?' by town



Most people reported that they live on a street with street dogs (Chart 9). There does not seem to be a consensus whether the number of dogs has increased or decreased over the past year (Table 15). Trends in the number and perceived density of street dogs over time should provide a good indicator whether the humane Dog Population Management (DPM) is achieving changes in terms of responsible pet

ownership and dog management. In general, the perception of the number of dogs on the streets is similar to our quantitative street survey assessments in which Cartagena and El Monte show the highest densities of dogs per km.

Chart 9: Responses to 'On an average day, how many dogs would you say are roaming on the street you live in?' by town

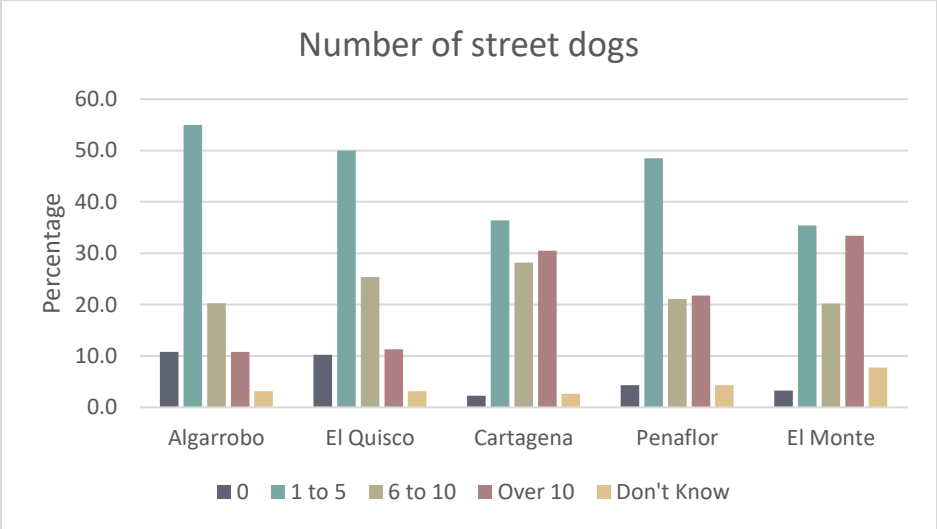


Table 15: Responses to 'Over the last 12 months, do you think there has been a change in the number of roaming dogs in your community, and if so, in what direction?' by town

City/Town Name	**Decreased (%)**	**Increased (%)**	**Neither decreased nor increased (%)**	**I don't know (%)**
Algarrobo	17.57	46.85	29.28	6.31
El Quisco	25.26	30.53	30.53	13.68
Cartagena	8.17	64.05	23.53	4.25
Peñaflor	35.93	15.10	36.84	12.13
El Monte	20.85	41.71	29.40	8.04

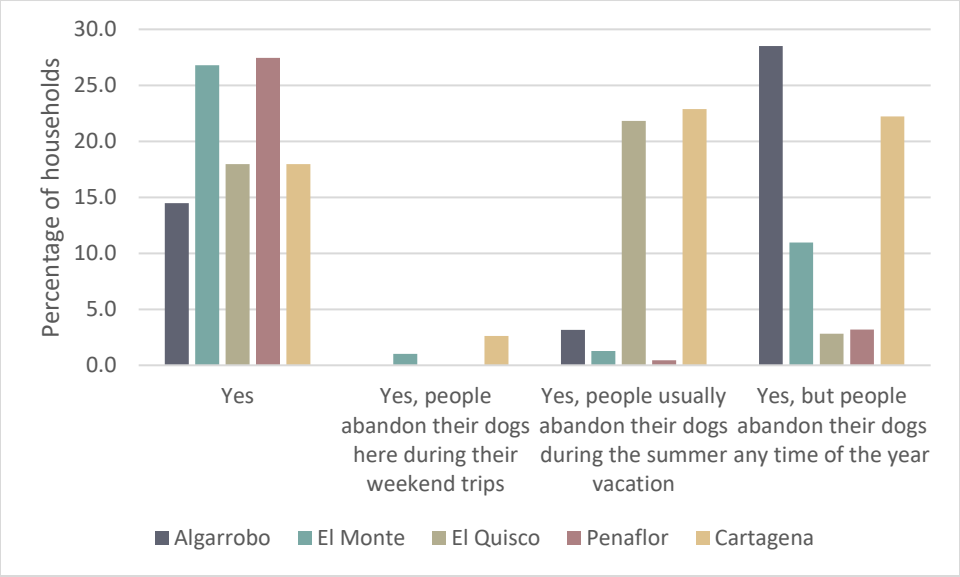
A common perception of roaming dogs in communities is that dogs are abandoned by tourists in the coastal area. The survey was conducted at the end of summer vacation period and we asked households whether they had encountered new dogs in their neighbourhood and if so, whether they knew where these dogs came from. Approximately 50% or greater of respondents in all towns were unaware of new dogs in their neighbourhood, with the exception of Cartagena where only 28.4% did not see any new dogs in the neighbourhood over the past 2 months. Proportion of households reporting to not have seen new dogs in their neighbourhood in the past two months:

→ Algarrobo 46.6%
→ El Quisco 51.4%

→ Cartagena 28.4%
→ Penaflor 63.1%
→ El Monte 47.9%

Respondents who reported seeing new dogs in their neighbourhoods during the past 2 months (summer vacation time) did not necessarily associate these sightings with abandonment of dogs over the vacation period (Chart 10).

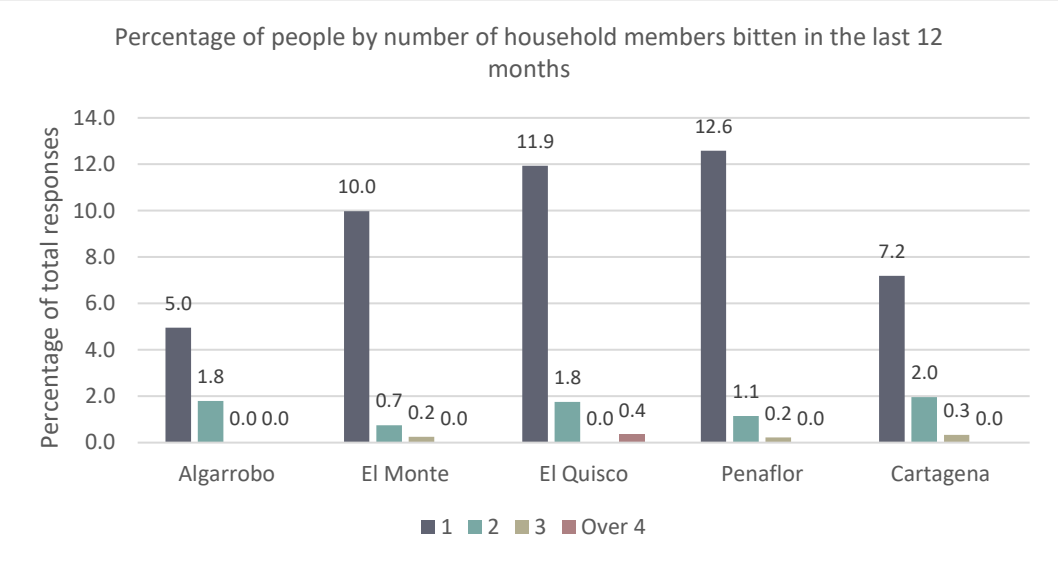
Chart 10: Responses to 'Are you aware of any new dogs roaming in your neighbourhood, in the last 2 months? Do you know where they come from?' by town



Dog bites

Dog bite rates among households was considerably high[3] (Chart 11) in the past 12 months: an average of 11% of households across the five towns had experienced at least one dog bite. There was no significant difference in the dog bite rate between towns (X^2=3.96, df=4, p=0.4114).

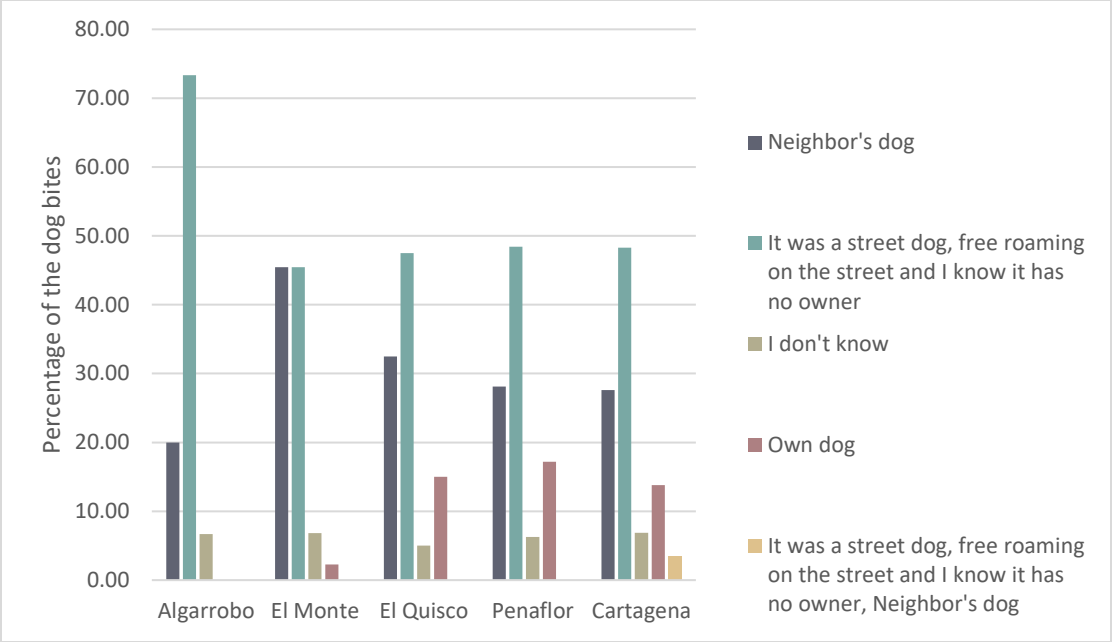
Chart 11: Responses to 'Has any household member been bitten by a dog in the last 12 months while in your town? And if so, how many people?' by town



While many households report unowned street dogs as the perpetrator of the bite (>45% for all towns), there is a significant number of dog bites occurring from neighbours' dogs (average 41.93%) as well as those owned by the household itself (average 9.65%) (Chart 12).

Chart 12: Responses to 'Which dog were they bitten by?'

[3] HSI KAP results globally: India – Ahmedabad (5%), Vadodara (6%), Nainital (3%); Mauritius (8%); La Paz, Bolivia (19.6%); Quezon City, Philippines (5%);



Discussion and Program Recommendations

We suggest that future surveys include rural areas surrounding the towns HSI works in to better understand the situation in Chile and better advise those municipalities. Furthermore, such additions would provide a necessary understanding of the interactions between rural and urban dog populations; research has found that human-mitigated dog movements between rural and urban settings influence population dynamics [4].

Baseline surveys should be conducted before any program is implemented in new areas, and, if focus areas are to be developed, further surveys and research should be conducted to ensure the program is evidence-based and has metrics in place.

The main results and recommendations from this report are as follows:

- **Sterilization program**: There appears to be no significant difference between towns that had a few HSI clinics and the ones that had a high number of HSI clinics. 1.) A low population turnover is helpful, however effective programs should always aim to target high numbers in a short time period to generate a population level impact[5]. The results of this survey indicate that on average although nearly half of pets were sterilized, numbers are lower than required to make an overall

[4] Villatoro, F. J., Sepúlveda, M. A., Stowhas, P., & Silva-Rodríguez, E. A. (2016). Urban dogs in rural areas: Human-mediated movement defines dog populations in southern Chile. *Preventive veterinary medicine*, *135*, 59-66.

[5] Kisiel LM, Jones-Bitton A, Sargeant JM, Coe JB, Flockhart DTT, Canales Vargas EJ, et al. (2018) Modeling the effect of surgical sterilization on owned dog population size in Villa de Tezontepec, Hidalgo, Mexico, using an individual-based computer simulation model. PLoS ONE 13 (6): e0198209. https://doi.org/10.1371/journal. pone.0198209

impact in the towns surveyed. We suggest efforts need to be adjusted to achieve higher levels of sterilization. 2.) The proportion of HSI sterilized dogs is low in all towns, regardless of the intensity of the HSI program. For example in Peñaflor (where we conducted the highest number of S/N clinics of all the sample towns, and as a representative high-effort (30-49 clinics 2015-2019; Chart 1) town in the HSI program) only 5% of the sterilized dogs were reportedly sterilized by HSI , 64.5% by private veterinarian and 23.5% by government. 41.5% of the total population was sterilized. It is unclear whether HSI has sterilized dogs that were reported under the "private vet" category as HSI branding and visibility is very low, however either way HSI's clinics will need to either or both 1. Be organized in a less ad-hoc manner with public campaigning and 2. HSI branding and visibility should be increased. (e.g. HSI branded pet passports for health records) Additionally, high numbers of litters by private dogs show that education to change behavior is still needed as reproduction in the private dog population is still high.

- **Dog Welfare**: Dogs appear to be in relatively good health overall, both on the street and in homes. Water provision is regular and extends to those that do not belong to the respective households. Fixed water and feeding stations on the streets represent general good community care provided to both dog populations. However, around 35% dogs in Cartagena and El Quisco did not see a veterinarian in the past 12 months, which could possibly be improved if low-cost veterinary services were more regularly available. Overall, welfare of confined dogs was good during the door-to-door surveys, however a few welfare issues were observed (e.g. repetitive behavior, matted coat etc.) where welfare could be improved. In general, it can be said that if the HSI program wants to improve welfare of dogs in the towns surveyed, it could focus on creating positive welfare for already confined dogs, which have all the five freedoms, but they could be improved. As the program aims to provide wellness veterinary care in the communities.

- **Abandonment of dogs**: Dog abandonment in El Monte and Peñaflor households does not correlate with vacation periods (the towns are not vacation towns), however it must be considered whether city dwellers from Santiago abandon their dogs in these nearby towns (El Monte and Peñaflor are approximately half an hour by car from central Santiago), and whether it is still the norm to abandon a pet when no longer wanted. Looking at the behavior of abandonment globally, abandonment occurs throughout the year, with increases around the vacation season. Summer vacation is therefore unlikely to be the only time for abandonment in Chilean towns (see responses in the relevant sections). Cartagena, possessing a very high number of households reporting new dogs in the past 2 months (summer vacation time), has a high number of residential dwellers compared to the other coastal towns and a very different demographic. "Tomas" and other low income/illegal settlement-type dwellings were prevalent in Cartagena. While it appears that vacation time has an influence on the abandonment of dogs, households (22.2%) also report that abandonment is high throughout the year, which is only also reported in El Quisco (21.8%). Chile has been recognized as a developed country since 2016 and like in many other developed countries, campaigns against the common practice of abandoning dogs and its acceptability should be the focus to address this trend over the summer.

- **Government partnership**: In order to achieve higher numbers of sterilizations in all towns in which HSI works in, it is advisable to collaborate with the government. The survey results show that the government, despite reaching nearly half (average 44.74%) of the owned dog population in the towns surveyed, is still not reaching enough. HSI programs have reached only a few percent of owner dogs by comparison. A partnership would guarantee that sufficient funding would be available and significant sterilization levels could be achieved, following the guidance of HSI's humane DPM experience globally. Interest in a partnership to conduct surveys as well as create evidence-based programs for rural and urban areas of Chile was expressed by the Ministry Undersecretary in a meeting during the Survey period. However, it has been noted that HSI is unable to receive funds from the government as HSI is not legally constituted in the country, hence this point cannot be considered at this point.

- **Cat sterilization**: On average 63% of all cats in households were sterilized, however nearly 40% of the owners of unsterilized cats reported to only sterilize their cat if it was offered for free. Therefore, it is helpful that the national program continues to offer cat sterilizations. Campaigns should further aim to improve the cultural norms around responsible cat ownership. HSI's involvement could potentially help the government in planning a more evidence-based program.

- **Dog bites**: Currently out of the scope of HSI's program, however the results suggest that campaigns should target this as a public health problem; aim to increase responsible pet ownership (e.g. appropriate confinement and good welfare/positive welfare) and support the creation of responsible community by-laws to involve the community in the dog population management. Good examples are Bogota in Colombia and Calgary in Canada, where a One Welfare approach has made a measurable and lasting impact.