HUMANE SOCIETY INTERNATIONAL

## Dog \& Cat Population Survey with Knowledge, Attitudes, and Practices Assessment Survey at several urban and rural locations of Costa Rica

June 2022


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## Report Summary

A monitoring, evaluation, and impact assessment survey, or MEIA survey, was carried by Humane Society International (HSI) in Costa Rica in July/August 2022. The three general goals of this MEIA survey were to 1) gather baseline data on dog-cat populations, both stray and owned; and 2) assess current knowledge, attitudes, and practices regarding responsible pet ownership in Costa Rica, and 3) use this data to assess feasibility of a companion animal program in Costa Rica. This document is intended to provide the background and programmatic context for this survey, and to present our research methodology, main findings, conclusions, and recommendations.

HSI surveyed households in four urban sites, three rural sites, and two rural coastal communities that were located adjacent to protected land.


Our main quantitative findings regarding the owned dog population are summarized in the table below. Free roaming dogs in the street may include owned dogs that are allowed to roam, as well as unowned strays, and community dogs.

| Site | Sample Size <br> $\left(\mathrm{H}^{*}\right)$ | Estimated Owned <br> Dog population | Estimated Owned <br> Cat Population | Sterilization Rate <br> of Owned Dogs |
| :--- | :---: | :---: | :---: | :---: |
| Curridabat | 452 | 16,268 | 8,554 | $71.6 \%$ |
| La Union | 415 | 37,227 | 17,577 | $59.8 \%$ |
| Montes de Oca | 393 | 9,596 | 4,845 | $81.1 \%$ |
| Cartago | 419 | 29,199 | 14,850 | $57.1 \%$ |
| Tortuguero (Pococi) | 52 | 56,732 | 18,136 | $71.7 \%$ |
| San Francisco (Pococi) | 34 | $\mathrm{~N} / \mathrm{A}$ | $\mathrm{N} / \mathrm{A}$ | $35.1 \%$ |
| Northern rural area | 162 | $\mathrm{~N} / \mathrm{A}$ | $\mathrm{N} / \mathrm{A}$ | $48.6 \%$ |
| Eastern rural area | 80 | $\mathrm{~N} / \mathrm{A}$ | $\mathrm{N} / \mathrm{A}$ | $43.9 \%$ |
| Southern rural area | 161 | $2,168 \mathrm{HH}$ |  |  |
| Sum |  |  | $55.2 \%$ |  |

*HH= Households

## Our main qualitative findings include the following:

1. Compared to urban sites, rural sites tended to have a higher turnover rate of the owned dog population, as indicated by the larger population of younger dogs. Urban sites on average had a larger aging dog population, while rural sites on average had a larger population of younger dogs. This may be due to a lack of access to affordable veterinary care in rural areas, which prevents dogs from reaching an older age.
2. There is a web of interactions between free-roaming dogs, wild jaguars, humans, and wild sea turtle species in rural coastal sites, as has long been known by local communities and conservation authorities. Both the free-roaming dogs and jaguars scavenge and feed on sea turtle eggs and hatchlings during the nesting season. Outside of the nesting season, jaguars will predate free-roaming dogs and cats.
3. Cases of animal cruelty were often underreported. We found that the major barriers to reporting incidences of animal cruelty involving domestic animals were an unwillingness to get involved, a perception that it is not the individual's responsibility, and a lack of knowledge of how and where to report such cruelty cases.
4. The coastal area of Tortuguero and its nearby neighbor, San Francisco, were included as survey sites. Tortuguero has seen more animal welfare programmatic work than the harder-to-access site of San Francisco. Targeted animal welfare efforts in Tortuguero have been successful thus far, as shown by the difference in sterilization rate and vaccination rate between Tortuguero and the nearby site of San Francisco. Both sites face many of the same difficulties and barriers to responsible pet ownership; however, Tortuguero has had more targeted animal welfare programs, in particular those run by ASVO. We not only see a difference in metrics between these sites, but the data also suggest a different petowning culture: participants in San Francisco were more likely to own dogs for protection than
participants in Tortuguero. It is possible that the animal welfare work performed in Tortuguero by ASVO and other local stakeholders has increased the human-canine bond from a utilitarian relationship to something deeper. Residents of San Francisco are limited by the difficulty of transporting their pets by boat to services in Tortuguero.

Based on these findings, we recommend an animal welfare program with the following components:

1. Humane education, for both school-age children as well as short, concise education seminars for new pet owners and for pet owners newly registering already owned animals; and an Animal Ambassador Program through which community members are trained to act as points of contact for animal-related concerns when official veterinary services are unavailable. Examples of their function could include relaying reports of animal cruelty, handing out resources on upcoming animal health events, and basic emergency animal care.
2. Education on how and when to make a formal complaint regarding animal welfare. An infographic circulated on social media or an official pamphlet may be of use.
3. Affordable veterinary services, including traveling veterinary services for remote sites, and affordable pet-safe transportation to veterinary clinics.

## Acknowledgements

HSI thanks the hardworking volunteers that carried out this survey: Krisya Nataly Retana Sanchez; Katherine Torres Ramirez; Keila Zuñiga Castillo; Raxell Liliana Arroyo Azofeifa; Jonathan Alvarado Vega; Andrea Granados Chacon; Darling Morales Solís; Ingrid Coulson Perez; Andrea Induni Vizcaino; Fabiola Morice Rodriguez; Karolina Marín Bermudez; Jean Carlo Rojas Uba; Fredder Mata Chaves, James Zuñiga (ASVO).

HSI also thanks photographer Luis Jose Villalobos Venegas for his permission to use two of his photographs in this report.

The HSI MEIA team would like to thank the HSI-Latin America team for their ongoing collaboration and support, including Sofía Herra, Grettel Delgadillo, Andrea Borel, Diana Mena, and Diana Rodriguez. Both teams thank consultant Sebastian Alfaro for his incredible hard work and organization.


## Background

## COMPANION ANIMAL OWNERSHIP PRACTICES IN COSTA RICA

Dog ownership is a common practice in Costa Rica, with 50.5\% of surveyed households in Costa Rica owning a dog as per a 2016 study carried out by World Animal Protection ("Estudio Nacional Sobre Tenencia de Perros En Costa Rica 2016" 2016). This study found an average of dog density of 1.8 dogs per household, 27.92 dogs per 100 people. Nearly half ( $45.5 \%$ ) of all owned dogs were received as a gift, highlighting a popular practice of gifting animals. In comparison, $22.9 \%$ of owners bought their dog, $13 \%$ rescued their dog from the street, and $7.7 \%$ adopted their dog from a shelter. A consequence of this gifting culture, as suggested by this 2016 study, is that many households (over 70\%) did not discuss the required responsibilities associated with owning a dog prior to obtaining the dog. This can lead to irresponsible pet ownership practices, or possibly even animal welfare concerns and cruelty. Another consequence of this pet culture where pet responsibilities are often not discussed is that a strong bond never develops between the pet and the owner, a situation that facilitates pet abandonment.

Owning wildlife species as pets is a common trend in Costa Rica, as in many other places. A 2001 study found that $33.3 \%$ of a sample ( $n=721$ ) of Costa Rican households kept wild species as pets. The majority of these species were bird species including parrots, but did also include other reptiles, mammals, fish, and invertebrates. If a family kept domestic species of pets, they were more likely to also keep wild species, and only $5.0 \%$ of households kept exclusively wild species (Drews 2001). This highlights the importance of reaching out to dog and cat owning households with information on the negative consequences of keeping wildlife as pets.

## DOG AND CAT WELFARE CONCERNS IN COSTA RICA

The 2016 WAP study found that $11.8 \%$ of dog spent their entire day chained or kenneled, highlighting a practice worth investigating. This report found only $0.9 \%$ of dog owners to allow their dogs to roam freely during the day ("Estudio Nacional Sobre Tenencia de Perros En Costa Rica" 2016); however, formative research suggested this number may be larger in reality.

Free-roaming cats also pose a concern, as they represent a significant threat to wildlife species. Populations of freeroaming cats can be devastating to wildlife populations, particularly on islands: $14 \%$ of modern bird, mammal, and reptile extinctions reported by the International Union for Conservation of Nature (IUCN) are attributed to free-


Figure 1. A free-roaming cat in Tirasses, Curridabat. (Photo by Indira Chakravarti)
roaming cats (Felis catus) on islands (Medina et al. 2011). A common misconception is that free-roaming cats only affect wildlife species when they are limited to an island; however, there is evidence that even in non-island environments cats cause lasting negative effects on wildlife, particularly birds (van Heezik et al. 2010). This highlights the importance of quantifying the roaming cat population before ultimately working to reduce roaming practices.

Other practices that cause animal welfare concern include pet abandonment, chaining of animals (mostly dogs), lack of recreational spaces for walking animals, open dumping of garbage, and interactions with wildlife due to increased proximity. Each of these concerns have been voiced from at least one survey site included in this survey.

## ZOONOTIC DISEASE RISK \& WILDLIFE INTERACTIONS

There are hundreds of possible zoonoses that may be transmitted between dogs and humans and cats and humans (Garde, Acosta-Jamett, and Bronsvoort 2013; Kravetz and Federman 2002). Rabies, a fatal neurological viral infection, is a disease of particular concern with regards to free-roaming dogs, as dogs are a primary reservoir for the virus. Rabies is transmitted via direct contact with the saliva or brain/nervous system tissue of an infected animal. In many parts of the world, transmission to humans happens most frequently when infected dogs bite humans. It should be noted that cats too have the potential to transmit rabies-as do all mammalsbut this is a less frequent occurrence (Kravetz and Federman 2002). Costa Rica has had a successful rabies management program, and a dog-transmitted autochthonous human case hasn't been reported since 1970; and the last canine rabies outbreak occurred in Guanacaste in 1987 (Pan American Health Organization 2005). However, rabies remains a concern for both humans and animals. Today, rabies in Costa Rica is predominantly found within populations of the common vampire bat, among other wildlife species (León et al. 2021). Today in Costa Rica, other zoonotic diseases that can be transmitted between dogs/cats and humans and dogs/cats and wildlife include toxoplasmosis, cryptosporidium, and giardia (Scorza et al. 2011), canine distemper virus (CDV) (Avendaño et al. 2016), canine protoparvovirus (Conrad et al. 2021), Leptospira (Baldi et al. 2019), and American trypanosomiasis (Bonilla et al. 2019; Rojas-Jiménez et al. 2021).

The risk of zoonotic disease transfer between companion animals, humans, and wildlife makes prevention of wildlife interactions an even higher priority. The spread of such diseases poses a risk to both human life, and animal life, including that of endangered animal species. A strong example in Costa Rica is increasing human encroachment on various wild cat species; this results in habitat loss and an increase in wild cats in human settlements; in turn, this increases transmission of canine distemper virus from domestic dogs to these wild felids (Conrad et al. 2021). Another example from Costa Rica is the transmission of toxoplasmosis (Toxoplasma gondii) from free-roaming domestic cats to neo-tropical primates, some of which are particularly vulnerable to infection (Niehaus et al. 2020). This is not unique to CDV or toxoplasmosis, however; humans and companion animals are increasingly coming into contact with wildlife in new ways, leading to an increase in emerging infectious diseases in all three populations (Daszak, Cunningham, and Hyatt 2001).

Beyond disease transmission, populations of domestic dogs and cats can also prey on wildlife, outcompete them for local resources, and induce behavior changes (Hughes and Macdonald 2013; Medina et al. 2014). This is concerning from both a conservation perspective, and an animal welfare perspective.

## Survey Sites \& Stakeholders

## URBAN SITES

Costa Rica is divided into seven provinces, each of which are further divided into the administrative unit of canton. Cantons are then further divided into districts. We surveyed four cantons within the Costa Rica Greater Metropolitan area (GAM). All four of these sites were considered urban. In terms of wealth and socio-economic status, there was great variability within each site. The maps shown here show the political boundaries of each urban and coastal rural site, along with the locations of our surveyed households.

## Curridabat

The canton of Curridabat is located in the San Jose province and has 65,206 inhabitants as per the 2011 census (Instituto Nacional de Estadística y Censos (INEC), 2011). Curridabat is one of the wealthier cantons surveyed, and census data from 2011 estimates that about $11.23 \%$ of the households in Curridabat are living below the poverty line. When using the standard international wealth index (IWI) at the provincial level, only $0.93 \%$ of inhabitants are considered to be poor (IWI<70), and an insignificant amount (near 0) are found to have an IWI below 35. This information is summarized in Table 1.

Of interest to HSI was the district of Tirasses within the canton of Curridabat, an area with higher rates of poverty than surrounding districts. The communities within Tirasses are often have more obstacles to obtaining adequate veterinary care for their animals.

Curridabat established an animalwelfare program in 2018, in conjunction with the National Animal Health Service (SENASA) to address cruelty and animal mistreatment and appointed a


Figure 2. Surveyed households within the canton of Curridabat (blue line). veterinarian to handle cruelty cases. The municipality has a pre-existing relationship with HSI, and HSI is in the process of developing a memorandum of understanding with them. Other existing animal welfare efforts included spay and neuter campaigns hosted with National Association for Animal Protection (ANPA), a local animal aid association. Through these efforts, more than 10,000 animals have been sterilized.

## Cartago

The canton of Cartago, within the Cartago province, is home 147,898 people as per the 2011 census. An approximate $17.45 \%$ of its households live below the poverty line. At the provincial level, the province of Cartago has an estimated $1.55 \%$ of households with an IWI index of below 70.

The canton of Cartago was one of the first municipalities to establish an animal welfare program. Founded in 2016, the Municipal Center for Animal Care and Education (CMECA) is meant to provide veterinary care for roaming animals, to manage roaming populations, and to provide animal welfare education. In 2021 SENASA appointed CMECA's veterinarian to handle the animal cruelty cases. The municipal government has shown interest in relationship-building with HSI and has participated in region trainings offered by HSI.


Figure 3. Surveyed households in the Cartago canton.

## Montes de Oca

Montes de Oca is a canton in the San Jose province, with 49,132 inhabitants as per the 2011 census. An approximate $6.35 \%$ of these households are estimated to live below the poverty line.

The municipal government has already engaged in some animal welfare activities, including spay/neuter clinics organized by ANPA. Over 700 animals have sterilized through these efforts thus far. The municipality has an animal welfare office, though it is manned by an official that also serves as the environmental inspector. The municipal government participated in HSI's Animal Welfare Pilot project for local governments.


Figure 4. Surveyed households in the Montes de Oca canton.

## La Unión

The canton of La Unión, within the Cartago province, has 99,399 inhabitants. 15.37\% of households in La Unión are estimated to be below the poverty line.

The municipal government of La Unión requested guidance and support from HSI in the creation of an animal welfare program. Previously, in 2017 and 2020, the municipality held small-scale spay/neuter programs.

The main welfare concerns from this canton include clandestine garbage dumping, which leads to aggregation of dogs and other animals, including wildlife. Interactions between domesticated animals and wildlife are therefore also a concern. Chaining dogs is also perceived to be a common practice within this canton.


Figure 5. Surveyed households in the La Unión canton.

COASTAL RURAL AREAS

## Tortuguero and San Francísco

The canton of Pococí has 125,962 inhabitants spread over 36,238 households. 31.95\% of these households are estimated to live below the poverty line. Two nearby sites in the Pococí canton of the Limon province were included in this survey: the towns of Tortuguero and of San Francísco. These towns are in proximity to the Tortuguero National Park; Tortuguero itself is adjacent to the national park, while San Francisco is further north, up the Tortuguero river, adjacent to otherwise protected land (the Barra del Colorado Wildlife Refuge) (see Figure 6,7).

Tortuguero National Park holds ecological significance as it is a major marine sea turtle nesting site, including for endangered and sensitive species. The region is extremely biodiverse, and is also home to many wild felines, including jaguars (Panthera onca). A major concern in the region is the increasingly frequent practice


Figure 7. Map of San Francisco and Tortuguero communities.


Figure 6. Households surveyed in the Pococí canton of Limon province.
of jaguars entering human settlements and preying on pet dogs and cats. This problematic from both a petowner's perspective, as well as a zoonotic disease standpoint. Outbreaks of canine distemper have been noted to pass between dogs and jaguars in the area previously. Another concern is free-roaming dogs scavenging the turtle eggs and hatchlings during the turtle nesting season, as this has been documented to occur in other turtle nesting sites (Figure 8a,b).


Figure 8a \& 8b. Images of free-roaming dogs scavenging turtle hatchlings in Ostional Wildlife Refuge, Guanacaste. (Photos by Luis Jose Villalobos Venegas; do not reproduce without permission.)

## RURAL SITES

This survey also included three rural areas nearby the city. The northern rural site included households in the Valverde Vega and Grecia cantons; the southern rural area included households in the Acosta and Mora cantons, and the eastern rural area included households in the Paraiso and Jimenez cantons. Maps of households surveyed in each rural area are available upon request.

Table 1. Census data and socio-economic indicators for urban sites and coastal rural sites surveyed.

| Province | Canton | Canton <br> Population <br> $(2011)$ | Canton <br> HH | \% of HH <br> living in <br> poverty <br> (estimate) <br> $(2011)$ | \% HH with <br> IWI* value <br> below 70 in <br> province | \% with <br> IWI* value <br> below 35 in <br> province |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| San Jose | Curridabat | 65,206 | 19,146 | $11.23 \%$ | 0.93 | 0.00 |
| San Jose | Montes de Oca | 49,132 | 16,589 | $6.35 \%$ |  | 0.00 |
| Cartago | Cartago | 147,898 | 38,618 | $17.45 \%$ | 1.55 |  |


| Cartago | La Union | 99,399 | 26,979 | $15.37 \%$ |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Limon | (Pococi) San Francisco | 125,962 | 36,238 | $31.95 \%$ | 6.38 | 0.18 |
| Limon | (Pococi) Tortuguero |  |  |  |  |  |

*The International Wealth Index, or IWI value, is a standardized wealth index that allows economic status of households to be compared across countries. An IWI ranking indicates how much a household possesses a basic set of assets and goes from 0 to 100. Households having an IWI index of below 70 are considered poor; below 50 poorer, and below 35 poorest (Smits and Steendijk 2015). The values here are calculated by the Global Data Lab based on a 2018 census carried out in Costa Rica.

## Other Stakeholders

Beyond the municipal governments of the cantons listed above, the following entities and people were also involved in this endeavor.

## SERVICIO NACIONAL DE SALUD ANIMAL (SENASA)

The Servicio Nacional de Salud Animal, or SENASA, is a government organization in charge of promoting, protect and restore animal health, as well as planning pests and diseases prevention, control and eradication programs. SENASA also establishes the coordination mechanisms between the different national institutions and the international organizations involved in animal matters.

## ASOCIACIÓN DE VOLUNTARIOS PARA EL SERVICIO EN LAS ÁREAS PROTEGIDAS (ASVO)

The Asociación de Voluntarios para el Servicio en las Áreas Protegidas, or ASVO, is a non-governmental volunteer organization working to conserve Costa Rica's natural areas while also benefiting local communities. The organization also collaborates with SINAC, the governmental body covering conservational efforts.

## CAÑO PALMA BIOLOGICAL STATION

Run by the Canadian Organization for Tropical Education and Rainforest Conservation (COTERC), a Canadian non-profit organization, Caño Palma Biological Station works on a variety long-term research projects to promote a greater understanding of local ecosystems. They host student and graduate researchers from around the world, as well as working with the local community and government agencies towards a variety of conservation goals.

## TORTUGUERO ENVIRONMENTAL COMMITTEE

The Committee is a coalition of environmental organizations from Tortuguero, for example the National Park, ASVO, Tortuguero's Integral Development Association and responsible tour operators, such as Roots and Tinamú Tours. The organization works to create ecolabeling, sustainability and animal welfare programs. The Committee also ensures responsible pet ownership in favor of coexistence with wildlife in Tortuguero.

## SINAC-MINAE

The Sistema Nacional de Áreas de Conservación del Ministerio de Ambiente y Energía (SINAC-MINAE) is a decentralized and participatory coordination system in charge of regulating the country's natural resources,
including forestry, wildlife, watersheds, and protected areas. This organization is a part of the Tortuguero Environmental Committee listed above. SINAC also dictates policies and executes processes aimed to achieve sustainability in Costa Rica, and is thus a valuable and strategic partner for HSI-LA's wildlife program.

## Survey Goals

Broadly, the goals of this survey were to better understand the cultural norms and practices surrounding owned and free-roaming dogs and cats in these provinces in Costa Rica, so that we may better serve both the animal and human populations living there with regards to how they interact and coexist. Specifically, our objectives were as follows:

Objective 1. Establish a baseline count of free-roaming dogs in some survey sites, so that we may determine animal density (animal per kilometer); animal welfare as measured by body condition score, visible skin conditions, and visible disease conditions like transmissible venereal tumor (TVT); sex ratio; breeding indicators (lactating females and pups); and a population estimate. Free-roaming dog counts were performed in 2014 as part of an HSI effort in some locations, and a sub-objective of objective 1 was to compare the 2014 data to current baseline data.

Objective 2. Establish a baseline count of free-roaming cats in certain survey sites, to approximate a population and determine density of cats per kilometer.

Objective 3. Assess dog and cat ownership practices and attitudes and obtain counts of these owned dogs and cats to estimate populations of owned cats and dogs. Practices and attitudes include general practices and attitudes regarding animal welfare, rabies vaccination, sterilization of companion animals, and the source of companion animals; we also wanted to assess what barriers people face that could prevent them from engaging in responsible pet owning behavior. It also includes assessing the perception of negative interactions or any issues of coexistence between humans and street dogs, and dogs/cats and wildlife, as well as perception of cruel animal practices among the community.

## Methodology

## STREET COUNT METHODOLOGY

Street counts of free-roaming dogs were carried out by first determining set routes within the towns, on which the counts would be conducted. These set routes, also called index or standard routes, were drawn in Google Maps along residential roads and highways but avoiding expressways, as dogs tend to avoid expressways. Survey routes averaging $20-30 \mathrm{~km}$ in distance were drawn in each of the areas using the "draw a line along roads" option in Google Maps. Google Maps is aware of one-way systems so the route could be followed easily using the Maps app on a GPS-enabled mobile phone that is synchronized with the Google account used for the survey. Routes are marked with a starting (Flag) and end point (House). For easy access, the routes were saved as KML files and stored in Google My Places, which could be accessed from smartphones both online and offline.
Street counts were conducted in the early morning, beginning at 5:20am, by the survey team, which included a driver and 1-2 data collectors in the car. The driver used Google Maps to follow the set route, and they maintained an average speed of about $10-15 \mathrm{~km} / \mathrm{hr}$ along the route. Concurrently, a data collector used the OSM Tracker app, which has an adapted button layout for the survey, enabling the observer to record the sighted dogs and collect specifics about the dog. The specific categories were sterilized female, unsterilized
female, lactating female, sterilized male, unsterilized male, and unknown adult dog (dog of unknown sex). Pups were also recorded and are defined as dogs that would not be old enough to be sterilized; the sex of the pups was not recorded. Welfare indicators such as skin problems and poor body condition scores (BCS1 and BCS2) were also recorded and saved together with GPS coordinates of the sighted dog.

Concurrently, the same protocol was completed for a count of free-roaming cats, though on a different device with a modified OSM Tracker app. This modified version included the following obligatory categories for cats: adult cat (any sex); ear-notched cat (indicating sterilization), kitten. Optional details included inputting whether the cat was sighted on the street ("outdoor") or within a yard, patio, or other place clearly associated with a home ("indoor"); or whether the cat was wearing a collar. A cat was considered "indoor" even if it was in an unenclosed area associated with a home. This option was included as a rough proxy for ownership, as formative research found it very common for pet cats to stay near their home but not be enclosed in any way.

Each street count track took approximately two hours to complete.
A series of street counts were performed following this methodology for dogs only in 2014. We compare our 2022 data to these values (see Findings).

## FORMATIVE RESEARCH METHODOLOGY AND KAP SURVEY DESIGN

The MEIA team had a general KAP (Knowledge, Attitudes, and Practices) questionnaire already made. However, we generally find that there are often questions that should be added, modified, or taken out based on the cultural context of the survey. We held 3 short, semi-structured interviews with key informants. A brief interview guide was made, including questions meant to identify the interviewees' idea of animal welfare in Costa Rica; what they thought a companion animal welfare program ought to address; and some reasons behind the pet-owning culture in Costa Rica.

As these were semi-structured interviews, these questions were meant to guide the interviewer. Interviews were not recorded and transcribed, but interviewers took brief notes, aided by the interview guide. Following interviews, interviewers met, and emergent themes were pulled from these notes. This rough vertical analysis allowed us to include questions on the KAP survey that were more relevant to Costa Rica.

## HOUSEHOLD KAP SURVEY: SAMPLING DESIGN AND DATA COLLECTION

KAP surveys were administered to households in each of the sites. Households were selected by a systematic random sampling method, in order to obtain a representative sample of each site. Surveyors were provided with pinned locations within each site using Google Maps, and were responsible for randomly selecting households to survey around each pinned location. To randomly select households, surveyors were instructed to ask every third house on either the left or the right side of the street to participate. If no one answered at a selected house, surveyors would move on to the very next house and ask; following either an agreement or refusal to participate in the survey, surveyors would move on to the next third house.

Based on the populations and density of homes of each site, a goal sample size was set for each site. We attempted to reach 400 consenting households in each of the four urban sites, and between 100-200 for the rural sites. For the rural coastal areas, which were sparsely populated as they were surrounded by protected land, we applied our sampling methodology (every $3^{\text {rd }}$ house) to all the streets within the small communities.

EpiCollect5, an online data capturing software that can be used as a smartphone application, was used to collect survey responses. The survey was loaded into EpiCollect5 and administered to households in-person by trained
surveyors. While the bulk of the survey was the same, we had a version for the Gran Area Metropolitana, and different versions for the rural sites and coastal rural sites adjacent to protected lands. As the rural sites were more likely to encounter wildlife, this version of the survey included more questions on wildlife interactions and issues of coexistence; the coastal rural sites were also asked questions about activity and wildlife interactions on protected land specifically.

The inclusion criteria were as follows: participants must be over the age of 18 and able to provide consent. Households were approached using the sampling framework indicated above, and if the individual met the inclusion criteria, consent was asked verbally, reading a pre-written paragraph. Participants were advised that there were no correct answers, that they could skip any question they wanted to, and that they could end the survey at any time. After obtaining a verbal consent, the trained surveyor walked the participant through the questionnaire, which was designed to take 15-20 minutes to complete. Once the survey was complete, the surveyor uploaded the results to the cloud-based database.

## METRICS

Some of the key quantitative metrics we aimed to calculate from our data collection included the following.
Dog and Cat Density: Dividing the total number of recorded dogs by the number of households surveyed yields a density of dogs per household (dogs/ household, or HH ). An estimate of the entire dog population in the region can then be calculated by first obtaining the density of dogs per 100 humans in the region, and multiplying that by the human population, as per the census. Similarly, these methods are used to calculate a cat density (cats per household, or cat/HH). Of interest as well is the dog density per dog-owning household (dogs/DOHH) and cat density per cat-owning household (cats/COHH).

Canine Age \& Sex Structure: The age structure of a population reflects the level of turnover and indicates how stable a population is. A lower turnover rate (individuals are spread evenly across age groups) in the population better supports humane efforts, as sterilized and vaccinated dogs remain longer in the population, instead of being replaced quickly by new, intact, and unvaccinated dogs. Knowing the sex ratio of male to female dogs is also important, as it helps predict future population growth.

We also included survey questions meant to assess knowledge, attitudes, and practices related to pet ownership; including those related to sterilization, vaccination, and acquisition of dogs.

## Findings

## Table 2. Sample sizes and owned dogs and cats.

| Site | Sample Size* | Number of owned dogs <br> reported | Number of owned cats <br> reported |
| :--- | :---: | :---: | :---: |
| Curridabat | 452 | 348 | 183 |
| La Union | 415 | 407 | 245 |
| Montes de Oca | 393 | 206 | 104 |
| Cartago | 419 | 366 | 146 |
| Tortuguero | 52 | 46 | 28 |
| San Francisco | 162 | 76 | 119 |
| Northern rural area | 80 | 73 | 42 |
| Western rural area | 161 | 139 | 119 |
| Southern rural area | 2,168 HH interviewed | 1,811 owned dogs reported | 942 owned cats reported |

* Sample size refers to the number of households (HH) that consented to be interviewed at that site.


## STREET COUNT FINDINGS

In 2014, a series of dog street counts were performed in Cartago, Heredia and Belen, and San Jose. These sites do not correspond exactly to the urban sites we surveyed for the KAP survey but still provide valuable information. For this street count, we followed those same routes from 2014 as closely as possible. In comparing the data from the two time points, we see that free-roaming dog density decreased along all three


Figure 9
street count
routes (see
Figure 9).
Figure 9. Free
roaming dog density in 2014 and 2022, expressed as dogs per km. In all sites, free-roaming dog density has decreased.

In addition to counting free-roaming dogs, we also counted free-roaming cats along every dog-counting route completed. The data for these cat counts in shown below in Table 3.

Table 3. Free roaming cat counts

| City/Town Name | Total cats counted | Track length (KM) | Cats/km |
| :--- | :---: | :---: | :---: |
| Cartago | 21.5 | 27.3 | 0.8 |
| Heredia and Belen | 17.5 | 32.7 | 0.5 |
| San Jose | 38.0 | 26.3 | 1.4 |

## DOG AND CAT OWNERSHIP

## Table 4. Estimates of owned dogs and cats for each surveyed canton. *

| Site | Estimated <br> dog-owning <br> households | Estimated <br> owned dog <br> population | Estimated <br> dogs per <br> 100 <br> people | Estimated <br> cat-owning <br> households | Estimated <br> owned cat <br> population | Estimated <br> cats per <br> 100 <br> people |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Curridabat | 9,489 | 16,268 | 22.6 | 4,955 | 8,554 | 11.9 |
| Cartago | 22,987 | 37,227 | 22.8 | 9,561 | 14,850 | 9.1 |
| Montes de <br> Oca | 6,988 | 9,596 | 17.7 | 3,540 | 4,845 | 8.9 |
| La Union | 17,218 | 29,199 | 26.6 | 9,327 | 17,577 | 16.0 |
| Pococí (San <br> Francisco and <br> Tortuguero) | 25,111 | 56,732 | 40.8 | 10,695 | 18,136 | 13.0 |

*All values rounded to nearest whole number.
Estimates for owned dog and cat populations are based on 2011 census data as well as the data collected as part of this survey. The methodology is as follows: We first used the 2011 census data and the World Bank estimate of $0.9 \%$ annual population growth in Costa Rica to calculate the human population of each canton. A standard exponential growth equation was used: $x_{t}=x_{0}(1+r)^{t}$, where $x_{t}=$ population at time $t ; x_{0}=$ original population or population at time $0 ; r=$ rate of growth ( $0.9 \%$ as per the World Bank). We then used the average household size estimates from the 2011 census to estimate the number of households in each canton in 2022. This number was then multiplied by the proportion of dog-owning houses our survey yielded, which was then multiplied dogs per dog-owning households (dog/DOHH) that our survey yielded. The results of each step are shown in the table below (Table 5); the intermediate data for cat population estimates is not shown below but follows the same methodology; the final estimate of the owned cat population is shown above in Table 4.

## Table 5. Estimates of owned dog populations based on 2011 census data.

| Canton | 2011 population (census data) | $\begin{gathered} \hline \text { Average HH } \\ \text { size } 2011 \end{gathered}$ | 2022 population estimate / \# of HH in 2022 (estimate) | \% dog-owning HH (DOHH) | Estimate of DOHH | Estimate of owned dog population in 2022 | $\begin{gathered} \text { Dogs per } \\ \text { HH } \end{gathered}$ | Average Dogs per DOHH |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Curridabat | $\begin{gathered} 65,206 \\ \text { people/ } \\ 19,146 \mathrm{HH}^{*} \end{gathered}$ | $\begin{gathered} 3.41 \text { people } \\ \text { per HH } \end{gathered}$ | $\begin{gathered} \text { 71,960 people / } \\ 21,129 \mathrm{HH} \end{gathered}$ | 44.9\% | 9,489 | 16,268 | 0.8 | 1.7 |
| La Union | $\begin{gathered} 99,399 / \\ 26,979 \mathrm{HH} \end{gathered}$ | 3.68 | 109,694/29,773 | 57.8\% | 17,218 | 29,199 | 1.0 | 1.7 |
| Montes de Oca | $\begin{gathered} 49,132 / \\ 16,589 \mathrm{HH} \end{gathered}$ | 2.96 | 54,221 / 18,307 | 38.2\% | 6,987 | 9,596 | 0.5 | 1.4 |
| Cartago | $\begin{gathered} \hline 147,898 / \\ 38,618 \mathrm{HH} \end{gathered}$ | 3.83 | 163,217/42,618 | 53.9\% | 22,987 | 37,227 | 0.9 | 1.6 |
| Pococí (San <br>  <br> Tortuguero) | $\begin{gathered} \hline 125,962 / \\ 36,238 \mathrm{HH} \end{gathered}$ | 3.48 | 139,009 / 39,991 | 62.8\% | 25,111 | 56,732 | 1.4 | 2.3 |

*HH stands for households.


Figure 10
Figure 10. Reasons for dog ownership across all sites. The $x$ axis represents the percentage of respondents from this site that included that particular answer in their response; e.g. $8.0 \%$ of respondents from Cartago included "Protection" as a reason for owning their dog. Note that respondents were allowed to choose more than one option.

Across all urban and rural sites, owning a dog as a pet for companionship was the most common reason for dog ownership. Protection was the second most common reason, though was much more common among rural sites than urban sites.

Receiving a dog as a gift from a friend or family member was the most common source of pet dogs, across both rural and urban sites. The second most common source was rescuing dogs off the street. The trends were similar across rural and urban sites for most sources of dogs; it was slightly more common in rural areas to have rescued a dog off the street or to have been gifted a dog (Figure 11).


Figure 11

Figure 11. Dog source among urban vs. rural respondents. The $x$ axis represents the percentage of respondents (urban or rural) that included the indicated source in their answer, e.g., $22.26 \%$ of all rural respondents indicated that they rescued at least one of their dogs from the street. Note that respondents were allowed to choose multiple answers, in the case of ownership of multiple animals.

## DEMOGRAPHY OF OWNED ANIMALS

The age-sex pyramid for owned dogs in urban sites showed a large elderly dog population (over 10 years). If we exclude this large age group and instead focus on the one-year age intervals under10 years, we see that the


Figure 12


Figure 13
Figures 12 \& 13. Age-sex pyramids for urban and rural sites. Urban sites have a larger aging population, and rural sites have a larger younger population. This may be linked to sterilization rates.
shape of the age-sex pyramid is somewhat stationary. This indicates near-equal percentages of each age group, low birth rates, and long life-expectancies. In comparison, the age-sex pyramid for rural sites shows a slightly smaller aging population, and a slightly larger young and middle-aged dog population. One conclusion that may be drawn from these differences is that owned dogs in urban areas are living longer. Urban dog populations
may be experiencing a smaller influx of new, younger animals than in rural sites (Mandal, Uyanga, and Prasad 1989).

Among urban sites, sterilized males and females were generally older (6.1 and 6.4 years, respectively) than the average age of unsterilized male and female dogs ( 4.9 and 4.4 years, respectively). This trend was similar in rural sites; however, the ages tended to be younger than in urban sites. Sterilized male and female dogs in rural sites were on average 5.2 and 5.3 years old, respectively, while unsterilized rural males and females were 4.2 and 3.7 years old, respectively, on average.

## STERILIZATION PRACTICES

Age-sex pyramids should also be considered alongside sterilization practices and rates. Sterilization rates will affect the fertility rate and population turnover of a population. In general, the urban sites surveyed had higher rates of sterilization; however, a notable exception is the coastal rural site of Tortuguero. This site had the second highest rate of sterilization across all sites. This is likely due to the focused efforts of local animal welfare organizations. It is worth noting that despite being very geographically close to Tortuguero, San Francisco does not share the same high sterilization rates. This is likely because those animal welfare efforts are targeted specifically to Tortuguero, and transport of animals across the water from San Francisco is difficult and often costly.


Figure 12
Figure 14. Sterilization rates across surveyed sites. Generally, urban sites had higher rates of sterilization and rural sites had lower rates. However, an exception is Tortuguero, a rural coastal site.


Figure 13
Figure 15. Frequency of sterilization providers across all sites, both urban and rural. The left axis refers to the proportion of responses from the specified site that included that response, e.g. $60 \%$ of participants from Curridabat that had sterilized dogs reported that they got one or more of their dogs sterilized at a private vet clinic. Note that the sample sizes for San Francisco and Tortuguero were much smaller than other sites.
Across all urban sites, a private veterinary clinic was the most common provider of sterilization services. This trend was also true for the three rural sites that surrounded the general metropolitan area (GAM). However, this trend did not hold for San Francisco and Tortuguero, the two coastal communities in the Limon province. These two areas were more remote, and did not have access to a private veterinary clinic. Those that did choose this option (from Tortuguero only) likely transported their dogs via boat away from these coastal areas to the mainland. In these two coastal areas, however, we do see the effects of local sterilization campaigns.

The most common answer when asked why a participant hadn't sterilized their dog was that they were planning to but hadn't yet (34.4\% of all respondents included this choice in their answer). This was initially assumed to be due to the perception that female dogs needed to birth a litter of pups at least once before getting sterilized. However, while this belief was prevalent, the data do not show a significant proportion of owners of young female dogs among those that chose this response. That is, only approximately $20 \%$ of people that chose this response owned a young (<3 years) female unsterilized dog. In fact, nearly $26 \%$ of people that chose this response owned a dog over the age of 3 years. Respondents may have felt obligated to give this response when their pet was not sterilized, which indicates that many people perceive pet sterilization as something they should do.

The second most common response was that it wasn't perceived as necessary ( $33.5 \%$ of all responses). This belief was more predominant in rural areas than in urban or rural coastal areas: $42.9 \%$ of rural respondents that did not sterilize their dog (those from the North, West, or Southern rural areas) indicated that it was because they did not believe it was necessary; in comparison, only $31.0 \%$ of urban and $11.5 \%$ of rural coastal respondents indicated this choice.

## VET CARE AND VACCINATION PRACTICES

Urban participants were asked if their dog(s) had seen a veterinarian in the past twelve months and were then categorized as either having had ALL of their dogs see a veterinarian, SOME of their dogs see a veterinarian, or NONE of their dogs see a veterinarian. As
 private veterinarians were less available in rural areas, rural participants were instead asked if their dog needed veterinary care in the past twelve months, and if so, what kind and from where it was sought if at all.

The majority of urban dog owners (76.1\%) had taken all of their dogs to the vet in the last twelve months; a further $4.4 \%$ had taken only some of their dogs to the vet in the last twelve months. $19.9 \%$ of urban dog owners had not taken their dog to see a vet in the last twelve months. Montes de Oca and Curridabat had similar trends in veterinary care seeking, and La Union and Cartago had similar trends to each other.

Figure 16. Up to date veterinary care in urban dog owners. This figure shows the proportion of urban dog owners from each site that had all, some, or none of their dogs see a veterinarian in the last twelve months. For example. Just over $80 \%$ of dog owners in Curridabat took all of their dogs to see a veterinarian in the past twelve months.

Among dog-owning households in rural areas, $32.8 \%$ reported having needed veterinary care for their pet in the last twelve months. Of these individuals, the most common reason was preventative care (51.7\%), followed by emergency care (25.8\%), followed by care for a suspected illness (22.5\%). Among rural respondents that needed veterinary care, $83.0 \%$ were able to take their pet to a veterinary clinic and did so. The next most common course of action reported was that the pet owner sought help from someone other than a veterinarian that they believe is knoweldgeable about animal health. Nearly all of these reponses came form dog owners in rural coastal sites (San Francisco or Tortuguero): in order to seek care from a standard veterinary clinic, residents of these areas would have to transport their pet via boat across the water to the mainland of Costa Rica. This was a very difficult and expensive task; therefore, many pet owners in need sought out the help of non-veterinarians in the area percieved to be knowledgeable about animal health.

Despite having no formal veterinarian nearby, Tortuguero had a $100 \%$ vaccination rate. Though this sample size is small, it still speaks to the strong efforts local organizations have made in regard to dog vaccination. Many dog owners in Tortuguero kept the physical record of all of their dogs' vaccinations that was provided to them.

The graphs below show the vaccination practices within each site and refer simply to whether the dog was ever vaccinated against anything, or not. Knowledge of which vaccinations were given to their dogs varied among sites. A private vet or vet clinic was the most common provider of vaccines among all sites, with the exception of the two rural coastal sites, who made use of local vaccination campaigns more than anything else.


Figure 15. Vaccination rate for owned dogs at urban sites.


Figure 16. Vaccination rate for owned dogs at rural sites.


Figure 18. By whom owned dogs received vaccine at rural sites


Figure 17. By whom owned dogs received vaccine at urban sites

## RATES OF DOG BITES

Participants from Tortuguero and San Francisco reported the highest rates of dog bites, though these sites also had the smallest sample sizes. It is likely that human population density plays a role in dog bites, as both communities were concentrated along a small area of land. However, we do not have population density data for Tortuguero and San Francisco, two very dense communities in an otherwise sparsely populated canton (Pococi). Population density data for each canton is shown below; rural areas surveyed are omitted as they spanned multiple cantons. The urban sites had lower bite rates than found in other Latin American countries we have worked with previously (6-11\%), but the rural coastal sites had significantly higher rates.

Table 6. Canton Population Densities vs. Rate of Reported Dog Bite

| Canton | Population Density (people/km ${ }^{2}$ ) | \%HH Reporting Dog Bite |
| :---: | :---: | :---: |
| Curridabat | 4,088 | $4.0 \%$ |
| Montes de Oca | 3,241 | $1.5 \%$ |
| La Union | 2,217 | $2.5 \%$ |
| Cartago | 514 | $5.4 \%$ |
| Pococí | 52 | $22.0 \%$ (San Francisco) |
|  |  | $21.7 \%$ (Tortuguero) |



Figure 20

Figure 19


Figure 21

## CHAINING AND ROAMING ANIMAL PRACTICES

The majority of urban respondents kept their dog inside the house during the daytime ( $85.7 \%$ of respondents) and the nighttime ( $80.6 \%$ ). Only $0.2 \%$ of urban respondents indicated that they allowed their dog to roam in
either the nighttime or the daytime. Confining or keeping the dog chained during the day were fairly uncommon practices both during the day and the night, with less than $1 \%$ of respondents indicating these answers.

Roaming was more common in rural areas, though still not a majority practice. $17.9 \%$ of rural respondents allowed their dogs to roam during the daytime and $4.8 \%$ allowed their dogs to roam in the nighttime. Chaining during the day and night were more common practices in rural areas ( $11.4 \%$ and $4.8 \%$, respectively).

Reasons for chaining dogs that respondents could choose from included 1) to ensure that the dog would protect the property, 2) to ensure that it did not bother household members or 3) neighbors, and 4) to ensure that it wouldn't escape. Rural respondents also had the option of choosing "to protect their pet from wild animals" as a reason for chaining. Among both rural and urban sites, the most common reported reason for chaining dogs was so that they wouldn't escape. It was initially assumed that dogs would be chained most often for property protection reasons; however, the majority ( $67.1 \%$ ) of respondents that cited "protection" as a reason for owning their dog, indicated that they never chain their dog.

## ANIMAL CRUELTY PRACTICES

Participants were asked to identify which of the following behaviors and practices would be considered cruelty towards animals: not providing them with adequate care; letting them roam unsupervised; intentionally hitting or injuring them; keeping them tied or locked up for long periods of time; breeding them for money; and keeping wildlife as pets.

The practice of chaining was identified by some respondents as a cruel practice, during the section on what practices should be considered animal cruelty. However, out of the 254 respondents that identified "keeping an animal tied or locked up for long periods of time, 12 (4.72\%) also reported that they chain their dog "most of the time.

Participants were also given the option of providing a free-form response to the question of what practices constitute animal cruelty, if none of the given responses were suitable. Themes identified among these responses included neglect: many responses identified providing a dog with inadequate food, shelter, exercise, and attention as cruel practices. Not sterilizing pets was also identified as a cruel practice by a few. Some also identified anthropomorphizing animals as cruel; this included practices like dressing dogs in human clothes, painting their nails, and so on.

Across all sites, $16.0 \%$ of respondents ( 299 total) indicated that they had witnessed an instance of animal cruelty in their neighborhood in the last twelve months. Tortuguero and San Francisco accounted for the largest proportion of animal cruelty reports per participants ( $42.3 \%$ and $32.6 \%$, respectively). Of the 299 incidences of animal cruelty reportedly seen by participants in the past year, 79 (35.9\%) people indicated that they reported these incidences to authorities. A preference to not put themselves in other people's affairs was identified as the major barrier to reporting ( $47.6 \%$ of responses). Other reasons identified were having a lack of information (16.8\%), not knowing where or how to report (15.9\%); a belief that reporting won't solve the problem (10.1\%), not having enough time (5.3\%), and not finding it necessary to report (4.3\%). On average, $26 \%$ of all mentioned animal cruelty instances were reported to authorities. This is grossly similar across all sites, though rates of reporting range from 0\% (San Francisco) to 41.7\% (Northern rural area). It should be noted that these extreme values come from sites with smaller sample sizes. Among the urban areas, reporting of animal cruelty instances was more common in Curridabat (31.9\%) and La Union (35.6\%) than in Montes de Oca (20.0\%) and Cartago (19.4\%). In San Francisco, where 0 out of the 11 animal cruelty incidences mentioned
to our team were reported to authorities, the most common reason why was that participants did not know where or whom to report to or how to file a report. This information is summarized in Table 7.

Table 7. Animal Cruelty Reporting Practices - All sites

|  | Respondents that witnessed an act of animal cruelty in their neighborhood in the last year (\% of respondents from that area that witnessed animal cruelty) | Respondents that went on to report act(s) of animal cruelty (\% of witnessed incidents reported) | Most common reason for not reporting |
| :---: | :---: | :---: | :---: |
| Curridabat | 72 respondents ( $16.0 \%$ of all Curridabat responses) | 23 (31.9\% of all witnessed incidents in Curridabat were reported) | Didn't want to get in trouble/involved |
| La Union | 73 (17.6\%) | 26 (35.6\%) | Didn't want to get in trouble/involved |
| Montes de Oca | 20 (5.1\%) | 4 (20.0\%) | Didn't want to get in trouble/involved |
| Cartago | 62 (15.8\%) | 12 (19.4\%) | Didn't want to get in trouble/involved |
| San Francisco | 11 (32.4\%) | 0 (0\%) | Don't know where or how to report |
| Tortuguero | 22 (42.4\%) | 4 (18.2\%) | Didn't want to get in trouble/involved |
| Western Rural area | 17 (21.0\%) | 4 (19.4\%) | Didn't want to get in trouble/involved |
| Southern Rural area | 10 (6.3\%) | 1 (10.0\%) | Didn't want to get in trouble/involved |
| Northern Rural area | 12 (7.4\%) | 5 (41.7\%) | Lack of information on the case |
| Total or Average across all sites | 299 (16.0\% of all respondents) | 79 (22.3\% of cruelty incidents were reported, on average, across all sites) | -- |

## PERCEPTIONS OF AND INTERACTIONS WITH FREE-ROAMING DOGS

In most urban sites, free-roaming dog populations were perceived to have decreased. In the Western and Northern rural sites, the majority of respondents said that they felt free-roaming dog populations had decreased, however, the opposite was true in the Southern rural site. $57.8 \%$ of respondents in Tortuguero indicated that local free-roaming dog populations had decreased; however, the nearby site of San Francisco noted an increase. This possibly speaks to the local targeted efforts of community stakeholders in Tortuguero that are promoting sterilization services, and shows a need for them to expand, if possible, to San Francisco.


## Figure 22

The majority of respondents from each urban site indicated wither that they saw 0 free-roaming dogs on an average day (Montes de Oca and Curridabat), or 1 to 5 dogs (La Union and Cartago). The scale of free-roaming dog populations seems to somewhat higher in rural areas: in each of the three rural areas surveyed, the majority of respondents indicated that they saw 1 to 5 free-roaming dogs daily. The rural coastal sites seem to have the largest free-roaming dog populations. In San Francisco, $44.1 \%$ of respondents said that they saw between 6 and 10 free-roaming dogs on an average day, while $35.3 \%$ said that they saw over ten. In Tortuguero, $30.8 \%$ said that they saw between 6 and 10 on an average day, while $40.4 \%$ said that they saw over 10 .

Participants were presented with the following options when asked what their main concerns were regarding free-roaming dogs: dog bites, dogs fighting, dog waste, risk to their own dogs, disease transmission, encounters with wildlife, jaguars hunting them, and the potential of free roaming dogs messing with garbage. Participants were also allowed to list other concerns, or to indicate that they had no concerns regarding free-roaming dogs. The most common concern across most sites was the risk of dog bites, followed by dog waste.


Figure 23


Participants were asked what people in their neighborhood generally do with litters of newborn pups and were given the following options to choose from: that people either give them away, leave them somewhere, sell

them, take them to a rescue, keep them, or that most litters die anyway. "Don't know" was also a response option. The data suggest that abandonment of newborn pups

Figure 24
("leaving them somewhere") was generally a rare response, except for in San Francisco, where 23.5\% of respondents chose this answer. Abandonment seems to be more commonplace in rural coastal and rural areas, and less common in urban settings.

## DOG FIGHTING

$1.0 \%$ of rural respondents indicated that they were aware of organized dog fights in their neighborhood; this was marginally larger than the $0.79 \%$ of urban respondents that indicated the same. Among all sites, San Francisco had the highest reports of dog fighting (5.9\%). For comparison, $7.6 \%$ of South African respondents and $2.7 \%$ of Mexican respondents indicated that there are organized dog fights in their neighborhood during our recent MEIA surveys in parts of South Africa and Mexico.

## INTERACTIONS BETWEEN COMPANION ANIMALS AND WILDLIFE

Urban respondents were asked if they had witnessed any interaction between humans, domestic cats or dogs, and wildlife. $9.2 \%$ of urban respondents indicated that they had, and these individuals were split equally between sightings of negative interactions between wildlife and dogs, and between wildlife and cats. Raccoons, opossums, and squirrels were frequently the wildlife seen to be interacting with cats and dogs. These interactions were typically categorized as either wildlife eating food meant for domestic animals, or domestic animals hunting or
harassing small wild animals (e.g., cats playing with wild rats and mice).
17 urban participants owned a wild animal as a pet, including budgerigars and other songbirds, miniature pigs, and turtles. 9 rural respondents reported owning a wild animal as a pet; species included turtles, parrots, rabbits, and songbirds. Proportionally, more urban respondents than rural reported owning a wild animal as a pet. It is worth noting that perceptions of what constitutes a wild animal differed among survey staff, urban participants, and rural participants.
Among rural respondents, $5.7 \%$ reported seeing interactions between wildlife and domestic cats, and $11.9 \%$ reported seeing interactions between wildlife and dogs ( $17.9 \%$ all together) in the past twelve months. Interactions were much more common among the rural coastal sites, as these made up $66.2 \%$ of all non-urban wildlife interactions reported. The most common type of wildlife interaction seen in rural areas was dogs and cats hunting or harassing small wild animals like toads or mice. Nearly all negative wildlife interactions reported in rural coastal areas consisted of jaguars predating companion animals; this was only reported in the two rural coastal sites. Jaguar attacks on dogs and cats were mentioned by some to only occur outside of turtle nesting season; others however, cited the frequency as about once to a few times a week.

Other wildlife interactions that pose concern in rural coastal areas include interactions between free-roaming domestic animals and the nesting turtles during turtle season. Nearly half (48.6\%) of all respondents from rural coastal sites reported that they believe that dogs do, in fact, roam freely without human supervision within the national park and other protected lands; however, $43.2 \%$ did not know.

Dog owners in rural coastal sites were asked if their own dog had ever been noted to hunt within the national park, and $37.5 \%$ of respondents denied that their dogs hunt in the national park, $34.4 \%$ reported not knowing, and $28.1 \%$ indicated that their dogs did in fact hunt in the park. Among the 9 individuals who reported that their dogs do hunt in the national park, the majority ( $77.7 \%$ ) said that it was for turtle eggs and hatchlings during turtle nesting season. The rest indicated that they hunted either small reptiles, birds, or bird eggs.

## Conclusions \& Summary

## COMPARISON TO 2016 WORLD ANIMAL PROTECTION STUDY

The 2016 World Animal Protection study found an average of 27.92 dogs per 100 humans. Our study found and average of 0.835 dogs per household. If we estimate an average household size of 3.47 individuals, based on the 2011 census data, then we calculate an average of 24.07 dogs per 100 people using the following arithmetic:

$$
\frac{0.835 \text { dogs }}{\text { household }}=\frac{0.835 \text { dogs }}{3.47 \text { people }}=\frac{x \text { dogs }}{100 \text { people }}=24.07 \text { dogs per } 100 \text { people }
$$

By this estimation, there has been a decrease in the number of dogs per humans in Costa Rica in the past six years. However, we are not able to say this with certainty as our sample size and methodology restrict us.

Our research on how people obtain their pet dogs aligns with the 2016 WAP study findings: the majority of people still seem to get their pets as gifts. This highlights a significant practice.

## WILDLIFE INTERACTIONS

There is the following web of interaction between rural coastal sites' pet dogs, wild jaguar populations, and wild sea turtle populations: during the turtle nesting season, both jaguars and free-roaming dogs predate and scavenge sea turtle eggs and hatchlings; outside of turtle nesting season, the wild jaguar population predates free-roaming dogs. It is also possible that when dogs feed on turtle hatchlings, a food source typical to jaguar diet, the likelihood of jaguars being forced to predate dogs increases. While some of these interactions are natural, others can and should be prevented. Wild jaguars predating free-roaming dogs is both distressing to pet owners and the local community, and it also puts jaguars at risk of diseases they may not have adequate immune responses to, such as canine distemper or rabies.

Rural respondents were more likely to witness interactions between wild animals and free-roaming dogs or cats, when compared to urban respondents. This aligns with our initial assumptions. However, urban respondents were more likely to keep a wild animal as a pet than their rural counterparts.

## ANIMAL CRUELTY

A major barrier to reporting incidences of animal cruelty was the perception that it was not a personal responsibility to report and cited an unwillingness to get involved. Another common reason for not reporting was not knowing what entity, if any existed, to report to.

## EFFECT OF ANIMAL WELFARE PROGRAMS IN RURAL COASTAL COMMUNITIES

Both Tortuguero and San Francisco are located on coastlines in the Limon province of Costa Rica, and both communities face many obstacles typical of remote, low-income, high-density communities. However, Tortuguero has seen more targeted animal welfare efforts than San Francisco, including sterilization and vaccination efforts. Due to these efforts, Tortuguero has markedly better sterilization and vaccination rates than San Francisco. This suggests that scaling up the current programs in Tortuguero to San Francisco as well would have a beneficial effect. The data also could suggest a different pet-owning culture in Tortuguero vs. San Francisco, in which the human-canine bond is often deeper among residents of Tortuguero. Supporting this claim is the facts that participants in San Francisco were more likely to own dogs for reasons of protection, more likely to abandon puppies, and more likely to mention organized dog fights. A major barrier facing residents of San Francisco is that they have difficulty transporting their pets across the water to reach the services in Tortuguero.

## Recommendations

## I. HUMANE EDUCATION

Humane education refers to education on how to be a responsible and caring pet owner. It is imperative that humane education be culturally relevant and tailored to the community being educated. For example, in rural coastal sites, it is difficult to transport a pet to a veterinary clinic regularly; instead of promoting this particular behavior, it may be more relevant to encourage pet owners to seek out veterinarians
at local spay/neuter events. When humane education is not culturally relevant, it may decrease the participants' feeling of self-efficacy or feelings of being able to be a responsible pet owner. We suggest two education forums and a third sub-program:

1. School-age humane education: An in-school or after school program aimed towards school-aged children. Broadly, this program would aim to instill a sense of personal responsibility in children for the welfare of animals; an example of this would be encouraging children to report animal cruelty to an adult. Generally, this program could take place within a One Health paradigm, in which the interconnectedness of animal health, human health, and environmental health is stressed. More specifically, this program could cover the five freedoms of animal welfare: the importance of preserving the biodiversity of Costa Rica, the importance of sterilization and vaccination services, among other topics.
2. Responsible Pet Ownership seminars for new pet owners: Mandatory seminars for anyone adopting a pet from a shelter or registering an already-owned pet. These should be concise modules, so that the length of the event is not prohibitive to adoption or registration. If possible, a list of resources could be distributed, including when and where the next sterilization campaigns will be, numbers for local vets including vet emergency rooms, and who to contact for animal cruelty complaints. Other resources that could be distributed could be a short list of items that are poisonous to dogs and cats, a brief summary of animal CPR, and the number to call in a veterinary emergency.
3. Animal Ambassador Program: This could be a program through which certain community members can be appointed "animal ambassadors," and given resources and education regarding animal welfare, so that they may act as a 'go-to' person when official capacities are unavailable. This is particularly relevant in remote areas, where we found that people will frequently seek out the help of someone who knows about animals, because they do not have any other veterinary care options. Such individuals would be ideal candidates for this program, as they are already a point of contact within the community. Ambassadors could be trained in basic wound care, animal CPR, and even routine vaccinations. These ambassadors could act as a secondary infrastructure when trained veterinarians are not available. School children can participate in this program as well, as "junior ambassadors." While they may not be trained in any animal care, they can be given resources to pass out to their families and communities. This would increase the sense of personal responsibility for animal welfare in children.

## II. LAW ENFORCEMENT AND COMPLAINT SYSTEM

In order to encourage responsible pet ownership behaviors to be commonplace, existing wildlife bylaws need to be enforced. We encourage officials to continue these efforts. We also encourage citizens to make formal complaints to the national authorities as necessary. An infographic or some other communication material detailing how to make these formal complaints may be of use.

## III. AFFORDABLE VETERINARY SERVICES

A tenet of any program should be affordable veterinary services. These could include sterilization and vaccination events led by municipal governments, as many cantons already have in place. At such events, there should also be a booth at which pet owners can register their pets and potentially obtain a collar and/or leash.

1. Traveling Veterinary Services for Remote Sites. For the rural sites that do not have a brick-andmortar veterinary facility, a traveling veterinary service is imperative. A veterinarian that is available at regular, reliable, and pre-determined intervals (e.g., start of every month) would fill a need in these communities. Sterilization and vaccination efforts that are already in place in some of these communities (e.g., Tortuguero) should be scaled up if possible.
2. Transport to veterinary services. In remote sites in particular, transporting a pet to a veterinary clinic is often difficult and prohibits veterinary care-seeking. Offering some sort of periodic pet-safe transportation to a clinic would fill a need and enable more animals to get the care they need. In coastal sites like Tortuguero and San Francisco, this may mean a pet-safe boat; in other remote sites it may require a pet-safe van or bus.
3. Augmented business models: The Ohio State University College of Veterinary Medicine recently published a comprehensive review of alternative business models meant to reduce the barriers many pet-owners face in receiving veterinary care. We recommend that veterinary clinics consider adding aspects of these business models to their practice as needed. The business models summarized in the report include:
a. Spectrum of care: This model offers clients veterinary care at costs relative to their economic ability to afford care, and their goals for giving their pet a good quality of life.
b. Specialized Basic: Specialized basic care is a model in which a limited set of services are provided in a high throughput, high quality manner. By only offering some specific services, these practices can see more patients and reduce costs for all clients.
c. Easy to Access: This model uses any mechanism possible to reduce the physical barriers to seeking veterinary care; an example would be a practice that offered pet transport from rural locations.
d. Subsidized: A subsidized model is one in which veterinary care costs for resource-limited clients are offset by funding from another source.

The ultimate goal of all of these efforts would be to increase the sense of responsibility Costa Ricans have regarding their pets and their local wildlife, and to reduce barriers to responsible pet-owning behaviors.

## IV. GOVERNMENT TRAINING AND CAPACITY BUILDING

HSI could provide standardized training on animal welfare best practices to all government stakeholders involved. This could include best vaccination, spay/neuter, and emergency care practices, among others.

An annual conference for local animal welfare stakeholders may also be of use: best practices could be disseminated and successful efforts from the last year highlighted. A type of ranking or award system among municipalities could encourage animal welfare efforts to be scaled up at the municipal level.

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## Appendices

## Appendix 1. General Summary

Across all tables, HH stands for households.

|  | Urban |  |  |  | Rural Coastal |  | Rural |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Curridabat | La Union | Montes <br> de Oca | Cartago | San <br> Francisco | Tortuguero | Northern <br> Rural <br> Area | Eastern <br> Rural <br> Area | Southern <br> Rural <br> Area |
| Consented | 452 | 415 | 393 | 419 | 34 | 52 | 162 | 81 | 160 |
| Declined | 53 | 188 | 27 | 80 | 7 | 8 | 27 | 8 | 6 |
| Response <br> Rate (\%) | 89.5\% | 68.8\% | 93.6\% | 84.0\% | 82.9\% | 86.7\% | 85.7\% | 91.0\% | 96.4\% |

Table A2. Demography of participants.

|  | Urban |  |  | Rural Coastal |  | Rural |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | Curridabat | La Union | Montes de <br> Oca | Cartago | San <br> Francisco | Tortuguero | Northern <br> Rural Area | Eastern <br> Rural Area | Southern <br> Rural Area |
| Male | 162 | 139 | 130 | 165 | 7 | 17 | 56 | 16 | 68 |
| Female | 290 | 275 | 261 | 253 | 27 | 35 | 106 | 65 | 92 |
| Nonbinary | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Don't wish <br> to say | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

Table A3. Age of Participants (Number and Percentage)

| Age Group | Curridabat |  | La union |  | Montes de oca |  | Cartago |  | Northern RA |  | Eastern RA |  | Southern RA |  | San <br> Francisco |  | Tortuguero |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 18 to 24 | 25 | 5.5\% | 32 | 7.7\% | 11 | 2.8\% | 31 | 7.4\% | 8 | 4.9\% | 5 | 6.3\% | 7 | 4.3\% | 8 | 23.5\% | 8 | 15.4\% |
| 25 to 30 | 32 | 7.1\% | 38 | 9.2\% | 33 | 8.4\% | 51 | 12.2\% | 16 | 9.9\% | 11 | 13.8\% | 15 | 9.3\% | 9 | 26.5\% | 10 | 19.2\% |


| 31 to 35 | 47 | 10.4\% | 42 | 10.1\% | 42 | 10.7\% | 33 | 7.9\% | 17 | 10.5\% | 6 | 7.5\% | 17 | 10.6\% | 3 | 8.8\% | 6 | 11.5\% |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 36 to 40 | 64 | 14.2\% | 47 | 11.3\% | 53 | 13.5\% | 45 | 10.7\% | 13 | 8.0\% | 10 | 12.5\% | 18 | 11.2\% | 2 | 5.9\% | 6 | 11.5\% |
| 41 to 45 | 58 | 12.8\% | 29 | 7.0\% | 56 | 14.2\% | 38 | 9.1\% | 10 | 6.2\% | 1 | 1.3\% | 18 | 11.2\% | 5 | 14.7\% | 5 | 9.6\% |
| 46 to 50 | 53 | 11.7\% | 36 | 8.7\% | 55 | 14.0\% | 35 | 8.4\% | 13 | 8.0\% | 5 | 6.3\% | 22 | 13.7\% | 1 | 2.9\% | 6 | 11.5\% |
| 51 to 55 | 44 | 9.7\% | 36 | 8.7\% | 43 | 10.9\% | 34 | 8.1\% | 21 | 13.0\% | 9 | 11.3\% | 5 | 3.1\% | 2 | 5.9\% | 3 | 5.8\% |
| 56 to 60 | 47 | 10.4\% | 33 | 8.0\% | 29 | 7.4\% | 38 | 9.1\% | 19 | 11.7\% | 12 | 15.0\% | 20 | 12.4\% | 3 | 8.8\% | 3 | 5.8\% |
| 61 to 65 | 19 | 4.2\% | 44 | 10.6\% | 22 | 5.6\% | 37 | 8.8\% | 17 | 10.5\% | 10 | 12.5\% | 10 | 6.2\% | 1 | 2.9\% | 4 | 7.7\% |
| Over 65 | 62 | 13.7\% | 70 | 16.9\% | 45 | 11.5\% | 74 | 17.7\% | 27 | 16.7\% | 10 | 12.5\% | 23 | 14.3\% | 0 | 0.0\% | 1 | 1.9\% |
| Don't wish to say | 1 | 0.2\% | 8 | 1.9\% | 4 | 1.0\% | 3 | 0.7\% | 1 | 0.6\% | 1 | 1.3\% | 6 | 3.7\% | 0 | 0.0\% | 0 | 0.0\% |
| Sum | 452 |  | 415 |  | 393 |  | 419 |  | 162 |  | 80 |  | 161 |  | 34 |  | 52 |  |

Table A4. Dog and Cat Ownership vs. Household size

|  | Urban |  | Rural Coastal |  | Rural |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | Curridabat | La <br> Union | Montes <br> de Oca | Cartago | San <br> Francisco | Tortuguero | Northern <br> Rural <br> Area | Eastern <br> Rural <br> Area | Southern <br> Rural <br> Area |
| Total HH | 452 | 415 | 393 | 419 | 34 | 52 | 162 | 81 | 160 |
| Number <br> of People | 53 | 188 | 27 | 80 | 7 | 8 | 27 | 8 | 6 |
| Response <br> Rate (\%) | $89.5 \%$ | $68.8 \%$ | $93.6 \%$ | $84.0 \%$ | $82.9 \%$ | $86.7 \%$ | $85.7 \%$ | $91.0 \%$ | $96.4 \%$ |

## Appendix 2. Animal Cruelty Data

Table A5. Counts of animal cruelty instances

|  | Urban |  |  | Rural Coastal |  | Rural |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | Curridabat | La <br> Union | Montes <br> de Oca | Cartago | San <br> Francisco | Tortuguero | Northern <br> Rural <br> Area | Eastern <br> Rural <br> Area | Southern <br> Rural <br> Area |
| Against <br> roaming cats <br> or dogs | 68 | 66 | 18 | 54 | 7 | 22 | 12 | 16 | 9 |


| Against other <br> animals | 2 | 5 | 1 | 6 | 1 | 0 | 0 | 0 | 0 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Against <br> roaming <br> cats/dogs AND <br> other animals | 1 | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 0 |

Note that participants were allowed to choose more than one answer.
Table A6. Perception of cruel animal practices by participants.

|  | Urban |  |  | Rural Coastal |  | Rural |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Curridabat | La <br> Union | Montes <br> de Oca | Cartago | San <br> Francisco | Tortuguero | Northern <br> Rural <br> Area | Eastern <br> Rural <br> Area | Southern <br> Rural <br> Area |  |
| Not providing <br> adequate care | 268 | 291 | 226 | 236 | 21 | 28 | 93 | 46 | 109 |
| Letting it roam <br> unsupervised | 233 | 69 | 139 | 75 | 14 | 21 | 33 | 15 | 20 |
| Intentionally <br> hitting or <br> injuring it | 312 | 301 | 260 | 311 | 28 | 36 | 108 | 60 | 129 |
| Keeping it tied <br> or locked up <br> for long periods <br> of time | 285 | 255 | 225 | 204 | 16 | 22 | 75 | 39 | 102 |
| Using them for <br> organized fights | 90 | 36 | 86 | 62 | 5 | 5 | 11 | 9 | 23 |
| Breeding <br> animals for <br> money | 59 | 35 | 47 | 62 | 0 | 4 | 10 | 6 | 19 |
| Keeping wildlife <br> as pets | 22 | 2 | 23 | 9 | 0 | 1 | 0 | 0 | 1 |
| Other | 29 | 35 | 16 | 32 | 2 | 6 | 6 | 9 | 17 |
| All responses | 451 | 415 | 391 | 417 | 34 | 52 | 162 | 80 | 159 |

Note that participants were allowed to choose more than one response.
Participants that chose "Other" as an option were allowed a free-form response. These responses were analyzed thematically, and the following themes were present. The counts of each are also shown.

Table A7. Other themes present in free-form answers.
Abandonment

| Neglect | 16 |
| :--- | :--- |
| Inadequate veterinary care | 6 |
| Inadequate space | 15 |
| Inadequate exercise | 4 |
| Inadequate shelter | 5 |
| Treating animals like pests; poisoning them | 8 |
| Shouting at animals | 5 |
| Ignoring needs | 14 |
| Malnutrition/withholding food | 2 |
| Taking advantage of animals | 4 |
| Not sterilizing pets | 11 |
| Humanizing (e.g. putting human clothes on animals) | 1 |
| Modifying their bodies (e.g. ear cropping, tail docking) | 1 |
| Physical harm | 2 |
| Organized fighting | 1 |
| Breeding | 2 |
| All responses | 109 |

