

A METHOD OF ESTIMATING URBAN DOG POPULATIONS AND ITS APPLICATION TO THE ASSESSMENT OF CANINE FECAL POLLUTION AND ENDOPARASITISM IN SASKATCHEWAN

J. O. Anvik, A. E. Hague and A. Rahaman*

INTRODUCTION

IN RECENT YEARS a substantial increase has occurred in the North American pet population. According to recent estimates (3), 2,000 to 3,500 dogs and cats are born in the United States each hour. This compares with the human growth rate of 415 people per hour and accounts for roughly 90 million dogs and cats in the United States. The annual rate of increase for the pet population is 4.5% per annum. A more comprehensive review and study of the environmental problems generated by urban dogs was done by Beck (1). There are many aspects to the current pet population increase: aesthetic and public health aspects, veterinary care, economic and nutritional aspects and pet population control.

Estimates for the daily production of dog feces in the U.S. amount to approximately 3,500 tons and that of urine to 36 million liters (3). Parasitological surveys have shown that 62% of the dogs in Iowa (2) and 88.6% of the dogs in Southeastern Michigan (5) were infected. Such a high prevalence of infections represents a real danger to uninfected dogs and a considerable potential source of human visceral larva migrans (3).

A concern for the problems generated by an increasing pet population prompted this study. The study consisted of three phases:

1. An estimation of the total dog population of Saskatoon,
2. determination of the prevalence of dog feces in streets and alleys of randomly selected blocks in Saskatoon, and
3. a survey of intestinal parasitism in dogs from five Saskatchewan urban centres.

MATERIALS AND METHODS

Phase 1: Estimation of total dog population

The dog population of Saskatoon was estimated using a variation of the Lincoln Index technique for estimating marked wildlife populations (4). The formula is:

$$\frac{\text{number in population}}{\text{number marked in population}} = \frac{\text{number in recaptured sample}}{\text{number of marked animals in recaptured sample}}$$

Since the dog control measures of Saskatoon generate data that are analogous to the above parameters, the formula can be solved by applying some easily obtained numbers: the number of dogs marked in population = the number of duly-licensed dogs (obtained from city hall for the year of 1972); the number in recaptured sample = the number of dogs picked up by the city dog catcher (obtained from the Saskatoon pound and is considered accurate since all caught dogs are impounded); and the number of marked animals in recaptured sample = the number of recaptured dogs which were licensed (these figures are year-end totals for 1972).

Phase 2: Prevalence of dog feces on Saskatoon streets and alleys

An official map of the city of Saskatoon is divided into 1,400 blocks, twenty of which were selected using a table of random numbers. The number of deposits of feces for each of the 20 blocks was determined by counting scats¹ on alleys and on a ten-foot wide strip from the curb of the sidewalk or from the edge of the street where no sidewalk existed. The counts were made by the authors on March 29, 30 and 31, 1973.

Phase 3: Intestinal parasites of impounded dogs from Saskatchewan urban centres

To obtain information of the types and frequency of intestinal parasite infections in Saskatchewan dogs, a population of impounded dogs was chosen to serve as an indicator of parasitic burdens in urban dogs. The most accessible and complete records available were those kept by the Animal Resources Centre (A.R.C.) on the Saskatoon

*Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Saskatchewan.

¹"Scat" as used here refers to the feces produced in a single act of defecation.

TABLE I

SCATS COUNTED IN SASKATOON STREETS AND ALLEYS OF RANDOMLY SELECTED BLOCKS, MARCH 29, 30, 31, 1973

Area	(a) No. of blocks surveyed	(b) No. of scats on sidewalks	(c) No. of scats in alleys	(d) Average scats/ block
Non-residential ^a	4	19	1	5.0 ^b
Residential	16	416	325	46.3 ^b
Total	20	435	326	38.05 ^c

^aSee Materials and Methods, Phase 2. The non-residential area included: industrial, 1 block, business, 1 block and school grounds, 2 blocks.

^bDerived from: $\frac{b + c}{a}$

^cThis figure represents a weighted average.

campus of the University of Saskatchewan. The A.R.C. received dogs from both urban and rural areas in Saskatchewan. The urban dogs received were unclaimed dogs impounded by police or dog catchers in the various centres. Single fecal examinations were carried out routinely by the A.R.C. on all dogs immediately upon their arrival. The 1972 A.R.C. fecal examination records of dogs from the cities of Regina, Yorkton, North Battleford and Prince Albert were examined. Since Saskatoon dogs were not acquired by the A.R.C. no parasitological records were available for 1972; the records from 1969 (the latest year in which sampling took place) were used. Dogs were recorded as being either positive or negative for the parasite in question with no attempt made to quantitate the extent of individual infections.

RESULTS

Phase 1: Estimation of dog population

When the numbers for total licensed dogs (4,400), recaptured dogs (1,043) and recaptured dogs with licenses (347) were substituted in the Lincoln Index, an estimate of

13,200 dogs was obtained. This number was taken to represent the entire dog population of Saskatoon, including owned, unowned, licensed and unlicensed dogs in 1972.

Phase 2: Prevalence of dog feces in Saskatoon streets and alleys

The results of the scat counts in alleys and streets were summarized (Table I). From the total average scats per block (38.05) and the number of blocks in the city (1,400) an estimate of 53,270 scats was obtained, as an estimate of the total number of scats on the streets and alleys on the last three days of March 1973. If a fecal output for a medium-sized dog is assumed to be 250 grams per day, a figure for daily output of Saskatoon's 13,200 dogs is calculated to be 3,300 kg feces per day, and there was an estimated accumulation of 13,318 kg of feces lying on sidewalks and alleys at the end of March.

Phase 3: Intestinal parasites of impounded dogs from Saskatchewan urban centres

The infection rates and types of intestinal parasites of pound dogs were tabulated for five Saskatchewan cities (Table II). In view of

TABLE II

INCIDENCE OF INTESTINAL PARASITES OF IMPOUNDED DOGS, SASKATCHEWAN, 1972

	Prince Albert	North Battleford	Yorkton	Regina	Saskatoon ^a	Total
No. of dogs	219	68	51	153	132	623
No. of dogs infected	81	16	25	51	25	198
% infected with one or more parasites	36.6	23.5	45.1	33.3	18.9	31.8

^aSaskatoon figures are for 1969.

TABLE III
 SUMMARY OF INTESTINAL PARASITES OF 623 IMPOUNDED DOGS IN SELECTED SASKATCHEWAN URBAN CENTERS, 1972
 (percent = positive, n = sample size)

	Isospora sp.	Metorchis conjunctus	Diphyl- lobothrium latum	Alaria sp.	Toxascaris leonina	Toxocara canis	Taenia sp.	Uncinaria sp.	Ancylostoma sp.
Prince Albert n = 219	3.65	1.37	4.1	6.4	10.5	1.37	14.15	12.3	—
North Battleford n = 68	1.5	—	—	2.9	4.4	—	11.8	5.9	—
Yorkton n = 51	5.9	—	—	19.6	1.96	1.96	25.5	—	—
Regina n = 153	15.0	—	0.65	3.27	13.0	2.6	1.96	0.65	0.65
Saskatoon ^a n = 132	2.27	—	0.76	1.51	8.35	3.03	2.27	1.51	0.76
Overall percentages (n = 623)	6.10	0.48	1.76	5.29	9.30	1.92	9.30	5.45	0.32

Note: Totals for each line do not add up to the percentages in Table II because some dogs had multiple infections.
^a1969 figures for Saskatoon.

the potential for visceral larva migrans, it should be noted that 70 (11.2%) were found to be positive for ascarids. The biggest percent infected with one or more parasites was in Yorkton (45.1%) and the lowest in Saskatoon (18.9%).

DISCUSSION

The approach to obtaining a quick relative estimate of urban dog populations used here was based on several assumptions. The dogs were assumed to be picked up for violations of leash laws with no bias as to size, age, sex or degree of friendliness. It must also be assumed that the licensed dogs were evenly mixed in the entire population and that they are no more likely to be caught than the unlicensed dogs. These assumptions represent the problems in any population estimation technique based on capture-recapture. The main advantages of the method are the minimal expense and time in that estimation of an urban dog population can quickly be calculated from data obtained from a few telephone calls in communities with licensing and effective pounds.

The results of the scat survey showed a relative scarcity of feces in industrial parks, business areas and school grounds. This suggested that the bulk of the canine fecal population problem in Saskatoon was in the residential areas. The figure of 53,270 stools for the city represents an extrapolation of the streets and alleys surveyed and does not include private yards, which likely contain a significant quantity of feces. The estimate of 13,318 kg of dog feces on the sidewalks and alleys is therefore an underestimation of the total amount of canine feces in the city.

From the A.R.C. records that were examined, 9.3% of the dogs were positive for *Toxascaris leonina* and 1.92% for *Toxocara canis*. This provides an indication of the number of dogs which are a potential source of human visceral larva migrans. There was a possible error in assuming that the impounded dogs are a representative sample of the dogs in each urban centre. An additional potential error was the possibility of the dogs becoming infected during their stay in the pounds, before coming to the A.R.C. This will in turn vary with the time spent in the pound (holding times for Saskatchewan pounds vary from zero to seven days) and the hygiene of the different pounds.

The parasite infection rates give an indication of the risk to which the canine and human populations are exposed. Since approximately 11% of the urban dogs are shedding ascarid

eggs into the environment, the accumulations of feces found in the city represent a possible canine and human health problem in addition to the aesthetic aspects of a befouled environment.

In this study an attempt was made to obtain an indication of the relative magnitude of urban dog problems in Saskatchewan. Whether or not these estimates reveal the exact magnitude of the problems is not of primary importance; rather, this study does give some indication of the order of magnitude of the problems.

SUMMARY

A variation of the Lincoln Index was utilized to obtain an estimate of 13,200 for the 1972 dog population of Saskatoon. This population has an estimated daily fecal output of 3,300 kg and the results of a scat count on streets and alleys revealed an accumulation of approximately 13,000 kg of feces on these areas alone. Eleven percent of 623 dogs from five urban centres in Saskatchewan were positive for *Toxascaris leonina* and *Toxocara canis*. An average of 31.8% of this sample yielded ova of some kind in their feces.

RÉSUMÉ

On s'est servi d'une modification de l'indice de Lincoln pour établir à environ 13,200 le nombre de chiens que comptait Saskatoon, en 1972. Ces animaux évacuaient quotidiennement environ 3,300 kg de matières fécales et les résultats du dénombrement des défécations dans les rues et les ruelles de la ville révélèrent une accumulation approximative de 13,000 kg de matières fécales, dans ces seuls endroits. Des 623 chiens provenant de cinq centres urbains de la Saskatchewan, 11% s'avérèrent parasités par *Toxascaris leonina* et *Toxocara canis*. Les fèces d'environ 31.8% de ces chiens recelaient des œufs d'une grande variété de parasites.

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BOOK REVIEW

Advances in Parasitology, Volume 11. Edited by Ben Dawes. Published by Academic Press, London and New York. 1973. 777 pages. Price \$39.50.

This volume contains nine major review papers and four "short" reviews, updating contributions in previous volumes of the series. Several of the reviews cover fields of direct interest to the veterinarian.

W. N. Beesley's review, "Control of Arthropods of Medical and Veterinary Importance", gives a detailed and extensive record of chemical control methods and mention of the alternative and additional methods in use or proposed up to 1972. Separate sections are devoted to control of Mosquitoes, Blackflies and Midges, Domestic flies, Tsetse flies, Blowflies and Screw-worms, Keds, Oestrid flies, Lice, Fleas, Ticks, and Mites. Data for this review are drawn from all continents, and they are discussed alongside such problems as insecticide resistance, mammalian toxicity, residues, and the need for more precise knowledge of the insecticidal action of chemicals. The 'sterile male' technique and other autocidal systems, the use of pheromones, juvenile hormone analogues and similar 'exotic' control methods are mentioned briefly, and conservatively placed in perspective with the chemical insecticides.

The review on "Lungworms of the Domestic Pig and Sheep" by J. H. Rose is a relatively short one which gathers information published before 1972 on these lungworms. The subjects of distribution, life-cycles, pathology in the definitive host, immunity, treatment and control are covered. As the author states, these lungworms are relatively less important in causing disease than are other helminths which infect these hosts, but this review, with its impressive list of references, provides an up-to-date authoritative look at the subject.

"New Knowledge of *Toxoplasma* and Toxoplasmosis" by Leon Jacobs provides coverage

of selected areas of the advances made in this field between 1967 and 1972. The discovery of the coccidial nature of *Toxoplasma* is explained, with considerable detail on the chronology of events in this saga, and the author's suggested terminology for the various developmental stages of *Toxoplasma* is provided. Short sections on Epidemiology and Animal Toxoplasmosis are included together with longer sections on Human Toxoplasmosis and Immunology. Very brief mention is made of advances in chemotherapy, and some of the recent discoveries concerning *Sarcocystis* are included. As the author implies, developments in this general field are likely to occur rapidly, and this review covers selected areas of the field.

"Global Problems of Imported Disease" are reviewed by L. J. Bruce-Chwatt. This review is concerned almost entirely with human disease problems. Imported animal diseases receive very brief mention with little documentation.

Other major reviews in this volume, which cover fields of more remote interest to the veterinarian are: "The Trypanosomes of Anura" by J. E. Bardsley and R. Harmsen. "The Epidermis and Sense Organs of the Monogenea and Some Related Groups" by K. M. Lyons. "Ultrastructure of the Tegument of Schistosoma" by D. J. Hockley. "Schistosomiasis and the Control of Mollusc Hosts of Human Schistosomes with Particular Reference to Possible Self-regulatory Mechanisms" by J. D. Thomas. "Functional Morphology of Cestode Larvae" by J. Slais. "Ontogeny of Cestodes and its Bearing on their Phylogeny and Systematics" by R. S. Freeman. Other short supplementary reviews (covering the period 1967-1972) in this volume are: "Recent Research on Malaria in Mammals excluding Man" by P. C. C. Garnham. "The Biology of the Acanthocephala" by W. L. Nicholas. "The Post-Embryonic Developmental Stages of Cestodes" by M. Voge. *J. R. Allen.*