National Street Dog Monitoring and Evaluation Survey

Royal Kingdom of Bhutan, June/July 2018

And

Knowledge, Attitude and Practices (KAP) survey

Thimphu and Paro, Royal Kingdom of Bhutan, July 2018

HUMANE SOCIETY INTERNATIONAL

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Photo credit: Dr. Amit Chaudhari; Roaming owned dogs (sterilized and unsterilized)

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Photo credit: Tamara Kartal; Street dog pack in Paro City interacting positively with Dr Amit

Background

With emerging methods to monitor and evaluate the impact of street dog programs, we conducted one of the first ever street dog surveys in 2015, designed and led by Dr. Lex Hiby (HSI consultant). This survey generated the first national evaluation of the sterilization rate across all Dzongkhags (districts) in the country as well as generated dog population estimates. Additionally, survey results in combination with clinic records and other monitoring surveys conducted by Dr. Karma Rinzin over time, were used to calculate the survival rates of sterilized dogs in order to distribute program efforts according to priority areas and areas with lower sterilization rates. The 2018 survey included a subset of the districts (eight Dzongkhags) but followed the below 2015 protocol, routes as well as start and end times. The results for the eight Dzongkhags surveys for both 2015 and 2018 are presented and discussed in this report.

Further we conducted a KAP (Knowledge, Attitude and Practices) survey to explore the relationship people have with their private and street dogs in urban and rural Paro and Thimphu.

There is a growing pool of evidence that dog populations and population dynamics are largely influenced by (dependent on) dog interactions and relationships with the local human

community (e.g. Morters et al., 2014[1]; Villatoro et al., 2016[2], and unpublished HSI data). Therefore it is crucial to understand how the human-dog relationship and the quality of the interaction (positive vs negative) influence dog population dynamics as well as street dog behavior. Private ("owned") dog populations have long been ignored in discussions of street dog population management. First, there is a widely held assumption that there are relatively few private dogs where street dogs are common. Second, it is assumed that private dogs and street dogs are two separate non-interacting populations (dog communities). As a result of several recent surveys in India, HSI now reports that dog demographic and KAP surveys show that not only should private and street dogs be considered as interacting communities (both are dependent on human behavior, control and food/water provision) but should also be addressed in a comprehensive dog management program to be sustainable.

This has multiple implications for sterilization and vaccination programs.

Private dogs need to be included in dog population management programs. They likely contribute to the street dog population because their litters are reared under relatively close human supervision and food provision, and because a large number (sometimes up to two-third) of them roam the streets with street dogs. The rate of abandonment of private dogs and pups from private dogs has not been determined but it is likely that street dogs are recruited from the private dog population. In Thimphu and Paro, in particular, since sterilization efforts have been maintained high throughout the years. Dr. Tenzin, Paro veterinarian, reports 1500 to 2000 sterilizations per year with an overall sterilization rate of over 80%. Veterinarians and the knowledge of their Dzongkhag proves to be crucial. Dr. Tenzin, for instance, is aware of newly introduced dogs to the area and abandoned dogs around his sterilization clinic, however the extent to which dogs are brought into the area as well as abandoned in the city remains unquantified at this point. Understanding more closely human directed movement of dogs as well as the role human play in the street dog population dynamics would not only help to improve the sterilization efforts of the program but provide an opportunity to create a human behavior and community engagement campaign to sustainably address the problem and not only fix the symptoms (pun intended).

This survey and this report are an extension of a KAP survey conducted by Dr. Karma Rinzin[3] and results will be compared across surveys in the second part of this report. We will explore what behaviors contribute to the problem and how they could be addressed in future efforts to take the program to the next phase.

Summary of the 2015 National Street Dog Survey

In 2015 street surveys were used to estimate sterilization coverage and roaming dog density in all districts. In the main town or towns and in randomly selected villages. Teams comprised of two surveyors were either recording dogs by walking or driving slowly along the streets. In the towns, observers used the Google Maps or My Maps applications to follow standard routes. Standard routes were designed prior to the survey to represent all areas,

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[1] Morters, M. K., McKinley, T. J., Restif, O., Conlan, A. J., Cleaveland, S., Hampson, K., Whay, H.R., Damriyasa, I. & Wood, J. L. (2014). The demography of free-roaming dog populations and applications to disease and population control. *Journal of Applied Ecology*, *51*(4), 1096-1106.

Morters, M. K., Bharadwaj, S., Whay, H. R., Cleaveland, S., Damriyasa, I. M., & Wood, J. L. N. (2014). Participatory methods for the assessment of the ownership status of free-roaming dogs in Bali, Indonesia, for disease control and animal welfare. *Preventive veterinary medicine*, *116*(1), 203-208

[2] 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.

[3] Rinzin, K. (2015): Population dynamics and health status of free-roaming dogs in Bhutan. PHD Thesis, College of Veterinary Medicine School of Veterinary and Life Sciences Murdoch University Western Australia

which can be followed on subsequent surveys to monitor changes in roaming dog density and population composition. The villages were searched to record details of as many unconfined dogs as possible. Town surveys were conducted early in the morning to avoid dense traffic whereas villages were surveyed at any time of day. Survey start and end times were recorded so that subsequent surveys can be conducted over the same time periods. The OSM tracker application was used to record the location of each dog seen by tapping icons that had been configured to show dogs of the following seven types: males and females with and without ear-notch (sign that the dog has been sterilized), lactating females, pups and unknown adults. The icon colors match those used in maps that can be generated from the database to show the distribution of dog types.

Acknowledgement

Survey Design and Methodology – Street Dog Survey

Street dog surveys focus on the street dog population, which likely represents proportions of roaming private and truly unowned dogs of unknown ratio. Street counts provide relative estimates of the roaming dog population and further provide a quantitative assessment of how many dogs residents encounter during their daily routines on the streets.

Street dog survey objectives:

- Generate a reliable estimate of the relative dog population per street kilometer
- Estimate the proportion of sterilized dogs within the street dog population
- Asses street dog welfare by tracking two indicators, body condition score and skin conditions as a proxy measure

Street Dog Survey 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 expressways (dogs tend to avoid these roads). Routes are marked with a starting (flag) and end point (police officer) (Image 1). For easy access, the routes are saved as KML files and stored in Google My Places, which can be accessed from smartphones (online and offline). A survey team, consisting of a driver and an observer in a car (or by foot), conducted the surveys early in the morning in towns or at any time in rural areas, following the start and end time from the 2015 survey. 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 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 is subsequently downloaded and stored in an Access database for analysis. The survey route was surveyed on two consecutive days, by the same survey team, to measure the accuracy and power to detect change.

Evaluation Metrics

Data gathered during transect surveys were used to generate a variety of metrics that were necessary to address the goals of this project. These included:

1) 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". As described previously, this metric does not account for incomplete detection, but still provides a valid indicator of underlying dog density that can be used to quantify change over time or patterns of dog density over space.

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

3) 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.

Image 1: Survey track through Thimphu Town
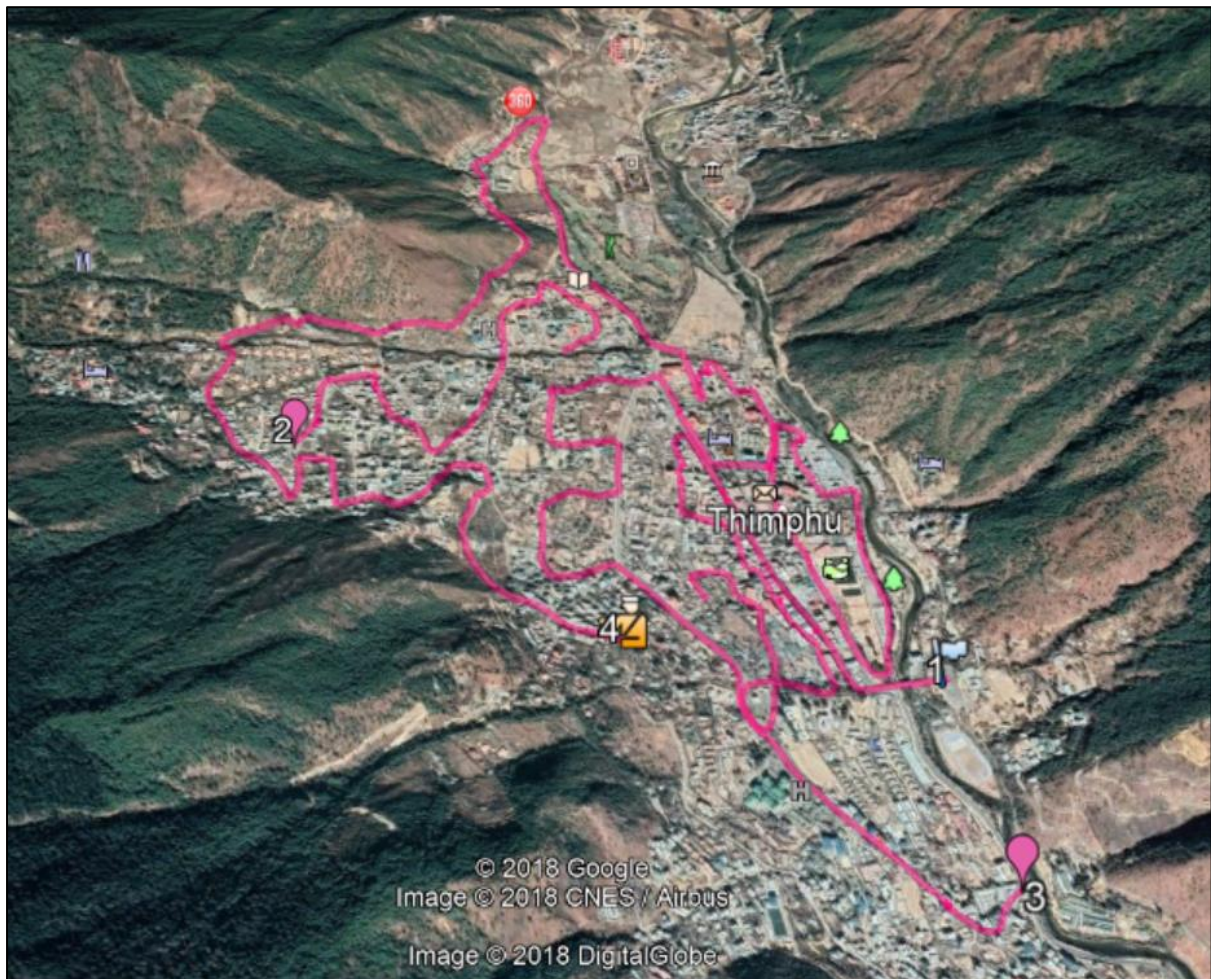
Results

Roaming Dog Abundance and density change

City boundaries were superimposed on Google Maps in order to restrict each track to a single defined area. The image in figure 1 illustrates the track for Thimphu town. The track is split into sections with numbered pin icons showing the start of each section. The flag icon is the start of the track and the policeman icon shows the end of the track. Each track is saved as a kml file that can be loaded into the My Places facility of Google Maps on the PC and then viewed using the Maps application on a smartphone synchronized with that Google account. Any of the tracks can therefore be followed at any time in the future by viewing the kml on the Maps application on a smartphone and moving the Maps cursor along each of the track sections in turn.

To complete the current survey, seven teams each consisting of a driver and observer followed each track twice, recording seven types of dogs seen (Female notched, Female unnotched, Lactating, Male notched, Male unnotched, Unknown adult and Pup) by using the OSMtracker phone app as an event recorder. The phones were GPS-enabled so the exact location of each sighting was recorded (Photo 1).

Photo 1: Recording of a street dog with a low body condition score and a skin infection. At the national museum in Paro.

Note: Tracks written in grey are tracks that cannot be used for comparison between 2015 and 2018 as the weather conditions were too different between the years. In 2015 the weather was sunny and rain was absent. The 2018 survey was conducted a month later, which is already the rainy season in Bhutan. Rain will directly influence the roaming behavior of dogs, meaning fewer dogs will be seen on the streets because dogs are hiding in shelters from the rain. It is advisable to conduct the next monitoring survey at the same time as in 2015 to avoid this problem and have more data that can be compared between the years.

There is no statistically significant difference between the dog densities in the different districts (One-way ANOVA, F = 1.15, df = 4, p = 0.362).

Town

Table 1 shows the count results for both surveys in 2015 as well as 2018 and the difference in dog numbers observed on the same track. The number of dogs encountered during the survey has decreased significantly in most urban areas of the districts, however Thimphu and Paro has experienced a significant increase in the number of street dogs. While we recorded 22.8% more dogs in Thimphu and 27.7% more dogs in Kabesa (Thimphu), we recorded the highest number of more dogs in Paro with an increased density of 76.8%. In contrast, we recorded much fewer dogs in Sarpang and Gelephu (Sarpang), 81.2% and 69.3% respectively.

Table 1: Summary of the urban areas surveyed in 2015 compared to 2018 and the change in dog density per km surveyed.

Name of the Dzongkhag	Name of the Town	Survey Year	Track length	Number of Dogs Counted	Change in Number of Dogs	% Density Change	Dogs/km
Bhumthang	Bhumthang	2018	4.78	74.5	-12.5	-14.4%	15.59
		2015	4.78	87			18.20
Chukha	Tsimalakha (Chukha)	2018	6.51	75	-47	-38.5%	11.52
		2015	6.51	122			18.74
Chukha	Gedu (Chukha)	2018	8.89	59	-31.5	-34.8%	6.64
		2015	8.89	90.5			10.18
Chukha	Phuentsholing (Chukha)	2018	13.08	77	-47.5	-38.2%	5.89
		2015	13.08	124.5			9.52
Paro	Paro	2018	3.73	148.5	64.5	76.8%	39.81
		2015	3.73	84			22.52
Sarpang	Sarpang	2018	3.68	16	-69	-81.2%	4.35
		2015	3.68	85			23.10
Sarpang	Gelephu (Sarpang)	2018	7.25	53.0	-119.5	-69.3%	7.31
		2015	7.25	172.5			23.79
Samdrupjongkher	Samdrupjongkher	2018	4.9	40.0	-21	-34.4%	8.16
		2015	4.9	61.0			12.45
Samdrupjongkher	Deothang	2018	3.69	30.5	-10	-24.7%	8.27
		2015	3.69	40.5			10.98
Thimphu	Kabesa (Thimphu)	2018	17.82	30	6.5	27.7%	1.68
		2015	17.82	23.5			1.32
Thimphu	Thimphu	2018	22.07	504	93.5	22.8%	22.84
		2015	22.07	410.5			18.60
Trashigang	Trashigang	2018	3.5	33	-63	-65.6%	9.43
		2015	3.5	96			27.43
Samtse	Samtse	2018	1.47	31	-39	-55.7%	21.09
		2015	1.47	70			47.62

Rural

Table 2 shows the results for the rural areas that were surveyed in 2018 compared with 2015. Most tracks show a decreased dog density since 2015, however a view showed a significant increase. In Chhoker in Bhumthang we recorded 87.5% more dogs compared to 2015. Olathang in Paro also showed an increased dog density of 69.7% as well as Zomlingthang in Sarpang (50% increase), Phuenshothang in Samdrup (16.7% increase)and both rural areas in Thimphu, Chamgang and Depsi, on which we recorded 107.7% and 153.3% more dogs in 2018. However, we also recorded significant reductions in dog density across all districts, e.g. in Jigmeling in Sarpang we recorded 81% fewer dogs compared to 2015. Sterilization coverage on all routes will be discussed later in this report.

In Table 3 we summarized the survey results per Dzongkhag. Overall it can be concluded that only Paro and Thimphu show an increased dog density, however as shown in table 1 and 2 there are significant differences between areas within a district.

Table 2: Summary of the rural areas surveyed in 2015 compared to 2018 and the change in dog density per km surveyed.

Name of the Dzongkhag	Name of the Rural area	Track length	Survey Year	Number of Dogs Counted	Change in Number of Dogs	% Density Change	Dogs/km
		3.9	2018	45	21	87.5%	11.54
	Chhoker	3.9	2015	24			6.15
		12.51	2018	57	-32	-36.0%	4.56
Bhumthang	Chumme	12.51	2015	89			7.11
		4.58	2018	14	2	16.7%	3.06
	Chapcha	4.58	2015	12			2.62
		7.65	2018	42	13	44.8%	5.49
	Chukha	7.65	2015	29			3.79
		3.67	2018	42	17	68.0%	11.44
	Wangakha	3.67	2015	25			6.81
		2.85	2018	5	-22	-81.5%	1.75
	Darla	2.85	2015	27			9.47
		5.85	2018	9	-30	-76.9%	1.54
	Tala	5.85	2015	39			6.67
		17.22	2018	24	-47	-66.2%	1.39
Chukha	Pasakha	17.22	2015	71			4.12
		8.39	2018	97	-30	-23.6%	11.56
	Bondey	8.39	2015	127			15.14
		6.37	2018	28	-23	-45.1%	4.40
	Chuzom	6.37	2015	51			8.01
		8.36	2018	28	-12	-30.0%	3.35
	Dopshari	8.36	2015	40			4.78
		11.7	2018	112	46	69.7%	9.57
Paro	Olathang	11.7	2015	66			5.64

	Semi Urban Paro	15.59	2018	155	-4	-2.5%	9.94
		15.59	2015	159			10.20
	Shaba	8.58	2018	38	-32	-45.7%	4.43
		8.58	2015	70			8.16
	Way to Tiger nest	4.45	2018	60	-4	-6.3%	13.48
		4.45	2015	64			14.38
	Jigmeling	4.5	2018	15	-64	-81.0%	3.33
		4.5	2015	79			17.56
	Gakiling	4.32	2018	10	-25	-71.4%	2.31
		4.32	2015	35			8.10
	Samtelling	3.49	2018	6	-21	-77.8%	1.72
		3.49	2015	27			7.74
Sarpang	Zomlingthang	2.78	2018	6	2	50.0%	2.16
		2.78	2015	4			1.44
	Phuenshothang	2.57	2018	7	1	16.7%	2.72
		2.57	2015	6			2.33
Samdrup	Pemathang	1.07	2018	6	-38	-86.4%	5.61
		1.07	2015	44			41.12
	Chamgang	7.02	2018	54	28	107.7%	7.69
		7.02	2015	26			3.70
Thimphu	Depsi	3.35	2018	31	19	158.3%	9.25
		3.35	2015	12			3.58
	Radi	8.67	2018	11	-17	-60.7%	1.27
		8.67	2015	28			3.23
	Khaling	2.01	2018	13	-4	-23.5%	6.47
		2.01	2015	17			8.46
Tarshigang	Wamrong	5.83	2018	32	-6	-15.8%	5.49
		5.83	2015	38			6.52
	Gomtu	5.07	2018	40	-10	-20.0%	7.89
		5.07	2015	50			9.86
	Tendu	4.26	2018	28	-23	-45.1%	6.57
		4.26	2015	51			11.97
	Ghumawni	3.43	2018	11	-30	-73.2%	3.21
		3.43	2015	41			11.95
Samtse	Chengmari	1.71	2018	22	-12	-35.3%	12.87
		1.71	2015	34			19.88

Table 3: Results of the street counts per Dzongkhag for 2015 and 2018

Name of the Dzongkhag	Survey Year	total track length	Number of Dogs Counted	Change in Number of Dogs	% Density Change	Dogs/km
Bhumthang	2018	21.19	176.5	-23.5	-11.8%	8.33
	2015	21.19	200			9.44
Chukha	2018	70.3	347	-193	-35.7%	4.94
	2015	70.3	540			7.68
Paro	2018	67.17	666.5	5.5	0.8%	9.92
	2015	67.17	661			9.84
Sarpang	2018	22.34	106	-296.5	-73.7%	4.74
	2015	22.34	402.5			18.02
Samdrupjongkher	2018	12.23	83.5	-68	-44.9%	6.83
	2015	12.23	151.5			12.39
Thimphu	2018	50.26	619	147	31.1%	12.32
	2015	50.26	472			9.39
Trashigang	2018	20.01	89	-90	-50.3%	4.45
	2015	20.01	179			8.95
Samtse	2018	15.94	132	-114	-46.3%	8.28
	2015	15.94	246			15.43

Composition of the roaming dog population

Table 4 and 5 present the composition of the dog populations on the streets of urban and rural areas.
Using the Kruskal Wallis H-test to test if there are any differences between locations showed that the percentage of females that are lactating between the routes of the five Dzongkhags did not differ significantly ($H = 0.95$, $df = 4$, $p = 0.92$). The same applies to the two recorded welfare indicators (visible skin condition and body condition score 1/2). The percentage of dogs with body condition scores 1 and 2 combined (emaciated and thin) did not statistically differ between the Dzongkhags ($H = 7.34$, $df = 4$; $p = 0.119$). The percentage of dogs with a visible skin infection did not statistically differ significantly between Dzongkhags either ($H = 2.64$, $df = 4$, $p = 0.619$). (Note that the sample size for three out of the five Dzongkhags was below five, therefore we should consider the p values an imperfect approximation for each of the indicators).

Table 4: Composition of the dog population averaged across the town areas surveyed.

Town	% Total Sterilized	% Sterilized Female	% Sterilized Male	Male : Female (1) ratio calculation	% Pups	% Lactating	% Skin Problem	% C1/C2 Body score
Bhumthang	52.6	49.1	55.7	1.1	8.7	3.6	0.0	1.7
Tsimalakha (Chukha)	85.2	89.2	79.2	0.6	1.3	0.0	0.0	0.0
Gedu (Chukha)	46.0	44.0	48.0	1.0	0.0	0.0	2.0	0.0
Phuentsholing (Chukha)	61.4	66.7	57.6	1.4	1.3	4.2	5.3	0.0
Paro	79.9	81.2	78.9	1.3	0.7	0.0	0.0	0.0
Sarpang	20.0	16.7	25.0	0.7	0.0	0.0	0.0	0.0
Gelephu (Sarpang)	64.7	61.1	68.8	0.9	0.0	0.0	2.9	0.0
Samdrupjongkher	58.8	50.0	71.4	0.7	0.0	0.0	11.8	0.0
Deothang	47.2	26.9	66.7	1.0	8.2	0.0	17.0	3.8
Kabesa (Thimphu)	83.3	78.6	90.0	0.7	0.0	0.0	4.2	0.0
Thimphu	70.9	64.3	76.1	1.3	1.9	1.4	2.5	0.0
Trashigang	69.0	72.7	66.7	1.6	0.0	0.0	24.1	0.0
Samtse	40.8	26.1	53.8	1.1	0.0	0.0	0.0	0.0
Bhutan Town	65.8	62.1	69.0	1.1	1.8	1.0	3.7	0.3

Table 5: Composition of the dog population averaged across the rural areas surveyed.

District	Geog	% Total Sterilized	% Sterilized Female	% Sterilized Male	Male: Female (1) ratio calculation	% Pups	% Lactating	% Skin Problem	% C1/C2 Body score
Bhumthang	Chhoker	18.2	17.6	18.8	0.9	11.1	0.0	0.0	3.0
Bhumthang	Chumme	52.9	58.8	47.1	1.0	10.5	0.0	2.9	0.0
Chukha	Chapcha	16.7	0.0	20.0	0.6	14.3	0.0	25.0	0.0
Chukha	Chukha	77.5	79.2	75.0	0.7	0.0	0.0	2.5	0.0
Chukha	Wangakha	62.1	52.4	87.5	0.4	11.9	19.0	0.0	0.0
Chukha	Darla	60.0	100.0	50.0	4.0	0.0	0.0	0.0	0.0
Chukha	Tala	83.3	66.7	100.0	1.0	0.0	0.0	0.0	0.0
Chukha	Pasakha	36.8	10.0	66.7	0.9	0.0	0.0	0.0	0.0
Paro	Bondey	54.5	56.3	52.2	0.7	8.2	0.0	1.8	0.0
Paro	Chuzom	47.6	46.2	50.0	0.6	10.7	0.0	9.5	0.0
Paro	Dopshari	47.6	46.2	50.0	0.6	10.7	0.0	9.5	4.8
Paro	Olathang	50.8	43.3	57.1	1.2	7.1	10.0	3.1	0.0
Paro	Semi Urban Paro	60.4	72.0	49.0	1.0	3.2	0.0	11.9	0.0
Paro	Shaba	70.0	83.3	50.0	0.7	0.0	0.0	5.0	0.0
Paro	Way to Tiger nest	40.7	42.9	38.5	0.9	6.7	0.0	3.7	0.0
Sarpang	Jigmeling	16.7	16.7	16.7	1.0	0.0	0.0	0.0	0.0
Sarpang	Gakiling	28.6	33.3	25.0	1.3	0.0	0.0	0.0	0.0
Sarpang	Samtelling	25.0	0.0	25.0	0.0	0.0	0.0	0.0	0.0
Sarpang	Zomlingthang	100.0	100.0	100.0	1.0	0.0	0.0	0.0	0.0
Samdrupjongkher	Phuenshothang	40.0	100.0	25.0	4.0	0.0	0.0	0.0	0.0
Samdrupjongkher	Pemathang	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0
Thimphu	Chamgang	60.0	70.0	40.0	0.5	11.1	0.0	6.7	0.0

Thimphu	Depsi	62.5	66.7	57.1	0.8	3.2	0.0	0.0	0.0
Trashingang	Radi	40.0	28.6	66.7	0.4	0.0	0.0	0.0	0.0
Trashingang	Khaling	66.7	62.5	75.0	0.5	0.0	0.0	8.3	0.0
Trashigang	Wamrong	65.4	57.1	75.0	0.9	6.3	7.1	0.0	0.0
Samtse	Gomtu	38.9	47.4	29.4	0.9	0.0	0.0	5.6	0.0
Samtse	Tendu	43.5	46.2	40.0	0.8	0.0	0.0	8.7	0.0
Samtse	Ghumawni	20.0	0.0	100.0	0.3	0.0	37.5	0.0	0.0
Samtse	Chengmari	66.7	80.0	61.5	2.6	0.0	0.0	0.0	0.0
Bhutan Geog		52.6	54.4	50.5	0.9	5.7	2.9	5.0	0.3

Averaged, the town areas in Bhutan have a higher sterilization rate than the rural areas. Lactating females are low in both areas, however about 2.9% of females were lactating in rural areas versus only 1% in towns. As a result of this higher fecundity in rural areas we observed 5.7% pups in rural areas and only 1.8% in towns.

Impact of Sterilization

Average sterilization rates for the surveyed Dzongkhags are shown in Chart 1. Overall sterilization rates are high within some areas (especially rural) with very low sterilization rates. Overall sterilization rates are important indicators, however the authors believe that the proportion of sterilized female sis especially important when programs aim to reduce the density of dogs as the number of unsterilized females do not only represent the fertility of a population but also a few males (or one in fact) would be sufficient to sire pups with these females. However, male dogs can be sterilized much faster and programs need to make a specific effort to sterilize female dogs. (More details can be found in the appendix). Lowest and highest sterilization rates in females and overall for towns and rural areas are presented for all tracks that can be compared between 2015 and 2018, excluding the tracks that had significantly more rain (see note above).

Chart 1: Average sterilization proportions by survey year and district
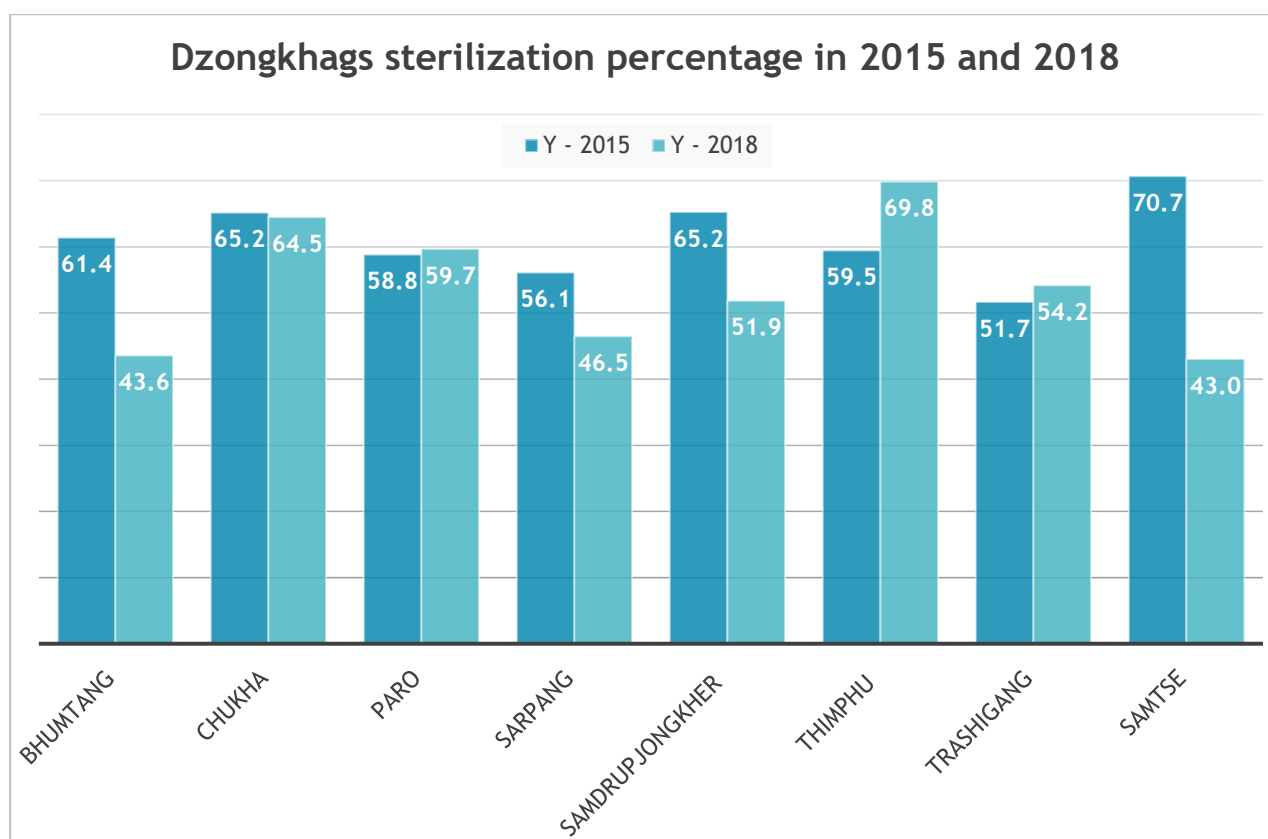
Town

In 2018, the lowest female sterilization rate in towns was recorded in Sarpang with 16.7% sterilized females and a total sterilization rate of 20%, a steep decrease compared to 2015 when we recorded 22% sterilized females and 49.7% total sterilized (Table 6). The highest female sterilization rate in 2018 was recorded in Paro with 81.2% sterilized females and a total sterilization rate of 79.9%. Compared to 2015 the proportion of sterilized females was lower at 72.1% as well as the total sterilization rate with 73.8%, hence an increase in sterilized females and total sterilized dogs 9.1% and 6.1% respectively.

Table 6: Sterilization percentages in towns recorded in 2015 and 2018

Srl No.	Town	2018			2015		
		% Total Sterilized	% Sterilized Female	% Sterilized Male	% Total Sterilized	% Sterilized Female	% Sterilized Male
1	Bhumthang	52.6	49.1	55.7	71.0	75.3	66.7
2	Tsimalakha (Chukha)	85.2	89.2	79.2	74.2	89.2	66.7
3	Gedu (Chukha)	46.0	44.0	48.0	73.7	78.4	71.9
4	Phuentsholing (Chukha)	61.4	66.7	57.6	62.2	73.7	57.9
5	Paro	79.9	81.2	78.9	73.8	72.1	75.4
6	Sarpang	20.0	16.7	25.0	49.7	22.0	67.4
7	Gelephu (Sarpang)	64.7	61.1	68.8	60.3	47.3	71.3
8	Samdrupjongkher	58.8	50.0	71.4	78.6	76.9	79.7
9	Deothang	47.2	26.9	66.7	47.1	33.3	52.8
10	Kabesa (Thimphu)	83.3	78.6	90.0	50.0	28.6	54.8
11	Thimphu	70.9	64.3	76.1	67.3	65.4	68.5
12	Trashigang	69.0	72.7	66.7	66.7	61.1	70.4
13	Samtse	40.8	26.1	53.8	78.0	69.4	83.3

Rural

The lowest female sterilization rates were recorded in Jigmeling in Sarpang with 16.7% and a total sterilization rate of 16.7%. A steep decrease from 2015, when we recorded 20.6% sterilized females and 41.5% total sterilized dogs. High sterilization rates have been recorded in several places and some of the high proportions are due to a low number of recorded dogs (Table 7).

Table 7: Sterilization percentages in rural areas recorded in 2015 and 2018

Srl No.	Geog	2018			2015		
		% Total Sterilized	% Sterilized Female	% Sterilized Male	% Total Sterilized	% Sterilized Female	% Sterilized Male
1	Chhoker	18.2	17.6	18.8	66.7	80.0	57.1
2	Chumme	52.9	58.8	47.1	50.7	55.6	45.7
3	Chapcha	50.0	71.4	20.0	33.3	66.7	16.7
4	Chukha	77.5	79.2	75.0	55.6	100.0	50.0
5	Wangakha	62.1	52.4	87.5	41.2	60.0	33.3

6	Darla	60.0	100.0	50.0	72.2	75.0	70.0
7	Tala	83.3	66.7	100.0	68.0	100.0	57.9
8	Pasakha	36.8	10.0	66.7	55.3	81.8	47.2
9	Bondey	54.5	56.3	52.2	53.2	53.8	52.8
10	Chuzom	47.6	46.2	50.0	60.9	60.0	61.9
11	Dopshari	47.6	46.2	50.0	87.5	85.7	88.5
12	Olathang	50.8	43.3	57.1	35.6	33.3	39.1
13	Semi Urban Paro	60.4	72.0	49.0	55.0	61.4	50.0
14	Shaba	70.0	83.3	50.0	66.7	54.5	72.7
15	Way to Tiger nest	40.7	42.9	38.5	55.4	59.1	52.9
16	Jigmeling	16.7	16.7	16.7	41.5	20.6	64.5
17	Gakiling	28.6	33.3	25.0	73.3	88.9	66.7
18	Samtelling	25.0	-	25.0	65.4	63.6	66.7
19	Zomlingthang	100.0	100.0	100.0	0.0	0.0	0.0
20	Phuenshothang	40.0	100.0	25.0	33.3	0.0	50.0
21	Pemathang	0.0	-	0.0	34.9	29.4	38.5
22	Chamgang	60.0	70.0	40.0	40.9	53.8	22.2
23	Depsi	62.5	66.7	57.1	12.5	0.0	33.3
26	Radi	40.0	28.6	66.7	21.1	0.0	33.3
27	Khaling	66.7	62.5	75.0	50.0	40.0	57.1
28	Wamrong	65.4	57.1	75.0	28.1	17.6	40.0
29	Gomtu	38.9	47.4	29.4	69.8	63.2	75.0
30	Tendu	43.5	46.2	40.0	68.1	52.6	78.6
31	Ghumawni	20.0	0.0	100.0	66.7	30.8	87.0
32	Chengmari	66.7	80.0	61.5	65.5	50.0	73.7

Discussion

Both 2015 and 2018 surveys were conducted after the dog management program was implemented for several years (since 2008) and therefore do not show steep declines in indicators that immediately reflect a high sterilization rate following a program start. Statistical analysis shows that there is no statistically significant difference in dog density, however more import would be to observe density change over time. Considering that the start date of the program is 10 years ago and we are only looking at two data points regression analysis would give us no meaningful results, especially since the slope of the decline can be expected to be low at this point in the program and only data over time will provide a measurable trend. Therefore, an analysis of multiple surveys over time will give us a better idea in the future.

The same can be said about the two most common indicators, pups on the streets and lactating females, both were very low in 2015 and 2018. In 2015 we recorded 5% pups and fewer pups, 3.7%, in 2018. Lactating females comprised 1.3% in 2015 and 2% in 2018. At this point, after 10 years of high-level sterilization efforts, comparing year to year variations will likely yield no significant differences, therefore annual surveys should be conducted to

track changes over time and account for natural variations between years to avoid misinterpretations of single datapoints and rather create trendlines over time.

Another indicator that the welfare of street dogs has increased (and subsequently the welfare of the human community as well) are sexually transmitted diseases like Transmissible Venereal Tumor (TVT). Unfortunately TVT was not tracked in street surveys. However, one of the authors (Dr Amit Chaudhari) and Dr Shrikant were both active in the early stages of the program and confirm together with Dr Hiruka that welfare indicators (that were not tracked in surveys) have significantly improved since the start of the program. TVT was a very common disease among roaming dogs in both rural and town areas and has now been almost eradicated from the dog population. The authors observed only two to three cases of TVT in the Paro and Thimphu area and conversations with locals revealed that it was considered a public health issue especially around the market areas but is no longer present in peoples' minds as dogs are not affected anymore.

However, qualitative assessments suggest that there are yet unaddressed or new factors that contribute to a stable, or in Thimphu and Paro to an even increasing, dog population. Observations suggest that dogs are very well fed in the town areas (several would be considered overweight) and some of the packs include several old dogs that are senior (>7 years). Personal conversations with Dr Tenzin who is responsible for the Paro district reveal that there is an influx of young unsterilized dogs of unknown origin. Dr Tenzin knows almost all dogs in his district and reports that annual sterilization numbers remain relatively stable, suggesting that new street dogs are constantly introduced to the area. Food sources are certainly available with an ever growing town population, growing tourism industry and as a result growing number of meat shops and other food sources.

While the above are observations and qualitative impressions apart from the sterilization numbers, our surveys also suggest a significant increase in dog densities in some areas and especially in Paro and Thimphu town. Paro has experienced an increase in dog density of 76.8% since 2015 and Thimphu of 22.8%. Both town area results suggest that the observations made by the authors are real and that external influences besides dog reproductive capacity must play a role and we suspect that human mitigated movement of dogs as well as carrying capacity play a not yet defined key role in this population dynamic and are rooted in the human-dog relationship. The next phase of the dog management program should therefore continue the very well established sterilization efforts but focus on understanding and changing the way the human and dog communities interact with each other. Campaigns should focus on creating behavior change and community empowerment to counteract the newly increasing dog population in some areas.

Survey Design and Methodology – KAP survey

Survey areas were chosen based on our street dog survey results and the knowledge that the largest proportion of dogs live in Thimphu and Paro. The town areas are rapidly growing and with it the number of construction sites and human density. As a result, where human and housing density increases the roaming dog population will face decreased living space and a higher rate of contact with humans than previously. Focusing this survey on the two main town areas in Bhutan will give us a good insight on how this may have affected people in terms of how they keep their private dogs and how they perceive street dogs.

We divided Thimphu and Paro in rural and urban areas. Paro urban was further divided into three areas A, B and C; Judging from Google Earth, only area B has high density housing, whereas areas A and B have lower housing densities.

Dog demographics and KAP survey

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. Inclusion criteria for households were:

- The person being interviewed had to be over 18 years old and a resident at the address
- 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. Once questionnaires were completed, the completed forms were saved and uploaded to a cloud-based database by the surveyor.

Household surveys were conducted with a systematic random sampling method, which samples a portion of the total available households in the area.

To remain consistent throughout the survey either the left or the right side of the street was surveyed and households were selected following an interval of either every third or fifth (Paro urban), every fifth (Thimphu urban) and every second (Paro and Thimphu rural). In case nobody was available at the selected household, either the household before or after was surveyed instead.

Systematic random sampling in comparison to simple random sampling is less susceptible to researcher error.

Results

We interviewed 983 households of which 11 declined to participate (98.9% response rate). The households owned 300 dogs in total. About two thirds of all dogs were male dogs (62.5%, 187) and the remaining were female dogs (37.5%, 112). The sterilization rate was overall low with only 39.7% (119) of the dogs being sterilized and 58% (174) confirmed not sterilized and another 2.3% (7) not certainly sterilized.

To explore how our observations and perception of the street dog population is compared to residents' perception, we included an open ended question in the survey. Responses for the question 'Why do you think there are street dogs in Thimphu/Paro?' were collated and trends were analyzed. The abandonment of dogs appears to be common in the region with people coming from rural areas to leave their dogs in the city, "People bring from other places and throw them on street in Thimphu city". When combined with an already large population of owned, unsterilized dogs, which are frequently allowed to roam, this leads to an increased population of street dogs. However, this does not explain why the population is able to persist in the area. The most frequent reasons given for the high number of street dogs related to food availability which is directly related to an increased human population in the region. As human populations have increased the number of food outlets such as meat shops,

restaurants and hotels have increased significantly. Many surveyed individuals also suggested that there was poor waste management within the city and strays were "Scavenging garbage all around". In addition, the Buddhist faith of the area forbids the harm of dogs and leads to many residents actively feeding strays. Overall the combination of an increasing human population, available food, and unregulated breeding seem to be the most significant reasons recognized by the public for an increasing stray dog population.

Further we explored what breeds households owned in all survey areas. Below is the table summarizing the results for all areas combined (Note that some interviewees considered their dogs pure bred and when asked about the breed revealed that the dog was a breed cross). Most pure bred dogs were smaller breeds (Lhasa Apso and Pomeranian) apart from the Tibetan Mastiff (14, 14.9%) and German Shepherd (4, 4.3%).

Table 8: Summary table of dog breeds owned by interviewees

Breed dog	Number (%)
Alsatian/ German shepherd	4 (4.3)
Lhasa Apso	23 (24.5)
Lhasa Apso cross	6 (6.4)
Beagle	1 (1.1)
Bull dog	1 (1.1)
Cocker spaniel	1 (1.1)
Pomeranian	26 (27.7)
Pomeranian cross	1 (1.1)
Labrador Retriever	3 (3.2)
Labrador Retriever cross	1 (1.1)
Pit bull terrier	1 (1.1)
Pug	1 (1.1)
Spitz	4 (4.3)
Tibetan mastiff	14 (14.9)
Unknown	7 (7.4)
Total	94 (100)
Total pure breed	79 (84)
Total cross breed	8 (16)

Further results of the KAP survey are discussed by area and subdivision in the following chapters.

THIMPHU

Thimphu – urban

KAP surveys in urban Thimphu were conducted along transects through different areas of the city, covering a wide range of housing types (Image 2).
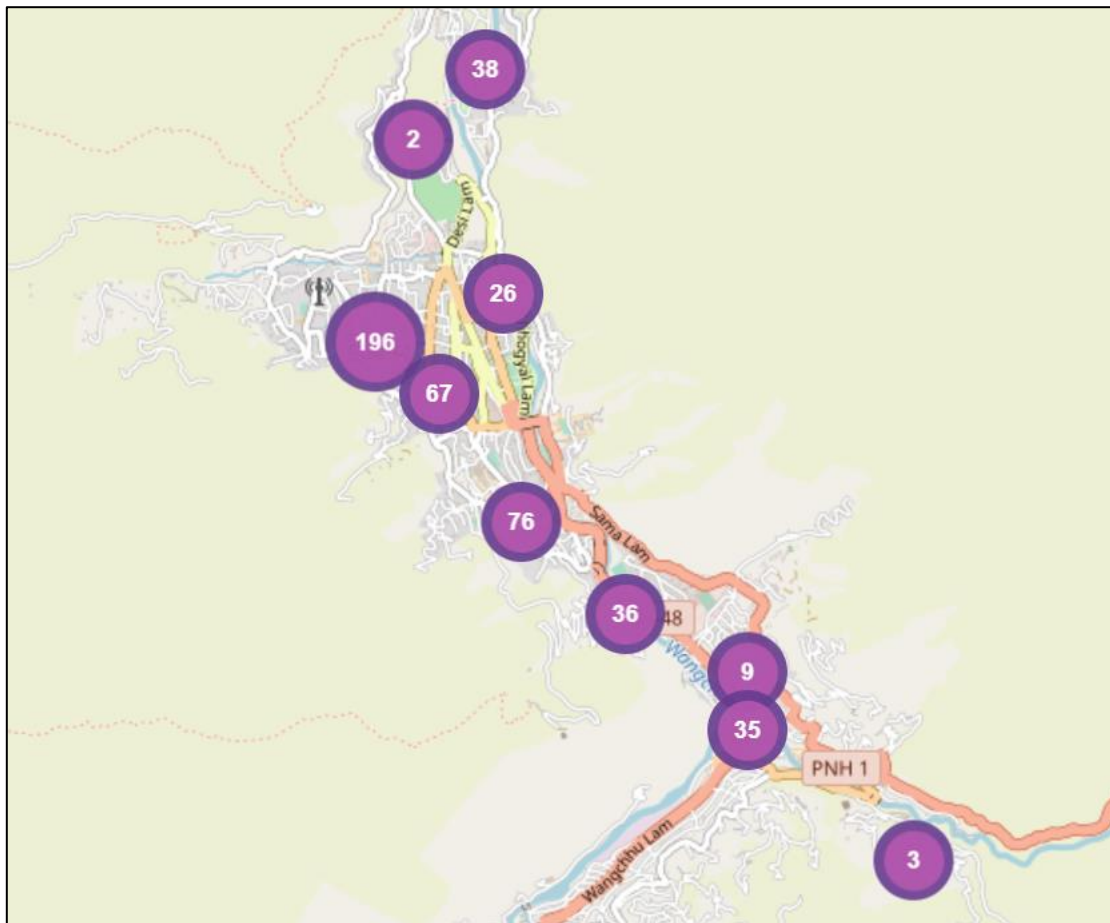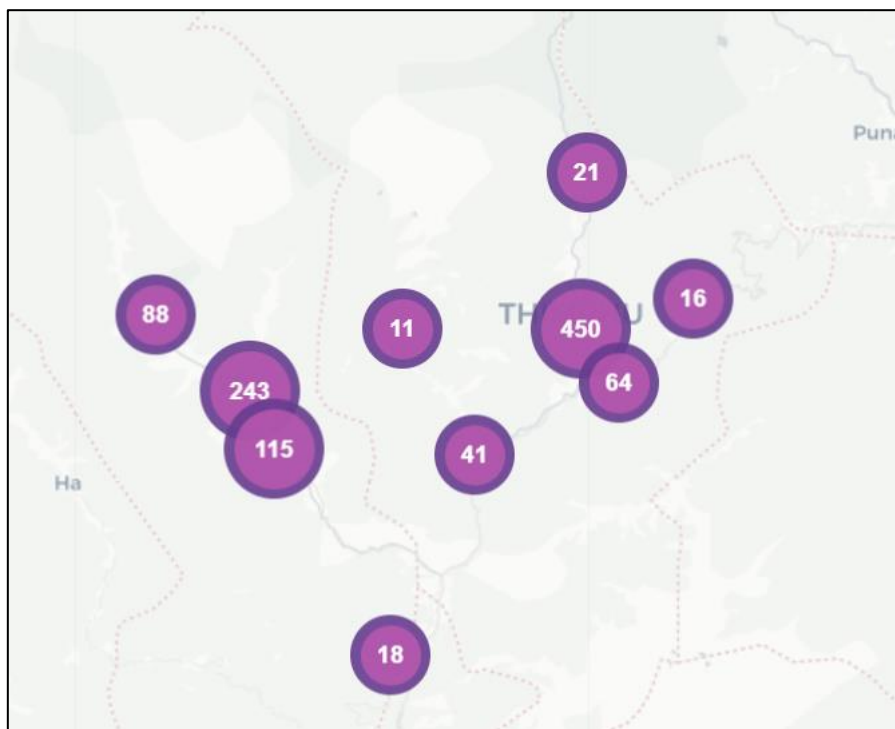
Image 2: Sampling areas in Thimphu City.

Image 3: Sampling areas in Thimphu and Paro

Human Demographics

We interviewed 404 households in Thimphu City. Gender of the interviewees were 63.4% (256) female and 36.6 (148) were male. Most interviewees were between 18 and 36 years old and their qualifications were diverse with almost three quarters of interviewees either educated up to 10th class, 12th class or graduate and above (Table 9).

Table 9: Age and education of interviewees

Age of the interviewee	Number	Percentage
18-24	89	22%
25-30	99	25%
31-36	73	18%
37-42	51	13%
43-48	20	5%
49-54	22	5%
over 55	50	12%
Total	404	100%
Qualification of the Interviewee		
Buddhist degrees	5	1%
Graduate or above	85	21%
Illiterate	66	16%
Non-formal education	43	11%
up to 10th class	102	25%
up to 12th class	103	25%
Total	404	100%

Most interviewees lived in an apartment without a garden (356, 88.0%) followed by semi-detached house with a garden (34, 8.5%) and detached house with a garden/compound (14, 3.5%). And if the home had a garden the garden was fenced in.

Dog Demographics and Owner Relationship

Of the 404 interviewed households 15% (61) owned at least one dog and 85% (343) did not. The main reason for owning a dog was pet/companionship (57, 83.8%) followed by owners who kept their dog for protection of the property (10, 14.7%) and hunting (1, 1.5%) (Note: owners were able to select more than one reason why they owned a dog).

Owning a single dog was most common (43, 70.5%), followed by two dogs (13, 21.3%), three (2, 3.3%), four (2, 3.3%) and one person owned five dogs (1.6%). There was no preference towards a gender as 51% (45) of the dogs were male and 49% (43) were female.

About a third (30.2%, 13) of the female dogs have had a litter in their lives. Many with only one (15.4%, 2) or two (38.5%, 5) litters but also four litters (23.1%, 3). And three dogs had reportedly five, seven and eleven litters in their lives. We asked how many puppies survived from their last litter to explore the survival rate. Most owners reported that puppies died in their last litter. Only two litters of two puppies had no loss, one litter had all five puppies survive and one interviewee reported that two puppies survived without indicating how many puppies there were in total. Owners reported the following survival rates for the last litter they raised, one litter had no surviving puppies out of two puppies born, one litter had one puppy survive out of two, three litters had two puppies survive out of four, one litter had two puppies survive out

of eight and another litter had five puppies survive out of seven. When asked what they usually do with the puppies most interviewees said that they give the puppies away as gifts (69%, 9), however the remaining dog owners (31%) were not too concerned and reported that they leave them on the street to find a home or the puppies would disappear by themselves (Table 10)

Table 10: Outcome of puppies born in homes

What do you usually do with the puppies?		
	Number	Percentage
Give them away as gifts to friends/family	9	69%
Leave them on the street to find a home	3	23%
Puppies wander off/disappear	1	8%
Sell to other dog owner in Thimphu	0	0%
Sell to other dog owner outside Thimphu	0	0%
Total	13	100%

The age structure of the private dogs was skewed towards young dogs with 58% of dogs being between young adults and three years old (Chart 2). The column chart below shows that the population is skewed towards younger dogs, indicating a relatively high turnover in the population as older dogs exist but are much fewer in numbers. This is also represented in the trendline, which has a slope of -.9886.

Chart 2: Age structure of the private dogs
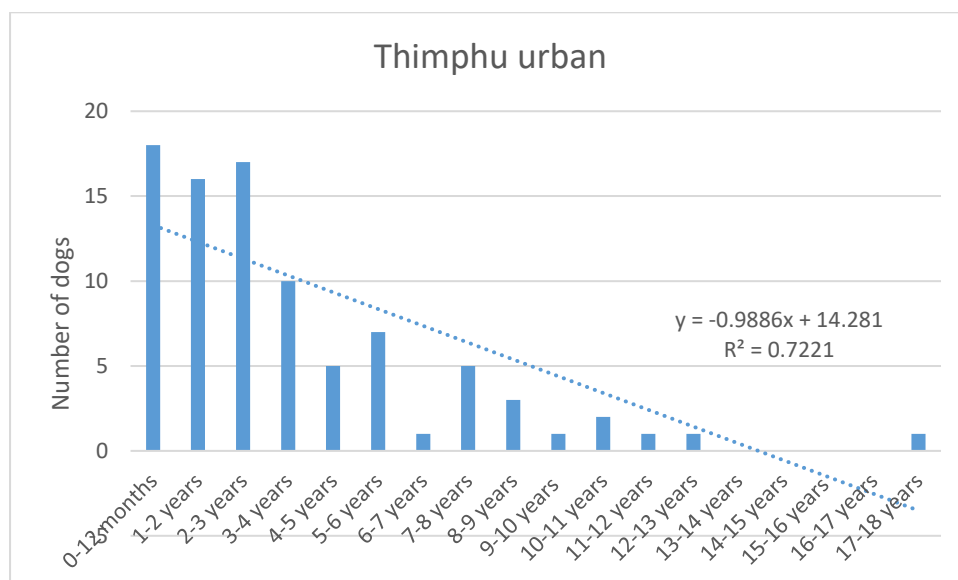
Private dogs were either a breed dog (35.2%, 31), a mixed breed dog (35.2%, 31) or a local dog (29.5%, 26). When asked where they got the dog from many people said that they had received the dog as a gift (47.7%, 42) and another similarly large proportion said that they either adopted the dog from the street of Thimphu (18.2%, 16) or that the dog was born in the household (11.4%, 10) (Table 11).

Table 11: Source of the private dog

Where did you get this dog?		
	Number	Percentage
Adopted from a shelter	1	1.1%
Adopted from another person in Thimphu	1	1.1%
Adopted from another person outside Thimphu	1	1.1%
Adopted from the street in Thimphu	16	18.2%
Adopted from the street outside Thimphu	1	1.1%
Born in this household	10	11.4%
Bought abroad/imported	6	6.8%
Bought by the owner/household within Thimphu	8	9.1%
Bought by the owner/household outside Thimphu	0	0.0%
Given/gifted to the person/owner/household	42	47.7%
Other	2	2.3%
Total	88	100.0%

Confinement practices

Responds bias is particularly high when dog owners are asked how or if they confine their dogs for multiple reasons, including for example insecurity about what the "expected" answer is or if neighbor's have complained. We asked three questions exploring how well confined dogs are by their owner in a 24-hour period, "Where is your dog right now?", "Where do you usually keep this dog during the day?" and "Where do you usually keep this dog during the night?". The three charts below are a summary of the responses we received. Proportions of dogs kept in the house did not vary significantly between the three questions and appears to be the preferred way of confinement, however between 7% and 9% of owned dogs roam the streets at any given time during the day. It is unclear if a proportion of the confined dogs are given access to roam free for shorter amount of times though.

Chart 3: Where is the dog right now?
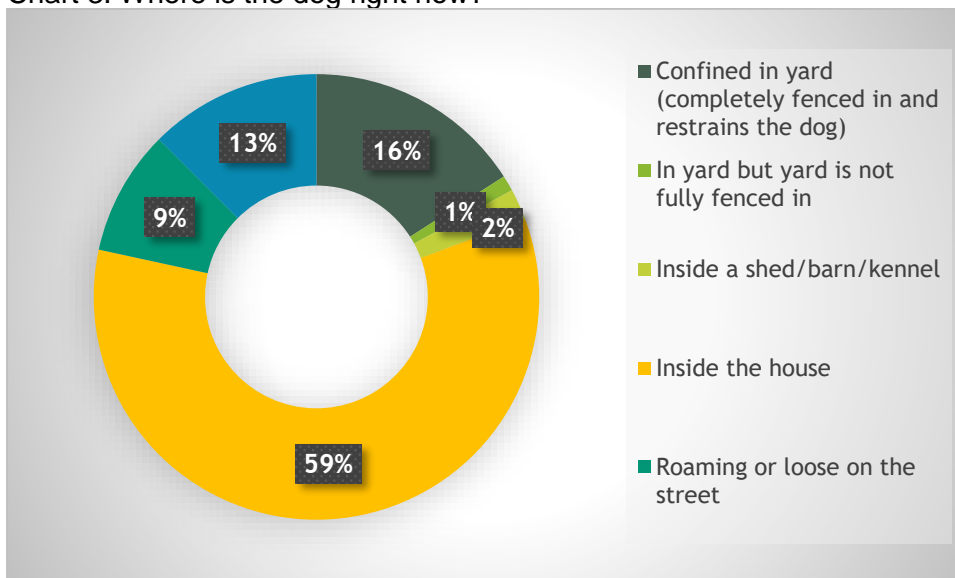
Chart 4: Where do you usually keep this dog during the day?
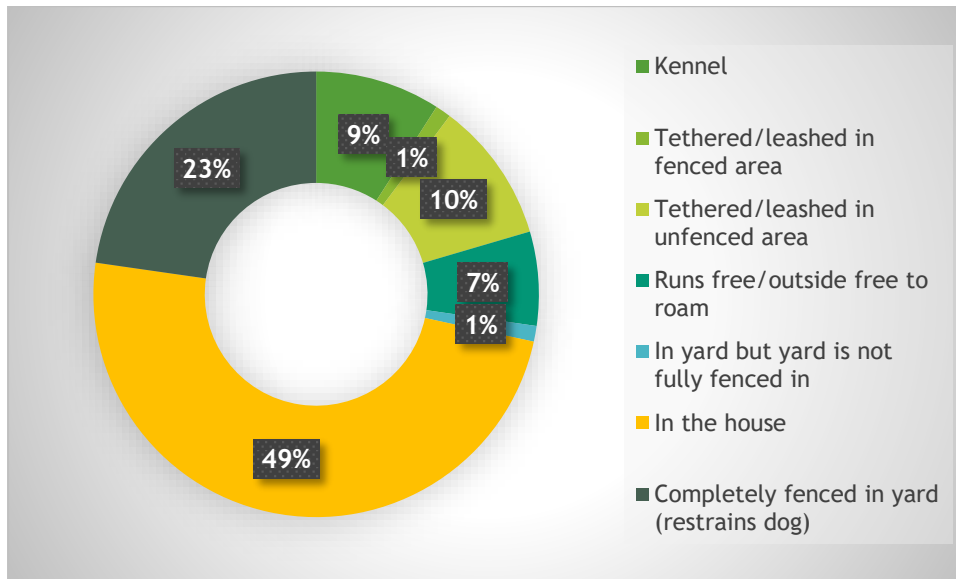
Chart 5: Where do you usually keep this dog during the night?
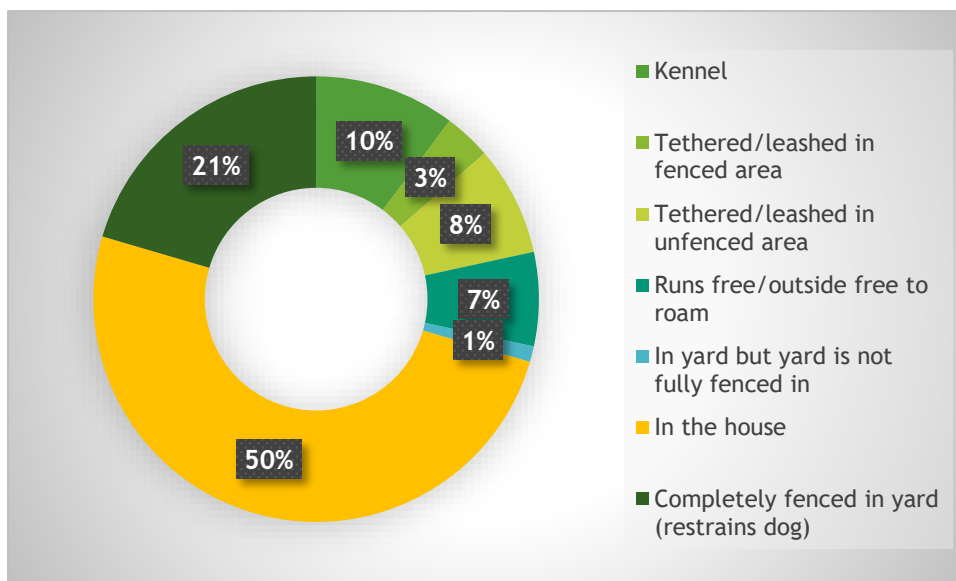
Care practices

All dog owners said that they feed their dog daily. And, although most dog owners (86.4%, 72) reported that they had visited the VH/LEC/Gonor in the last 12 months with their dog, the sterilization rate was very low among private dogs. Only 33% (29) of dog owners owned a sterilized dog, 2.3% (2) owner did not know whether their dog was sterilized or not and 64.7% (57) did not own a sterilized dog. When asked why they did not sterilize their dog almost a quarter (25.4%, 15) said that they want puppies (Chart 6).

We also asked whether the dog was dewormed in the last 12 months and the majority of dogs were reported to have been dewormed (83.7%, 72) and only 16.3% (14) were not, a ratio that is likely skewed towards a positive response as deworming is not a very common practice.

Dog registration was similarly high with 78.4% (69) of dogs registered and only 21.6% unregistered. Both questions as well as the question whether dogs had seen a veterinarian in the last 12 months appear to be biased towards what is considered "responsible" considering the much lower percentage of sterilized dogs. We suspect that the real proportion of dogs receiving regular veterinary care and registration is much lower.

Chart 6: Reasons to not sterilize an owned dog
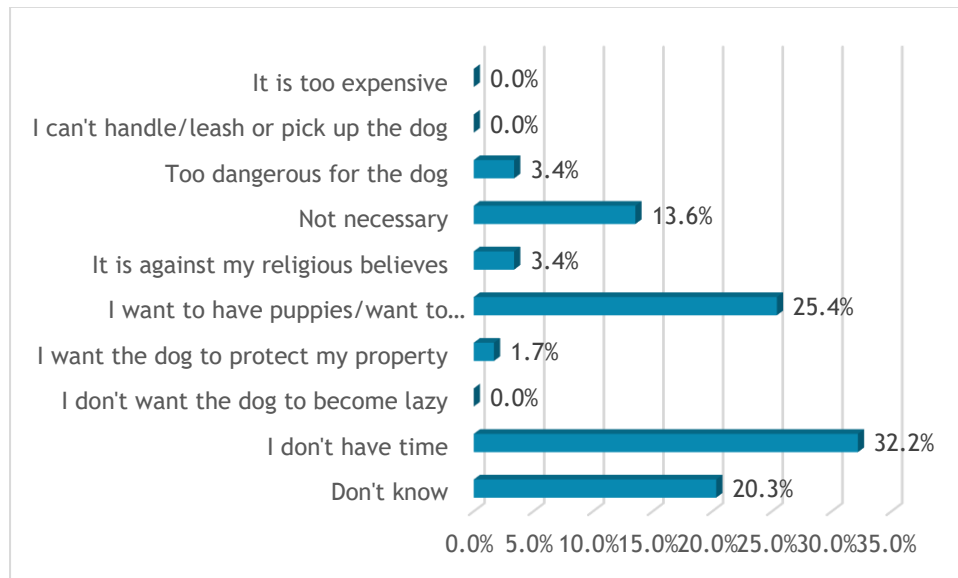
Dog Owner Behavior and living with street dogs

To explore common practices among dog owners in the city we asked interviewees about their neighborhood's dog owner behavior. Indirect questions relieve the respondents of any guilt about their own behavior and therefore reduces the likelihood of response bias.

When we asked, "Do you know anyone in your neighborhood whose dog had puppies in the last 12 months?" 72.9% (293) said no, 22.1% (89) said that they do not know and 5% (20) said that they were aware of someone. We then followed up with the question "Do you know of anyone in your neighborhood who has abandoned puppies or dogs in the last 12 months?", to which only 2% (8) said yes and 71.3% (288) said no and 26.7% (108) did not know. Overall this tells us that puppies and abandonment of dogs (puppies and adults) might not be very common but does happen to some extend in the city as well.

In terms of responsible dog ownership, we asked generally "What do you think are the most important things that owned dogs need to have access to? Name as many as you can.". The most common answer was food with 28.8% (368) followed by water with 11.7% (149) and vaccination with 11.4% (146) (Table 12).

Table 12: What dogs need

What do you think are the most important things that owned dogs need to have access to? Name as many as you can .	Number	Percentage
Water	149	12%
Food	368	29%
Vaccination	146	11%
Treatments again fleas and ticks	20	2%
Treatment for worms	17	1%
Vet care when they get sick	126	10%
Euthanasia when they are suffering from an incurable illness or disease	3	0%
Exercise	37	3%
Roaming freely without supervision	21	2%
Confinement/supervision	13	1%
shelter from cold/rain/sun	169	13%
An owner	84	7%
Interaction with people	53	4%
Interaction with other dogs	7	1%
Sterilisation	63	5%
Total	1276	100%

As previously discussed, street dogs we encounter on the streets are usually a combination of dogs who have a person that claims ownership and dogs that truly do not belong to a specific person. We explored this with several questions as well as how people in Thimphu City feel about the street dog situation.

When asked if there are any street dogs they know of who have an owner but roamed 90 or 22.3% of the interviewees said yes. However, 288 or 71.3% were not aware of any owned but roaming dogs and 26 or 6.4% were not sure.

Interviewees report some level of care provided to street dogs as 215 (53.2%) said that they feed street dogs sometimes, and 25 (6.2%) reported that they feed street dogs every day, 4 (1%) once a week and 2 (0.5%) several times a month. However, 158 (39.1%) reported that they never feed street dogs.

When we inquired about how many dogs the interviewee sees on a regular day in the street they live in 41.8% (169) said that they see 10 or more, 33.4% (135) see 1-5 dogs, 23.8% (96) encounter 6-10 dogs and 4 (1%) said they see none.

When asked how they feel about this number and if they think it has changed over the last 10 years 67% said they think it increased (Chart 7).

Chart 7: Perception of how the street dog population has changed in the last 10 years
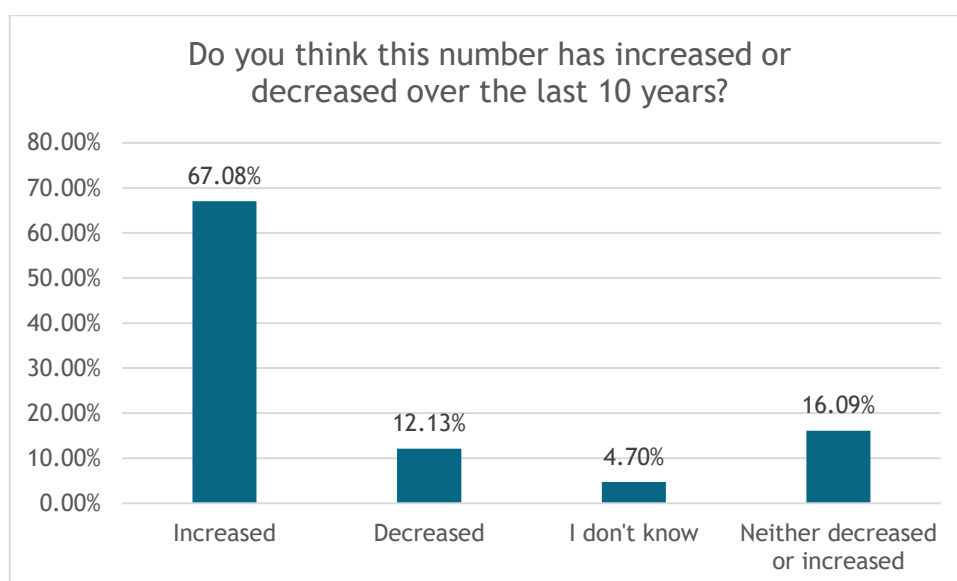
The response to "How frequently (in a week's time) would you say you feel threatened by street dogs you meet on the streets?" respondents did not seem to be very concerned. Fifty-four percent (54.2%, 219) said that they never feel threatened, 25.5% (103) sometimes and 8.7% (35) rarely. Only 8.4% (34) and 3.2% (13) said that they feel always and often (respectively) threatened by street dogs.

When asked what they thought was most concerning about living in a city with street dogs, dog bites was by far the most common answer. About sixty-five percent (65.6%) of all respondents said that dog bites are their biggest concern followed by rabies with 14.4% and barking/growling/lunging at them with 6.4%. Other nuisances were not much considered at this point (Table 13).

Table 13: Nuisances that are most concerning

What do you find most concerning about living in a city with street dogs?	Number (%)
Dog bite	265 (65.6%)
Dog poo and pee	5 (1.2)
Barking/growling/lunging	26 (6.4)
Risk to my own dog	0 (0)
Car accidents	1 (0.2)
Rabies	58 (14.4)
Messing with the garbage	10 (2.5)
Chasing vehicles	2 (0.5)
Dogs with skin conditions	2 (0.5)
Dogs fighting with each other	2(0.5)
Injured dogs/Sick dogs	6 (1.5)
I have no concerns	14 (3.5)
Poor street dogs, nobody cares for them	1 (0.2)
There are no street dogs in my area	0 (0)
Dog packs	12 (3.0)
Total	404 (100)

To evaluate how familiar people were with the sterilization program of street dogs we asked if they knew what the ear marking means. Below half of the interviewees knew that the ear notch means that the dog is sterilized (37.9%, 153), however almost as many (43.1%, 174) respondents did not know what the ear notch means at all (Chart 8). And the remaining respondents were misinformed about what the ear notch means.

Chart 8: What does it mean if a dog has an ear notch?
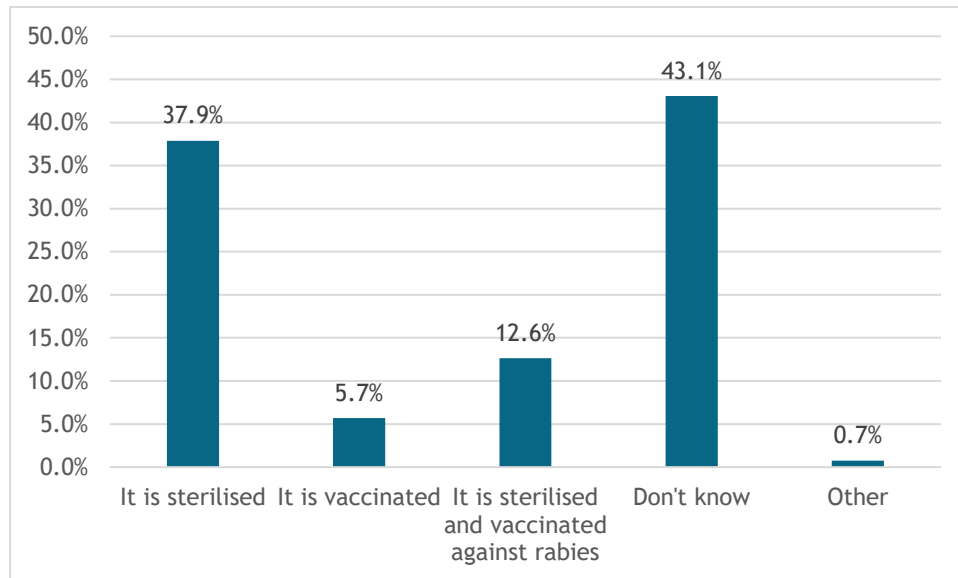
Dog bites

We asked interviewees if they or any household member had been bitten by a dog in the last 12 months. Sixty (60) people or 14.9% of households reported that they experienced a dog bite in the last 12 month, a rate that is about 2.5 fold higher than we usually see in for example India. Dog types who caused the bite were street dogs without an owner (73.3%, 44), the neighbor's dog (15%, 9) and the own household dog (11.7%, 7).

Attitudes

Attitude questions were asked in terms of percentage agreed. Following the trial of the questionnaire it became clear that traditionally used scales from strongly agree to strongly disagree was difficult to explain and ask interviewees, so with inputs from Dr Yoenten we decided to use a percentage scale people are used to from political votes.

Interpretation and analysis are more complicated using this scale but the results are summarized in the chart below. Two questions are standing out on either side on the scale. A strong disagreement of 77.1% of interviewees strongly disagreeing (reporting 0% agreement) with the statement that "Street dogs should be removed and euthanized." And on the other side a strong agreement of 64.4% of interviewees (reporting 100% agreement) with the statement "Street dogs should be sterilized". These results are not surprising as they reflect the Bhutanese culture of happiness and kindness and are also an integral part of the current dog management program.

Chart 9: Summary of attitude questions and answers

Legend:
- Street dogs should be removed and euthanized
- Street dogs are a part of my community and don't bother me
- Street dogs should be sterilized
- The government is doing a good job in managing the dog population
- I like all dogs
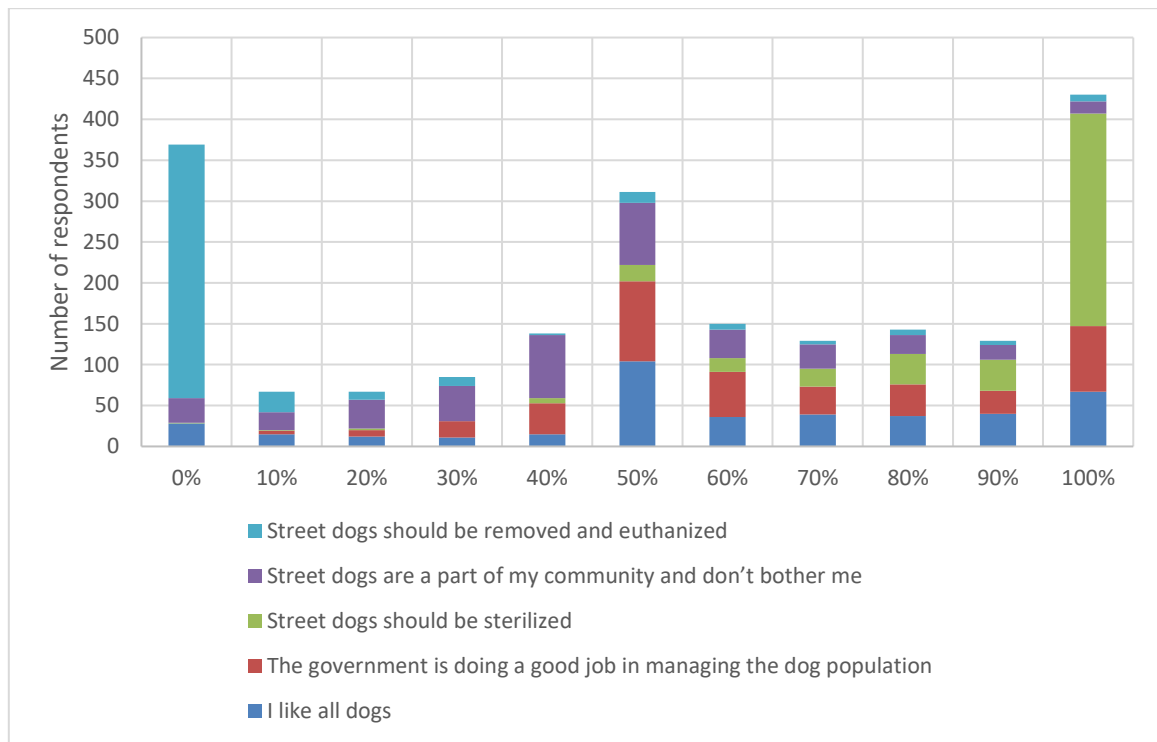
PARO

Paro – urban

We divided Paro urban into three areas, A, B and C. Areas were chosen based on Google Earth images that provided a relatively naive impression of housing density. We suspected that B represents a dense area, whereas A and C could be semi-urban.

Human Demographics

We interviewed 394 households. 64.2% (253) of interviewees were female and 35.8% (141) were male, and most of the interviewees were between 18 and 36 years of age (Chart 10).

Chart 10: Interviewees' age

Age of the interviewees
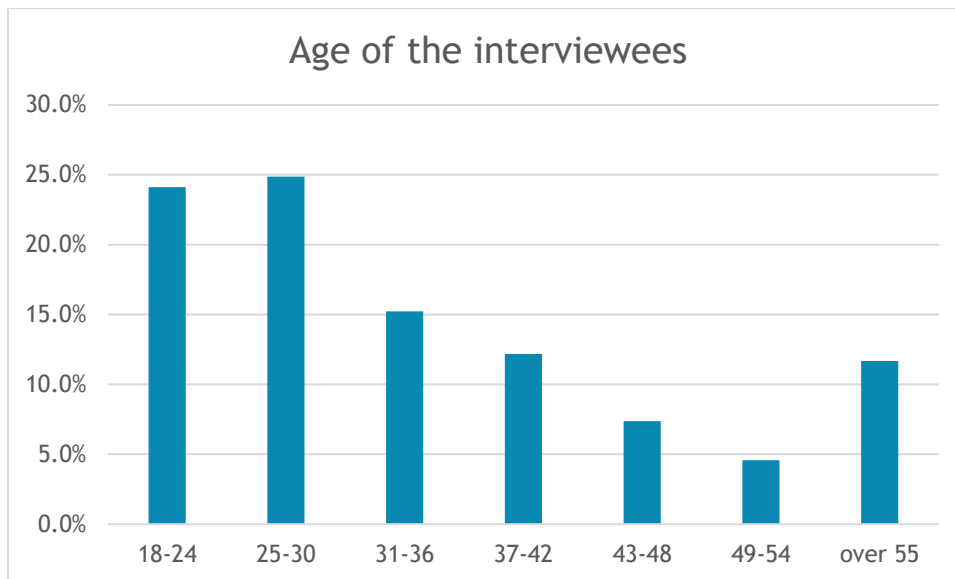
Educational levels were diverse, with about a third of the interviewees having an education level up to 10th class (33.8%, 133). 22.8% (90) had a qualification up to 12th class, 15% (59) were illiterate, 14.2% (56) graduate, 13.2% (52) non formal and 1% (4) had a Buddhist degree.

Housing was mostly apartments (74.4%, 293), followed by semi-detached (21.1%, 83) and detached (4.6%, 18). If semi and detached houses had gardens about one third had a fully fenced in yard (37.6%, 38) and the other two third did not (61.4%, 62).

Of the 394 households 82 (20.8%) owned at least one dog and 312 (79.2%) did not own a dog. The main purpose of keeping a dog was companionship/pet (73%, 73), followed by protection of the property/crops (34%, 24), herding (2%, 2) and hunting (1%, 1). Some owners kept dogs for multiple reasons. The majority owned one dog (75.5%, 62), followed by two dogs (18.3%, 15), three (4.9%, 4) and one household owned four dogs (1.2%, 1).

Dog Demographics and Owner Relationship

We recorded 111 dogs of which 65 (58.6%) were male and 46 (42.4%) were female. Dog owners of female dogs were asked if the dog has had a litter in their lives, to which less than a third responded yes (23.9%, 11) and more than two thirds (76.1%, 35) responded no. Overall females that were allowed to have litters had multiple liters in their lives. Of the females who had a litter, four (4, 36.4%) had three litters, three (3, 27.3%) had seven litters, two (2, 18.2%) had four litters and one (1, 9.1%) dog had eight litters in her life.

When asked how many of the puppies survived in the last litter, the general litter size was large. Survival of puppies varied but even large litters had good survival rates (Table 14)

Table 14: survival rate of puppies born to owned females

How many puppies survived in the last litter?	
Number of surviving puppies	**Number of litters (%)**
0	1 (9.1)
1	1 (9.1)
2	1 (9.1)
7	1 (9.1)
1 of 3	1 (9.1)
1 of 4	1 (9.1)
2 of 4	1 (9.1)
2 of 5	1 (9.1)
5 of 6	1 (9.1)
6 of 7	1 (9.1)
7 of 7	1 (9.1)
Total	**11 (100)**

When asked what owners usually do with the puppies, 10 of the 11 owners responded. 9 (90%) said that they usually give them away as gifts to family and friends and one owner (10%) reported that the puppies usually wonder of or disappear.

The majority of private dogs was gifted to the owner (55%, 61), followed by adopted from the streets of Paro (11.7%, 13) and bought by the owner (9.9%, 11) or other (9.9%, 11). Fewer owners kept dogs that were born in their own home (6.3%, 7). A few owners report that they have adopted a street dog from outside Paro (1.8%, 2), adopted the dog from another person outside Paro (1.8%, 2), adopted the dog from the streets outside of Paro (1.8%, 2) or bought/imported the dog (1.8%, 2). Only one person adopted the dog from a shelter (0.9%, 1) and another person adopted the dog from a private person in Paro (0.9%, 1).

The age structure of the private dogs was skewed towards young dogs (34.2% under or three years old), however not as strongly as in Thimphu (Chart 11). The column chart below shows that the population is skewed towards younger dogs, mainly between <1 and 5 years, indicating a relatively high turnover in the population, however older dogs >5 years exist. This is also represented in the trendline, which has as slope of -1.0471.

Chart 11: Age structure of the private dogs

Paro urban

$y = -1.0471x + 15.775$
$R^2 = 0.7901$
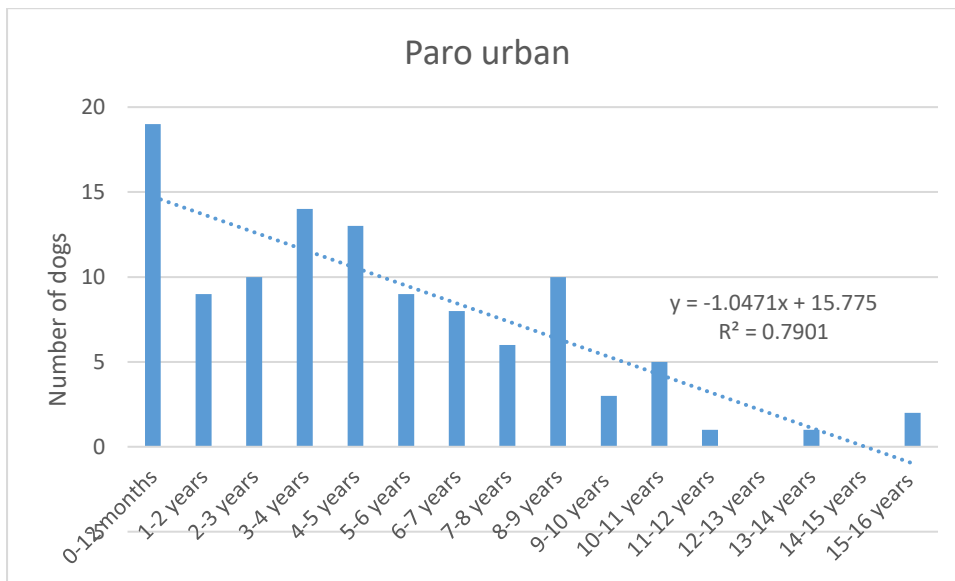
Confinement practices

We asked the same three confinement questions to explore how well confined dogs are by their owners in a 24 hour period, "Where is your dog right now?", "Where do you usually keep this dog during the day?" and "Where do you usually keep this dog during the night?". The three charts below are a summary of the responses we received. Proportions of dogs kept in the house did not vary significantly between the three questions and appears to be the preferred way of confinement, however between 9% and 16% of owned dogs roam the streets at any given time during a 24 hour day. It is, however, overall about 5% higher than in Thimphu. It is unclear if a proportion of the confined dogs are given access to roam free for shorter amount of times though, therefore the number of roaming dogs can be much higher overall.

Confinement in kennels increases significantly during the night (14%) whereas only 4% are confined in kennels during the day.

Chart 12: Where is your dog right now?

Legend:
- Confined in yard (completely fenced in and restrains the dog)
- In yard but yard is not fully fenced in
- Inside a shed/barn/kennel
- Inside the house
- Roaming or loose on the street

Values: 36%, 3%, 7%, 31%, 13%, 10%
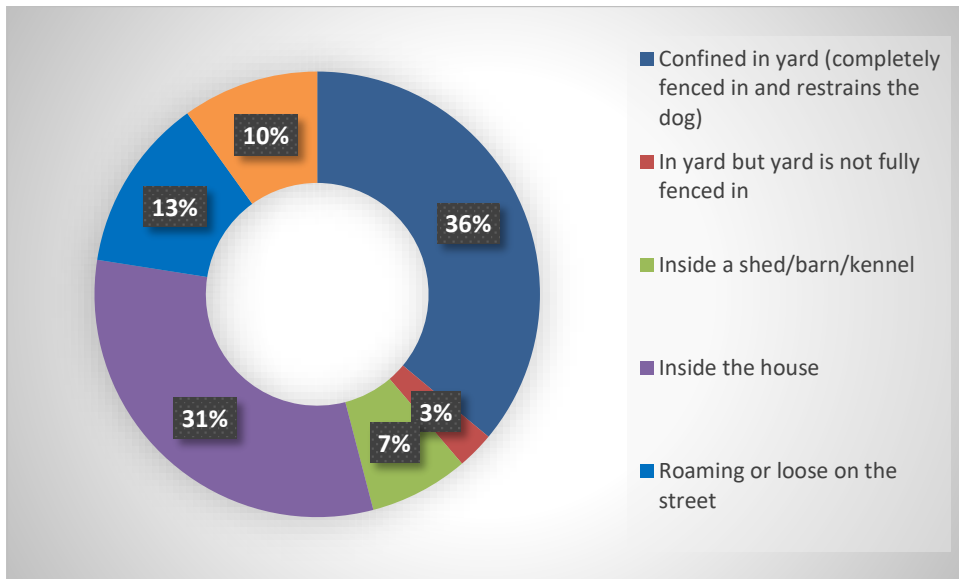
Chart 13: Where do you usually keep this dog during the day?

Legend:
- Kennel
- Tethered/leashed in fenced area
- Tethered/leashed in unfenced area
- Runs free/outside free to roam
- In yard but yard is not fully fenced in
- In the house
- Completely fenced in yard (restrains dog)

Values: 4%, 5%, 13%, 10%, 4%, 28%, 36%
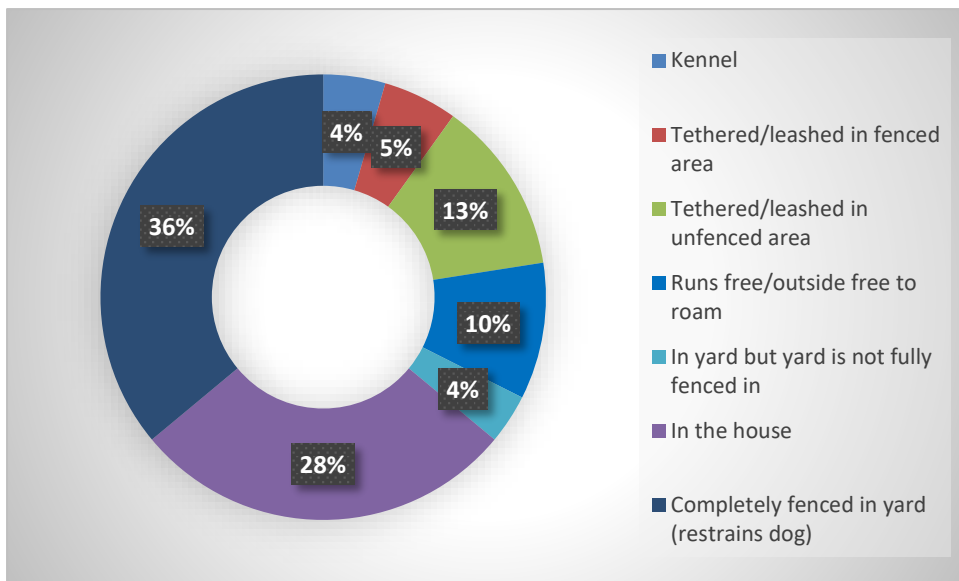
Chart 14: Where do you usually keep this dog during the night?

Legend:
- Kennel
- Tethered/leashed in fenced area
- Tethered/leashed in unfenced area
- Runs free/outside free to roam
- In yard but yard is not fully fenced in
- In the house
- Completely fenced in yard (restrains dog)

Values shown: 14%, 4%, 13%, 9%, 4%, 24%, 32%
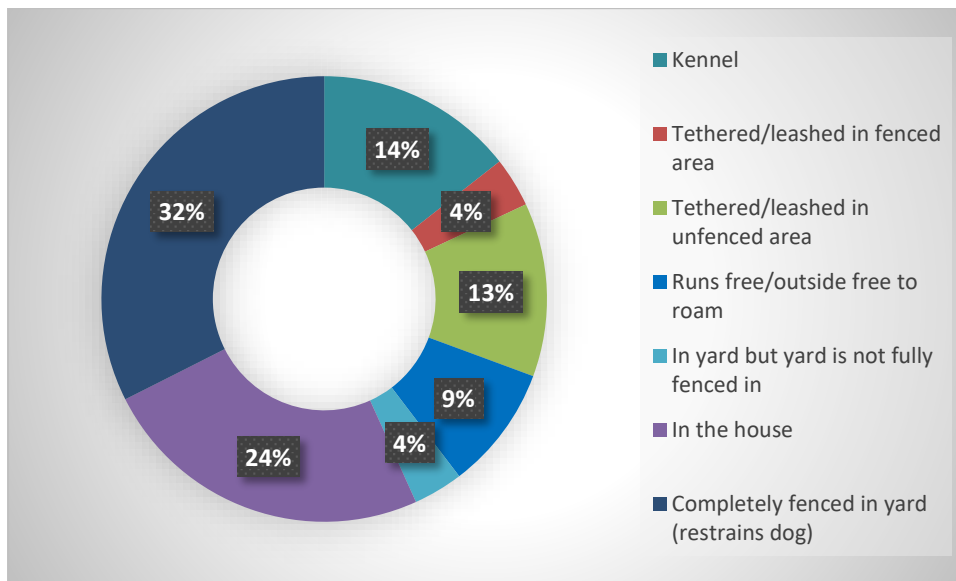
Care practices

All dog owners said that they feed their dogs regularly, 110 daily and one dog owner weekly. Most dog owners (66.6%, 74) reported that they had visited the VH/LEC/Gonor in the last 12 months with their dog, however the sterilization rate was relatively lower among private dogs but higher than in Thimphu. 46.8% (52) of dog owners owned a sterilized dog, 3.6% (4) owner did not know whether their dog was sterilized or not and 49.6% (55) did not own a sterilized dog. When asked why they did not sterilize their dog many dog owners reported that they do not have time (41.9%, 26) followed by almost a third considering sterilization to not be necessary (30.6%, 19) (Chart 15).

We also asked whether the dog was dewormed in the last 12 months and the majority of dogs were reported to have been dewormed (66.7%, 74) and only about a third (32.4%,14) were not. Dog registration was similarly high with 69.4% (77) of dogs registered and about a third 30.6%, 34) unregistered. Both questions as well as the question whether dogs had seen a veterinarian in the last 12 months appear to be biased towards what is considered "responsible" considering the much lower percentage of sterilized dogs and the not common practice of deworming dogs. We suspect that the real proportion of dogs receiving regular veterinary care and registration is much lower like in Thimphu.

Chart 15: Reasons why dog owners do not sterilize their dogs

Reason	Percentage
It is too expensive	0.0%
I can't handle/leash or pick up the dog	0.0%
Too dangerous for the dog	0.0%
Not necessary	30.6%
It is against my religious believes	1.6%
I want to have puppies/want to breed with it	11.3%
I want the dog to protect my property	1.6%
I don't want the dog to become lazy	1.6%
I don't have time	41.9%
Don't know	11.3%
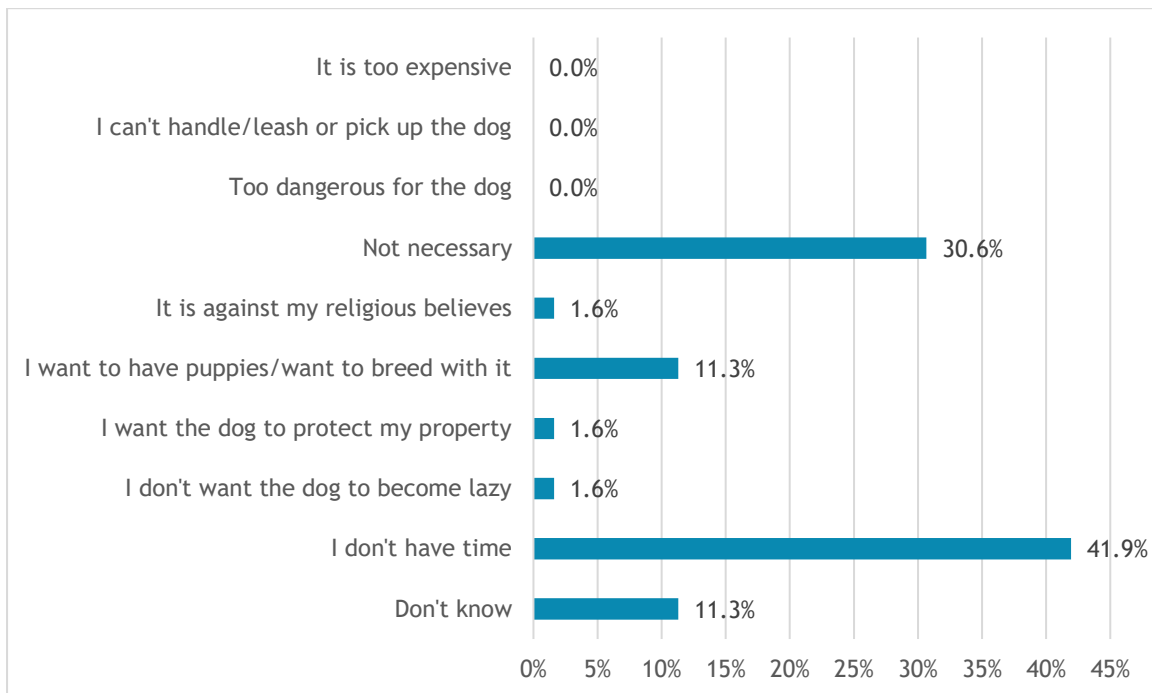
Dog Owner Behavior and living with street dogs

We asked households in Paro about their neighborhoods' dog owner behaviors.

When we asked, "Do you know anyone in your neighborhood whose dog had puppies in the last 12 months?" 86.8% (341) said no, 7.1% (28) said that they do not know and 6.1% (4) said that they were aware of someone. We then followed up with the question "Do you know of anyone in your neighborhood who has abandoned puppies or dogs in the last 12 months?", to which only 1% (4) said yes and 89.6% (353) said no and 9.4% (37) did not know. Similar to Thimphu this indicates that puppies and abandonment of dogs (puppies and adults in general) might not be very common but does happen to some extend in the city as well.

As a measure of how much households know about dog needs we asked "What do you think are the most important things that owned dogs need to have access to? Name as many as you can.". The most common answer was food with 32.8% (391) followed by water with 15.6% (186) and vaccination with 13.4% (160) (Chart 16). Interestingly more households were aware that sterilization is good for dogs compared to Thimphu, 11.8% versus 5% respectively.

Chart 16: What do you think are the most important things that owned dogs need to have access to? Name as many as you can.

Category	Percentage
Sterilisation	11.8%
Interaction with other dogs	0.4%
Interaction with people	1.7%
An owner	2.4%
shelter from cold/rain/sun	8.0%
Confinement/supervision	3.4%
Roaming freely without supervision	0.5%
Exercise	1.6%
Euthanasia when they are suffering from an incurable...	0.0%
Vet care when they get sick	6.3%
Treatment for worms	1.5%
Treatments again fleas and ticks	0.6%
Vaccination	13.4%
Food	32.8%
Water	15.6%
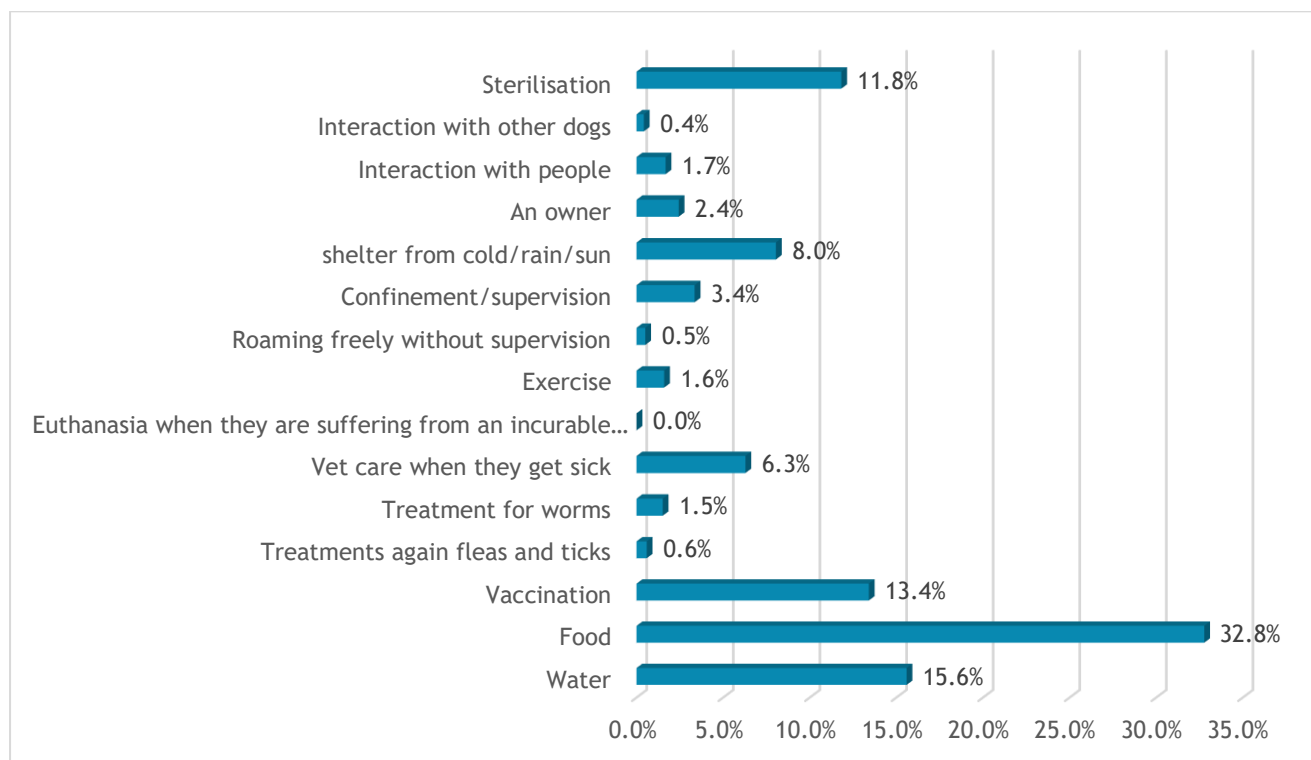
When asked if there are any street dogs they know of who have an owner but roamed 14.8% (58) of the interviewees said yes. However, 329 (83.7%) were not aware of any owned but roaming dogs and 6 (1.5%) were not sure.

Interviewees report some level of care provided to street dogs as 211 (53.6%) said that they feed street dogs sometimes, and 34 (8.6%) reported that they feed street dogs every day, 2 (0.5%) once a week and 3 (0.8%) several times a month. However, 144 (36.5%) reported that they never feed street dogs.

When we inquired about how many dogs the interviewee sees on a regular day in the street they live in 44.4% (175) said that they see 10 or more, 35.8% (141) see 1-5 dogs, 19% (75) encounter 6-10 dogs and 3 (0.8%) said they see none. When then asked how they feel about this number and if they think it has changed over the last 10 years 75.9% (299) said they think it has increased and only 7.6% (30) said they think it has decreased (Chart 17).

Chart 17: Perception of how the street dog population has changed in the last 10 years
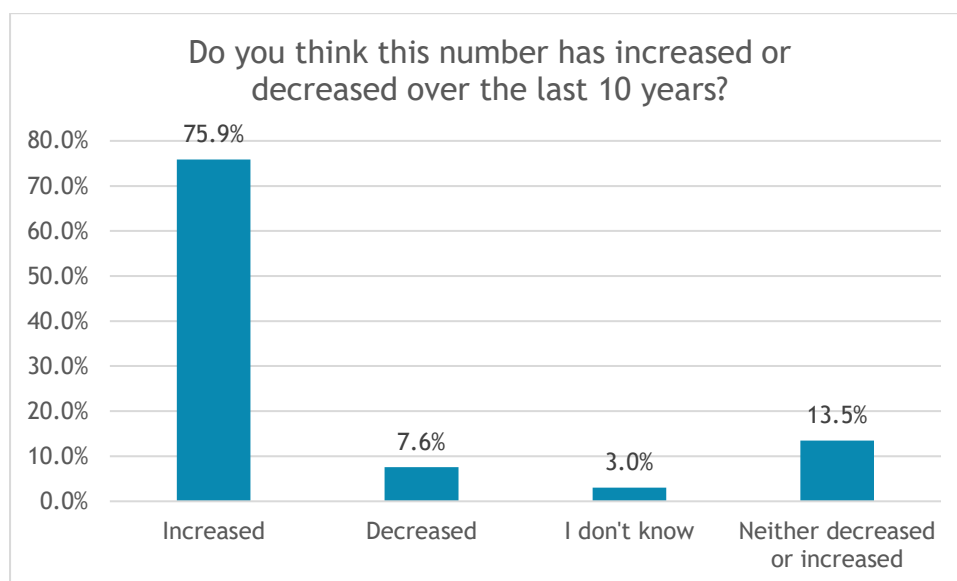
We asked two questions to explore how interviewees feel about living with street dogs.

The response to "How frequently (in a week's time) would you say you feel threatened by street dogs you meet on the streets?" respondents did not seem to be very concerned. About sixty percent (60.4%, 238) said that they never feel threatened, 22.1% (87) sometimes and 6.3% (25) rarely. However, 8.4% (33) and 2.8% (11) said that they feel always and often (respectively) threatened by street dogs.

Compared to Thimphu, Paro interviewees responded similarly when asked what they thought was most concerning about living in a city with street dogs. Dog bites was by far the most common answer. 78.1 % (307) of all respondents said that dog bites are their biggest concern followed by rabies with 9.7% (38) and 6.1% (24) of interviewees who felt that they had no concerns. Other nuisances were not much considered but are summarized in (Table 15).

Table 15: Nuisances caused by roaming dogs

What do you find most concerning about living in a city with street dogs?	
	Number (%)
Dog bite	307 (78.1)
Dog poo and pee	2 (0.5)
Barking/growling/lunging	7 (1.8)
Risk to my own dog	1 (0.3)
Car accidents	0 (0)
Rabies	38 (9.7)
Messing with the garbage	3 (0.8)
Chasing vehicles	2 (0.5)
Dogs with skin conditions	0 (0)
Dogs fighting with each other	0 (0)
Injured dogs/Sick dogs	2 (0.5)
I have no concerns	24 (6.1)
Poor street dogs, nobody cares for them	0 (0)
There are no street dogs in my area	0 (0)

Dog packs	7 (1.8)
Total	393 (100)

Surprisingly, more than half of the interviewees did not accurately know what the ear notch on a dog means. 40.6% (160) responded that they did not know what it means, almost as many (36.8%, 145) knew that it means that the dog is sterilized and the remaining interviewees thought the dog was either vaccinated (8.4%, 33) or sterilized and vaccinated against rabies (13.5%, 53) or responded other (0.8%, 3).

Dog bites

To explore how frequently dog bites occur we asked interviewees if they or any household member had been bitten by a dog in the last 12 months. 11.7% (46) of the households reported that they experienced a dog bite in the last 12 month, a rate that is again about 2.5 fold higher than we usually see in for example India. Dog bites were dominantly caused by street dogs without an owner (69.6%, 32), the neighbor's dog (17.4%, 8), the own household dog (8.7%, 4) as well as by unknown dogs (4.3%, 2).

Attitudes

We employed the same attitude questions and measurement scales from 0% to 100% as we did in Thimphu (see Thimphu for explanation).

Interpretation and analysis are more complicated using this scale but the results are summarized in the chart below. Two questions are standing out on either side on the scale. A strong disagreement of 91% (360) of interviewees strongly disagreeing (reporting 0% agreement) with the statement that "Street dogs should be removed and euthanized." And on the other side a strong agreement of 59% (233) of interviewees (reporting 100% agreement) with the statement "Street dogs should be sterilized". These results are not surprising as they reflect the Bhutanese culture of happiness and kindness and are also an integral part of the current dog management program. However, interviewees were not very decisive about the statement "Street Dogs are a part of my community and don't bother me", about 12% disagreed (chose 30%) and 25% and 28% chose to agree with the statement 40% and 50% respectively, indicating that feelings about this statement are quite mixed.

Chart 18: Summary of attitude questions and answers

Legend:
- ■ Street dogs should be removed and euthanized
- ■ Street dogs are a part of my community and don't bother me
- ■ Street dogs should be sterilized
- ■ The government is doing a good job in managing the dog population
- ■ I like all dogs
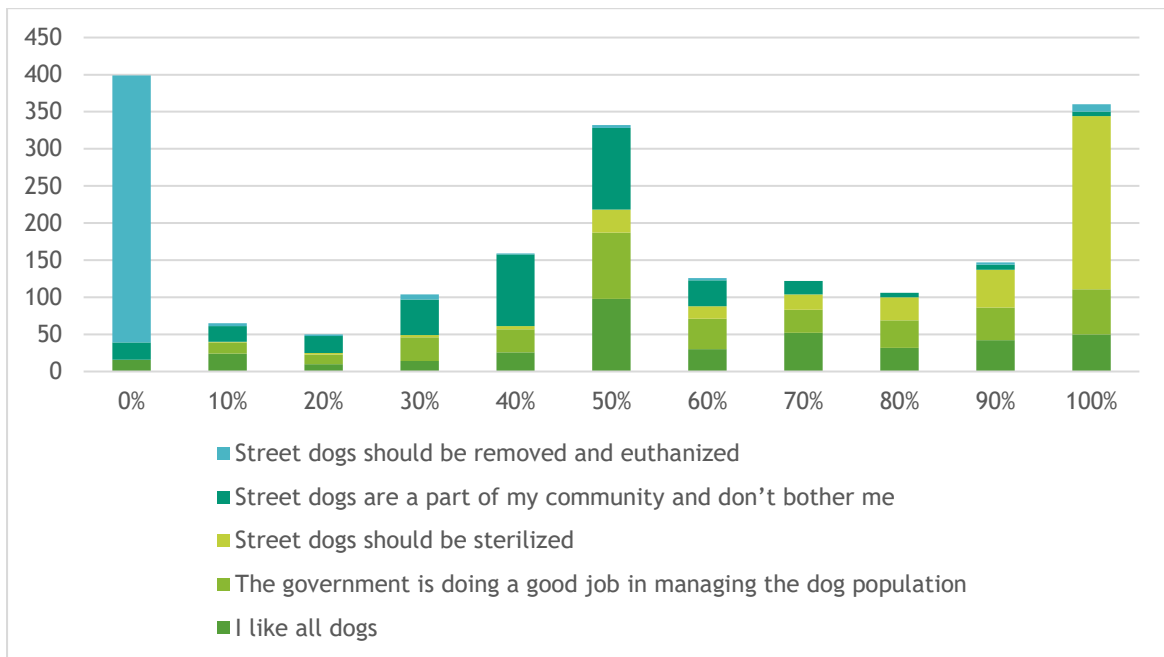
Paro – urban by area

As discussed before we divided the urban area of Paro into three zones. Zone A, B and C (Image 4), of which we consider B to have high human/housing density and zones A and C lower densities judged based on Google Earth images.

Image 4: KAP survey areas A, B and C
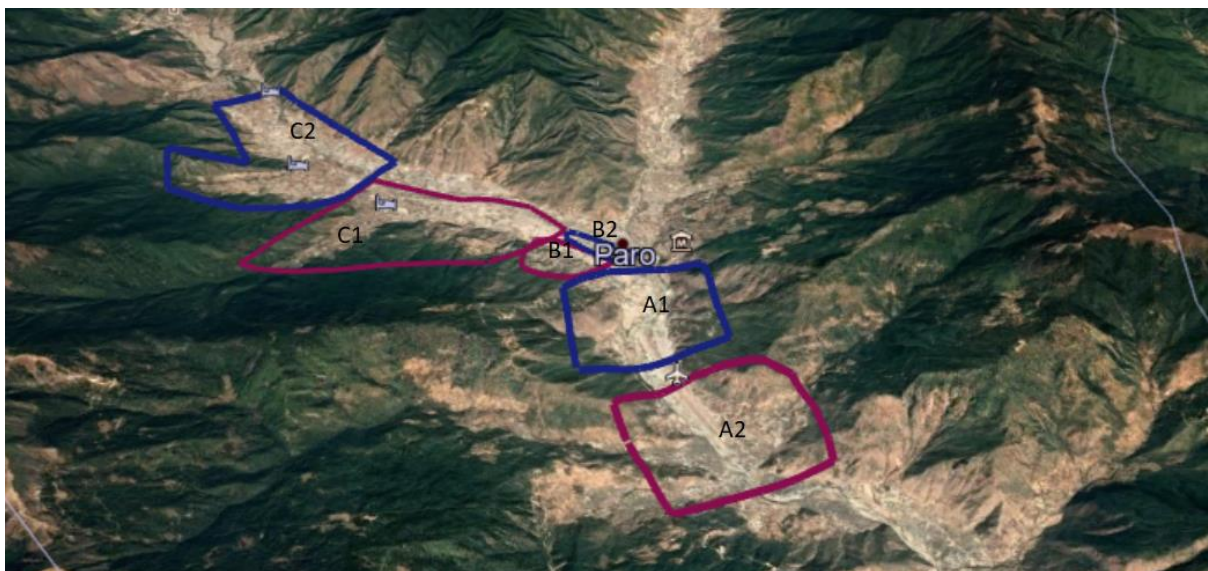
The suspicion that area B is urban and areas A and C are rather semi-urban is somewhat confirmed if we look at dog ownership rates. While in area A 24% (31) and in area C 26.6% (34) households owned a dog, only 12.4% (17) owned a dog in area B. With rising human density, and hence housing density and change in housing types, we usually see a decrease in dog ownership rates, which we can see in Paro as well.

Utility of the dogs did not differ immensely and most dogs in all areas were kept for companionship, however sterilization rates between the areas varied. Area A had a

sterilization rate of 36.4%, area B had a rate of 56.5% and area C a rate of 52.3%. We can only speculate but it might be the proximity to the veterinary clinic and a lack of transport opportunities for dog owners in rural areas to be able to get their dogs to the clinic.

Confinement practices between the three areas varied significantly (Charts 19-21). The most obvious difference is that private dog owners in area B tend to control their dogs much more and keep them under supervision, either in the house or in a fully fenced in yard. Whereas area C appears to have much higher proportions of roaming private dogs.

These differences, the semi urban influence and with it the close proximity of semi-urban areas to the center of Paro could be one of the reasons why we have seen such a steep increase in roaming dogs and might explain why there is a constant influx of new dogs to the central area.

Chart 19: Where is the dog right now?

Categories (top to bottom):
- Tethered/leashed outside in…
- Roaming or loose on the street
- Inside the house
- Inside a shed/barn/kennel
- In yard but yard is not fully…
- Confined in yard (completely…

Axis: 0.00% 10.00% 20.00% 30.00% 40.00% 50.00% 60.00%

Legend: ■ C ■ B ■ A
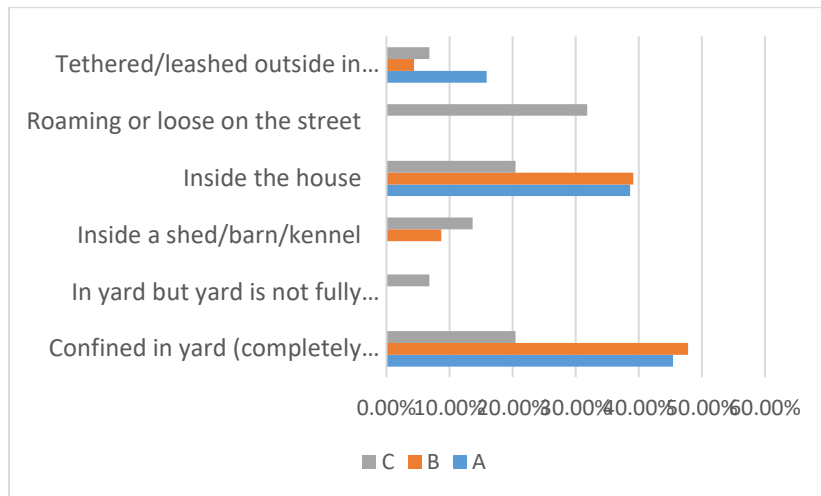
Chart 20: Where do you usually keep this dog during the day?

Categories (top to bottom):
- Completely fenced in yard…
- In the house
- In yard but yard is not fully…
- Runs free/outside free to roam
- Tethered/leashed in unfenced area
- Tethered/leashed in fenced area
- Kennel

Axis: 0.00% 10.00% 20.00% 30.00% 40.00% 50.00% 60.00%

Legend: ■ C ■ B ■ A
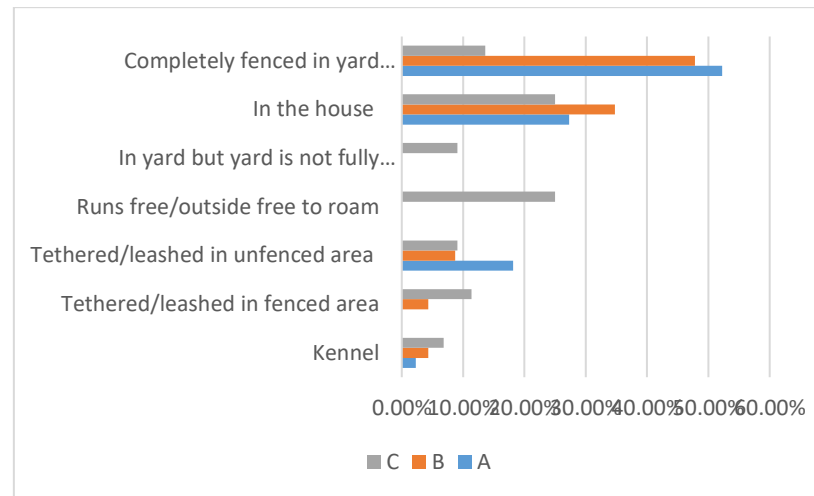
Chart 21: Where do you usually keep this dog during the night?

Categories (top to bottom):
- Completely fenced in yard…
- In the house
- In yard but yard is not fully…
- Runs free/outside free to roam
- Tethered/leashed in unfenced area
- Tethered/leashed in fenced area
- Kennel

Axis: 0.00% 10.00% 20.00% 30.00% 40.00% 50.00% 60.00%

Legend: ■ C ■ B ■ A
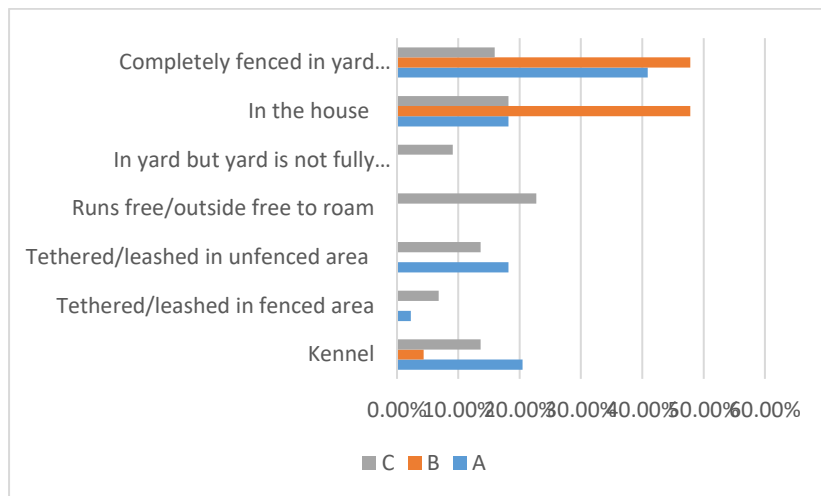
Thimphu and Paro – rural

In rural Thimphu and Paro all available houses in the surrounding villages were interviewed following the interval of every second household (Image 3).

Human Demographics

We spoke with 174 households in the rural areas of Thimphu and Paro. There were slightly more female (54%, 94) interviewees compared to male interviewees (46%, 80). Most of the interviewees were between 25 and 48 years old and the majority lived in detached houses (Table 16), contrary to most people in the urban areas who lived in apartments. Compared to the urban areas more interviewees were illiterate (49.4%, 86) and much fewer interviewees had a qualification graduate or above (3.5%, 6).

Table 16: Interviewee demographics

Age of the interviewee (%)		Qualification (%)		Housing types (%)	
18-24	12 (6.9)	**Buddhist degrees**	6 (3.5)	**Detached (house with garden/compound)**	111 (63.8)
25-30	23 (13.2)	**Graduate or above**	6 (3.5)	**Apartment (without any garden)**	18 (10.3)
31-36	34 (19.5)	**Illiterate**	86 (49.4)	**Semi-detached (household with garden but sharing with other households)**	45 (25.9)
37-42	47 (27)	**Non-formal education**	5 (2.9)		
43-48	41 (23.6)	**up to 10th class**	59 (33.9)		
49-54	8 (4.6)	**up to 12th class**	12 (6.9)		
over 55	9 (5.2)				
Total	174 (100)	**Total**	174 (100)	**Total**	174 (100)

Another difference to urban areas was that many home yards were not fenced in. Only about a third (27.6%, 43) were fenced in, while the rest was not (72.4%, 113). Dog ownership rate was high with 43.1% (75) of the households owning a dog. When asked why households kept a dog, 50% (46) said that their dog is a companion/pet another 47.8% (44) said that the dog protects the property/crops and 2.1% (2) said that they keep a dog for herding.

Dog Demographics and Owner Relationship

We recorded 100 dogs in both rural areas. There was a clear gender bias towards male dogs as they comprised 77% (77) and females only 23% (23). About half (52.2%, 12) of the female dogs have had a litter in their lives versus 47.8% (11) did not. Six females had one litter and the remaining six had two litters. A stark difference compared to the urban female dogs.

Survival rate of the puppies was divers. When asked how many puppies survived in the last litter only one household lost an entire litter (four puppies out of four), another litters had one

puppy surviving out of a litter of five puppies. And several litters had two puppies surviving and a few had large litters from which all puppies survived (Chart 22).

Chart 22: Number of puppies surviving out of a litter of x puppies
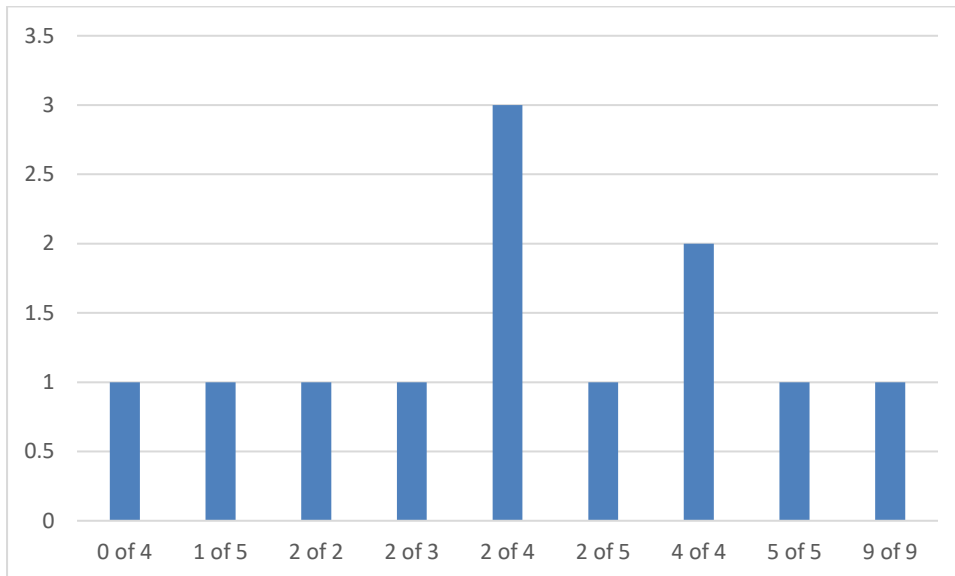
Like in urban areas the most common practice was to give puppies away to friends and family (61.5%, 8) followed by puppies wandering of or disappearing (23.1%, 3) and selling the puppy to other dog owners in the Thimphu/Paro area (15.4%, 2).

Similar to urban areas most households owned a local dog (44.6%, 45) and about a third (32.7%, 33) breed dogs followed by mixed breed dogs (22.8%, 23).

When asked where the household acquired the dogs the majority reported that they had received the dog as a gift (55.5%, 56), followed by the dog was born in the same household (17.8%, 18), adopted from the streets in Thimphu/Paro (14.9%, 15), bought by the owner in Thimphu/Paro (6.9%, 7) as well as bought abroad/imported (2%, 2), other (2%, 2) and one (1%) dog was adopted from a street outside of Thimphu/Paro.

The age structure of the private dogs was very different to both Thimphu and Paro urban areas. Almost half of the dogs were between the age of four and seven (48.5%), making the population consist mostly of adults and senior dogs. 17.8% were over seven years old and 33.7% were between below one and four years old (Chart 23). Turnover can therefore be assumed relatively lower compared to Thimphu but similar to Paro (slopes of the trendlines are similar).

Chart 23: Age structure of the private dog population

Chart title: Thimpuh and Paro rural

y = -0.9059x + 13.95
R² = 0.4146

Y-axis: Number of dogs

X-axis categories: 0-12 months, 1-2 years, 2-3 years, 3-4 years, 4-5 years, 5-6 years, 6-7 years, 7-8 years, 8-9 years, 9-10 years, 10-11 years, 11-12 years, 12-13 years, 13-14 years, 14-15 years, 15-16 years
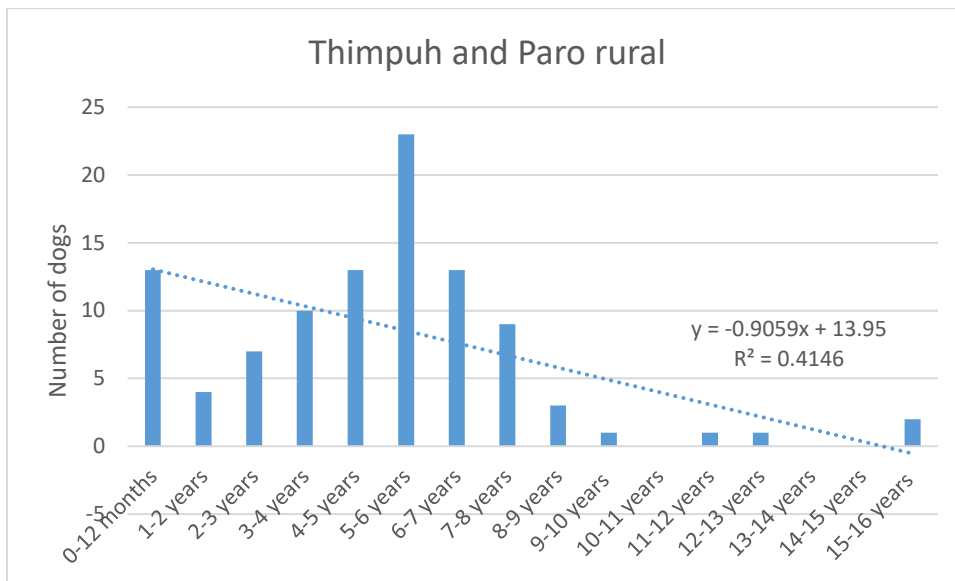
Dog Owner Behavior and living with street dogs

In stark contract with urban areas more interviewees were aware of owned dogs roaming the streets. When asked if they knew of dogs that were roaming but had an owner 46% (80) said that they do. There is also a higher percentage of households feeding street dogs regularly (Chart 24).

Chart 24: Do you ever feed street dogs?

Bar values: Sometimes 57.23%, No, Never 13.87%, Every Day 23.70%, Once a week 4.62%, Several times a month 0.58%
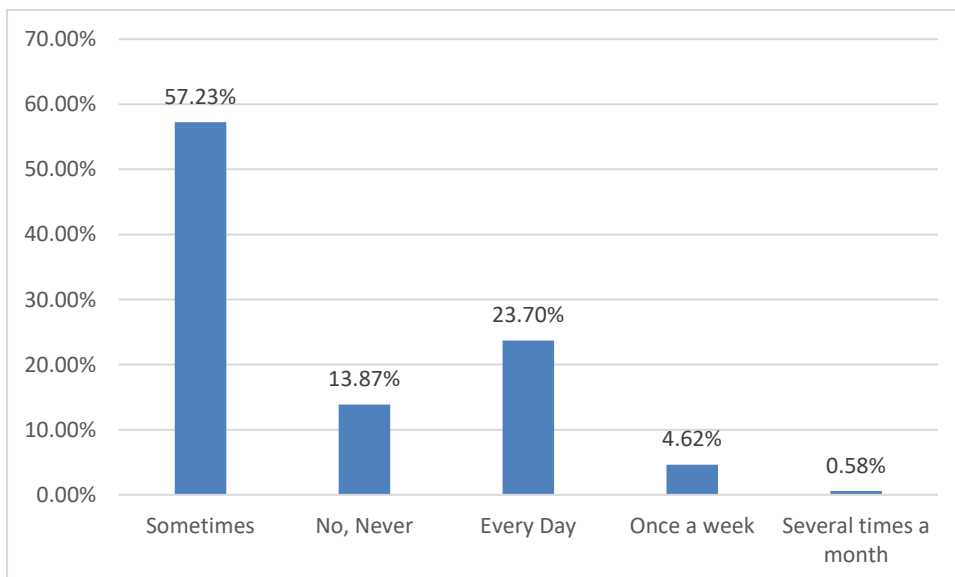
When asked how often they feel threatened by street dogs in a week's time, many interviewees responded that they do feel regularly threatened. Interviewees said that they feel either often (37.9%, 66), sometimes (35%, 61) or always (8%, 14) threatened, on the other hand a smaller proportion said that they do not feel regularly threatened, rarely (13.8%, 24) and never (5.2%, 9).

When asked what the things are they are most concerned about the majority said that they are most concerned about dog bites (74.1%129) followed by barking/growling/lunging (6.9%, 12) and messing with the garbage (4.6%, 8). A few people also said that they had no concerns (2.9%, 5) or that dog packs (2.9%, 5), the risk to their own dogs (2.9%, 5), dogs with skin conditions (1.1%, 2), rabies (1.1%, 2) and injured/sick dogs (0.6%, 1).

We asked the interviewees how many dogs they encounter on a regular day in the street they live in. the most common range was 1-5 dogs (66.1%, 115), followed by 6-10 (29.3%, 51), 10 or more (3.45%, 6) and no dogs at all (1.15%, 2). Which means that the perceived dog density in rural areas is much lower than in urban areas. When asked whether the number of street dogs has changed in the last ten years, an overwhelming 76.4% (133) said that it had increased, followed by that the number had not changed (14.4%, 25), that the number had decreased (6.3%, 11) and I don't know (2.9%, 5).

The majority of interviewees was aware that an ear notched dog means that it is sterilized (54.6%, 95). Another 8% (14) at least new that it means that the dog is sterilized, however also associated rabies vaccination with it. 16.1% (28) thought that the ear notch means the dog is vaccinated, 20.1% (35) did not know what it means and 1.2% (2) thought it means something else.

Similar to the urban areas, not many (although more than in urban areas) interviewees were aware of neighbors who had puppies born to their dog in the last 12 months. Only 14.9% (26) were aware of it, 82.2% (143 were not and 2.9% (5) did not know. When asked if interviewees knew of neighbors abandoning dogs or puppies 6.9% (12) said that they knew someone, 89.7% (156) said no and 3.45% (6) did not know.

When asked what they felt dogs needed to be happy, the vast majority said food (65.3%, 158), followed by veterinary care when they are sick (6.6, 16) shelter from cold/rain/sun (4.1%, 10) and an owner (3.7%, 9) among other things (Table 17)

Table 17: "What do you think are the most important things that owned dogs need to have access to? Name as many as you can."

Answer	Number (%)
Water	9 (3.7)
Food	158 (65.3)
Vaccination	22 (9.1)
Treatments again fleas and ticks	0 (0)
Treatment for worms	0 (0)
Vet care when they get sick	16 (6.6)
Euthanasia when they are suffering from an incurable illness or disease	0 (0)
Exercise	1 (0.4)
Roaming freely without supervision	2 (0.4)
Confinement/supervision	4 (1.7)
shelter from cold/rain/sun	10 (4.1)
An owner	9 (3.7)
Interaction with people	0 (0)
Interaction with other dogs	0 (0)
Sterilisation	12 (5)

Confinement practices

Confinement practices were very differently proportioned in rural areas. While the majority of dogs in urban areas were kept in the house dogs in rural areas are mostly loose and uncontrolled. At the time of the interview only 12% (12) had their dogs inside the house. Over half the households had a dog loose around the house, with 20.8% (21) reporting that the dog was roaming or loose on the street and another 28.7% (29) reporting that the dog was loose in the yard but the yard was not fully fenced in, hence did not restrict the dogs' movement (Chart 25). The confinement practices were reported similarly for the day (Chart 26) as well as the time of the interview. Significantly fewer dogs are roaming during the night, 37% compared to 48%, and more dogs are kenneled, 5% compared to 15% (Chart 27).

Chart 25: Where is the dog right now?
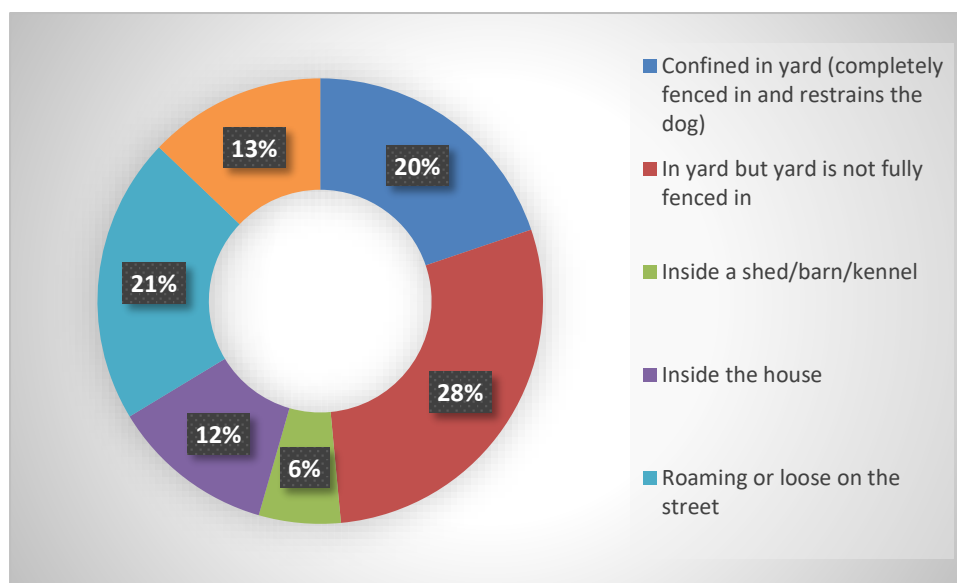
Chart 26: Where do you usually keep this dog during the day?
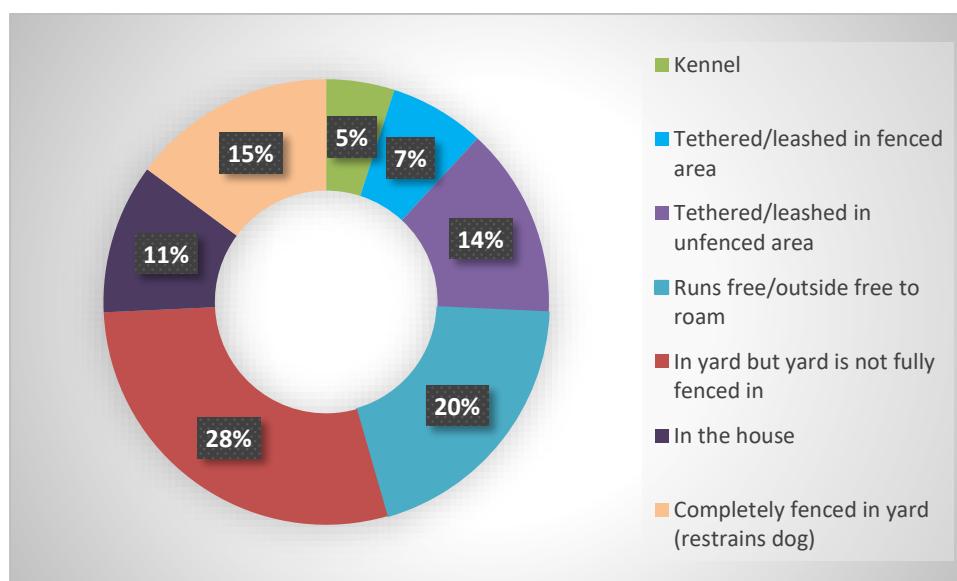
Chart 27: Where do you usually keep this dog during the night?

Legend:
- Kennel
- Tethered/leashed in fenced area
- Tethered/leashed in unfenced area
- Runs free/outside free to roam
- In yard but yard is not fully fenced in
- In the house
- Completely fenced in yard (restrains dog)
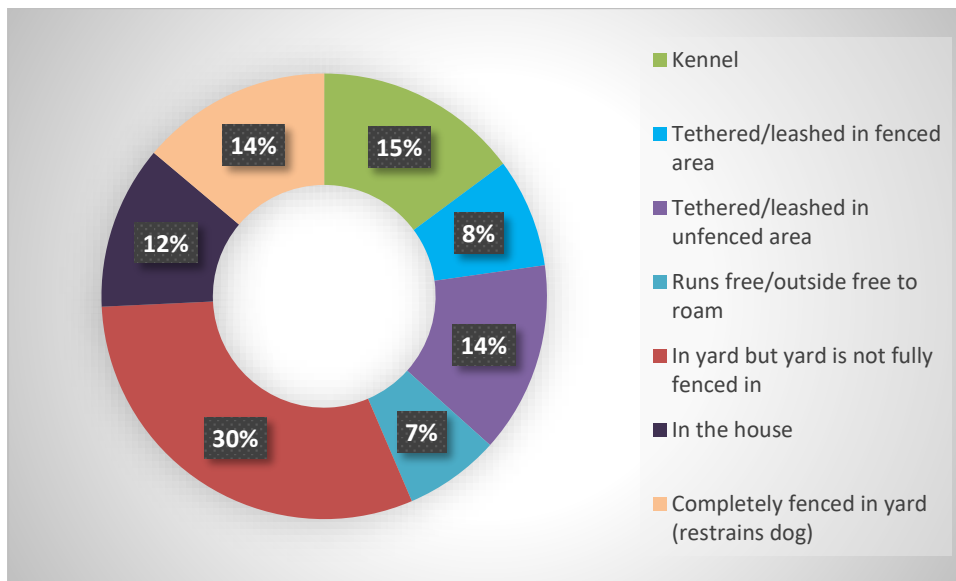
Care practices

All dog owners (101) reported that they feed their dogs on a daily basis. Only 37.6% (38) of the dogs were sterilized and 61.4% (62) were not. Most owners of unsterilized dogs reported that they felt that sterilization was unnecessary (62.3%, 47), followed by that they want the dog to protect the property (12.5%, 9) and hence think neutering will alter the dog's behavior. Other reasons were that they do not know why (8.3%, 6), the owner had no time (5.6%, 4), the owners wants to breed with the dog (4.2%, 3), the owner does not want the dog to become lazy (2.8%, 2) or one owner reported that sterilization is against his/her religious believes (1.4%, 1).

Again there was a very positive responds towards responsible vet care provision questions similar to the urban areas, which is in contrast to the sterilization rate reported. 53.5% (54) reported that they had visited the VH/LEC/Gonor in the las t12 months with their dog and almost as many dog owners (48.5%, 49) reported that they had dewormed their dogs in the last 12 months. Only about a third, however, reported that they had their dog registered (32.7%, 33). But we doubt that the three questions above are completely unbiased and might not reflect the real veterinary care practices. Future studies should find indirect measures to explore those further.

Dog bites

A much lower number of households have experienced a dog bite in the last 12 months compared to the urban areas but similarly to other areas in Asia. About 2.9% (5) in rural Thimphu and Paro experienced a dog bite whereas 97.1% (169) did not. The dog bites were either inflicted by a neighbor's dog (60%, 3) or a street dog without an owner (40%, 2).

Attitudes

We employed the same attitude questions and measurement scales from 0% to 100% as we did in Thimphu (see Thimphu for explanation) and Paro urban.

The results are summarized in the chart below (Chart 28). Similar to Thimphu and Paro urban two questions are standing out on either side of the scale. A strong disagreement of 78.2% (136) of interviewees disagreeing (reporting 0% agreement) with the statement that "Street dogs should be removed and euthanized." And on the other side a strong agreement of 66.1% (115) of interviewees (reporting 100% agreement) with the statement "Street dogs should be sterilized". Slightly more interviewees in rural areas were in support of sterilization compared to the urban areas, However, interviewees were not very decisive about the statement "Street Dogs are a part of my community and don't bother me", over half of the respondents (56.3%, 98) chose to agree 50% with the statement, and the other 50% was evenly distributed over the other percentage choices reflecting some level of uncertainty about this question.

Chart 28: Summary of the attitude scales for five attitude statements
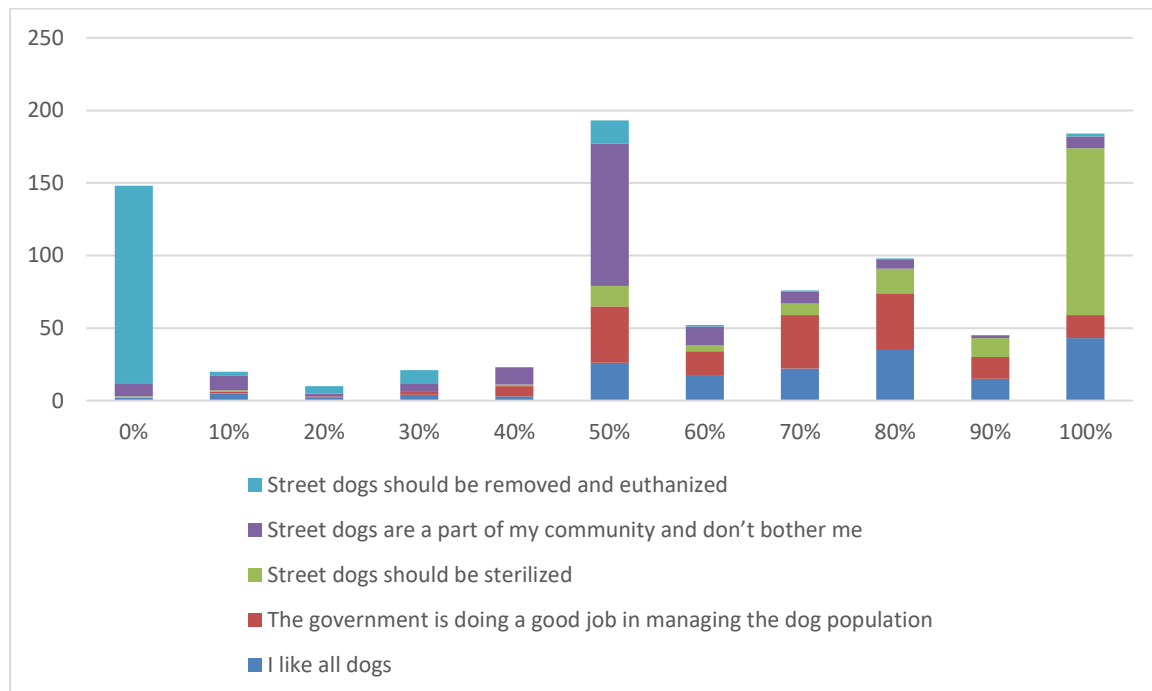
Discussion and Recommendations - Dog Community Management

The KAP survey reveals that the private dog population and the street dog population are interacting communities. However, the extend is unclear, the need to implement campaigns targeting dog owners and their private dogs appear necessary. Main themes that have come up in this survey are:

1. Perceived and actual increase of the dog population
2. Support of humane management in urban and rural areas
3. Undirected feeding (e.g. meat shops) and active feeding by residents supporting roaming dogs is perceived as a key factor/driver in the dog population – campaigns involving stakeholders like meat shop owners should be initiated to change the dynamic around meat shops and public spaces to create safe environments for both humans and dogs
4. Owned but roaming dogs are commonly known in urban and especially rural areas – confinement campaigns should encourage communities to adopt bylaws

5. We recorded relatively low sterilization rates in the owned dog population in most areas and therefore we see a relatively high dog turnover - areas with lower private dog sterilization rates should be targeted in the next phase of the project
6. Puppy survival rates are relatively high
7. Dog owners already adopt dogs from the streets - campaigns could create a pet culture shift, making gifting a puppy less appealing while promoting adoptions and responsible dog ownership
8. Dog bite rates, apart from rural areas, are about 2.5 times higher than seen elsewhere in Asia (e.g. we usually see a dog bite rate of 5-6% in India) – Implementations of comprehensive campaigns addressing dog bites and human-dog interactions

Besides the results of this survey, the authors' observations and conversations with Dr. Rinzin and Dr. Hiruka all suggest that street dog behavior is very varied in both Thimphu and Paro, with some packs being easily agitated by human presents and other packs being very well adjusted to humans approaching them or passing by. Dog agglomerations were observed around the many meat shops. Dog packs around them where perceived as usually more aloof to even slightly aggressive in both urban areas, especially in the early morning hours. We consider them street dogs with no private person claiming ownership but instead living off of meat shop provided food and garbage. We suspect that the reason for aggressive and more aversive reacting dogs could potentially be a result of negative human-dog interactions as the shared space for humans and dogs is becoming increasingly smaller. However, more aggressive versus attention seeking dog packs were sometimes just a street or two away from each other, which makes it difficult for us to conclude with certainty that the human-dog relationship is the only reason for the aggressive behavior of the dogs, at this point.

On the other hand, we would confidently report that with distance to the town centers (high human density) and away from meat shops, dogs and dog packs tended to be more friendly and approachable and pack sizes were much smaller.

Appendix

Survey results for all survey tracks by Dzongkhag and survey year 2015 and 2018

Bhumtang 2018	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Bhumthang town	13	13.5	1	13.5	17	6.5	10	74.5	58	30.5	27.5	52.6	49.1	30.5	55.7	1.1	8.7	3.6	0.0	0.0	1.0	1.7
Chhoker	14	3	0	13	3	5	7	45	33	6	17	18.2	17.6	16	18.8	0.9	11.1	0.0	0.0	0.0	1.0	3.0
Chumme	7	10	0	9	8	6	17	57	34	18	17	52.9	58.8	17	47.1	1.0	10.5	0.0	1.0	2.9	0.0	0.0
Total	34	26.5	1	35.5	28	17.5	34	176.5	125	54.5	61.5	43.6	43.1	63.5	44.1	1.0	9.9	1.6	0	0.0	0	0.0

Chukha 2018	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Tsimalakha (Chukha)	4	33	0	5	19	1	13	75	61	52	37	85.2	89.2	24	79.2	0.6	1.3	0.0	0.0	0.0	0	0
Gedu (Chukha)	14	11	0	13	12	0	9	59	50	23	25	46.0	44.0	25	48.0	1.0	0.0	0.0	1.0	2.0	0	0
Phuentsholing (Chukha)	7	16	1	14	19	1	19	77	57	35	24	61.4	66.7	33	57.6	1.4	1.3	4.2	3.0	5.3	0	0
Chapcha	2	5	0	4	1	2	0	14	12	6	7	50.0	71.4	5	20.0	0.7	14.3	0.0	3.0	25.0	0	0
Chukha	5	19	0	4	12	0	2	42	40	31	24	77.5	79.2	16	75.0	0.7	0.0	0.0	1.0	2.5	0	0
Wangakha	6	11	4	1	7	5	8	42	29	18	21	62.1	52.4	8	87.5	0.4	11.9	19.0	0.0	0.0	0	0
Darla	0	1	0	2	2	0	0	5	5	3	1	60.0	100.0	4	50.0	4.0	0.0	0.0	0.0	0.0	0	0
Tala	1	2	0	0	3	0	3	9	6	5	3	83.3	66.7	3	100.0	1.0	0.0	0.0	0.0	0.0	0	0
Pasakha	9	1	0	3	6	0	5	24	19	7	10	36.8	10.0	9	66.7	0.9	0.0	0.0	0.0	0.0	0	0
Total	48	99	5	46	81	9	59	347	279	180	152	64.5	65.1	127	63.8	0.8	2.6	3.3	0	0.0	0	0.0

Paro 2018	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Paro	6.5	28	0	9.5	35.5	1	68	148.5	79.5	63.5	34.5	80	81	45	78.9	1.3	0.7	0.0	0.0	0.0	0.0	0.0
Chuzom	7	6	0	4	4	3	4	28	21	10	13	48	46	8	50.0	0.6	10.7	0.0	2.0	9.5	0.0	0.0
Bondey	14	18	0	11	12	8	34	97	55	30	32	55	56	23	52.2	0.7	8.2	0.0	1.0	1.8	0.0	0.0
Dopshari	7	6	0	4	4	3	4	28	21	10	13	48	46	8	50.0	0.6	10.7	0.0	2.0	9.5	1.0	4.8
Olathang	14	13	3	15	20	8	39	112	65	33	30	51	43	35	57.1	1.2	7.1	10.0	2.0	3.1	0.0	0.0
Semi Urban Paro	14	36	0	26	25	5	49	155	101	61	50	60	72	51	49.0	1.0	3.2	0.0	12.0	11.9	0.0	0.0
Shaba	2	10	0	4	4	0	18	38	20	14	12	70	83	8	50.0	0.7	0.0	0.0	1.0	5.0	0.0	0.0
Way to Tiger nest	8	6	0	8	5	4	29	60	27	11	14	41	43	13	38.5	0.9	6.7	0.0	1.0	3.7	0.0	0.0
Total	72.5	123	3	81.5	109.5	32	245	666.5	389.5	232.5	198.5	59.7	62.0	191	57.3	1.0	4.8	1.5	0	0.0	0	0.0

Sarpang 2018	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Sarpang	5	1	0	3	1	0	6	16	10	2	6	20.0	16.7	4	25.0	0.7	0.0	0.0	0.0	0.0	0	0
Gelephu (Sarpang)	7	11	0	5	11	0	19	53	34	22	18	64.7	61.1	16	68.8	0.9	0.0	0.0	1.0	2.9	0	0
Jigmeling	5	1	0	5	1	0	3	15	12	2	6	16.7	16.7	6	16.7	1.0	0.0	0.0	0.0	0.0	0	0
Gakiling	2	1	0	3	1	0	3	10	7	2	3	28.6	33.3	4	25.0	1.3	0.0	0.0	0.0	0.0	0	0
Samtelling	0	0	0	3	1	0	2	6	4	1	0	25.0		4	25.0	#DIV/0!	0.0	#DIV/0!	0.0	0.0	0	0
Zomlingthang	0	2	0	0	2	0	2	6	4	4	2	100.0	100.0	2	100.0	1.0	0.0	0.0	0.0	0.0	0	0
Total	19	16	0	19	17	0	35	106	71	33	35	46.5	45.7	36	47.2	1.0	0.0	0.0	0	0.0	0	0.0

Samdrupjongkher 2018	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Samdrupjongkher	10	10	0	4	10	0	6	40	34	20	20	58.8	50.0	14	71.4	0.7	0.0	0.0	4.0	11.8	0.0	0.0

	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Deothang	9.5	3.5	0	4.5	9	2.5	1.5	30.5	26.5	12.5	13	47.2	26.9	13.5	66.7	1.0	8.2	0.0	4.5	17.0	1.0	3.8
Phuenshothang	0	1	0	3	1	0	2	7	5	2	1	40.0	100.0	4	25.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Pemathang	0	0	0	1	0	2	3	6	1	0	0	0		1	0.0	#DIV/0!	33.3	#DIV/0!	0.0	0.0	0.0	0.0
Total	19.5	14.5	0	12.5	20	4.5	12.5	83.5	66.5	34.5	34	51.9	42.6	32.5	61.5	1.0	5.4	0.0	0	0.0	0	0.0
Thimphu 2018	**Female**	**Female sterile**	**Lactating**	**Male**	**Male sterile**	**Pup**	**Unknown adult**	**Total Count**	**Total Known**	**Total Sterilized**	**Total Female**	**% Total Sterilized**	**% Sterilized Female**	**Total Male**	**% Sterilized Male**	**Male female (1) ratio calculation**	**% Pups**	**% Lactating**	**Skin Problem**	**% Skin Problem**	**Total Body score C1/C2**	**% C1/C2 Body score**
Kabesa (Thimphu)	1.5	5.5	0	0.5	4.5	0	18	30	12	10	7	83.3	78.6	5	90.0	0.7	0.0	0.0	0.5	4.2	0	0
Thimphu	35.5	66.5	1.5	31.5	100.5	9.5	259	504	235.5	167	103.5	70.9	64.3	132	76.1	1.3	1.9	1.4	6.0	2.5	0	0
Chamgang	6	14	0	6	4	6	18	54	30	18	20	60	70	10	40.0	0.5	11.1	0.0	2.0	6.7	0	0
Depsi	3	6	0	3	4	1	14	31	16	10	9	62.5	66.7	7	57.1	0.8	3.2	0.0	0.0	0.0	0	0
Total	46	92	1.5	41	113	16.5	309	619	293.5	205	139.5	69.8	65.9	154	73.4	1.1	2.7	1.1	0	0.0	0	0.0
Trashigang 2018	**Female**	**Female sterile**	**Lactating**	**Male**	**Male sterile**	**Pup**	**Unknown adult**	**Total Count**	**Total Known**	**Total Sterilized**	**Total Female**	**% Total Sterilized**	**% Sterilized Female**	**Total Male**	**% Sterilized Male**	**Male female (1) ratio calculation**	**% Pups**	**% Lactating**	**Skin Problem**	**% Skin Problem**	**Total Body score C1/C2**	**% C1/C2 Body score**
Trashigang	3	8	0	6	12	0	4	33	29	20	11	69.0	72.7	18	66.7	1.6	0.0	0.0	7.0	24.1	0	0
Radi	5	2	0	1	2	0	1	11	10	4	7	40.0	28.6	3	66.7	0.4	0.0	0.0	0.0	0.0	0	0
Khaling	3	5	0	1	3	0	1	13	12	8	8	66.7	62.5	4	75.0	0.5	0.0	0.0	1.0	8.3	0	0
Wamrong	5	8	1	3	9	2	4	32	26	17	14	65.4	57.1	12	75.0	0.9	6.3	7.1	0.0	0.0	0	0
Total	16	23	1	11	26	2	10	89	77	49	40	63.6	57.5	37	70.3	0.9	2.2	2.5	0	0.0	0	0.0
Samtse 2018	**Female**	**Female sterile**	**Lactating**	**Male**	**Male sterile**	**Pup**	**Unknown adult**	**Total Count**	**Total Known**	**Total Sterilized**	**Total Female**	**% Total Sterilized**	**% Sterilized Female**	**Total Male**	**% Sterilized Male**	**Male female (1) ratio calculation**	**% Pups**	**% Lactating**	**Skin Problem**	**% Skin Problem**	**Total Body score C1/C2**	**% C1/C2 Body score**
Samtse	8.5	3	0	6	7	0	6.5	31	24.5	10	11.5	40.8	26.1	13	53.8	1.1	0.0	0.0	0.0	0.0	0	0
Gomtu	10	9	0	12	5	0	4	40	36	14	19	38.9	47.4	17	29.4	0.9	0.0	0.0	2.0	5.6	0	0

	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Tendu	7	6	0	6	4	0	5	28	23	10	13	43.5	46.2	10	40.0	0.8	0.0	0.0	2.0	8.7	0	0
Ghumawni	5	0	3	0	2	0	1	11	10	2	8	20.0	0.0	2	100.0	0.3	0.0	37.5	0.0	0.0	0	0
Chengmari	1	4	0	5	8	0	4	22	18	12	5	66.7	80.0	13	61.5	2.6	0.0	0.0	0.0	0.0	0	0
Total	31.5	22	3	29	26	0	20.5	132	111.5	48	56.5	43.0	38.9	55	47.3	1.0	0.0	5.3	0	0.0	0	0.0

Bhumtang 2015	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Bhumthang	9	27.5	0	12	24	0.5	14	87	72.5	51.5	36.5	71.0	75.3	36	66.7	1.0	0.6	0.0	1.0	1.4	0	0
Chhoker	1	4	0	3	4	5	7	24	12	8	5	66.7	80.0	7	57.1	1.4	20.8	0.0	1.0	8.3	0	0
Chumme	16	20	0	19	16	10	8	89	71	36	36	50.7	55.6	35	45.7	1.0	11.2	0.0	0.0	0.0	0	0
Total	26	51.5	0	34	44	15.5	29	200	155.5	95.5	77.5	61.4	66.5	78	56.4	1.0	7.8	0.0	0	0.0	0	0.0

Chukha 2015	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Tsimalakha (Chukha)	3.5	29	0	21.5	43	9	16	122	97	72	32.5	74.2	89.2	64.5	66.7	2.0	7.4	0	0	0	0	0
Gedu (Chukha)	4	14.5	0	13.5	34.5	4.5	19.5	90.5	66.5	49	18.5	73.7	78.4	48	71.9	2.6	5.0	0	0	0	0	0
Phuentsholing (Chukha)	7.5	21	0	32	44	2	18	124.5	104.5	65	28.5	62.2	73.7	76	57.9	2.7	1.6	0	0	0	0	0
Chapcha	1	2	0	5	1	1	2	12	9	3	3	33.3	66.7	6	16.7	2.0	8.3	0	0	0	0	0
Chukha	0	2	0	8	8	2	9	29	18	10	2	55.6	100.0	16	50.0	8.0	6.9	0	0	0	0	0
Wangakha	2	3	0	8	4	1	7	25	17	7	5	41.2	60.0	12	33.3	2.4	4.0	0	0	0	0	0
Darla	2	6	0	3	7	1	8	27	18	13	8	72.2	75.0	10	70.0	1.3	3.7	0	0	0	0	0
Tala	0	6	0	8	11	3	11	39	25	17	6	68.0	100.0	19	57.9	3.2	7.7	0	0	0	0	0
Pasakha	2	9	0	19	17	3	21	71	47	26	11	55.3	81.8	36	47.2	3.3	4.2	0	0	0	0	0
Total	22	92.5	0	118	169.5	26.5	111.5	540	402	262	114.5	65.2	80.8	287.5	59.0	2.5	4.9	0.0	0	0.0	0	0.0

Paro 2015	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Paro	8.5	22	0	7.5	23	2	21	84	61	45	30.5	73.8	72.1	30.5	75.4	1.0	2.4	0.0	0.5	0.8	0	0
Bondey	17	21	1	34	38	2	14	127	111	59	39	53.2	53.8	72	52.8	1.8	1.6	2.6	0.0	0.0	0	0
Chuzom	10	15	0	8	13	5	0	51	46	28	25	60.9	60.0	21	61.9	0.8	9.8	0.0	1.0	2.2	0	0
Dopshari	2	12	0	3	23	0	0	40	40	35	14	87.5	85.7	26	88.5	1.9	0.0	0.0	1.0	2.5	0	0
Olathang	23	12	1	14	9	7	0	66	59	21	36	35.6	33.3	23	39.1	0.6	10.6	2.8	4.0	6.8	0	0
Semi urban Paro	21	35	1	36	36	20	10	159	129	71	57	55.0	61.4	72	50.0	1.3	12.6	1.8	11.0	8.5	0	0
Shaba	10	12	0	12	32	0	4	70	66	44	22	66.7	54.5	44	72.7	2.0	0.0	0.0	0.0	0.0	0	0
Way to tiger nest	8	13	1	16	18	4	4	64	56	31	22	55.4	59.1	34	52.9	1.5	6.3	4.5	2.0	3.6	0	0
Total	99.5	142	4	130.5	192	40	53	661	568	334	245.5	58.8	57.8	322.5	59.5	1.3	6.1	1.6	0	0.0	0	0.0

Sarpang 2015	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Sarpang	20.5	6.5	2.5	15	31	3	6.5	85	75.5	37.5	29.5	49.7	22.0	46	67.4	1.6	3.5	8.5	1.0	1.3	0	0
Gelephu (Sarpang)	36	34.5	2.5	25	62	4.5	8	172.5	160	96.5	73	60.3	47.3	87	71.3	1.2	2.6	3.4	1.0	0.6	0	0
Jigmeling	25	7	2	11	20	4	10	79	65	27	34	41.5	20.6	31	64.5	0.9	5.1	5.9	0.0	0.0	0	0
Gakiling	1	8	0	7	14	2	3	35	30	22	9	73.3	88.9	21	66.7	2.3	5.7	0.0	1.0	3.3	0	0
Zomlingthang																						
Samtelling	4	7	0	5	10	1	0	27	26	17	11	65.4	63.6	15	66.7	1.4	3.7	0.0	0.0	0.0	0	0
Total	86.5	63	7	63	137	14.5	27.5	398.5	356.5	200	156.5	56.1	40.3	200	68.5	1.3	3.6	4.5	0	0.0	0	0.0

Samdrupjongkher 2015	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Samdruojonkher	4.5	15	0	6.5	25.5	0.5	9	61	51.5	40.5	19.5	78.6	76.9	32	79.7	1.6	0.8	0	0	0	0	0
Deothang (SJKR)	5	2.5	0	8.5	9.5	4.5	10.5	40.5	25.5	12	7.5	47.1	33.3	18	52.8	2.4	11.1	0	0	0	0	0

	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Phuenshothang	1	0	0	1	0	0	2	4	2	0	1	0.0	0.0	1	0.0	1.0	0.0	0	0	0	0	0
Pemathang	1	0	0	1	1	1	2	6	3	1	1	33.3	0.0	2	50.0	2.0	16.7	0	0	0	1	33.3333333
Total	11.5	17.5	0	17	36	6	23.5	111.5	82	53.5	29	65.2	60.3	53	67.9	1.8	5.4	0.0	0	0.0	0	0.0

Thimphu 2015	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Kabesa (Thimphu)	2.5	1	0	7	8.5	0.5	4	23.5	19	9.5	3.5	50.0	28.6	15.5	54.8	4.4	2.1	0.0	0.0	0.0	0	0
Thimphu	26.5	52	1	41	89	15.5	185.5	410.5	209.5	141	79.5	67.3	65.4	130	68.5	1.6	3.8	1.3	5.0	2.4	0	0
Chamgang	12	5	0	16	10	0	1	44	43	15	17	34.9	29.4	26	38.5	1.5	0.0	0.0	2.0	4.7	0	0
Depsi	6	7	0	7	2	1	3	26	22	9	13	40.9	53.8	9	22.2	0.7	3.8	0.0	1.0	4.5	0	0
Total	47	65	1	71	109.5	17	193.5	504	293.5	174.5	113	59.5	57.5	180.5	60.7	1.6	3.4	0.9	0	0.0	0	0.0

Trashigang 2015	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Trashigang	7.5	17	0	6.5	32.5	3.5	3	70	63.5	49.5	24.5	78.0	69.4	39.0	83.3	1.6	5.0	0.0	2.5	3.9	0	0
Radi	7	0	0	8	4	5	4	28	19	4	7	21.1	0.0	12.0	33.3	1.7	17.9	0.0	0.0	0.0	0	0
Khaling	3	2	0	3	4	1	4	17	12	6	5	50.0	40.0	7.0	57.1	1.4	5.9	0.0	0.0	0.0	0	0
Wamrong	14	3	0	9	6	3	3	38	32	9	17	28.1	17.6	15.0	40.0	0.9	7.9	0.0	0.0	0.0	0	0
Total	31.5	22	0	26.5	46.5	12.5	14	153	126.5	68.5	53.5	54.2	41.1	73	63.7	1.4	8.2	0.0	0	0.0	0	0.0

Samtse 2015	Female	Female sterile	Lactating	Male	Male sterile	Pup	Unknown adult	Total Count	Total Known	Total Sterilized	Total Female	% Total Sterilized	% Sterilized Female	Total Male	% Sterilized Male	Male female (1) ratio calculation	% Pups	% Lactating	Skin Problem	% Skin Problem	Total Body score C1/C2	% C1/C2 Body score
Samtse	7.5	17	0	6.5	32.5	3.5	3	70	63.5	49.5	24.5	78.0	69.4	39.0	83.3	1.6	5.0	0.0	2.5	3.9	0	0
Gomtu	7	12	0	6	18	4	3	50	43	30	19	69.8	63.2	24.0	75.0	1.3	8.0	0.0	0.0	0.0	0	0
Tendu	9	10	0	6	22	0	4	51	47	32	19	68.1	52.6	28.0	78.6	1.5	0.0	0.0	3.0	6.4	0	0
Ghumawni	9	4	0	3	20	2	3	41	36	24	13	66.7	30.8	23.0	87.0	1.8	4.9	0.0	0.0	0.0	0	0

Chengmari	5	5	0	5	14	3	2	34	29	19	10	65.5	50.0	19.0	73.7	1.9	8.8	0.0	0.0	0.0	0	0
Total	37.5	48	0	26.5	106.5	12.5	15	246	218.5	154.5	85.5	70.7	56.1	133	80.1	1.6	5.1	0.0	0	0.0	0	0.0