How to estimate a canine population?

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IZSVe

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INTRODUCTION. There are several reasons that during the last thirty years urged some public and private enterprises to attempt an estimate of a country's dog census.

Prominent among those motivations are goals relevant to the public health:
-The determination of the abundance and distribution of the dog population for the study of the incidence of some zoonoses (e.g. leishmaniasis, rabies).
-The study of shared human pathologies so as to acquire a better understanding of their pathogenesis and etiology.
-The investigation of the variations in dog population and the need of plans for its control.

There are also economic reasons relevant to the veterinary field: market research in the use of products for common pets and of the veterinary services of a determined area (Wise 1992, Nassar 1989). Our research group is currently working at the determination of the canine population of Venice and Vicenza area for the establishment of a cancer registry to be used, among other things, to compare the data with another of our registries active since 2001 in another region in the North of Italy (Ivrea): in order to set up a canine cancer registry – and putting it to use in the determination of the incidence of cancer in this specie and the eventual comparison of the corresponding human pathology statistics – it is first of all necessary to have ascertained the canine census of the area.

Very few are the studies published in this field (Egenvall 1999, Patronek, 1997). Some countries obtain estimates through the work of national institutes of statistic research. For instance in the US the American Veterinary Medical Association calculated different coefficients that, mapped with the number of families or inhabitants of a certain area, makes it possible to guess the pertinent canine population. For the purpose, Italy, as opposed to other countries, set up centralized dog registry offices; in spite of this, the lack of an active and continuous update of data produces unreliable figures. This may result into an overestimation of the population caused by the failure to eliminate the deceased subjects from the database. The only available national estimates attribute to our country a population of 6.9 million dogs (Eurispes 2003). The purpose of this research is in fact to provide a model to estimate the overall canine population.

MATERIALS AND METHODS. Two different methods for the estimation of the canine population have been employed. In the registry activated in 2001 in Piedmont (Ivrea) we have used a capture-recapture (C-R) method (Lincoln Petersen) – normally used in ecology – on the canine population of 46 municipalities. The first stage of C-R consists in capturing a number of individuals (m) that are marked and subsequently released within the general population. At a second stage a new random sample (n) is captured out of which C will result to be already marked. In the hypothesis that the marked subjects will perfectly merge with the unmarked animals, the proportion of the marked individuals within the unknown overall population N and within the second sample n, remains constant: C / n = m / N (table A).

In our case the first 'capture' was represented by the data from the municipal canine general offices, opportunely corrected by excluding the deceased subjects (correction carried out on the basis of telephone survey, table B). The second sample (recapture), obtained through an anonymous survey, made it possible to estimate the proportion of unregistered dogs and therefore the overall population. Those results have been subsequently validated by a specifically planned census carried out in 2005. This has also made it possible to correct the data in the registry office of the area. We later decided to draw from the data thus obtained a coefficient representing the ratio between dogs per family. This coefficient was used to establish the canine population of the provinces of Venice and Vicenza. In order to do so the following variables were also taken into account: altitude (3 classes), number of inhabitants per square kilometer (4 classes) and number of families per municipality.

RESULTS. Table B sums up the results of the estimation of the canine population of Ivrea's area, obtained with the capture-recapture method. After the 2005 census, the estimate of 10,095 dogs has been corrected to 11,489. Later on, we calculated a series of coefficients representing the variation in the number of dogs per family in relation to: the altitude of the territory of residence (figure 1 and table C), the density of population per square kilometer (figure 2), the number of families per municipality, and the combined variation of two of these parameters (Table D). By multiplying these coefficients to the number of families in the municipalities of the area of Venice and Vicenza, we have obtained three different estimates of the overall canine population (Table E).

CONCLUSION. Our coefficients, when applied to the overall number of Italian families, produce estimates of the population of pet dogs that are not so dissimilar to the ones elaborated by the research institute Eurispes (2003). The availability in the future of the results of other surveys will allow the assessment of the validity of those obtained with this research. However our results show that centralized dog registries, even though they must be considered immensely valuable tools, cannot be relied on to perform duties in public health until they are supported by an accurate and continuous checking and updating of data.

REFERENCES. Egenvall A, Hedhammer A, Bonnet BN, Olson P. Survey of the Swedish Dog Population: Age, Gender, Breed, Location and Enrolment in Animal Insurance. Acta vet.scand. 1999, 40, 3: 231- 240. Nassar R, Mosier JE. Census data: How you can use it to reach more patients. Veterinary Medicine May 1986, 419-425. Patronek GJ, Beck AM, Glickman LT. Dynamics of dog and cat population in a community. J. Amer. Vet. Med. Ass.1997, 210, 5, March 1: 637- 642. Wise JK. Veterinary Service Market for companion animal ownership and demographics. J. Amer. Vet. Med. Ass. 1992, 201: 990-992.

The capture-recapture method

	source 2	
source 1	+	-
+	c	m
-	n	?
		N Popul.
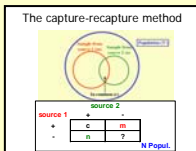
TABLE A

Estimation of the canine population in the Ivrea's area through C-R

Dogs listed in registry of 46 municipalities	17,777
Survival rate after telephone survey (n=590)	0.45
First capture (i.e. 17,777*0.45)	8,005
Second capture (postal random survey)	627
Recaptured dogs (i.e. included in registry)	497
Estimated population size	10,095

TABLE B

figure 1 - altitude / dogs per family relationship
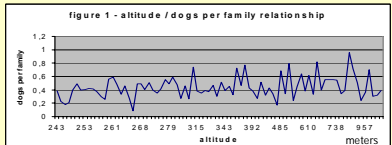
ALTITUDE (meters)	COEFFICENTS
0 - 299	0.295
300 - 599	0.353
>= 600	0.498

TABLE C

Coefficients by altitude and density

	ALT 1	ALT 2	ALT 3
DENS 1	0.402	0.348	0.491
DENS 2	0.497	0.496	0.558
DENS 3	0.473	0.348	
DENS 4	0.227	0.325	

TABLE D

figure 2 - density / dogs per family relationship
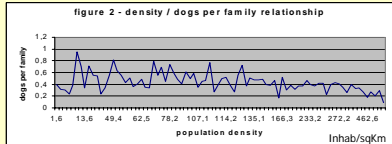
	ESTIMATION BY DENSITY	ESTIMATION BY ALTITUDE	ESTIMATION BY ALTITUDE AND DENSITY
VENICE PROVINCE	128,047	99,301	134,822
VICENZA PROVINCE	94,900	97,810	84,000

TABLE E – VENICE AND VICENCE AREAS CANINE POPULATION