

# LIVING WORLD

Journal of the Trinidad and Tobago

Field Naturalists' Club

[admin@ttfnc.org](mailto:admin@ttfnc.org)

ISSN 1029-3299



TRINIDAD AND TOBAGO  
FIELD NATURALISTS' CLUB

## Population Density of Small Mammals in the Arima Valley, Trinidad, West Indies

H.P. Nelson and E.S. Nelson

Nelson, H.P., and Nelson, E.S. 2008. Population Density of Small Mammals in the Arima Valley, Trinidad, West Indies. *Living World, Journal of The Trinidad and Tobago Field Naturalists' Club*, 2008, 08-13.

# Population Density of Small Mammals in the Arima Valley, Trinidad, West Indies

H. P. Nelson and E. S. Nelson

#8 St. Ann's Road, Port of Spain, Trinidad and Tobago.

E-mail: howien@hotmail.com

## ABSTRACT

A trapping study of small mammal species richness was conducted at the Springhill Estate in the Arima Valley, Trinidad between 9 April and 11 May, 2005. A total of 12 individuals and 12 recaptures of two rodent and one marsupial species was observed after 1848.5 trap nights. Densities of *Oryzomys capito* and *Marmosa robinsoni* were estimated at 362.9 and 305.3 per square kilometre, respectively.

**Key words:** Arima Valley, premontane forest, small mammals, population density.

## INTRODUCTION

Small mammal trapping in the Neotropics can be notoriously challenging. Tropical forest communities are complex three-dimensional systems (Hice and Schmidly 2002; Vieira and Monteiro-Filho 2003), mammalian species densities are often naturally low (Nelson 1996), sampling techniques can be logistically difficult and resource seasonality, bait type, rain, ants, and moonlight all affect trapping success (Smythe 1986; Voss and Emmons 1996). All these factors have contributed to a relatively limited number of studies devoted to assessment of small mammal species richness in Trinidad in the last two decades. This is especially true for higher elevation habitats in the country, for which there have been few published studies. Studies to date have included work done during the 1950s by the Trinidad Regional Virus Laboratory (now the Caribbean Epidemiology Centre – CAREC) while conducting studies on arboviruses (Worth *et al.* 1968; Tikasingh 2000); a limited study of the mammals of Simla (Alkins 1979); an inventory of the Arima Valley by Beebe (1952); and work at Ture Forest by Everard and Tikasingh (1973). The study presented here was a preliminary investigation into small mammal species richness on Asa Wright Nature Centre's Springhill Estate.

Trinidad and Tobago has a diverse native mammalian fauna comprising of 64 bat species and 32 non-volant mammals. This includes six native didelphid and eight native murid small mammal species (Nelson and Nelson in prep.). This rich and interesting fauna is typically continental, due to the separation of Trinidad from the South American mainland approximately 11,000 years ago (Kenny 1995).

The lack of data on basic ecological parameters such as the diversity and density of small mammals, presents a significant challenge to understanding patterns of meta-population dynamics, community structure and prioritising research and conservation objectives of these species (O'Connell 1989; Malcolm 1990; Voss and Emmons 1996; Mares and Ernest 1995). In addition, the potential

threat posed by colonising exotic mammalian species (e.g. *Cricetomys gambianus*) and their associated ecto- and endoparasites (Cooper 2006) makes comprehensive knowledge of the ecology of the native suite of small mammals essential for their conservation.

## STUDY SITE

The Springhill Estate is located in the upper Arima Valley at 365 m from sea-level, on the south-facing slope of the Northern Range. This estate covers 193 acres and is one of several in the valley owned by the Asa Wright Nature Centre.

The forest in this area has been classified as tropical premontane moist forest by Nelson (2004) and as part of Beard's (1946) lower montane forest type. However, much of the estate is in various stages of succession following the historical conversion of the forest to a coffee and cocoa estate.

## MATERIALS AND METHODS

Trapping was conducted in the middle of Trinidad's dry season, between 9 April, 2005 and 11 May, 2005. A total of 88 commercially built Sherman traps (23 cm x 7.5 cm x 7.5 cm; Fig. 1) was laid at 5 m intervals along a 215 m trap-line, with two traps at each station. The trap-line was established within a late successional secondary forest, and roughly followed the 'Adventure Trail' of the Springhill Estate. Traps were laid along natural runways on the forest floor, such as logs and roots, or under low undergrowth. Where possible, one trap at each station was strung up on lianas and branches above the ground (0.5 – 1.5 m). A mixture of peanut butter, jam, oats and either sardines or bacon fat was used as bait. Traps were checked in the morning (0600 - 0800) and in the evening (1600 - 1800), when they were also re-baited. Each trapping session lasted five to seven consecutive nights.

Every individual was weighed, measured, examined for age, sex, ectoparasites, and the location of capture



**Fig. 1.** Sherman trap used in this study. 23 cm x 7.5 cm x 7.5 cm.

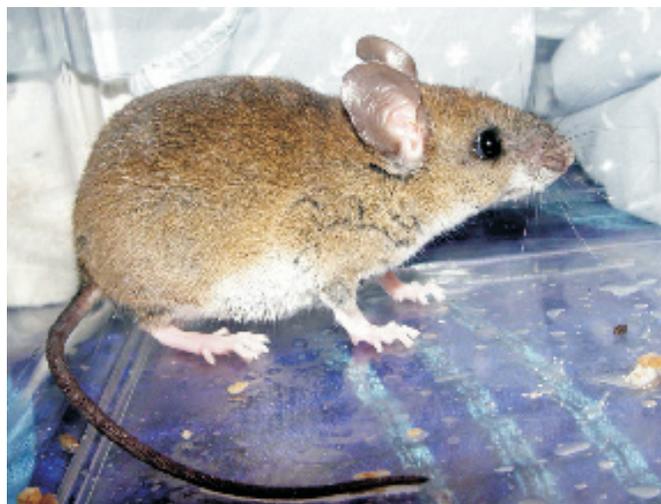
was noted. Ectoparasites were preserved in alcohol for future examination. Identifications were made using Emons (1997), Eisenberg (1989), Patton *et al.* (2000), Voss *et al.* (2001) and Voss *et al.* (2004). Animals were marked using fur-clipping and by painting an ear with nail-polish. All animals were released, except for one unidentified murid rodent, which was kept for identification purpose and details of which will be published separately. All research activities were consistent with the American Society of Mammalogists guidelines for the capture, handling, and care of mammals (ASM 1998).

The area sampled by the trap-line was calculated using Malcolm's approximation (1990), which estimates the area sampled for each species using the maximum distance between recaptures. Density was estimated using Schumacher's modification of Schnabel's estimator (Caughley 1977).

## RESULTS

Trapping was conducted for a total of 1936 trap nights and 1848.5 effective trap nights (subtracting half a trap night for each closed trap). Twelve individuals of three species, (one marsupial and two rodents) were captured 24 times, for a trap success rate of 1.3%. Terrestrial traps had all but one of the total captures. Average capture rates per 100 trap nights were 0.54 for *Oryzomys capito*, 0.70 for *Marmosa robinsoni*, and 0.05 for the unidentified murid.

Five individuals of the Common Rice Rat, *O. capito* (Fig. 2), were caught, with one individual re-captured three times and two individuals re-captured once. Six individuals of Robinson's Mouse Opossum, *M. robinsoni* (Fig. 3) were caught. One *M. robinsoni* individual was re-caught five times and two were re-caught once. One unidentified murid rodent (Fig. 4) was caught in the understory level traps. Morphometrics of all individuals are presented at Table 1.



**Fig. 2.** Common Rice Rat, *Oryzomys capito*.



**Fig. 3.** Robinson's Mouse Opossum, *Marmosa robinsoni*.



**Fig. 4.** Unidentified murid rodent.

The sampling area of the trap-line was estimated to 2.37 ha and 1.63 ha for *O. capito* and *M. robinsoni*, respectively. Density estimates using Schnabel's estimator were 362.9 per km<sup>2</sup> for *O. capito*, and 305.3 per km<sup>2</sup> for *M. robinsoni*.

**Table 1.** Morphometric measurements (mm) and weights (g) of small mammal captures at the Springhill Estate, Arima Valley.

Species	Head Body	Tail	Total Length	Ear	Hind Foot	Weight	Sex	Age
<i>Marmosa robinsoni</i>	124.79	138.01	262.8	21.06	16.74	56	m	adult
	121.68	133.66	255.34	17.6	17.87	58	m	adult
	82.45	98.58	181.03	14.01	13.66	11.5	f	juvenile
	103.65	154	257.65	18.09	19.71	73.5	m	adult
	109.57	136.5	246.07	20.28	15.56	38.5	f	juvenile
	128	152	280	21	20	54.5	m	adult
<b>Average</b>	<b>111.69</b>	<b>135.46</b>	<b>247.15</b>	<b>18.67</b>	<b>17.26</b>	<b>48.67</b>		
<i>Oryzomys capito</i>	102.66	96.66	199.32	13.3	25.15	50	m	sub-adult
	111.3	100	211.3	15.42	21.28	59	m	adult
	115.03	105.11	220.14	17.61	25.54	61	m	sub-adult
	114.14	100.21	214.35	16.79	26.72	57	f	adult
	114.01	91.94	205.95	15.52	26.6	46.5	f	adult
<b>Average</b>	<b>111.43</b>	<b>98.78</b>	<b>210.21</b>	<b>15.73</b>	<b>25.06</b>	<b>54.70</b>		
Unidentified Murid	80.25	98.4	178.65	12.37	17.32	21.5	m	sub-adult

## DISCUSSION

Low capture success is common among trapping studies of Neotropical mammals. Our trapping success rates were low but consistent with other studies, where trap success rates of between 0.45 – 7.1% have been reported (Emmons 1984; Patton *et al.* 2000; Caro *et al.* 2001; Voss *et al.* 2001; Hice and Schmidly 2002; Grelle 2003). Nelson (1996) also reported low capture success whilst trapping in the Trinity Hills Wildlife Sanctuary in southern Trinidad.

Rates of captures per trap nights for *O. capito* observed in this survey are comparable with those found in other studies (Table 2). It should be noted that seasonal changes in capture response for both *O. capito* and *M. robinsoni* have been reported elsewhere (O'Connell 1989). In this regard, Everard and Tikasingh (1973) also observed large increases in capture rates of *O. capito* during the course

of their three year study in Trinidad.

Our density estimates also appear consistent with densities of *M. robinsoni* and *O. capito* reported in other studies (Table 2). The large variation in the densities reported for both species from other sites in the Neotropics reflects inter-year and between-site variations (Table 2). In Venezuela for instance, *O. capito* populations were highest in the rainy season, while *M. robinsoni* were higher in the dry season (O'Connell 1989). Fleming (1971, 1972) found fluctuating densities of both *M. robinsoni* and *O. capito* in Panama over a one-year period. Both populations had significant increases in population size towards the end of the wet season. Population explosions of *O. capito* in Trinidad were noted by Everard and Tikasingh (1973). Our study only estimated population density during a single dry season, and so we were unable to detect inter-seasonal variations in density for our study site. Food availability, seasonality, predation and intrinsic reproductive cycles have been proposed as limiting factors for small mammal populations (Fleming 1971; O'Connell 1989; Glanz 1990; Mares and Ernest 1995). Emmons (1984)

noted that the large differences in densities between sites could also be accounted for by edaphic variability.

The density we observed for *M. robinsoni* and *O. capito* suggests that they are abundant and may constitute a significant proportion of the small mammal biomass at the Springhill Estate. Everard and Tikasingh (1973) previously found *O. capito* to be the most numerous of the ground-dwelling mammals at the Turure Forest in Trinidad. It is typical for trapping to be dominated by a few taxa, comprising of morphologically unspecialised forest floor dwellers, such as *Oryzomys* species (Voss and Emmons 1996).

The low capture rate for the unidentified murid we detected in this study suggests that this species is relatively uncommon, and is perhaps an indication of why it previously remained unrecorded.

It is possible that this rodent has not been captured in

**Table 2.** Reported densities of *M. robinsoni* and *O. capito*.

Country	Density (per km <sup>2</sup> )		Capture Rates per 100 Trap Nights	
	<i>Oryzomys capito</i>	<i>Marmosa robinsoni</i>	<i>Oryzomys capito</i>	<i>Marmosa robinsoni</i>
Brazil	40.4 <sup>~</sup>	45 - 200 <sup>^</sup>	2.78, 0.70 and 0.91 <sup>~</sup>	
Panama	34 - 430 <sup>§</sup>	27 <sup>^</sup> ; 31 - 225 <sup>§</sup>		
Trinidad	372 <sup>°</sup>		0.20, 0.54 and 1.33 (over 3 years) <sup>°</sup>	
Venezuela	0 - 320 <sup>°</sup>	137 <sup>^</sup> ; 30 - 550 <sup>°</sup> ; 25 - 425 <sup>°</sup>		1.47 <sup>°</sup>
Unknown	276.9 <sup>±</sup>	123.5 <sup>±</sup>		
This study	363	305	0.54	0.70

**Sources:** <sup>§</sup>Fleming 1972; <sup>°</sup>O'Connell 1983; <sup>±</sup>Robinson and Redford 1986; <sup>^</sup>Glanz 1990; <sup>°</sup>Everard and Tikasingh 1973; <sup>~</sup>Malcolm 1990.

previous studies as the habitat requirements of some rice rat species can be very specialised (Emmons 1997). We detected this rodent in premontane moist forest, a habitat where there have been very limited previous surveys. Additionally, this rodent was trapped above ground, a mammalian habitat dimension that has not been extensively surveyed in Trinidad and Tobago.

Estimating density and home range from trapping and mark-recapture studies are fraught with difficulties. This is due to the numerous assumptions associated with each population estimator, such as the presence of open or closed populations, the definition of effective sampling areas, metapopulation dynamics and edge effects (Caughley 1977; Slade and Blair 2000). It is in this context that we acknowledge the limitations of this study especially given our small sample size and limited sampling period.

In this study, only traps of one size were used. The authors propose that a larger size of Sherman trap would be better suited for capturing the suite of small mammals present in Trinidad, both due to the size of animals and to prevent trap injuries (a particular problem with the long tailed marsupials). Additionally, many small mammals spend their entire lives in the canopy, and are often not trapped by terrestrial or low-level traps (Malcolm 1990; Voss and Emmons 1996; Grelle 2003; Vieira and Monteiro-Filho 2003). Several methods in canopy-trapping have been recently developed (Malcolm 1991; Vieira 1998), which could be used to further study the arboreal mammal community in Trinidad. Finally, some small mammals are also only taken by pitfall trapping (Voss *et al.* 2001), including rare species

(Hice and Schmidly 2002). This last technique has not to our knowledge, been extensively used in Trinidad.

The published data suggests that only a limited suite of sampling techniques have been used in Trinidad and Tobago to survey small mammals. This factor and the related limited diversity of habitats surveyed to date, point to a need to undertake more thorough surveys of the small mammalian fauna of Trinidad and Tobago.

More extensive surveying of the Springhill Estate is required to give a complete picture of the small mammalian species richness there. Canopy trapping and surveys of riparian habitats would greatly enhance any future assessment.

Studies of this kind are fundamental for establishing a baseline of small mammal population ecology. With forest cover on Trinidad declining at a rate of 0.8% annually (FAO 2003), due to the human-induced habitat change, native small mammal populations may become threatened with extirpation in some parts of the island. Habitat degradation and fragmentation, remain key threats to the biodiversity of the Northern Range (EMA 2005), and can also increase the chance of colonisation by exotic species. However, there is little published work on recent mammalian colonisation in the Northern Range. Conservation efforts on Neotropical mammals often risk being ineffective in the absence of baseline data on distribution, diversity, abundance and biomass (Mares and Ernest 1995). We hope this study adds to the body of work on small mammals, and encourages future research of mammalian ecology in Trinidad.

## ACKNOWLEDGEMENTS

We would like to express our thanks to the Asa Wright Nature Centre for allowing us to undertake this study at Springhill Estate. We would also like to express our thanks to the Conservator of Forests and the Head of the Wildlife Section in Trinidad for providing the permits necessary for our study.

## REFERENCES

- Alkins, M. E.** 1979. The Mammals of Trinidad. *Occasional Paper No. 2*. St. Augustine, Trinidad and Tobago: Department of Life Sciences, University of the West Indies. 75 p.
- ASM Animal Care and Use Committee.** 1998. Guidelines for the Capture, Handling, and Care of Mammals as Approved by the American Society of Mammalogists. *Journal of Mammalogy*, 79: 1416 - 1431.
- Beard, J. S.** 1946. The Natural Vegetation of Trinidad. Oxford: Oxford University Press. 152 p.
- Beebe, W.** 1952. Introduction to the ecology of the Arima Valley, Trinidad. *Zoologica*, 37: 157 - 83.
- Caro, T. M., Kelly, M. J., Bol, N. and Matola, S.** 2001. Inventorying mammals at multiple sites in the Maya mountains of Belize. *Journal of Mammalogy*, 82(1): 43 - 50.
- Caughley, G.** 1977. Analysis of Vertebrate Populations. New York: John Wiley and Sons. 234 p.
- Cooper, R. G.** 2006. The possibility of naturalisation of the African giant rat (*Cricetomys gambianus* Waterhouse 1840) in the Caribbean. *Living World, Journal of The Trinidad and Tobago Field Naturalists' Club*, 2006: 54 - 55.
- Eisenberg, J. F.** 1989. Mammals of the Neotropics: The Northern Neotropics. Chicago: University of Chicago Press. 449 p.
- EMA (Environmental Management Authority).** 2005. *Report of an Assessment of the Northern Range, Trinidad and Tobago: People and the Northern Range*. State of the Environment Report 2004. Port-of-Spain: Environmental Management Authority. 184 p.
- Emmons, L. H.** 1984. Geographic variations in densities and diversities of non-flying mammals in Amazonia. *Biotropica*, 16: 210 - 222.
- Emmons, L. H.** 1997. Neotropical Forest Mammals, a Field Guide. Chicago: University of Chicago Press. Second Edition. 281 p.
- Everard, C. O. R. and Tikasingh, E. S.** 1973. Ecology of the rodents, *Proechimys guyannensis trinitatis* and *O. capito velutinus* on Trinidad. *Journal of Mammalogy*, 54: 875 - 886.
- Food and Agriculture Organization (FAO).** 2003. State of the World's Forests 2003. Food and Agriculture Organization, Rome. 151 p.
- Fleming, T. H.** 1971. Population ecology of three species of Neotropical rodents. *Miscellaneous Publications Museum of Zoology, University of Michigan*, 143: 1 - 77.
- Fleming, T. H.** 1972. Aspects of the population dynamics of three species of opossums in the Panama canal zone. *Journal of Mammalogy*, 53: 619 - 623.
- Glanz, W. E.** 1990. Neotropical Mammal Densities: How Unusual is the Community on Barro Colorado Island, Panama? p. 287-313. In **A. H. Gentry**, ed. Four Neotropical Rainforests. New Haven: Yale University Press. 640 p.
- Grelle, C. E. V.** 2003. Forest structure and vertical stratification of small mammals in a secondary Atlantic Forest, Southeastern Brazil. *Studies on Neotropical Fauna and Environment*, 38: 81 - 85.
- Hice, C. L. and Schmidly, D. J.** 2002. Effectiveness of pitfall traps for sampling small mammals in the Amazon Basin. *Journal of Neotropical Mammalogy*, 9: 85 - 89.
- Kenny, J.** 1995. Views from the Bridge: A Memoir on the Freshwater Fishes of Trinidad. St. Joseph, Trinidad. 98 p.
- Malcolm, J. R.** 1990. Estimation of mammalian densities in continuous forest north of Manaus. p.133-146. In **A. H. Gentry**, ed. Four Neotropical Rainforests. New Haven: Yale University Press.
- Malcolm, J. R.** 1991. Comparative abundances of Neotropical small mammals by trap height. *Journal of Mammalogy*, 72: 188 - 192.
- Mares, M. A. and Ernest, K. A.** 1995. Population and community ecology of small mammals in a gallery forest of central Brazil. *Journal of Mammalogy*, 76: 750 - 768.
- Nelson, H. P.** 1996. Ecological studies of forest mammals in the West Indies with a focus on Trinidad. MPhil. Thesis, Department of Life Sciences, University of the West Indies, St. Augustine, Trinidad. 119 p.
- Nelson, H. P.** 2004. Tropical Forest Ecosystems of Trinidad: Ecological Patterns and Public Perceptions. PhD. Thesis, Department of Wildlife Ecology, University of Wisconsin-Madison, Madison Wisconsin, USA. 464 p.
- Nelson, H. P. and Nelson, E. S.** in preparation. A Field Guide to the Mammals of Trinidad and Tobago.
- O'Connell, M. A.** 1983. *Marmosa robinsoni*. *Mammalian Species*, 203: 1 - 6.
- O'Connell, M. A.** 1989. Population dynamics of Neotropical small mammals in seasonal habitats. *Journal of Mammalogy*, 70: 532 - 548.
- Patton, J. L., Da Silva, M. N. F. and Malcolm, J. R.** 2000. Mammals of the Rio Jurua and the evolutionary and ecological diversification of Amazonia. *Bulletin of the American Museum of Natural History*, 244: 1 - 306.
- Robinson, J. G. and Redford, K. H.** 1986. Body size, diet and population density of Neotropical forest mammals. *American Naturalist*, 128(5): 665 - 680.
- Slade, N. A. and Blair, S. M.** 2000. An empirical test of using counts of individuals captured as indices of population size. *Journal of Mammalogy*, 81: 1035 - 1045.
- Smythe, N.** 1986. Competition and resource partitioning in the guild of Neotropical terrestrial frugivorous mammals. *Annual Review of Ecology and Systematics*, 17:169 - 188.
- Tikasingh, E. S.** 2000. The Hunt for Caribbean viruses. A History of the Trinidad Regional Virus Laboratory. CAREC Monograph Series 2. 156 p.
- Vieira, E. M.** 1998. A technique for trapping small mammals in the forest canopy. *Mammalia*, 62: 306 - 310.
- Vieira, E. M. and Monteiro-Filho, E. L. A.** 2003. Vertical stratification of small mammals in the Atlantic rainforest of south-eastern Brazil. *Journal of Tropical Ecology*, 19: 501 - 507.

**Voss, R. S. and Emmons, L. H.** 1996. Mammalian diversity in Neotropical lowland rainforests: A preliminary assessment. *Bulletin of the American Museum of Natural History*, 230: 1 - 120.

**Voss, R. S., Lunde, D. P. and Simmons, N. B.** 2001. The mammals of Paracou, French Guiana: a Neotropical lowland rainforest fauna Part 2. nonvolant species. *Bulletin of the American Museum of Natural History*, 263: 1 - 236.

**Voss, R. S., Tarifa, T. and Yensen, E.** 2004. An Introduction

to *Marmosops* (Marsupialia: Didelphidae), with the description of a new species from Bolivia and notes on the taxonomy and distribution of other Bolivian forms. *American Museum Novitates*, 3466: 1 - 40.

**Worth, C. B., Downs, W. G., Aitken, T. H. G. and Tikasingh, E. S.** 1968. Arbovirus studies in Bush Bush Forest, Trinidad, W.I., September 1959 - December 1964. IV. Vertebrate populations. *American Journal of Tropical Medicine and Hygiene*, 17(2): 269 - 275.