Estimation of roaming dog populations in Timor Leste

CrossMark

Acácio Cardoso Amaral [a], Michael P. Ward [b,*], Joana da Costa Freitas [a]

[a] *Department of Animal Health, Faculty of Agriculture, Universidade Nacional Timor Lorosa'e, Dili, Timor-Leste*
[b] *University of Sydney, Faculty of Veterinary Science, Camden, NSW, Australia*

ARTICLE INFO

ABSTRACT

The continued spread of rabies through the eastern islands of Indonesia poses a risk of rabies introduction to Timor Leste. To prepare for such an incursion and to undertake surveillance activities, the size and distribution of the roaming dog population needs to be estimated. We present the results of the first such surveys ever undertaken in Timor Leste.

Roaming dog surveys were undertaken in each capital of the 13 districts of Timor Leste, including the national capital, Dili. Within these locations, local urban areas (*aldeias*) were targeted and sight–re-sight counts were undertaken on consecutive days. Estimated dog populations were adjusted for the sampling fraction.

Overall, counts were performed in a total of 53 of 131 (40.5%) *sucos* and in 192 of 797 (24.1%) *aldeias* in these selected *sucos*. Within the surveyed urban areas, there were an estimated 21.2 people per roaming dog, a ratio substantially higher than the World Health Organization's average global estimate of 10 people per dog. The highest populations of dogs were estimated in the cities of Dili (4919), Baucau vila (3449) and Lospalos (2536). The latter two are important because of their location in the northeast of Timor Leste, where the risk of rabies incursion from recently infected islands in eastern Indonesia, is likely greatest. The sight–resight method of estimating roaming dog populations is practical in developing countries; more use of photography to aid resighting of dogs could increase the accuracy of this method.

© 2013 Elsevier B.V. All rights reserved.

1. Introduction

During the past 15 years, rabies has continued to spread through parts of eastern Indonesia, with some notable incursions in previously disease-free islands. These include Flores (1997), Ambon and Seram (2003), Buru (2006), Bali (2008) and Larat and Yamdena (2010). In 2012, rabies was reported from the islands of Babar and Kisar (International Society for Infectious Diseases, 2013). This brings rabies to within 50 km of the nation of Timor Leste. The island of Timor, consisting of Timor Leste and Indonesian West Timor (Timor Barat), is historically free of rabies. In addition to a potential rabies incursion via Timor Leste's maritime border with the Indonesian province of Maluku, if West Timor became infected then with the porous and mountainous land border between it and Timor Leste, the entire island would likely be quickly infected.

Large populations of roaming dogs are one factor that increases the risk of rabies establishment, should a rabies incursion occur in an area free of disease. For rabies to establish following an introduction, there needs to be sufficient contact between dogs, and this is a function of the number (density) of the resident roaming dog population. Such populations are mostly likely to exist in urban areas. The World Health Organisation has developed a dog categorization index based on dog restraint and dog dependency on humans (Cliquet, 2011). It emphasizes the continuum of "owned" and "stray" dogs. Within this matrix, the "family dog" is fully restricted and fully dependent, whereas feral dogs are unrestricted and

non-dependent. The term "neighbourhood dog" is used to describe dogs which are semi-restricted (for example, kept within a household compound for part of the day) and semi-dependent. In this context "owned dogs" are either fully- or semi-restricted, and "stray dogs" are either semi-dependent or non-dependent. Here, we use the term "roaming dogs" to describe those dogs that might be sighted on the street – they can be either owned or unowned, and either semi-restricted or unrestricted. Their dependency on humans is unknown (and unassessed).

Most dogs in Timor Leste are roaming dogs since most houses are unfenced. Besides impacts such as dog bites and traffic accidents, there is growing concern that this roaming dog population and the spread of rabies within the region has dramatically increased the risk of rabies spreading to, and establishing in, Timor Leste. To evaluate this risk, create surveillance programmes and develop response plans, the size and distribution of the roaming dog population in Timor Leste needs to be known. For contingency planning for an incursion of a disease such as rabies, a risk-based approach is needed targeting roaming dog populations in urban areas. Thus, the estimation method needs to be considered in the context of the use of the data. To our knowledge, such dog population information has never been generated in this country. We describe here a stratified sight–resight survey of the roaming dog population of Timor Leste.

2. Materials and methods

Timor Leste is an independent country located between Indonesia and Australia. On the island of Timor, it shares a land border with West Timor, Nusa Tenggara Timor, Indonesia. To the east it borders the Indonesian province of Maluku, via a maritime border with the islands of Kisar, Wetar and Alor. The island of Kisar is approximately 30 nautical miles north of the northeast tip of Timor Leste. Timor Leste officially gained its independence in 2002, and it remains a low human development nation (ranked 134 out of 186 using the Human Development Index; http://en.wikipedia.org/wiki/Human_Development_Index accessed 04.08.13).

The nation of Timor Leste is administratively divided into 13 districts. Each district is further divided into subdistricts and *sucos*. There are a total of 65 subdistricts and 442 *sucos* in Timor Leste. Furthermore, *sucos* can be divided into *aldeias* (hamlets/villages/neighbourhoods). There are a total of 2225 *aldeias* in Timor Leste, the smallest administrative unit in Timor Leste (NSD and UNFPA, 2010).

2.1. Selection of aldeias

The capital within each of the 13 districts of Timor Leste (or the national capital, in the case of Dili) was selected. The students conducting the survey were instructed to focus on the urban *aldeias* (even in district capitals, some *aldeias* are rural). If the students were unable to survey all urban *aldeias* (because of logistical considerations and the need to complete the survey in one week), then based on the number of *aldeias* that the students could count, *aldeias* were randomly selected. Within the selected capitals (subdistricts), 53 of 131 (40.5%) *sucos* and 192 of 797 (24.1%) *aldeias* were surveyed.

2.2. Counting of roaming dogs

The procedure used for counting the roaming dog population in Timor Leste followed that described by the World Society for the Protection Animal (WSPA, 2013). Free roaming dogs in this study included homeless dogs without owners or keepers and free-ranging dogs with owners or keepers but roaming by themselves away from home at the time of counting. This is analogous to the term 'street dog', except that most of these dogs were likely owned.

Second- and third-year animal health students enrolled at the Universidade Nacional Timor Lorosa'e (UNTL) counted dogs in this survey. Each student counted dogs within their home district. Thus, the counters were familiar with their area, increasing their ability to spot and identify dogs. The students received training during December 2012, based on the World Society for the Protection of Animal's *Surveying Roaming Dog Populations: Guidelines on Methodology* (WSPA, 2013). This training was led by two of the authors (MPW, ACA) and included both theory and practice. The practice included a group counting exercise, conducted in the capital city of Timor Leste, Dili, to familiarize students with the method and to ensure standardization.

Counters walked consistently in the street of each selected *aldeias* for 2 days from 8:00 am to 5:00 pm. On day 1, all dogs on the street of each *aldeias* were counted. When dogs were observed on day 1, any specific identifying physical characteristics were recorded. The counters recorded each dog's sex, colour and body condition and specific markings (such as scars) and identifying characteristics including lameness. Some (but not all) counters took photographs to aid in the re-sighting of dogs. On day 2, roaming dogs in the same *aldeias* were counted by the same counter during the same time of day using the same method. Specific physical markings and characteristics recorded on day 1 (and photos, if available) were used on day 2 to identify which dogs had been re-sighted.

2.3. Estimation of roaming dogs

The number of dogs counted on day 1 ($n1$), day 2 ($n2$) and the number of dogs observed on day 1 that were re-sighted on day 2 ($m2$) were used to estimate the total urban roaming dog population, both seen and unseen during the survey, as described in Eq. (1) (Beck, 2011):

$$\frac{(n1+1) \times (n2+1)}{m2+1} - 1 \qquad (1)$$

where $n1$ and $n2$ are the number of dogs counted on days 1 and 2, respectively, and $m2$ is the number of dogs on day 1 that are re-sighted on day 2.

To estimate the total number of dogs within each capital (subdistrict), counts were adjusted using the *aldeias* sampling fraction, the proportion of *aldeias* within the subdistrict that were surveyed.