2016

Free Roaming Street Dog Population Survey of South Delhi Municipal Corporation

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FREE ROAMING STREET DOG POPULATION SURVEY OF SOUTH DELHI MUNICIPAL CORPORATION (104 WARDS)

Report written by :
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SUMMARY

The wards in the 4 zones that comprise the South Delhi region were merged into 3, 4 or 5 groups per zone in order to establish a system for monitoring the roaming dog population. One survey route, on average 27.5 km long, was designed within each group to sample the streets and highways throughout the group. Six teams, each consisting of a motorcycle driver and observer, recorded the dogs seen as sterilised and unsterilized males and females, lactating females, pups and unknown adults while driving slowly along the route. Poor skin and body conditions (BCS 1 or 2) were recorded as welfare indicators. The surveys were conducted from first light to avoid excessive traffic and some repeated to provide estimates of variance in the counts and hence the significance of observed changes in roaming dog density over time.

Extrapolating the adult dogs recorded during the monitoring surveys via total street length and dividing by an estimated 0.44 detectability gives an estimate of 189,285 total adult roaming dogs. The monitoring surveys estimate an average density of 10.01 adult roaming dogs per km of street in the early morning of which 39.2% are female. On average 27.8% of adult females are spayed and 7.3% lactating. 40.3 % of males are castrated. There are an estimated 3.1 dogs per 100 people.

All the survey routes are provided as a resource for monitoring changes in the roaming dog population. In addition a database is provided to display the monitoring baseline and to upload and display subsequent survey data.

SURVEY DURATION

Survey design – 1st August, 2016 to 20th August, 2016

Ground Data Collection- 25th August, 2016 to 3rd September, 2016

Data Analysis and report writing – 12th September, 2016 to 10th October, 2016

SURVEY TEAM

Lex Hiby, Dr. Amit Chaudhari, Keren Nezareth,Tamara Kartal, Dr. Shrikant verma, Dr. Shivendra, Dr. Gabbar, Pawan and Parvinder

Pictures were taken during the street dog population survey.

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INTRODUCTION

The following sections provide results of street surveys carried out at the request of the SDMC to monitor the density and composition of the South Delhi roaming dog population. By a "roaming dog" we mean any dog that may move freely at times on the city streets or other public areas, such as a "stray", "community dog" or unconfined owned dog.

Results include roaming dog density expressed as the number counted per km of street length, the percentage of females and males that have been sterilised (as evidenced by the presence of an ear notch) and the percentage of females that are lactating (and thus raising a litter of puppies). Dog density per km of street length is quick and easy to monitor and most relevant to the city residents because it determines the number of dogs they will encounter as they move around the city. Breeding activity as evidenced by percentage of females lactating is related to the risk of children being bitten by females responding to a perceived threat to their pups (Reece et al 2013[1]) and to the nuisance of dogs barking and fighting over females in heat. Some residents are distressed by seeing dogs that are in very poor condition or worried about related health risks so dogs that were emaciated or had visible skin conditions were also recorded.

Total abundance within the South Delhi region was estimated by multiplying observed density by total street length and dividing by the average estimated detectability. Mark resight experiments estimate that about half the population of roaming dogs are detected by early morning street surveys. The most recent and extensive set of mark resight experiments conducted earlier this year in Kathmandu estimated detectability at 0.44, which is the value used in this report. Although abundance estimates are useful for planning an intervention we do not recommend they be used for monitoring. Observed density is much easier to monitor and less affected by development and expansion of the city, factors beyond the control of an ABC programme. Furthermore the percentage of females seen on the street surveys that are lactating will be the first aspect of the population to respond to the programme.

ROAMING DOGS DENSITY

Standard routes were designed using Google Maps to run along highways and residential streets. One route, on average 27.5 km long, was designed within each group. The tracks covered 5.7% of the total length of Google Maps streets and highways within the South Delhi region.

[1] Reece, J.F., Chawla, S.K. & Hiby, A.R., 2013. Decline in human dog-bite cases during a street dog sterilisation programme in Jaipur, India. *The Veterinary record*, 172(18), p.473. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23492927

Table 1 – Free Roaming Dog population for all 104 wards.

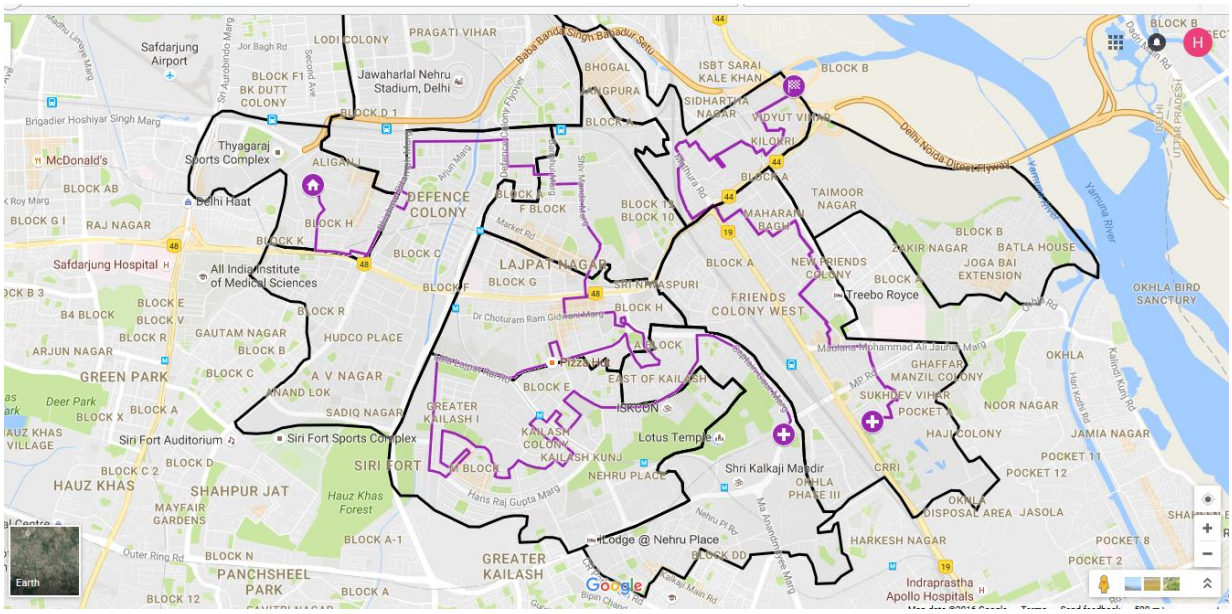
Free Roaming Dog Population of the 104 wards							
Ward Number	Free Roaming Dogs		Ward Number	Free Roaming Dogs		Ward Number	Free Roaming Dogs
101	1223		136	1753		175	6957
102	1304		137	944		176	6212
103	5604		138	809		177	11679
104	5385		139	8361		178	2338
105	897		140	1136		179	2046
106	978		141	1159		180	2046
107	1223		142	1098		181	2192
108	1223		143	1768		182	1608
109	1379		144	1098		183	1754
110	1264		145	607		184	1461
111	1494		146	643		185	1511
112	1379		147	965		186	1360
113	1379		148	772		187	1360
114	1379		153	247		188	1511
115	1223		154	588		189	1169
116	1264		155	562		190	1360
117	1407		156	625		191	1378
118	1172		157	562		192	562
119	772		158	625		193	625
120	772		159	625		194	500
121	11904		160	500		195	1360
122	13423		161	861		196	1360
123	1524		162	1704		197	1511
124	1953		163	258		198	1360
125	3048		164	861		199	1057
126	1172		165	947		200	1209
127	1524		166	947		201	2172
128	1993		167	1033		202	1521
129	708		168	1033		203	1303
130	579		169	1591		204	1303
131	643		170	2727		205	1000
132	579		171	1206		206	1629
133	1182		172	915		207	1955
134	1349		173	2499		208	977
135	1281		174	2840			

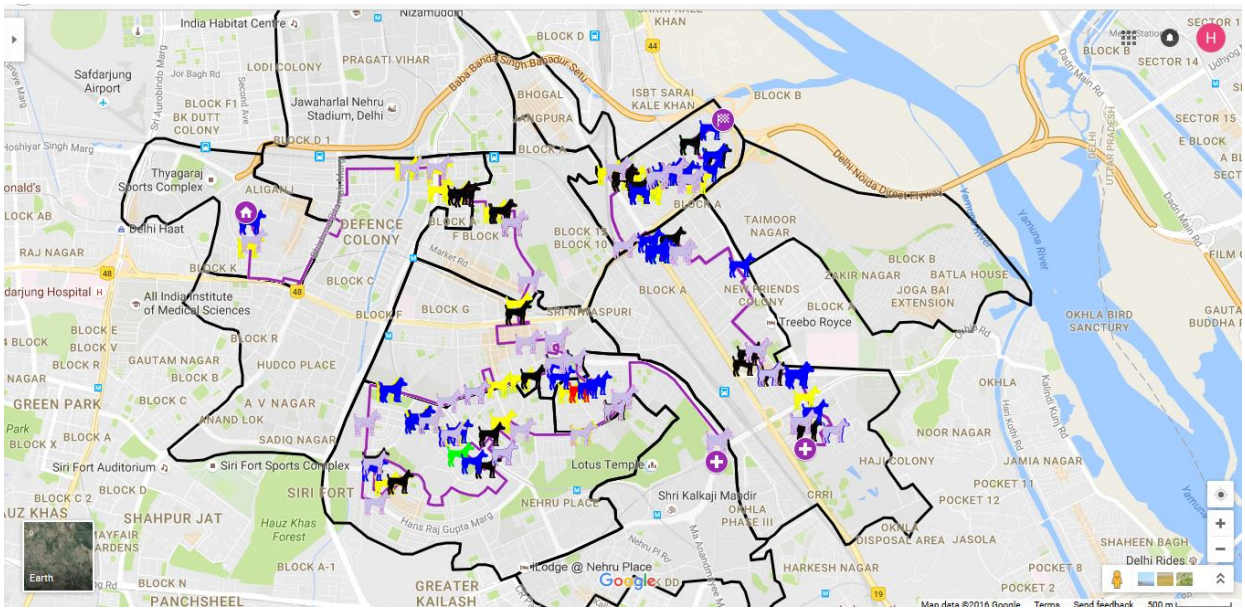
Group boundaries were superimposed on Google Maps in order to restrict each route to a single group. The image in figure 1 illustrates the route for Central Zone group 3. The route runs from the house icon to the chequered flag. Each route is saved as a kml file that can be loaded into the My Places facility of Google Maps on the PC and then viewed using the Maps application on a smartphone synchronised with that Google account. Any of the routes can therefore be followed at any time in the future by viewing it on a smartphone and navigating to move the location cursor along the route.

To complete the current survey, six teams each consisting of a motorcycle driver and observer followed each route once or 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 application as an event recorder. The phones were GPS-enabled so the exact location of each event was recorded. On completion of the survey the recorded events were exported to a gpx file that was transferred to a PC for upload to a "DogDensity.mdb" Access database. The database includes reports and forms to facilitate upload and provide detailed results. The tracks actually completed during the surveys (as opposed to the pre-planned routes) were generated during the upload and used to adjust the route for any unforeseen obstacles. The 17 saved routes could therefore be followed during future surveys without encountering those problems.

Further details of the recording system are given in the Monitoring section below.

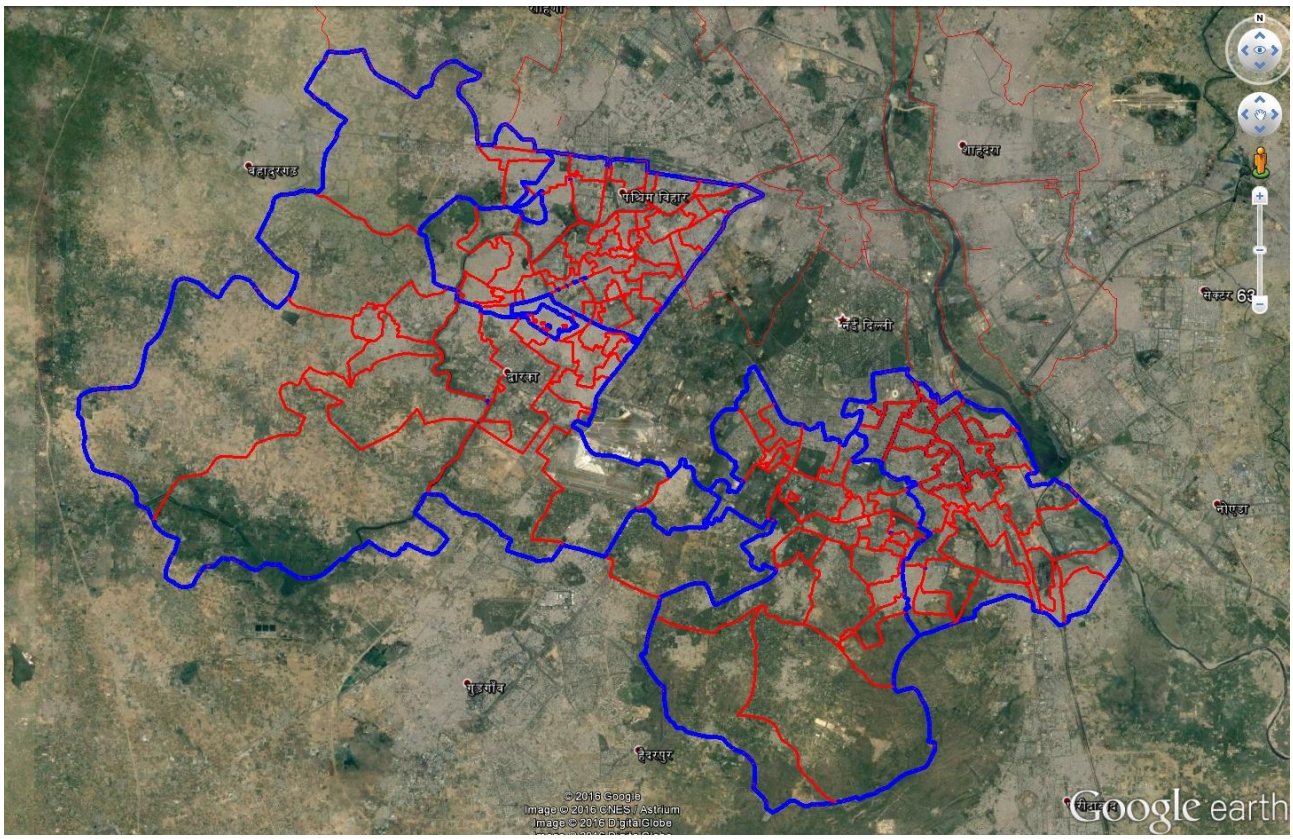
Figure 1 - Survey route for Central Zone_G3. The purple line shows the route running along streets shown in Google Maps from the house icon to the chequered flag. The black lines show the boundaries of the wards in that group. Green and yellow dog icons show spayed and entire females, red icons show lactating females, black and blue icons show castrated and entire males.





Delhi zone and ward boundaries were downloaded from https://archive.org/details/delhi-wards-map and selected wards within each zone merged into regions large enough to accommodate survey routes long enough to average over local variations in dog density.

Figure 2 – Blue lines show the 4 zones that comprise the SDMC region, red lines the wards within those zones. Dark blue lines show ward group Central Zone_G3 at the north of the Central zone.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पश्चिम विहार
शाहदरा
सेक्टर 62
नई दिल्ली
द्वारका
नोएडा
गुड़गांव
फ़रीदाबाद
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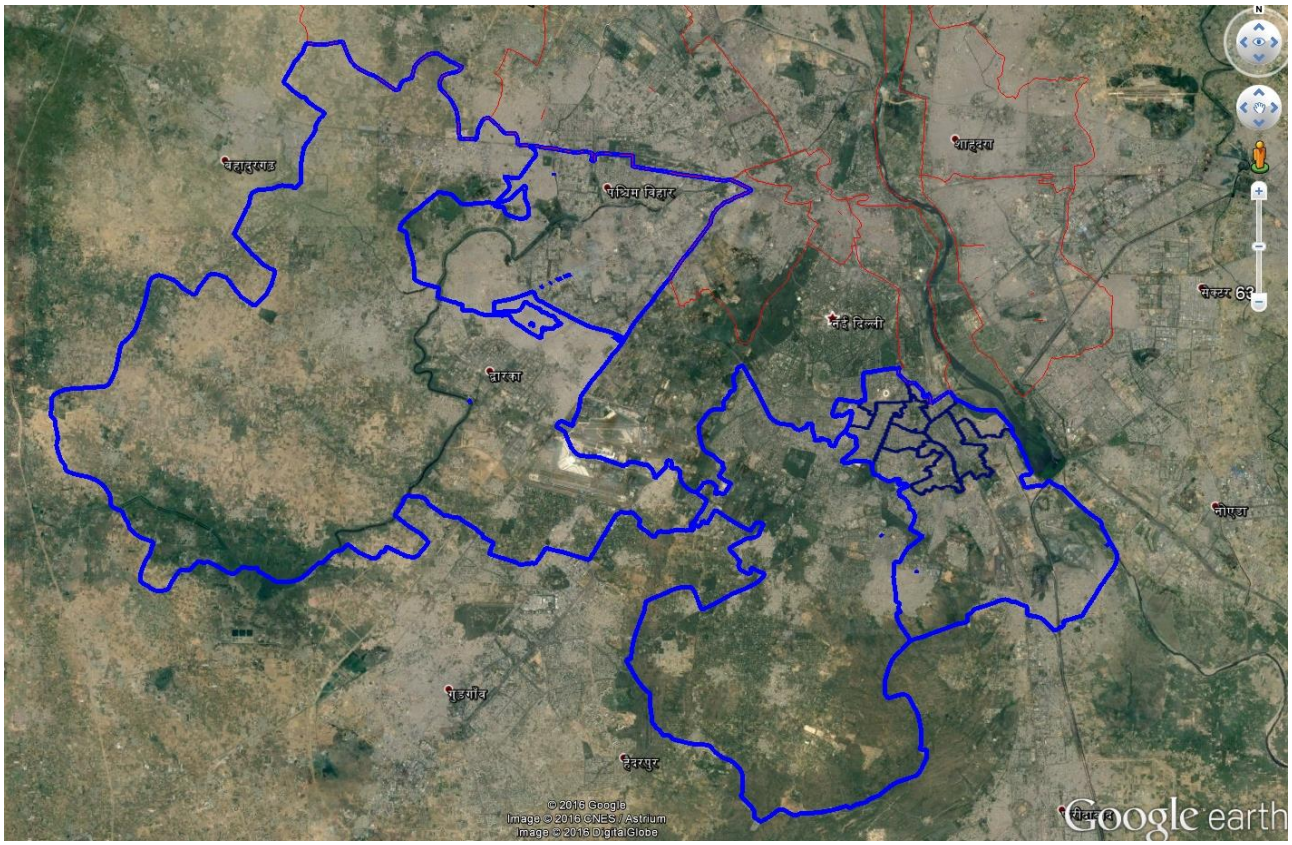
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Table 2 shows the count results, extrapolation to total dogs roaming the streets in the early morning and to total population by correcting for detectability. In the second column the average number of dogs counted over the one or two surveys conducted along each route is expressed as the number of dogs counted per km of street length. The dogs per km is multiplied by the total street length in column three to give the estimated number of dogs on all the streets in the ward group at the time of the surveys (column four). The final column estimates the total number of dogs that may roam at any time in each group (the roaming dog abundance) by dividing the number in column four by the estimated probability of 0.44 that a dog that may roam at any time will be on the streets at the time of the surveys ("detectability"). The total roaming estimates summed over the 17 groups is 189,285.

Table 2 - Count Results for all ward groups

Group	Dogs counted per km	Total street length	Dogs on streets	Total roaming
Central Zone_G1	11.0	436.2	4779	10861
Central Zone_G2	14.3	463.7	6647	15107
Central Zone_G3	5.1	536.3	2749	6248
Najafgarh Zone_G1	6.6	560.4	3679	8361
Najafgarh Zone_G2	7.7	348.9	2683	6098
Najafgarh Zone_G3	7.1	419.3	2967	6743
Najafgarh Zone_G4	7.8	361.4	2830	6432
Najafgarh Zone_G5	4.6	221.0	1020	2318
South Zone_G1	8.1	794.3	6430	14614
South Zone_G2	6.0	627.4	3790	8612
South Zone_G3	12.4	878.8	10933	24848
South Zone_G4	13.5	369.6	4999	11361
West Zone_G1	15.8	704.4	11144	25327
West Zone_G2	12.4	290.3	3587	8151
West Zone_G3	9.2	546.9	5056	11491
West Zone_G4	14.4	336.3	4835	10989
West Zone_G5	14.1	366.5	5159	11724

Averaged by zone				
Zone	Dogs counted per km	Total street length	Dogs on streets	Total roaming
Central	10.13	1436	14175	32216
Najafgarh	6.76	1911	13179	29952
South	10.00	2670	26152	59435
West	13.18	2244	29781	67682

COMPOSITION OF THE ROAMING DOG POPULATION

Table 3 - Composition of dog population observed on the streets.

Group	% female	% females notched	% females lactating	% males notched	% pups	% emaciated	% skin problem
Central Zone_G1	42	87	2	88	1	0.4	0.7
Central Zone_G2	43	44	9	39	2	4.5	4.0
Central Zone_G3	39	5	5	54	1	0.0	2.7
Najafgarh Zone_G1	44	33	6	44	16	1.5	0.7
Najafgarh Zone_G2	37	46	20	70	7	0.5	0.5
Najafgarh Zone_G3	40	15	9	30	5	0.5	2.1
Najafgarh Zone_G4	39	21	17	18	2	0.0	0.0
Najafgarh Zone_G5	40	18	11	46	5	0.0	0.0
South Zone_G1	37	2	8	23	4	2.1	4.3
South Zone_G2	39	6	7	11	6	0.0	0.0
South Zone_G3	37	55	10	73	2	0.0	0.6
South Zone_G4	28	17	1	22	4	1.1	1.9
West Zone_G1	44	20	4	29	9	5.0	0.7
West Zone_G2	32	26	3	41	5	1.0	1.2
West Zone_G3	44	55	4	59	11	2.5	0.0
West Zone_G4	42	4	2	16	3	3.1	1.6
West Zone_G5	39	19	6	22	2	0.0	2.7

Averaged by zone							
Zone	% female	% female notched	% females lactating	% males notched	% pups	% emaciated	% skin problem
Central	41.33	45.33	5.33	60.33	1.33	1.63	2.47
Najafgarh	40.00	26.60	12.60	41.60	7.00	0.50	0.66
South	35.25	20.00	6.50	32.25	4.00	0.80	1.70
West	40.20	24.80	3.80	33.40	6.00	2.32	1.24

SPATIAL DISTRIBUTION OF THE ROAMING DOG POPULATION

Zones were found to vary in both dog density and percentage composition. The West zone has both the highest roaming dog density and total number. Najafgarh has the lowest density because much of the total street length consists of streets joining rather than within settlements. By far the highest percentage of lactating females was found in Najafgarh. The Central zone has the highest percentage of sterilised (and therefore ear-notched) dogs (87% of females and 88% of males in group 1) and relatively low percentages of lactating females and pups.

Judging by the generally low percentages of dogs recorded as “emaciated” (Body Condition Score 1 or 2) or requiring treatment for a skin condition welfare was found to be reasonably good, suggesting some level of support from the local population and benefit from previous sterilisation programmes.

Figure 3 illustrates dog density over the South Delhi area. The colour of the icons indicates the dog type seen at that location:

Green = Female notched

Yellow = Female unnotched

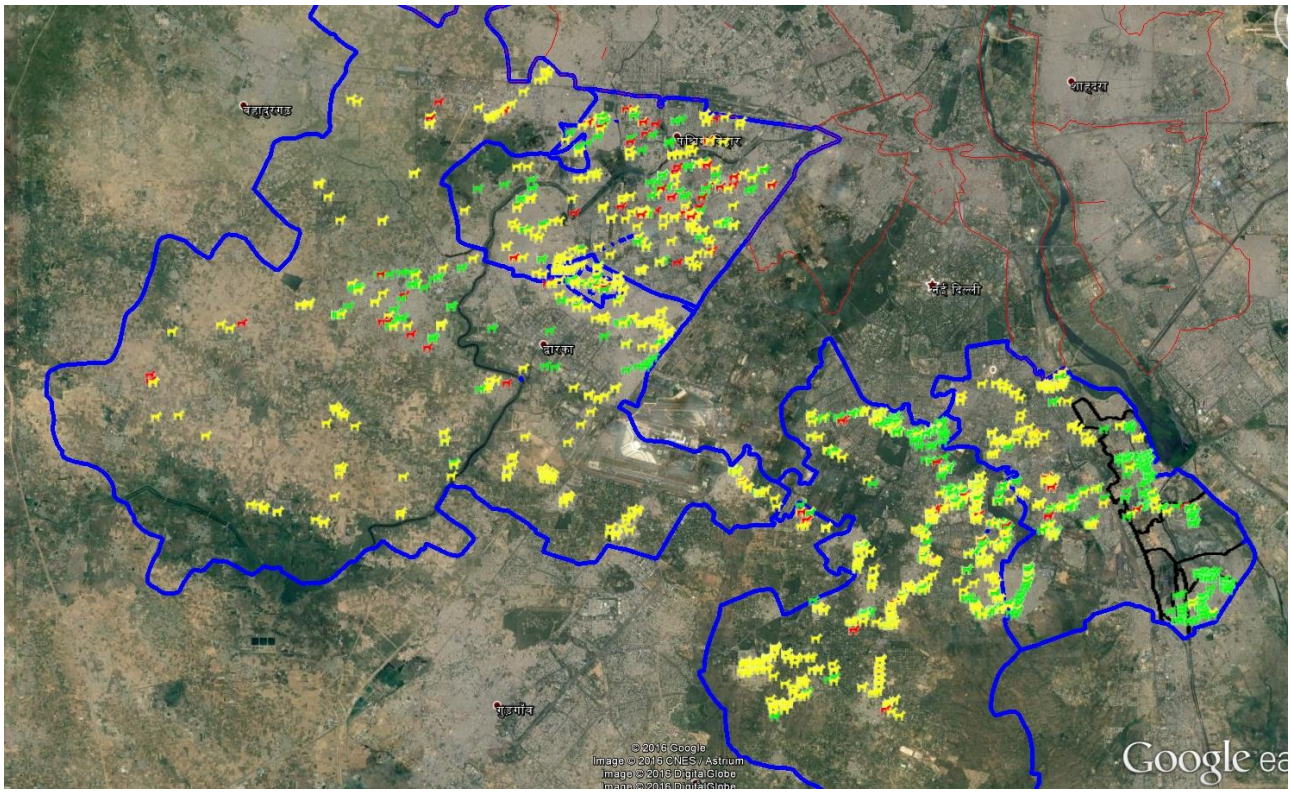
Red = Lactating

Black = Male notched

Blue = Male unnotched

For example, figure 3 compares the spatial distribution of spayed and lactating females. Note the high density of lactating females in West zone and the high percentage of sterilised females and low density of lactating females in group 1 of Central zone. Dogs recorded at the same location are shown as a single icon only, however in a live Google Earth display of a kml file generated by the database such the separate icons are shown in an expanded pattern.

Figure 3 – GoogleEarth display of spayed (green) and lactating (red) dogs seen on surveys of 17 routes in the South Delhi region. Yellow icons show entire females.



MONITORING

SURVEY CONSISTENCY

The route files provided with this report are a resource that can be used to monitor the population into the future. However for the results to be comparable, it is vital that the same search protocol and, if possible, the same observers are used on each track. On upload of the street counts to the database the driver and observer names and the timing and duration of each survey are recorded. The protocol used during the surveys was kept deliberately simple: all dogs seen from the motorcycle were recorded and those that could not be sexed without getting off the motorcycle to make the dog stand up were recorded as "Unknown adult".

THE POWER TO DETECT CHANGE IN DOG DENSITY

Table 4 illustrates the generally limited amount of variation in the roaming dog counts made on the replicated route surveys:

Table 4 - Replicate route counts.

Group	Route Length	Count	Dogs counted per km
Central Zone_G1	34	287	8.44
Central Zone_G1	34	458	13.47
Central Zone_G2	21.73	328	15.09
Central Zone_G2	21.73	295	13.58
Central Zone_G3	29.94	177	5.91
Central Zone_G3	29.94	130	4.34
South Zone_G2	30.3	106	3.50
South Zone_G2	30.3	260	8.58
West Zone_G2	26.02	312	11.99
West Zone_G2	26.02	331	12.72
West Zone_G3	27.53	237	8.61
West Zone_G3	27.53	272	9.88
West Zone_G4	16.31	243	14.90
West Zone_G4	16.31	226	13.86
West Zone_G5	20.85	304	14.58
West Zone_G5	20.85	283	13.57

The total number of dogs counted over the replicate surveys was 4249. The average number counted per km over the 8 groups was 10.28 dogs per km. Taking the square root of the sum of the eight within-group variances, to estimate the standard deviation of a total count over all groups, and dividing by that total count, gives a coefficient of variation (CV) of 0.08055 for the estimate of average dogs counted per km.

To estimate the resulting power to detect a change in dog density let $D1$ and $D2$ represent the average dogs counted per km over the same eight groups at the same time in two different years. Under the null hypothesis of no change in the population dog density, the absolute difference in the estimates divided by the standard deviation of the difference has the Student's t distribution based on 5 degrees of freedom:

$$\frac{|D1 - D2|}{0.08055 \times (D1 + D2)/2 \times \sqrt{2}} \sim t_5$$

Thus an observed proportional change in mean density can be considered to be significant (at the 95% level) if it exceeds $0.08055 \times \sqrt{2} \times t_{0.05,5}$ or about 29% (e.g. if 5000 were counted in one year then

counting 1464 fewer over the same routes at the same time in another year would be sufficient to indicate a significant decline in average density).

Table 5 – Ward groups.

Group	Wards under Group	Total Number of Wards
Central Zone- G1	201 202 203 204 206 207 208	7
Central Zone-G2	185 186 187 188 190 195 196 197 198 199 200	11
Central Zone-G3	153 154 155 156 157 158 159 160 192 193 194 205	12
South Zone-G1	178 179 180 181 182 183 184 189	8
South Zone-G2	161 163 164 165 166 167 168 171 191	9
South Zone-G3	175 176 177	3
South Zone-G4	162 169 170 173 174	5
West Zone-G1	121 122	2
West Zone-G2	101 102 105 106 107 108 115	7
West Zone-G3	109 110 111 112 113 114 116 124	8
West Zone-G4	103 104	2
West Zone-G5	117 118 123 125 126 127 128	7
Najafgarh Zone-G1	139	1
Najafgarh Zone-G2	141 142 143 144 172	5
Najafgarh Zone-G3	134 135 136 137 138 145	6
Najafgarh Zone-G4	119 120 129 130 131 132 146 147 148	9
Najafgarh Zone-G5	133 140	2

DISCUSSION

Extrapolating by street length from the street counts and dividing by the detectability estimate provided by the mark/re-sight experiments gives an estimate of 189,285 dogs roaming on the streets in the South Delhi area.

Twenty five surveys of the seventeen prepared routes were conducted, taking an average of 2 hours 15 minutes each to complete, a total of 56 hours for driver and observer. The method is thus efficient as a way to monitor and study the status of the roaming dog population over a large area.

There was generally little day to day variation in counts along the standard routes suggesting that such counts have enough power to detect moderate changes in roaming dog density and other indicators. It is essential use a consistent search protocol, particularly in regard to timing and duration of the surveys. We suspect there is then little difference between observers. However a conservative approach would be to use the same observers to survey the routes they surveyed previously or at least to check for consistency between observers in the number of dogs seen along the same route. Ideally monitoring would be conducted by one or more local NGOs, as in Jaipur where Help In Suffering have monitored dog density

along a standard track in the Pink City region since 1998, using largely the same team of observers. Furthermore, as surveying is only possible early in the morning a local NGO might be able to incorporate surveys into their normal work schedule.

In relation to timing, the possibility of seasonality in breeding (as in northern India) should be checked using previous ABC records of pregnancy in females collected for sterilisation. Surveys conducted just prior to the breeding season are more consistent because they include a minimum number of pups, surveys following the peak in breeding are more sensitive to the degree of breeding activity.

Although sterilisation will undoubtedly reduce breeding behaviour as evidenced by lactating females on the streets, it may have little effect on dog density if the pups that would have been produced by the sterilised females have very little chance of surviving to maturity. It is therefore important to also identify and access females whose pups are likely to survive and become part of the roaming dog population.

RECOMMENDATIONS

1. Annual dog population monitoring survey require in order compare baseline survey data and to see impact of the dog sterilization program, annual monitoring also helps in tracking progress of the dog sterilization program and shows initial success indicator of sterilization impact like reduction in lactating females and pups.