Population variability of Neotropical rodents: influence of body size, habitat, and food habits

Variabilidad poblacional de roedores neotropicales: influencia de tamaño corporal, hábitat y hábitos alimentarios

MARGARET A. O'CONNELL

Wildlife Biology Program and Department of Zoology, Washington Sate University, Pullman, WA 99164-4220, U.S.A.

ABSTRACT

Population variability of Neotropical rodents is examined with respect to taxon, body mass, habitat association, and trophic category. The coefficient of variation of reported density estimates of local populations is used as a measure of variability. The Cricetid rodents exhibit the greatest range of variability. Larger species are less variable than smaller ones. Populations of rodents from temperate forests and tropical savannas are more variable than those from tropical wet forests. No clear relation between trophic category and population variability is discernible.

Key words: Population variability, Neotropical Region, Rodents.

RESUMEN

La variabilidad poblacional de roedores neotropicales se examina con respecto a taxón, tamaño corporal, asociación al hábitat, y categoría trófica. El coeficiente de variación de las densidades estimadas de poblaciones locales de roedores se usa como estimador de su variabilidad. Los roedores cricétidos exhiben el mayor rango de variabilidad. Las poblaciones de especies grandes son menos variables que las de especies pequeñas. Las poblaciones de roedores de bosques templados y sabanas tropicales son más variables que aquellas de bosques tropicales húmedos. No existe una relación clara entre la categoría trófica y la variabilidad poblacional de roedores.

Palabras claves: Variabilidad poblacional, Región Neotropical, Roedores.

INTRODUCTION

Populations of Neotropical rodents exhibit fluctuations of variable magnitude, but our understanding of the factors underlying these fluctuations is limited due to the dearth of long-term studies. Murua & Gonzalez's (this volume) work on southern Chilean rodents is an exception. They report within -and between- year fluctuations in populations of Oryzomys longicaudatus and Akodon olivaceus in temperate rain forests. They consider the former species to be an environmental tracker, responding to variations in the seed crop, whereas fluctuations of the latter species are viewed as cyclic, similar to the microtine cycles of the Holarctic. Their results are intriguing, but I think it premature to describe the fluctuations as cyclic, as evi-

(Received 10 December 1985. Accepted 7 July 1986.)

denced by the revision of the periodicity of A. olivaceus cycles from four years (Murúa & González 1985) to five years (Murúa & González, this volume). Although elucidation of the temporal dynamics of Neotropical small mammal populations must await more long-term studies, the purpose of this paper is to address several broad questions concerning the variability of Neotropical rodent populations. Specifically, I examine patterns in population variability as they relate to taxon, body mass, habitat association, and trophic category.

METHODS

To standardize field estimates of population variability, I used the coefficient of variation (CV) for mean density estimates

of Neotropical rodents as a measure of variability. Comparative density information on these species is summarized in Table 1. All density estimates were based on mark-recapture studies. In four cases, CV's were based on capture frequencies along transects rather than on density estimates (see Table 1). The remainder of the CV's were based on density values obtained from trapping grids. Approximately half of these studies included border strips around the grid for density estimates. The majority of these grid studies expressed population size as the minimum number known alive. Other grid studies used either some statistical estimation of density or simply expressed population size in terms of abundance. Densities expressed in forms other than number/ hectare were converted to number/hectare for ease of comparison. Nomenclature follows Honacki et al. (1982).

The coefficient of variation of abundance estimates has been used to examine population variability in other vertebrate populations (e.g., Karr 1982). I calculated the CV's for the density estimates using the standard formula: $CV = s \times 100/Y$ (s= standard deviation; Y = mean). Sokal & Rohlf (1981, p. 59) suggest that CV's calculated in this manner might be biased, especially when small sample sizes are involved, and present a corrected estimate: $CV^* = (1 + 1/4n)CV$. The range of sample sizes (= number of censuses) used in the calculation of CV's for the density estimates (Table 1) suggest that this potential bias might be problematical. However, I calculated CV's using both formulae and my results were the same. I consider statistical tests significant at P < 0.05.

RESULTS AND DISCUSSION

Mean density estimates ranged from less than one to 97 animals/ha and CV's were from 14 to about 160 (Table 1). Significant correlation of mean and CV would invalidate use of CV, but this was not the case (r = -0.21; df = 71; ns). The population studies varied considerably in length (Table 1). I determined if the CV and length of study were significantly correlated. One might expect the CV to increase with length of study because longer studies would have a greater likelihood of incorporating population fluctuations. Conversely, the CV could decrease with length of the study due to the central limit theorem. Although CV exhibited an increase with length of study, the trend was not significant (r = +0.20; df = 75; ns).

Relationships between body size and population dynamics have been suggested for a variety of mammalian taxa (e.g., McNab 1980). To examine such a relationship for these Neotropical rodents, CV was plotted against body mass in Figure 1. A significant negative correlation (r =-0.24; df = 75; P < 0.05) was observed, indicating that populations of larger species are less variable. Among the smaller species, a wide range of CV's was observed, suggesting the need to further examine patterns.

The distribution of the CV's between different rodent families are illustrated with respect to habitat association and trophic category in Figures 2 and 3. The family Cricetidae was subdivided with two general, *Oryzomys* and *Akodon*, separated from the other genera because of large sample size. Differences between the mean CV's for the taxa, habitat association, and trophic categories were examined by oneway Analysis of Variance (Table 2).

Most populations studied had CV's less than 100. The greatest variability was observed within the Cricetid species, with CV's ranging from 19.1 to 157.7. Comparison of the different taxa suggested that the mean CV for the Cricetidae was greater than that of other taxa, although the difference was only marginally significant (Table 2). Because of the large sample size of the Cricetids relative to the other taxa, I compared the CV's of the Cricetids with those of all other taxa combined using a t-test for unequal variance (Sokal & Rohlf 1981). This comparison indicated that populations of the Cricetid species were indeed more variable than populations of the other species (t = 3.78; P < 0.05). Populations from tropical wet forests exhibited the lowest CV's, whereas those from temperate forests and tropical savannahs were significantly larger (Table 2). Fleming (1975) suggested that among tropical habitats, populations of small mammals from tropical grasslands might be less constant than those from tropical forests. These comparisons support his speculations. The mean CV's for the different trophic categories were not significantly different.

POPULATION VARIABILITY OF NEOTROPICAL RODENTS

TABLE 1

Density estimates and coefficients of variation of these estimates for populations of Neotropical rodents

Densidades estimadas y coeficientes de variación de dichos estimados para poblaciones de roedores neotropicales

Oryzomys Ecuador - Galapagos/ bauri 65 ++ 28.0 FR/OM 31 Clark 1980 0. bicolor Venezuela/ Tropical savanna 25 0.7 ± 0.4 61.2 FR/OM 6 August 1981 0. capito Panama/Tropical 50 2.3 ± 1.3 57.0 FR/OM 13 Fleming 1971 0. capito Panama/Tropical 50 1.1 ± 1.1 100.0 FR/OM 13 Fleming 1971 0. capito Panama/Tropical 60 16.0 ± 3.7 23.1 FR/OM 9 Everard & 0. capito Panama/Tropical 60 $12.\pm 1.2$ 65.0 FR/OM 9 Everard & 0. concolor Venezuela/Tropical 60 $12.\pm 1.2$ 65.0 FR/OM 22 O'Connell 1981 humid forest (0.0-3.2) Tripical savanna $(3.322.0)$ 0 Connell 1981 0. eliurus Brazil/ 30 9.8 ± 7.3 74.5 FR/OM 24 Mello 1980 0. longicaudatus Ch	Family/species	Locality/ Habitat	Mass (grams)	Density * (Range)	CV **	Trophic Category ***	Length of Study (mo)	+ Source
genateminis Tropical savanna Venezuela/Tropical $0.2, 0.5$ FR/GR 16 August 1981 HETEROMYIDAE Liomys Panama/Tropical 65 7.9 ± 2.0 25.6 FR/GR 13 Fleming 1971 Liomys Panama/Tropical 65 7.9 ± 2.0 25.6 FR/GR 13 Fleming 1971 Liomys August 1981 (3.9.6.3) S.9\pm 1.4 23.7 FR/GR 13 Fleming 1974 Li salvini Costa Rica/ 70 1.0\pm 0.8 74.8 FR/GR 22 O'Connell 1981 Heteromys Venezuela/Tropical 70 1.1 \pm 0.7 65.5 FR/GR 13 Fleming 1974 Aropical Wet forest (0.0-2.2) Costa Rica/ 71 13.5 ± 3.1 23.3 FR/GR 13 Fleming 1974 H desmarestianus Costa Rica/ 71 13.5 ± 3.1 23.3 FR/OM 61 August 1981 O/Picomys Ecuador - Galapagos/ 65 ++ 28.0 FR/OM 13 Fleming 1971	SCIURIDAE							
genateminis Tropical savanna Venezuela/Tropical $0.2, 0.5$ FR/GR 16 August 1981 HETEROMYIDAE Liomys Panama/Tropical 65 7.9 ± 2.0 25.6 FR/GR 13 Fleming 1971 Liomys Panama/Tropical 65 7.9 ± 2.0 25.6 FR/GR 13 Fleming 1971 Liomys August 1981 (3.9.6.3) S.9\pm 1.4 23.7 FR/GR 13 Fleming 1974 Li salvini Costa Rica/ 70 1.0\pm 0.8 74.8 FR/GR 22 O'Connell 1981 Heteromys Venezuela/Tropical 70 1.1 \pm 0.7 65.5 FR/GR 13 Fleming 1974 Aropical Wet forest (0.0-2.2) Costa Rica/ 71 13.5 ± 3.1 23.3 FR/GR 13 Fleming 1974 H desmarestianus Costa Rica/ 71 13.5 ± 3.1 23.3 FR/OM 61 August 1981 O/Picomys Ecuador - Galapagos/ 65 ++ 28.0 FR/OM 13 Fleming 1971	Sciurus	Venezuela/	250	0.4 ± 0.1	32.5	FR/GR	26	O'Connell 1981
Venezuela/Tropical dry forest 250 $0.\pm 2.5$ FR/GR 16 August 1981 HETEROMYIDAE (0.4-0.9) (0.4-0.9) (0.4-0.9) (0.4-0.9) Liomys Panama/Tropical dry forest 65 7.9 ± 2.0 25.6 FR/GR 13 Fleming 1971 Lashirin Costa Rica/ 43 5.9 ± 1.4 23.7 FR/GR 12 O'Connell 1981 August 1981 Costa Rica/ 70 1.1 ± 0.7 65.5 FR/GR 12 O'Connell 1981 Heteromys Venezuela/Tropical 70 1.1 ± 0.7 65.5 FR/GR 13 Fleming 1974 H. desmarestianus Costa Rica/ 77 13 $\pm 2.3.3$ FR/GR 13 Fleming 1974 CRICETIDAE Tropical desert (0.2-1.2) (0.2-1.2) (7) 6 August 1981 O. copito Panama/Tropical 50 1.1 ± 1.1 100.0 FR/OM 13 Fleming 1971 O. copito Panama/Tropical 50 1.1 ± 1.1 10.0 FR/OM	granatensis	Tropical savanna						
dry forest $(0.40.9)$ HETEROMY[DAE Liomys Panama/Tropical 65 7.9 ± 2.0 25.6 FR/GR 13 Fleming 1971 Listric Costa Rica/ 43 5.9 \pm 1.4 23.7 FR/GR 13 Fleming 1974 Lossy Venezuela/Tropical 70 1.0 \pm 0.8 74.8 FR/GR 22 O'Connell 1981 Intercomys Venezuela/Tropical 70 1.1 \pm 0.7 65.5 FR/GR 13 Fleming 1974 dry forest (0.0-2.2) 0.2.3 Fleming 1974 Tropical wet forest (0.2-1.2) H. desmarestianus Costa Rica/ 77 13.5 ± 3.1 23.3 FR/GR 13 Fleming 1974 Octoolor Venezuela/ 25 0.7 ± 0.4 61.2 FR/OM 64 August 1981 0.2-10 moist forest (0.2-1.2) (0.2-1.2) Tridia//Topical 50 1.1 ± 1.1 100.0 FR/OM 13 Fleming 1971 0. capito Panama/Tropical 50 1.	•	-	250		25.5	FR/GR	16	August 1981
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		· •						5
adspirus L, salvinidry forest $(5.4+1.0)$ $(5.4+1.0)$ L, salviniCosta Rica/ Tropical dry forest43 5.9 ± 1.4 23.7 FR/GR13Fleming 1974HeteromysVenezuela/Tropical70 1.0 ± 0.8 74.8FR/GR22O'Connell 1981anomalushumid forest(0.0-3.0)Venezuela/Tropical70 1.1 ± 0.7 65.5 FR/GR16August 1981dry forest(0.0-2.2)(0.0-2.2)Tropical desert(7)13.5 ± 3.1 23.3FR/GR13Fleming 1974CRICETIDAECosta Rica/7713.5 ± 3.1 23.3FR/OM6August 1981OryzomysEcuador - Galapagos/65++28.0FR/OM6August 1981O. capitoPanama/Tropical50 2.3 ± 1.3 57.0FR/OM13Fleming 1971Moist forest(0.2-1.2)(0.0-3.2)Trinidad/Tropical50 1.2 ± 1.2 65.0FR/OM13Fleming 1971Morama/Tropical50 1.2 ± 1.2 65.0FR/OM22O'Connell 19811881O. concolorVenezuela/Tropical60 1.2 ± 1.2 65.0FR/OM22O'Connell 1981O. concolorVenezuela/Tropical61 1.2 ± 1.2 65.0FR/OM22O'Connell 1981O. concolorVenezuela/Tropical61 1.2 ± 1.2 FR/GR53Meseree et al. 1982O. concolorVenezuela/Tropical60 1.2 ± 1.2 FR/GR53 <td>HETEROMYIDAE</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	HETEROMYIDAE							
adspirus L, salvinidry forest $(5.4+1.0)$ $(5.4+1.0)$ L, salviniCosta Rica/ Tropical dry forest43 5.9 ± 1.4 23.7 FR/GR13Fleming 1974HeteromysVenezuela/Tropical70 1.0 ± 0.8 74.8FR/GR22O'Connell 1981anomalushumid forest(0.0-3.0)Venezuela/Tropical70 1.1 ± 0.7 65.5 FR/GR16August 1981dry forest(0.0-2.2)(0.0-2.2)Tropical desert(7)13.5 ± 3.1 23.3FR/GR13Fleming 1974CRICETIDAECosta Rica/7713.5 ± 3.1 23.3FR/OM6August 1981OryzomysEcuador - Galapagos/65++28.0FR/OM6August 1981O. capitoPanama/Tropical50 2.3 ± 1.3 57.0FR/OM13Fleming 1971Moist forest(0.2-1.2)(0.0-3.2)Trinidad/Tropical50 1.2 ± 1.2 65.0FR/OM13Fleming 1971Morama/Tropical50 1.2 ± 1.2 65.0FR/OM22O'Connell 19811881O. concolorVenezuela/Tropical60 1.2 ± 1.2 65.0FR/OM22O'Connell 1981O. concolorVenezuela/Tropical61 1.2 ± 1.2 65.0FR/OM22O'Connell 1981O. concolorVenezuela/Tropical61 1.2 ± 1.2 FR/GR53Meseree et al. 1982O. concolorVenezuela/Tropical60 1.2 ± 1.2 FR/GR53 <td>Liomys</td> <td>Panama/Tropical</td> <td>65</td> <td>7.9± 2.0</td> <td>25.6</td> <td>FR/GR</td> <td>13</td> <td>Fleming 1971</td>	Liomys	Panama/Tropical	65	7.9± 2.0	25.6	FR/GR	13	Fleming 1971
L. salvini Costa Rica/ Tropical dry forest 43 $5,9\pm1,4$ 23.7 FR/GR 13 Fleming 1974 Heteromys Vonecula/Tropical 70 1.0 ± 0.8 74.8 FR/GR 22 O'Connell 1981 anomalus humid forest (0.0-3.0) 65.5 FR/GR 16 August 1981 dry forest (0.0-2.2) 70 13.5 ± 3.1 23.3 FR/GR 13 Fleming 1974 H. desmarestianus Costa Rica/ 77 13.5 ± 3.1 23.3 FR/GR 13 Fleming 1974 Goldon Costa Rica/ 77 13.5 ± 3.1 23.3 FR/GR 13 Fleming 1974 Goldon Venezuela/ 25 0.7 ± 0.4 61.2 FR/OM 31 Clark 1980 Ocyzomys Ecuador - Galapagos/ 65 ++ 28.0 FR/OM 13 Fleming 1971 O. bicolor Venezuela/ 70 0.2 ± 1.2 60.12 FR/OM 13 Fleming 1971 O. coloof Tropicial 60	•	• •						· · · · · · · · · · · · · · · · · · ·
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	L. salvini		43		23.7	FR/GR	13	Fleming 1974
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		•				-,		0
anomalus humid forest dry forest $(0.0-3.0)$ H. desmarestianus Costa Rica/ Tropical wet forest 70 1.1 ± 0.7 65.5 FR/GR 16 August 1981 H. desmarestianus Costa Rica/ Tropical wet forest 77 13.5 ± 3.1 23.3 FR/GR 13 Fleming 1974 CRICETIDAE CRICETIDAE Cryzomys Ecuador - Galapagos/ buri 65 ++ 28.0 FR/OM 31 Clark 1980 O. colior Venezuela/ Tropical desert $0.2.12$, (7) (7) (7) O. capito Panama/Tropical 50 2.3 ± 1.3 57.0 FR/OM 13 Fleming 1971 moist forest $(0.3-4.3)$ Trinidad/Tropical 60 16.0 ± 3.7 23.1 FR/OM 22 O'Connell 1981 humid forest $(0.0-3.2)$ Trikasingh 1973 Yenezuela/Tropical 60 12.2 ± 1.2 65.0 FR/OM 22 O'Connell 1981 humid forest $(0.0-3.2)$ Tropical swana $(3.3-32.0)$ $(3.3-2.0)$ $(2.3 \pm$	Heteromys		70		74.8	FR/GR	22	O'Connell 1981
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		· •			,	,		
H. desmarestianusdry forest $(0.0-2.2)$ 13.5 ± 3.1 23.3 FR/GR 13 Fleming 1974Costa Rica/ Tropical wet forestCRICETIDAEOryzomys bauriEcuador - Galapagos/ Tropical desert 65 \leftrightarrow 28.0 FR/OM 31 (7) Clark 1980Oryzomys bauriCark 1980Oryzomys bauriConceruela/ Panama/Tropical 25 0.7 ± 0.4 61.2 61.2 FR/OM 61 August 1981O. capitoPanama/Tropical projeal savana (0.24.3) $0.2.12$ $0.2.3 \pm 1.3$ 57.0 FR/OM FR/OM 13 Fleming 1971On capitoPanama/Tropical dry forest vergreen forest vergreen forest $(0.0-3.2)$ Trinidad/Tropical 10.3 ± 1.1 100.0 FR/OM 22 0.0 0.0 $0.0.3.2)0.00.0.4.6.6)0.20.20.00.0.4.6.6)0.34.6.6)Orecruela/Tropical0.0.4.6.6651.3 \pm 1.110.0.0FR/OM22220.00.00.00.0.4.6.6)0.8 \pm 7.30.3.2.0)74.5FR/OM240.0.4Mello 1980Orecruela/Tropical0.0.4.6.6651.3 \pm 1.41.3 \pm 1.4.812.2FR/OM7424Mello 1980ConcolorVenexuela/Tropical651.3 \pm 1.4.815.2FR/OM7424Mello 1980ConcolorVenexuela/Tropical$			70		65.5	FR/GR	16	August 1981
H. desmarestianus Costa Rica/ Tropical wet forest 77 13.5 ± 3.1 23.3 FR/GR 13 Fleming 1974 CRICETIDAE Oryzomys Ecuador - Galapagos/ bauri 65 ++ 28.0 FR/OM 31 Clark 1980 Oryzomys Ecuador - Galapagos/ bauri 55 ++ 28.0 FR/OM 31 Clark 1980 O. bicolor Venezuela/ 25 0.7 ± 0.4 61.2 FR/OM 6 August 1981 O. capito Panama/Tropical 50 2.3 ± 1.3 57.0 FR/OM 13 Fleming 1971 moist forest (0.24.3) Panama/Tropical 60 16.0 ± 3.7 23.1 FR/OM 9 Everad & evergreen forest (10.0-3.2) Or concolor Venezuela/Tropical 65 1.3 ± 1.1 80.0 FR/OM 22 O'Connell 1981 O. elinus Brazil/ 30 9.8 ± 7.3 74.5 FR/GR 7 Fulk 1975 ocnical atus Chile/Temperate 46 4.6 ± 4.0 87.8 FR/GR 7 Fulk 1975 O. longicauda		· •				,		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	H. desmarestianus		77		23.3	FR/GR	13	Fleming 1974
Oryzomys Ecuador - Galapagos/ bauri 65 ++ 28.0 FR/OM 31 Clark 1980 0. bicolor Venezuela/ Tropical savanna 25 0.7 ± 0.4 61.2 FR/OM 6 August 1981 0. capito Panama/Tropical 50 2.3 ± 1.3 57.0 FR/OM 13 Fleming 1971 0. capito Panama/Tropical 50 1.1 ± 1.1 100.0 FR/OM 13 Fleming 1971 0. capito Panama/Tropical 60 16.0 ± 3.7 23.1 FR/OM 9 Everard & 0. capito Panama/Tropical 60 $12.\pm 1.2$ 65.0 FR/OM 9 Everard & 0. concolor Venezuela/Tropical 60 $12.\pm 1.2$ 65.0 FR/OM 22 O'Connell 1981 humid forest (0.0-3.2) Tripical savanna $(3.322.0)$ 0 Connell 1981 0. eliurus Brazil/ 30 9.8 ± 7.3 74.5 FR/OM 24 Mello 1980 0. longicaudatus Ch		•						-
bauri Tropical desert (7) 0. bicolor Venezuela/ 25 0.7 ± 0.4 61.2 FR/OM 6 August 1981 0. capito Panama/Tropical 50 2.3 ± 1.3 57.0 FR/OM 13 Fleming 1971 0. capito Panama/Tropical 50 2.3 ± 1.3 57.0 FR/OM 13 Fleming 1971 0. capito Panama/Tropical 50 1.1 ± 1.1 100.0 FR/OM 13 Fleming 1971 dry forest (0.0-3.2) Trinidad/Tropical 60 1.2 ± 1.2 65.0 FR/OM 22 O'Connell 1981 humid forest (0.0-3.2) Tripical savanna $(3.3-32.0)$ O'Connell 1981 0. eliurus Brazil/ 30 9.8 ± 7.3 74.5 FR/OM 24 Mello 1980 0. longicaudatus Chile/Temperate 46 4.6 ± 4.0 87.8 FR/GR 7 Fulk 1975 cerub grassland (0.0-7.6) (27) + pers.comm. (27) + pers.comm. </td <td>CRICETIDAE</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	CRICETIDAE							
bauri Tropical desert (7) 0. bicolor Venezuela/ 25 0.7 ± 0.4 61.2 FR/OM 6 August 1981 0. capito Panama/Tropical 50 2.3 ± 1.3 57.0 FR/OM 13 Fleming 1971 0. capito Panama/Tropical 50 2.3 ± 1.3 57.0 FR/OM 13 Fleming 1971 0. capito Panama/Tropical 50 1.1 ± 1.1 100.0 FR/OM 13 Fleming 1971 dry forest (0.0-3.2) Trinidad/Tropical 60 1.2 ± 1.2 65.0 FR/OM 22 O'Connell 1981 humid forest (0.0-3.2) Tripical savanna $(3.3-32.0)$ O'Connell 1981 0. eliurus Brazil/ 30 9.8 ± 7.3 74.5 FR/OM 24 Mello 1980 0. longicaudatus Chile/Temperate 46 4.6 ± 4.0 87.8 FR/GR 7 Fulk 1975 cerub grassland (0.0-7.6) (27) + pers.comm. (27) + pers.comm. </td <td>Oruzomus</td> <td>Equador - Calapagos/</td> <td>65</td> <td></td> <td>28.0</td> <td>EP/OM</td> <td>21</td> <td>Clark 1990</td>	Oruzomus	Equador - Calapagos/	65		28.0	EP/OM	21	Clark 1990
O. bicolor Venezuela/ Tropical savanna 25 0.7 ± 0.4 61.2 FR/OM 6 August 1981 O. capito Panama/Tropical moist forest 50 2.3 ± 1.3 57.0 FR/OM 13 Fleming 1971 O. capito Panama/Tropical dry forest 60 $1.6.0 \pm 3.7$ 23.1 FR/OM 9 Everard & Everated Trinidad/Tropical evergreen forest 60 $1.6.0 \pm 3.7$ 23.1 FR/OM 9 Everard & Everated O. concolor Venezuela/Tropical humid forest 60 1.2 ± 1.2 65.0 FR/OM 22 O'Connell 1981 0. concolor Venezuela/Tropical humid forest $(0.0-3.2)$ O'Connell 1981 $(0.0-3.2)$ O'Connell 1981 0. eliurus Tropical savanna $(3.3 \pm 1.1$ 80.0 FR/OM 22 O'Connell 1981 0. longicaudatus Chile/Temperate 46 ± 4.0 87.8 FR/GR 7 Fulk 1975 0. longicaudatus Chile/Temperate 45 5.9 ± 7.4 12.4 FR/GR 53 Meserve et al. 1982 Chile/ Gremperate forest $(0.0-16.0)$	· ·		05	**	20.0	I'R/OM		Cialk 1960
$ \begin{array}{c} \mbox{Tropical savanna} & (0.2-1.2) & FR/OM & 13 & Fleming 1971 \\ \mbox{Panama/Tropical} & 50 & 2.3 \pm 1.3 & 57.0 & FR/OM & 13 & Fleming 1971 \\ \mbox{Orest} & (0.34.3) & FR/OM & 13 & Fleming 1971 \\ \mbox{dry forest} & (0.0-3.2) & Trinidad/Tropical & 60 & 16.0 \pm 3.7 & 23.1 & FR/OM & 9 & Everard & Tikasingh 1973 \\ \mbox{vergreen forest} & (11.0-21.2) & Tikasingh 1973 & Venezuela/Tropical & 60 & 12.2 \pm 1.2 & 65.0 & FR/OM & 22 & O'Connell 1981 \\ \mbox{humid forest} & (0.0-3.2) & O'Connell 1981 & 0.0 & FR/OM & 22 & O'Connell 1981 \\ \mbox{humid forest} & (0.3-4.6) & 0 & 9.8 \pm 7.3 & 74.5 & FR/OM & 24 & Mello 1980 & Tropical savanna & (3.3-32.0) & O'Connell 1981 & 0.0 & $			25	07+04	61.2	EP/OM		August 1091
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	0. 010000		25		01.2	FR/OM	U	August 1901
moist forest $(0.34.3)$ Panama/Tropical50 1.1 ± 1.1 100.0 FR/OM13Fleming 1971dry forest $(0.0-3.2)$ Trinidad/Tropical60 16.0 ± 3.7 23.1 FR/OM9Everard &evergreen forest $(11.0-21.2)$ Tikasingh 1973Venezuela/Tropical60 1.2 ± 1.2 65.0FR/OM22O'Connell 1981humid forest $(0.0-3.2)$ Venezuela/Tropical65 1.3 ± 1.1 80.0FR/OM22O'Connell 1981o. concolorVenezuela/Tropical65 1.3 ± 1.1 80.0FR/OM24Mello 1980o. eliurusBrazil/30 9.8 ± 7.3 74.5FR/OM24Mello 1980o. longicaudatusChile/Temperate46 4.6 ± 4.0 87.8FR/GR7Fulk 1975Scrub grassland $(0.0-7.6)$ (3)(27)+ pers. comm.(3)Chile/45 5.9 ± 7.4 125.4FR/GR53Meserve et al. 1982Temperate forest $(0.0-29.6)$ (27)+ pers. comm.(1.0-62.0)(47)in pressChile/Temperate45 11.4 ± 10.4 91.0FR/GR53Murúa et al.aria forest $(1.0-41.0)$ (46)in press0.1 h ± 1.4 19.0O. nigripesArgentina/40 14.7 ± 19.9 146.7FR/OM47Negus et al. 1961O. nigripesArgentina/40 14.7 ± 19.9 146.7FR/OM47Negus et al. 1961 <td< td=""><td>0 capito</td><td></td><td>50</td><td>• •</td><td>570</td><td>EP/OM</td><td>12</td><td>Floming 1071</td></td<>	0 capito		50	• •	570	EP/OM	12	Floming 1071
Panama/Tropical dry forest50 1.1 ± 1.1 100.0FR/OM13Fleming 1971dry forest $(0.0-3.2)$ Trinidad/Tropical evergreen forest $(1.0-21.2)$ FR/OM9Everard &venezuela/Tropical humid forest60 1.2 ± 1.2 65.0FR/OM22O'Connell 19810. concolorVenezuela/Tropical humid forest65 1.3 ± 1.1 80.0FR/OM22O'Connell 19810. concolorVenezuela/Tropical venezuela/Tropical humid forest65 1.3 ± 1.1 80.0FR/OM22O'Connell 19810. concolorVenezuela/Tropical venezuela/Tropical savanna $(3.3-32.0)$ O'Connell 1981098 ± 7.374.5FR/OM24Mello 19800. longicaudatusChilc/Temperate scrub grassland $(0.0-7.6)$ (3) (27)+ pers. comm.Chilc/45 5.9 ± 7.4 125.4FR/GR53Murúa et al.1982Temperate forest $(0.0-16.0)$ + pers. comm.+ pers. comm.+ pers. comm.+ pers. comm.Chile/Temperate train forest $(1.0-41.0)$ (47)in pressMurúa et al.grassland $(0.0-30.8)$ $(0.5-17.8)$ (10) $(1.79.2)$ $(1.79.2)$ O. nigripesArgentina/40 $1.4 \pm 1.99.1$ FR/OM (2) Value et al. 1982O. nigripesArgentina/40 (2.5 ± 2.7) $(0.4,7)$ FR/OM (2) Value et al. 1981O. nigripesArgentina/40 (3.5 ± 2.1)	O. cupito		50		\$7.0	FR/OM	15	Fiching 19/1
$ \begin{array}{cccc} dry \ forest & (0.0-3.2) \\ Trinidad/Tropical & 60 & 16.0 \pm 3.7 & 23.1 & FR/OM & 9 & Everard \& \\ evergreen \ forest & (11.0-21.2) & Tikasingh 1973 \\ Venezuela/Tropical & 60 & 1.2 \pm 1.2 & 65.0 & FR/OM & 22 & O'Connell 1981 \\ humid \ forest & (0.0-3.2) & & & & & & & & & & & & & & & & & & &$			50		100.0	EP/OM	12	Eleming 1971
$\begin{array}{cccccccccccccccccccccccccccccccccccc$			50		100.0	I R/OM	15	Fiching 1971
evergreen forest Venezuela/Tropical humid forest(11.0-21.2) 1.2 ± 1.2 Tikasingh 1973 O'Connell 1981 O'Connell 1981 			60	•	23.1	FR/OM	9	Everard &
Venezuela/Tropical humid forest60 1.2 ± 1.2 65.0 FR/OM 22O'Connell 19810. concolorVenezuela/Tropical humid forest65 1.3 ± 1.1 80.0 FR/OM 22O'Connell 19810. eliunusBrazil/30 9.8 ± 7.3 74.5 FR/OM 24Mello 19800. eliunusBrazil/30 9.8 ± 7.3 74.5 FR/OM 24Mello 19800. longicaudatusChile/Temperate scrub grassland $(0.0^{-7.6})$ (3) (3) 0. longicaudatusChile/I 45 5.9 ± 7.4 125.4 FR/GR 7 Fulk 19750. longicaudatusChile/I 45 5.9 ± 7.4 125.4 FR/GR 53 Meserve et al. 19820. longicaudatusChile/I 45 $(4.7 \pm 5.4$ 115.2 FR/GR 16 Meserve et al. 1982Temperate forest $(0.0^{-16.0})$ $+ fers. comm.$ $+ fers. comm.$ $+ fers. comm.$ Chile/Temperate 45 11.4 ± 10.4 91.0 FR/GR 53 Murúa et al.grassland $(1.0^{-41.0})$ (46) in pressChile/Temperate 45 11.4 ± 10.4 91.0 FR/GR 17 Dalby 1975Temperate grassland $(0.0^{-3.0})$ (36) (36) (36) O. nigripesArgentina/ 40 14.7 ± 19.9 146.7 FR/GR 17 Dalby 1975Temperate grassland $(0.5^{-17.8})$ (19) (19) (19) $(17.9.2)$ <t< td=""><td></td><td>· •</td><td>00</td><td></td><td>23.1</td><td>I R/OM</td><td>,</td><td></td></t<>		· •	00		23.1	I R/OM	,	
humid forest $(0.0-3.2)$ $(0.0-3.$		-	60		65.0	FR/OM	22	
O. concolor Venezuela/Tropical 65 1.3 ± 1.1 80.0 FR/OM 22 O'Connell 1981 0. eliunus Brazil/ 30 9.8 ± 7.3 74.5 FR/OM 24 Mello 1980 0. eliunus Brazil/ 30 9.8 ± 7.3 74.5 FR/OM 24 Mello 1980 0. longicaudatus Chile/Temperate 46 4.6 ± 4.0 87.8 FR/GR 7 Fulk 1975 Scrub grassland (0.0-7.6) (3) (3) Chile/ 45 5.9 ± 7.4 125.4 FR/GR 53 Meserve et al. 1982 Temperate forest (0.0-29.6) (27) + pers. comm. Chile/ 45 (4.7 ± 5.4) 115.2 FR/GR 16 Meserve et al. 1982 + pers. comm. Chile/Temperate 45 11.8 ± 14.8 125.2 FR/GR 53 Murúa et al. 1982 Temperate forest (1.0-62.0) (47) in press Chile/Temperate 45 11.4 ± 10.4 91.0 FR/GR 53 Murúa et al. 1992 <td></td> <td>· •</td> <td>00</td> <td></td> <td>00.0</td> <td>110,010</td> <td>22</td> <td>o connen 1901</td>		· •	00		00.0	110,010	22	o connen 1901
humid forest $(0.3-4.6)$ O. eliurusBrazil/30 9.8 ± 7.3 74.5 FR/OM24Mello 1980Tropical savanna $(3.3-32.0)$ (3.3-32.0)(3.3-32.0)(3.3-32.0)O. longicaudatusChile/Temperate46 4.6 ± 4.0 87.8 FR/GR7Fulk 1975Scrub grassland $(0.0-7.6)$ (3)(3)(3)(3)Chile/45 5.9 ± 7.4 125.4 FR/GR53Meserve et al. 1982Temperate forest $(0.0-29.6)$ (27)+ pers. comm.Chile/45 (4.7 ± 5.4) 115.2 FR/GR16Meserve et al. 1982Temperate forest $(0.0-16.0)$ + pers. comm.Chile/Temperate45 11.8 ± 14.8 125.2 FR/GR53Murúa et al.rain forest $(1.0-62.0)$ (47)in pressChile/Temperate45 11.4 ± 10.4 91.0 FR/GR53Murúa et al.grassland $(0.0-30.8)$ (36)(46)in pressO. nigripesArgentina/40 14.7 ± 19.9 146.7 FR/OM12Valle et al. 1961Coastal sedge $(0.5-17.8)$ (19)(19)(20)Valle et al. 1982Tropical savannaNeacomysVenezuela/Tropical15 2.6 ± 2.7 104.9 FR/OM22O'Connell 1981KeiperNemid forest $(0.10.1)$ RhipidomysVenezuela/Tropical 100 1.1 ± 1.1 99.1 FR/OM22O'Connell 1981 <td>0 concolor</td> <td></td> <td>65</td> <td></td> <td>80.0</td> <td>FR/OM</td> <td>22</td> <td>O'Connell 1981</td>	0 concolor		65		80.0	FR/OM	22	O'Connell 1981
O. eliurus Brazil/ Tropical savanna 30 9.8 ± 7.3 74.5 FR/OM 24 Mello 1980 O. longicaudatus Chile/Temperate scrub grassland 46 4.6 ± 4.0 87.8 FR/GR 7 Fulk 1975 O. longicaudatus Chile/Temperate grassland 45 5.9 ± 7.4 125.4 FR/GR 7 Fulk 1975 O. longicaudatus Chile/ 45 5.9 ± 7.4 125.4 FR/GR 7 Fulk 1975 Chile/ 45 5.9 ± 7.4 125.4 FR/GR 53 Meserve et al. 1982 Temperate forest (0.0-29.6) (27) + pers. comm. Chile/ 45 (1.7 ± 5.4) 115.2 FR/GR 53 Murúa et al. Temperate forest (0.0-16.0) (4.7 \pm 19.4) 91.0 FR/GR 53 Murúa et al. grassland (1.0-62.0) (47) in press 0 14.7 \pm 19.9 146.7 FR/GR 17 Dalby 1975 Temperate grassland (0.0-30.8) (36) (36)	0.00100	•	05		00.0	I R/OM	24	O Common 1701
O. longicaudatusTropical savanna $(3.3-32.0)$ O. longicaudatusChile/Temperate46 4.6 ± 4.0 87.8 FR/GR7Fulk 1975Scrub grassland $(0.0-7.6)$ (3.3) Chile/45 5.9 ± 7.4 125.4 FR/GR53Meservc et al. 1982Temperate forest $(0.0-29.6)$ (27) + pers. comm.Chile/45 (4.7 ± 5.4) 115.2 FR/GR16Meserve et al. 1982Temperate forest $(0.0-16.0)$ + pers. comm.Chile/Temperate45 11.8 ± 14.8 125.2 FR/GR53Murúa et al.rain forest $(1.0-62.0)$ (47) in pressChile/Temperate45 11.4 ± 10.4 91.0 FR/GR53Murúa et al.grassland $(1.0-41.0)$ (46) in pressO. nigripesArgentina/40 14.7 ± 19.9 146.7 FR/GR17Dalby 1975Temperate grassland $(0.0-30.8)$ (36) (36) (36) (36) O. palustrisUSA, Louisiana/55 6.6 ± 6.0 91.7 FR/OM 12 Valle et al. 1982Tropical sedge $(0.5-17.8)$ $(17-9.2)$ $(1.7-9.2)$ $(1.7-9.2)$ (22) O'Connell 1981NeacomysVenezuela/Tropical 15 2.6 ± 2.7 104.9 FR/OM 22 O'Connell 1981RhipidomysVenezuela/Tropical 100 1.1 ± 1.1 99.1 FR/OM 22 O'Connell 1981	O eliunus		30		74 5	FR/OM	24	Mello 1980
O. longicaudatus Chilo/Temperate 46 4.6 ± 4.0 87.8 FR/GR 7 Fulk 1975 scrub grassland (0.0-7.6) (3) (3) (3) (3) Chilo/ 45 5.9 ± 7.4 125.4 FR/GR 53 Meserve et al. 1982 Temperate forest (0.0-29.6) (27) + pers. comm. Chile/ 45 (4.7 ± 5.4) 115.2 FR/GR 16 Meserve et al. 1982 Temperate forest (0.0-16.0) + pers. comm. + pers. comm. + pers. comm. Chile/Temperate 45 11.8 ± 14.8 125.2 FR/GR 53 Murúa et al. rain forest (1.0-62.0) (47) in press Murúa et al. grassland (1.0-41.0) (46) in press O. nigripes Argentina/ 40 14.7 ± 19.9 146.7 FR/GR 17 Dalby 1975 Temperate grassland (0.0-30.8) (36) (36) (36) (36) (36) (36) (36) (36) (36) (36) (36) (36) (36) (36) (36) <td>0.014745</td> <td>•</td> <td>50</td> <td></td> <td>, 1.5</td> <td>1 10,011</td> <td>21</td> <td>Mono 1700</td>	0.014745	•	50		, 1.5	1 10,011	21	Mono 1700
scrub grassland $(0.0-7.6)$ (3)Chilc/45 5.9 ± 7.4 125.4 FR/GR53Meserve et al. 1982Temperate forest $(0.0-29.6)$ (27) + pers. comm.Chile/45 $(4.7 \pm 5.4$ 115.2 FR/GR16Meserve et al. 1982Temperate forest $(0.0-16.0)$ + pers. comm.Chile/Temperate45 11.8 ± 14.8 125.2 FR/GR53Murúa et al.rain forest $(1.0-62.0)$ (47)in pressChile/Temperate45 11.4 ± 10.4 91.0 FR/GR53Murúa et al.grassland $(1.0-41.0)$ (46)in pressO. nigripesArgentina/40 14.7 ± 19.9 146.7 FR/GR17Dalby 1975Temperate grassland $(0.0-30.8)$ (36)O. palustrisUSA, Louisiana/55 6.6 ± 6.0 91.7 FR/OM47Negus et al. 1981O. subflavusBrazil/40 5.3 ± 2.1 39.6 FR/OM12Valle et al. 1982Tropical savanna $(1.7-9.2)$ NeacomysVenezuela/Tropical15 2.6 ± 2.7 104.9 FR/OM22O'Connell 1981RhipidomysVenezuela/Tropical100 1.1 ± 1.1 99.1 FR/OM22O'Connell 1981	O longiogudatus	-	46		87 8	FR/GR	7	Fulk 1975
Chilc/45 5.9 ± 7.4 125.4 FR/GR53Meserve et al. 1982Temperate forest $(0.0-29.6)$ (27) + pers. comm.Chile/45 $(4.7 \pm 5.4$ 115.2 FR/GR16Meserve et al. 1982Temperate forest $(0.0-16.0)$ + pers. comm.Chile/Temperate45 11.8 ± 14.8 125.2 FR/GR53Murúa et al.rain forest $(1.0-62.0)$ (47)in pressChile/Temperate45 11.4 ± 10.4 91.0 FR/GR53Murúa et al.grassland $(1.0-41.0)$ (46)in pressO. nigripesArgentina/40 14.7 ± 19.9 146.7 FR/GR17Dalby 1975Temperate grassland $(0.0-30.8)$ (36)O. palustrisUSA, Louisiana/55 6.6 ± 6.0 91.7 FR/OM47Negus et al. 1981O. subflavusBrazil/40 5.3 ± 2.1 39.6 FR/OM12Valle et al. 1982Tropical savanna $(1.7-9.2)$ NeacomysVenezuela/Tropical15 2.6 ± 2.7 104.9 FR/OM22O'Connell 1981Kenupeshumid forest $(0.70.1)$ 1.1 ± 1.1 99.1 FR/OM22O'Connell 1981	o. tongiculuutus		40		07.0	I R/OR		I UIR 1775
Temperate forest $(0.0-29.6)$ (27) + pers. comm.Chile/45 $(4.7 \pm 5.4$ 115.2 FR/GR16Meserve et al. 1982Temperate forest $(0.0-16.0)$ + pers. comm.Chile/Temperate45 11.8 ± 14.8 125.2 FR/GR53Murúa et al.rain forest $(1.0-62.0)$ (47) in pressChile/Temperate45 11.4 ± 10.4 91.0 FR/GR53Murúa et al.grassland $(1.0-41.0)$ (46)in pressO. nigripesArgentina/40 14.7 ± 19.9 146.7 FR/GR17Dalby 1975Temperate grassland $(0.0-30.8)$ (36)O. palustrisUSA, Louisiana/55 6.6 ± 6.0 91.7 FR/OM47Negus et al. 1961Coastal sedge $(0.5-17.8)$ (19)O. subflavusBrazil/40 5.3 ± 2.1 39.6 FR/OM12Valie et al. 1982Tropical savanna $(1.7-9.2)$ NeacomysVenezuela/Tropical15 2.6 ± 2.7 104.9 FR/OM22O'Connell 1981RhipidomysVenezuela/Tropical100 1.1 ± 1.1 99.1 FR/OM22O'Connell 1981		-	45	• •	125.4	FR/GR		Meserve et al. 1982
Chile/45 $(4.7\pm5.4$ 115.2 FR/GR 16Mcserve et al. 1982Temperate forest $(0.0-16.0)$ + pers. comm.Chile/Temperate45 11.8 ± 14.8 125.2 FR/GR 53Murúa et al.rain forest $(1.0-62.0)$ (47) in pressChile/Temperate45 11.4 ± 10.4 91.0 FR/GR 53Murúa et al.grassland $(1.0-41.0)$ (46)in pressO. nigripesArgentina/40 14.7 ± 19.9 146.7 FR/GR 17Dalby 1975Temperate grassland $(0.0-30.8)$ (36)(36)O. palustrisUSA, Louisiana/55 6.6 ± 6.0 91.7 FR/OM 47Negus et al. 1961Coastal sedge $(0.5-17.8)$ (19)O. subflavusBrazil/40 5.3 ± 2.1 39.6 FR/OM 12Valle et al. 1982Tropical savanna $(1.7-9.2)$ NeacomysVenezuela/Tropical15 2.6 ± 2.7 104.9 FR/OM 22O'Connell 1981RhipidomysVenezuela/Tropical100 1.1 ± 1.1 99.1 FR/OM 22O'Connell 1981		•	10		120.1	. N/OR		
Temperate forest $(0.0-16.0)$ + pers. comm.Chile/Temperate45 11.8 ± 14.8 125.2 FR/GR53Murúa et al.rain forest $(1.0-62.0)$ (47) in pressChile/Temperate45 11.4 ± 10.4 91.0 FR/GR53Murúa et al.grassland $(1.0-41.0)$ (46) in pressO. nigripesArgentina/40 14.7 ± 19.9 146.7 FR/GR 17 Dalby 1975Temperate grassland $(0.0-30.8)$ (36) (36) (36) (36) O. palustrisUSA, Louisiana/55 6.6 ± 6.0 91.7 FR/OM47Negus et al. 1961Coastal sedge $(0.5-17.8)$ (19) (19) (19) $(1.7-9.2)$ $(1.7-9.2)$ NeacomysVenezuela/Tropical15 2.6 ± 2.7 104.9 FR/OM22O'Connell 1981tenuipeshumid forest $(0.710.1)$ (1.1 ± 1.1) 99.1 FR/OM22O'Connell 1981			45		115.2	FR/GR		•
Chile/Temperate45 11.8 ± 14.8 125.2 FR/GR 53Murúa et al.rain forest $(1.0-62.0)$ (47) in pressChile/Temperate45 11.4 ± 10.4 91.0 FR/GR 53Murúa et al.grassland $(1.0-41.0)$ (46) in pressO. nigripesArgentina/40 14.7 ± 19.9 146.7 FR/GR 17Dalby 1975Temperate grassland $(0.0-30.8)$ (36) (36) O. palustrisUSA, Louisiana/55 6.6 ± 6.0 91.7 FR/OM 47Negus et al. 1961Coastal sedge $(0.5-17.8)$ (19) (19) $(17-9.2)$ $(17-9.2)$ $(17-9.2)$ NeacomysVenezuela/Tropical15 2.6 ± 2.7 104.9 FR/OM 22O'Connell 1981tenuipeshumid forest $(0.710.1)$ $(0.10.1)$ FR/OM 22O'Connell 1981		- /		-	110.2	. Ny Gir	10	
rain forest $(1.0-62.0)$ (47) in pressChile/Temperate45 11.4 ± 10.4 91.0 FR/GR53Murúa et al.grassland $(1.0-41.0)$ (46) in pressO. nigripesArgentina/40 14.7 ± 19.9 146.7 FR/GR17Dalby 1975Temperategrassland $(0.0-30.8)$ (36) 0O. palustrisUSA, Louisiana/55 6.6 ± 6.0 91.7 FR/OM47Negus et al. 1961Coastal sedge $(0.5-17.8)$ (19) (19) 0subflavusBrazil/40 5.3 ± 2.1 39.6 FR/OM12Valle et al. 1982Tropical savanna $(1.7-9.2)$ (2.6 ± 2.7) 104.9 FR/OM22O'Connell 1981NeacomysVenezuela/Tropical15 2.6 ± 2.7 104.9 FR/OM22O'Connell 1981RhipidomysVenezuela/Tropical100 1.1 ± 1.1 99.1 FR/OM22O'Connell 1981		-	45		125.2	FR/GR	53	•
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			45		120.2	INJOR		
grassland $(1.0-41.0)$ (46) in pressO. nigripesArgentina/40 14.7 ± 19.9 146.7 FR/GR17Dalby 1975Temperate grassland $(0.0-30.8)$ (36) (36) O. palustrisUSA, Louisiana/55 6.6 ± 6.0 91.7 FR/OM47Negus et al. 1961Coastal sedge $(0.5-17.8)$ (19) O. subflavusBrazil/40 5.3 ± 2.1 39.6 FR/OM12Valle et al. 1982Tropical savanna $(1.7-9.2)$ NeacomysVenezuela/Tropical15 2.6 ± 2.7 104.9 FR/OM22O'Connell 1981tenuipeshumid forest $(0.10.1)$ 1.1 ± 1.1 99.1 FR/OM22O'Connell 1981			45		91.0	FR/GR		
O. nigripes Argentina/ Temperate grassland 40 14.7 ± 19.9 146.7 FR/GR 17 Dalby 1975 Temperate grassland $(0.0-30.8)$ (36) (36) (36)			-10		21.0	I N/OK		
Temperate grassland $(0.0-30.8)$ (36) O. palustrisUSA, Louisiana/55 6.6 ± 6.0 91.7 FR/OM 47 Negus et al. 1961Coastal sedge $(0.5-17.8)$ (19) O. subflavusBrazil/40 5.3 ± 2.1 39.6 FR/OM 12 Valle et al. 1982Tropical savanna $(1.7-9.2)$ $(1.7-9.2)$ $Venezuela/Tropical$ 15 2.6 ± 2.7 104.9 FR/OM 22 O'Connell 1981tenuipeshumid forest $(0.10.1)$ 1.1 ± 1.1 99.1 FR/OM 22 O'Connell 1981	O. nigripes		40	• •	146 7	FR/GR		•
O. palustris USA, Louisiana/ 55 6.6 ± 6.0 91.7 FR/OM 47 Negus et al. 1961 Coastal sedge (0.5-17.8) (19) O. subflavus Brazil/ 40 5.3 ± 2.1 39.6 FR/OM 12 Valle et al. 1982 Tropical savanna (1.7-9.2)			10		1.0.7			
Coastal sedge $(0.5 \cdot 17.8)$ (19) O. subflavusBrazil/40 5.3 ± 2.1 39.6 FR/OM12Valle et al. 1982Tropical savanna $(1.7 \cdot 9.2)$ 15 2.6 ± 2.7 104.9FR/OM22O'Connell 1981NeacomysVenezuela/Tropical15 2.6 ± 2.7 104.9FR/OM22O'Connell 1981tenuipeshumid forest $(0.10.1)$ 777RhipidomysVenezuela/Tropical100 1.1 ± 1.1 99.1FR/OM22O'Connell 1981	O palustris		55		917	FR/OM		Negus et al 1961
O. subflavus Brazil/ 40 5.3 ± 2.1 39.6 FR/OM 12 Valle et al. 1982 Tropical savanna (1.7-9.2) (1.7-9.2) 0'Connell 15 2.6 ± 2.7 104.9 FR/OM 22 0'Connell 1981 tenuipes humid forest (0:10.1) 0 1.1 ± 1.1 99.1 FR/OM 22 0'Connell 1981	o. painstits		55		21.1	1 10/0141		
Tropical savanna (1.7-9.2) Neacomys Vcnezucla/Tropical 15 2.6 ± 2.7 104.9 FR/OM 22 O'Connell 1981 tenuipes humid forest (0:10.1) 0 1.1 ± 1.1 99.1 FR/OM 22 O'Connell 1981	0 subflame		40		30 6	FR/OM		Valle et al 1087
Neacomys Vcnezucla/Tropical 15 2.6 ± 2.7 104.9 FR/OM 22 O'Connell 1981 tenuipes humid forest (0:10.1) 0	c. subjiaras		- T U		39.0	I N/OM	12	valle et al. 1702
tenuipes humid forest (0:10.1) Rhipidomys Venezuela/Tropical 100 1.1 ± 1.1 99.1 FR/OM 22 O'Connell 1981	Neacomys		15		104.9	FR/OM	22	O'Connell 1981
Rhipidomys Venezuela/Tropical 100 1.1 ± 1.1 99.1 FR/OM 22 O'Connell 1981	-	· •	15		104.7	TR/OW	22	6 Conneil 1701
			100		00.1	FR/OM	22	O'Connell 1091
	nastacalis	humid forest	100	(0.3-5.0)	77.1	I'R/OM	<i>44</i>	Comment 1761

O'CONNELL

Family/species	Locality/ Habitat	Mass (grams)	Density* (Range)	CV **	Trophic Category ***	Length of Study (mo)	Source
Rhipidomys sp.	Venezuela/	80	1.6 ± 1.3	81.2	FR/OM	26	O'Connell 1981
Knipidomys sp.	Tropical savanna	80	(0.0-5.0)	01.2	I'R/OW	20	O Connen 1981
Thomasomys	Brazil/Tropical	90	(0.0-5.0)	49.1	FR/GR	9	Davis 1945
lorsalis	moist forest	, , ,		49.1	r n, on	,	Duvis 1745
4kodon	Brazil/Tropical	35	++	70.4	FR/HB	9	Davis 1945
arviculoides	moist forest	50		/0.1	1 11,112		24101910
A. azarae	Argentina/	24	97.2 ± 42.0	43.2	FR/HB	17	Dalby 1975
	Temperate grassland		35.8-178.3)		,	(36)	-
A. longipilis	Argentina/	37	3.2 ± 0.61	19.1	FR/OM	23	Pearson & Pearson
	Temperate forest		(2.8-3.9)			(3)	1982
	Argentina/	37	5.5 ± 3	54.6	FR/OM	23	Pearson & Pearson
	Temperate forest		(3.1-9.4)			(4)	1982
	Argentina/	37	4.4 ± 5.6	127.3	FR/OM	23	Pearson & Pearson
	Temperate forest		(0.4-10.8)			(3)	1982
	Chilc/Temperate	51	7.1 ± 1.7	23.6	IN/OM	10	Fulk 1975
	scrub grassland		(4.8-8.7)			(4)	
	Chile/Temperate	51	2.8 ± 0.8	28.1	IN/OM	15	Meserve 1981
	scrub grassland		(1.4-3.6)			(8)	
	Chile/	51	11.4 ± 5.8	51.0	IN/OM	53	Meserve et al. 1982
	Temperate forest	- 1	(0.0-21)	22.6	TNUON ((27)	+ pers. comm.
	Chile/	51	12.6 ± 4.1	32.6	IN/OM	16	Meserve et al. 1982
	Temperate forest	<i>c</i> 1	(6.2-21.0)	162.2	DUON	60	+ pers. comm.
	Chile/Temperate	51	2.4 ± 3.9	157.7	IN/OM	53	Murúa and Meserve
	rain forest Chile/Temperate	51	(0.0-24.0) 3.5 ± 3.4	96.8	IN/OM	(47) 53	pers. comm. Murúa and Meserve
	grassland	51	(0.0-15.0)	90.0	IN/OM	(46)	pers. comm.
4. olivaceus	Argentina/	25	(0.0-13.0) 3.1 ± 3.2	102.4	FR/OM	23	Pearson & Pearson
4. Onvaceus	Temperate forest	23	(0.0-7.2)	102.4	I'R/OM	(4)	1982
	Chile/Temperate	31	10.5 ± 4.9	46.7	IN/OM	7	Fulk 1975
	scrub grassland	51	(6.3-15.9)	10.7	111/011	(3)	1 ulk 1975
	Chile/Temperate	30	67.2 ± 28.3	42.1	IN/OM	10	Fulk 1975
	scrub grassland	50	(30.3-97.0)	.2.1	nų oni	(4)	
	Chile/Temperate	30	16.5 ± 7.5	45.2	IN/OM	15	Meserve 1981
	scrub grassland	•••	(7.1-31.4)			(8)	
	Chile/	30	17.6 ± 11.4	64.8	IN/OM	53	Meserve et al. 1982
	Temperate forest		(1.2-45.9)			(27)	+ pers. comm.
	Chile/	30	29.6 ± 15.4	52.0	IN/OM	16	Meserve et al. 1982
	Temperate forest		(11.1-55.6)				+ pers. comm.
	Chile/Temperate	30	17.3±15.9	92.1	IN/OM	53	Murúa and Meserve
	rain forest		(1.0-60.0)			(46)	pers. comm.
	Chile/Temperate	30	16.1 ± 12.6	78.2	IN/OM	53	Murúa and Meserve
	grassland		(1.0-67.0)			(47)	pers. comm.
A. nigrita	Brazil/Tropical	40	+ +	60.6	FR/HB	9	Davis 1945
	moist forest						
A. sanborni	Chile/	30	3.1± 3.6	117.8	IN/OM	53	Meserve et al. 1982
	Temperate forest		(0.0-16.0)			(27)	+ pers. comm.
	Chile/	30	2.6 ± 1.6	62.0	IN/OM	16	Meserve et al. 1982
	Temperate forest		(1.2-6.2)				+ pers. comm.
A. urichi	Venezuela/Tropical	55	2.9±1.7	59.0	FR/HB	22	O'Connell 1981
7 1 .	humid forest		(0.6-5.9)	100 7		24	010
Zygodontomys brevicauda	Venezuela/	40	9.8 ± 13.1	133.7	FR/OM	26	O'Connell 1981
	Tropical savanna Venezuela/Tropical	40	(0.0-40.0) 0.6 ± 0.6	100.0	FR/OM	16	August 1981
	· •	40		100.0	FR/OM	10	August 1981
Polomun Inniumun	dry forest	40	(0.0-1.8) 10.7 ± 11.3	105 6	FR/OM	19	Mello 1980
Bolomys lasiurus (= Zygodontomys)	Brazil/ Tropical savanna	-+0	(0.0-42.0)	105.0		17	
B. lasiurus	Brazil/	40	(0.0-42.0) 8.6 ± 5.6	64.8	FR/OM	12	Valle <i>et al.</i> 1982
6. lasiurus (= Zygodontomys)	Tropical savanna	-10	(1.7-16.7)	07.0	1 10/044	12	. and cr ut. 1702
(= 2 ygodoniomysj Calomvs	Brazil/	25	(1.7-10.7) 11.1 ± 7.7	69.6	FR/OM	24	Mello 1980
callosus	Tropical savanna	25	(2.7-32.7)	07.0		21	
C. musculinus	Argentina/	12	(2.7-52.7) 1.9 ± 1.8	94.7	FR/OM	17	Dalby 1975
	Temperate grassland	12	(0.0-62.0)	24.1		(36)	
	remperate stassianu						
Oxymycterus	Argentina/	90	5.6 ± 2.2	39.3	IN/OM	17	Dalby 1975

.

Family/species	Locality/ Habitat	Mass (grams)	Density* (Range)	CV **	Trophic Category ***	Length of Study (mo) ⁺	Source
Irenomys	Argentina/	43	2.9 ± 1.9	65.5	HB/BR	23	Pearson & Pearson
tarsalis	Temperate forest		(1.4-5.1)			(3)	1982
Auliscomys	Argentina/	78	3.7 ± 1.8	48.6	FR/HB	23	Pearson & Pearson
micropus	Temperate forest		(0.0-4.1)	•		(4)	1982
Phyllotis	Chile/Temperate	51	41 ± 7.9	19.3	FR/GR	10	Fulk 1975
darwini	scrub grassland		(29.4-46)			(4)	
	Chile/Temperate	50	2.7 ± 1.9	70. 4	FR/GR	7	Fulk 1975
	scrub grassland		(0.6-4.4)			(3)	
	Chile/Temperate	50	9.8 ± 6.0	61.3	FR/GR	15	Meserve 1981
	scrub grassland		(4.3-21.4)			(8)	
Holochilus	Argentina/	160	3.7 ± 3.5	94.6	HB/GR	17	Dalby 1975
brasiliensis	Temperate grassland		(0.0-10.7)			(36)	
Sigmodon	Venezuela/	55	1.5 ± 1.4	94.2	HB/BR	26	O'Connell 1981
alstoni	Tropical savanna		(0.0-4.3)				
CAVIIDAE							
Microcavia	Argentina/	360	23.5 ± 7.5	32.1	HB/GR	11	Rood 1972
australis Cavia anonos	Temperate grassland	50 <i>5</i>	(8.3-33.3)			(8)	
Cavia aperea	Argentina/	525	20.6 ± 16.4	79.8	HB/GR	11	Rood 1972
	Temperate grassland		(8.3-39.2)			(3)	
OCTODONTIDAE							
Octodon degus	Chile/Temperatc scrub grassland	210	3.6 ± 1.3	36.1	HB/BR	7 (3)	Fulk 1975
	Chile/Temperate	210	(2.5-5.0) 29.1 ± 23.5	81.0	HB/BR		Meserve et al. 1984
	scrub grassland	210	(6.3-64.2	01.0	IID/ DK	(5)	Meselve et ut. 1904
	Chile/Temperate	210	34.1 ± 17.4	51.0	HB/BR		Meserve et al. 1984
	scrub grassland	210	(10.0-63.0)	51.0	IID, DR	(14)	11050110 01 41. 1904
	Chile/Temperate	210	21.1 ± 10.5	50.0	HB/BR		Jaksić <i>et al</i> . 1981
	scrub grassland	210	(11.6-39.2	50.0	ΠD/DIX	(10)	Jaksie er ut. 1901
ABROCOMIDAE							
Abrocoma bennetti	Chile/Temperate	275	1.6 ± 1.3	80.1	FR/HB		Meserve pers. comm
ECHIMYIDAE	scrub grassland		(0.0-3.6)			(8)	
		225		25.5	ED/CD	22	01011 100 1
Proechimys	Venezuela/Tropical	325	4.4 ± 1.1	25.5	FR/GR	22	O'Connell 1981
guairae	humid forest		(2.5-6.1)				
P. guyannensis	Trinidad/Tropical	350	10.5 ± 1.5	13.9	FR/GR		Everard &
	evergreen forest		(9.2-13.0)				Tikasingh 1973
P. semispinosus	Panama/Tropical	280	3.6 ± 1.7	46.6	FR/GR	13	Fleming 1971
	moist forest		(1.0-5.8)				
P. semispinosus	Panama/Tropical	300	2.1 ± 1.3	61.9	FR/GR	13	Fleming 1971
-	dry forest		(0.6-3.9)				-
Thrichomys	Brazil/Tropical	300	5.4 ± 4.2	77.8	FR/HB	14	Streilein 1982
peroides	thorn scrub		(0.0-10.8)				

* no/ha ± 1 SD

** CV = Coefficient of variation; calculated prior to rounding mean density estimates

*** FR/GR = frugivore/granivore; FR/OM = frugivore/omnivore; IN/OM = insectivore/omnivore; FR/HB = frugivore/ herbivore; HB/BR = herbivore/browser; HB/GR = herbivore/grazer.

+ numbers in parentheses refer to number of censuses during study, if not equal to duration of study in months.

++ only capture frequencies available.

O'CONNELL

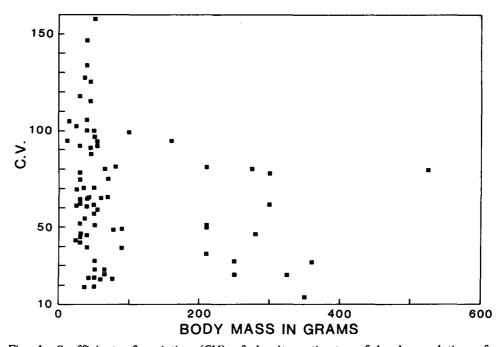


Fig. 1. Coefficient of variation (CV) of density estimates of local population of Neotropical rodents plotted against body mass (r = -0.24; df = 75; P < 0.05). Coeficientes de variación (CV) de los estimadores de densidad de poblaciones locales de roedores neotropicales graficados contra sus masas corporales (r = -0.24; gl = 75; P < 0.05).

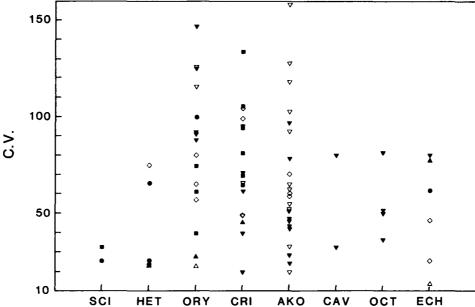


Fig. 2. The relation between coefficient of variation (CV) of density estimates and habitat association for Neotroplical rodent taxa. \blacksquare = Tropical savannah; \bullet = Tropical dry forest; \diamond = Tropical humid forest; \triangle = Tropical wet forest; \blacktriangle = Tropical desert; \triangledown = 'Temperate grassland; \triangledown = Temperate forest. Sci = Sciuridae; Het = Heteromyidae; Ory = Oryzomys; Cri = Cricetidae (exclusive of Oryzomys and Akodon); Ako = Akodon; Cav = Caviidae; Oct = Octodontidae; Ech = Echimyidae + Abrocomidae.

Relación entre el coeficiente de variación (CV) de los estimadores de densidad y la asociación al hábitat de roedores neotropicales. \blacksquare =Sabana tropical; \blacksquare =Bosque tropical seco \diamond = Bosque tropical húmedo; \triangle = Bosque tropical perhúmedo; \blacktriangle =Desierto tropical; \blacksquare =Pradera templada; \heartsuit =Bosque tropical húmedo; do. Sci = Sciuridae; Het = Heteromyidae; Ory = Oryzomys; Cri = Cricetidae (excepto Oryzomys y Akodon); Ako = Akodon; Cav = Caviidae; Oct = Octodontidae; Ech = Echymyidae + Abrocomidae.

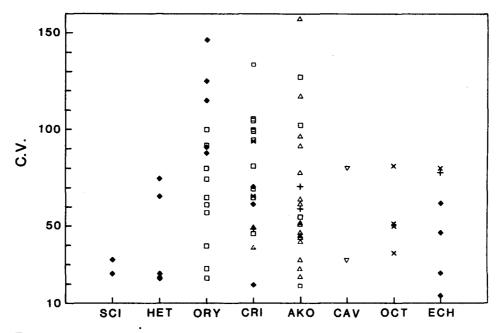


Fig. 3. The relation between coefficient of variation (CV) of reported density estimates and trophic category (following Eisenberg 1981) for neotropical rodent taxa. $\Box =$ Frugivore/omnivore; + = Frugivore/herbivore; $\blacklozenge =$ Frugivore/granivore; $\bigtriangleup =$ Insectivore/ omnivore; x = Herbivore/browser; $\nabla =$ Herbivore/grazer. Taxon abbreviations as in Figure 2.

Relación entre el coeficiente de variación (CV) de los estimadores de densidad y la categoría trófica (de acuerdo a Eisenberg 1981) de roedores neotropicales. $\Box = \text{Frugívoro/omnívoro}; + = \text{Frugívoro/herbívoro}; = \text{Frugívoro/granívoro}; \triangle = \text{Insectívoro/omnívoro}; x = \text{Herbívoro/ramo-neador}; \nabla = \text{Herbívoro/pastoreador}.$ Las abreviaciones para los roedores son las mismas que en la Figura 2.

TABLE 2

Comparison (one-way Analysis of Variance) of mean coefficients of variation (CV) for density estimates of Neotropical rodents with taxon, habitat, and trophic category. Sample size shown in parentheses. Abbreviations for trophic category as in Table 1. Means joined by lines are not significantly different (Student-Newman-Keuls Test).

Comparación (mediante análisis de varianza de una vía) de los coeficientes medios de variación (CV) para los estimadores de densidad de roedores neotropicales, de acuerdo al taxón, hábitat y categoría trófica. Los tamaños muestrales van entre paréntesis. Las abreviaciones para las categorías tróficas son las mismas que en la Tabla 1. Las medias conectadas por la misma línea no difieren significativamente entre sí (prueba de Student-Newman-Keuls).

TAXON MEAN CV		HABITAT	MEAN CV	TROPHIC MEAN O		
Cricetidae	73.8 (58)	Temperate forest	83.1 (17)	FR/OM	76.0 (24)	
Caviidae	55.9 (2)	Tropical savanna	75.7 (10)	HB/GR	68.5 (3)	
Octodontidae	54.5 (4)	Tropical humid forest	66.0 (12)	HB/BR	65.4 (7)	
Echimyidae + Abrocoma	51.0 (6)	Temperate grassland	64.4 (25)	IN/OM	64.4 (16)	
Heteromyidae	42.6 (5)	Tropical dry forest	57.5 (7)	FR/GR	62.4 (21)	
Sciuridae	29.0 (2)	Tropical desert	50.7 (3)	FR/HB	59.9 (6)	
F = 2.16 (P < 0.0)		Tropical wet forest $F = 2.25$ (P < 0.05)	20.1 (3)	$F = 0.50 (P < 10^{-1})$	0.78)	

Intra-taxon Comparisons

In addition to these general trends, examination of Table 1 and Figures 2 and 3 suggests considerable intra-taxon population variability. Some of this variation can be attributed to habitat and/or trophic differences; other cases are less clear cut.

The family Heteromydae includes two Neotropical genera, *Liomys* and *Heteromys*. Both genera are frugivorous/granivorous, but the former is commonly associated with more xeric habitats (Fleming 1971, 1974, Genoways 1973) as compared to the latter (Rood & Test 1968, Fleming 1974, Handley 1976). Comparison of the CV's (Table 1, Figure 2) indicates that populations of *Liomys* from tropical dry forests and of *Heteromys* from mesic tropical forests are less variable than populations of *Heteromys* from more xeric tropical forests.

Proechimys is a common rodent in the forests of Central and northern South America, and typically contributes a large percentage of the non-volant small mammalian biomass (Gliwicz 1973, Eisenberg et al. 1979, Emmons 1982). Densities of Proechimys species vary between habitats (Gliwicz 1973, Eisenberg et al. 1979, Emmons 1982) as well as seasonally. Part of the difference in population variability observed (Table 1) might relate to sampling procedures. For example, more pronounced seasonal fluctuations were observed in Panamá (Fleming 1971) than in Venezuela (O'Connell 1981) or Trinidad (Everard & Tikasingh 1973). However, Fleming's year-long trapping began and ended in June (early wet season) when these animals are least likely to be trapped (Leigh & Smythe 1978), which would magnify apparent fluctuations.

The genus Oryzomys is widespread throughout the Neotropics and extends into the Nearctic. Rice rats have radiated into numerous habitats and several species are often sympatric (Fleming 1970). The highest mean densities of Oryzomys were observed in temperate grasslands and relatively aseasonal tropical forests (Table 1, Figure 2). In seasonal tropical forests, populations of O. capito were highest during the early to midwet season (Fleming 1971, O'Connell 1981). In contrast, population levels of Oryzomys from seasonal tropical savannahs were highest during the dry period (Valle et al. 1982). Oryzomys

populations from temperate grasslands and forests exhibit highest densities during autumn-winter months (Dalby 1975, Murúa *et al.*, in press). Clark (1980) suggested that populations of *Oryzomys* in tropical deserts and forests are more stable than those from temperate regions. Examination of Figure 2 indicates that this general trend is supported. Intra-specific differences (e.g., *O. capito*) in population variability are also related to habitat (Table 1).

The genus Akodon has radiated into a variety of habitats in the Neotropics. Seasonal fluctuations in populations of Akodon species have been observed in both temperate (Dalby 1975, Murúa & González 1985) and tropical (Davis 1945, O'Connell 1981) habitats. Examination of Figure 2 suggests no outstanding relationship between population variability and habitat. Akodon populations from temperate grasslands are somewhat less variable than those from tropical forests, but populations from temperate forests exhibit a tremendous range of variability. In the temperate habitats two or more Akodon species may be sympatric, and although densities differ, there is little relationship between density and variability. In some cases the numerical dominant exhibits greater variability than the less common species, but in others, the reserve is true (Table 1). Food habits vary between Akodon species (Figure 3) and within species (e.g., A. longipilis) from different areas (Meserve 1981, Pearson 1983). Again, there is no clear trend between population variability and trophic category. For example, although most populations of the insectivorous/omnivorous Akodon had lower CV's than other trophic categories, one population had the highest CV of any examined (Figure 3). However, it should be noted that in this case (A. longipilis; Murúa and Meserve, personal communication), the population had remained low ($\bar{x} = 1.8/ha$) throughout most of the study and increased substantially (x = 17.5/ha) for a two month period. Meserve (1981) suggested that sympatric Akodon species in Chile overlap in habitat use but exhibit dietary specialization. Glanz (1984) related dietary differences to morpholocial characteristics but suggested sympatric Akodon species exhibit microhabitat specialization as well. Removal experiments with these species indicate that interspecific competition plays a minimal role in affecting population

dynamics (Murua and Meserve, personal communication). Unraveling the factors influencing the population dynamics of this genus will depend on ongoing studies.

Neotropical rodents of a variety of taxa from different habitats periodically exhibit dramatic fluctuations in population size or "ratadas". These outbreaks have been recorded, for example, in Akodon and Calomys from temperate grasslands in Argentina (Crespo 1944, 1966, Dalby 1975); Oryzomys and Phyllotis from coastal Peru and Chile (Gilmore 1947, Pearson 1975, Pefaur et al. 1979); and Zygodontomys from tropical savannahs in Venezuela (O'Connell 1982). Although the factors underlying these outbreaks vary between habitats, they are typically associated with local climatic or resource conditions (e.g., increased rainfall, effects of el Niño, seed set of bamboo, annual patterns of flooding). The close correlation of these outbreaks with local conditions and their irregular timing suggest that they are irruptions rather than cyclic fluctuations.

Assessment of the temporal dynamics of rodent populations must include consideration of numerous factors (e.g., Jaksić et al. 1981, Asher & Thomas 1985) and for Neotropical populations will depend on a database of long-term studies from many habitats. I have limited my treatment only to very general comparisons: body mass, taxon, broad habitat association, and simplified trophic category. These comparisons suggest that population variability is inversely related to body mass and that habitat exerts an influence on population variability in these rodents. French et al. (1975) reviewed the demographic patterns of small mammals on a worldwide basis and concluded that taxonomic groups were characterized by different degrees of population stability. For example, populations of Murids and microtines were classified as high density (66-118/ha) and unstable, whereas populations of cricetines, Heteromyids, and Sciurids were considered low density (7-15/ha) and stable (French et al. 1975). Their review included few Neotropical rodent species, reflecting the paucity of data at that time. My results indicate that whereas Neotropical Sciurids and Heteromyids generally fit the above conclusion, generalizations become more difficult when comparisons are focused within the cricetines. Populations of some

cricetines are found at relatively low and stable densities whereas others (even conspecifics in different habitats) are characterized by greater and highly variable densities. This variability is attributable to the responsiveness of local populations to microhabitat differences and the effects of seasonal and yearly climatic patterns on resource abundance and distribution.

ACKNOWLEDGMENTS

I thank P.L. Meserve and R. Murúa for access to unpublished data and J.G. Hallett, B.J. Weddell, and P.L. Meserve for comments on the manuscript.

LITERATURE CITED

- ASHER SC & VG THOMAS (1985)Analysis of temporal variation in the diversity of a small mammal community. Canadian Journal of Zoology 63: 1106-1109.
- AUGUST PV (1981) Population and community ecology of small mammals in northern Venezuela. PhD Thesis, Boston University, Boston, Massachusetts.
- CLARK DB (1980) Population ecology of an endemic Neotropical island rodent: Oryzomys bauri of Santa Fe Island, Galapagos, Ecuador. Journal of Animal Ecology 49: 185-198.
- CRESPO JA (1944) Relaciones entre estados climáticos y la ecología de algunos roedores del campo (Cricetidae). Revista Argentina Zoogeográfica 41: 137-144.
- CRESPO JA (1966) Ecología de una comunidad de roedores silvestres en el Partido de Rojas, Provincia de Buenos Aires. Revista del Museo argentino de Ciencias Naturales "Bernardino Rivadavia" Ecología 1: 79-134.
- DALBY PL (1975) Biology of Pampa rodents, Balcarce Area, Argentina. Publications of the Museum, Michigan State University, Biological Series 5: 149-272.
- DAVIS DE (1945) The annual cycle of plants, mosquitoes, birds, and mammals in two Brazilian forests. Ecological Monographs 15: 244-295.
- EISENBERG JF, MA O'CONNELL & PV AUGUST (1979) Density, productivity, and distribution of mammals in two Venezuelan habitats. In Eisenberg JF (Ed) Vertebrate ecology in the northern Neotropics: 187-207. Smithsonian Institution Press, Washington, D.C.
- EISENBERG JF (1981) The mammalian radiations. University of Chicago Press, Chicago, Illinois.
- EMMONS LH (1982) Ecology of *Proechimys* (Rodentia, Echimyidae) in southeastern Peru. Tropical Biology 23: 280-290.
- EVERARD COR & ES TIKASINGH (1973) Ecology of the rodents Proechimys guyannensis trinatatis and Oryzomys capito velutinus on Trinidad. Journal of Mammalogy 54: 875-886.
- FLEMING TH (1970) Notes on the rodent faunas of two Panamanian forests. Journal of Mammalogy 51: 473-490.
- FLEMING TH (1971) Population ecology of three species of Neotropical rodents. Miscellaneous Publica-

tions of the Museum of Zoology, University of Michigan 143: 1-77.

- FLEMING TH (1974) The population ecology to two species of Costa Rican Heteromyid rodents. Ecology 55: 493-510.
- FLEMING TH (1975) The role of small mammals in tropical ecosystems. In Golley FB, K Petrusewicz & L Ryszkowski (Eds) Small mammals: their productivity and population dynamics: 269-298. Cambridge University Press, Cambridge.
- ge. FRENCH NR, DM STODDART & B BOBEK (1975) Patterns of demography in small mammal population. In Golley FB, K Petrusewicz & L Ryszkowski (Eds) Small mammals: their productivity and population dynamics: 73-102. Cambridge University Press, Cambridge.
- FULK GW (1975) Population ecology of rodents in the semiarid shrublands of Chile. Occasional Papers, The Museum, Texas Tech University 33: 1-40.
- GENOWAYS HH (1973) Systematics and evolutionary relationships of spiny pocket mice, genus *Liomys*. Special Publications of The Museum, Texas Tech University 5: 1-368.
- GILMORE RM (1947) Cycle behavior and economic importance of the rata-muca (*Oryzomys*) in Peru. Journal of Mammalogy 28: 231-241.
- GLANZ WE (1984) Ecological relationships of two species of *Akodon* in central Chile. Journal of Mammalogy 65: 433-441.
- GLIWICZ J (1973) A short characteristic of a population of *Proechimys semispinosus* (Tomes, 1860) - a rodent of the tropical rain forest. Bulletin de L'Academie Polonaise des Sciences, Biology Series 21: 413-418.
- HANDLEY CO Jr (1976) Mammals of the Smithsonian Venezuela Project. Brigham Young University Science Bulletin, Biology Series, 20: 1-91.
- HONACKI JH, KE KINMAN & JW KOEPPL (1982) Mammal species of the world. Allen Press, Inc. and The Association of Systematics Collections, Lawrence, Kansas.
- JAKSIC FM, JL YAÑEZ & ER FUENTES (1981) Assessing a small mammal community in central Chile. Journal of Mammalogy 62: 391-396.
- KARR JR (1982) Population variability and extinction in the avifauna of a tropical land bridge island. Ecology 63: 1975-1978.
- LEIGH EG Jr. & N SMYTHE (1978) Leaf production, leaf consumption and the regulation of folivory on Barro Colorado Island. In Montgomery GG (Ed) The ecology of arboreal folivores: 33-50. Smithsonian Institution Press, Washington, D.C.
- MCNAB BK (1980) Food habits, energetics, and the population biology of mammals. American Naturalist 116: 106-124.
- MELLO DA (1980) Estudo poblacional de algunas especies de roedores do cerrado (norte do Municipio de Formosa, Goias). Revista Brasileira de Biología 40: 843-860.
- MESERVE PL (1981) Resource partitioning in a Chilean semi-arid small mammal community. Journal of Animal Ecology 50: 745-757.
- MESERVE PL, R MURUA, O LOPETEGUI & JR RAU (1982) Observations on the small mammal fauna of a primary temperate rainforest in

southern Chile. Journal of Mammalogy 63: 315-317.

- MESERVE PL, RE MARTIN & J RODRIGUEZ (1984) Comparative ecology of the caviomorph rodent Octodon degus in two Chilean mediterraneantype communities. Revista Chilena de Historia Natural 57: 79-89.
- MURUA R & LA GONZALEZ (1985) A cycling population of Akodon olivaceus (Cricetidae) in a temperate rain forest in Chile. Acta Zoologica Fennica 173: 77-79.
- MURUA R, LA GONZALEZ & PL MESERVE (in press) Population biology of Oryzomys longicaudatus philippii (Rodentia: Cricetidae) in southern Chile. Journal of Animal Ecology.
- NEGUS NC, E GOULD & RK CHIPMAN (1961) Ecology of the rice rat *Oryzomys palustris* (Harian), on Breton Island, Gulf of Mexico, with a critique of the social stress theory. Tulane Studies in Zoology 8: 95-123.
- O'CONNELL MA (1981) Population ecology of small mammals from northern Venezuela. PhD Thesis, Texas Tech University, Lubbock, Texas
- O'CONNELL MA (1982) Population biology of North and South America grassland rodents: A comparative review. In Mares MA & HH Genoways (Eds) Mammalian biology in South America: 167-185. Special Publication Series, Pymatuning Laboratory of Ecology, University of Pittsburgh Press, Pittsburgh, Pennsylvania.
- PEARSON OP (1975) An outbreak of mice in the coastal desert of Peru. Mammalia 39: 376-386.
- PEARSON OP (1983) Characteristics of a mammalian fauna from forests in Patagonia, southern Argentina. Journal of Mammalogy 64: 476-492.
- PEARSON OP & AK PEARSON (1982) Ecology and biogeography of the southern rainforests of Argentina. In Mares MA & HH Genoways (Eds) Mammalian biology in South America: 129-142. Special Publication Series, Pymatuning Laboratory of Ecology, University of Pittsburgh Press, Pittsburgh.
- PEFAUR JE, JL YAÑEZ & FM JAKSIC (1979) Biological and environmental aspects of a mouse outbreak in the semi-arid region of Chile. Mammalia 43: 313-322.
- ROOD JP (1972) Ecological and behavioral comparisons of the three genera of Argentine cavies. Animal Behavior Monographs 5: 1-83.
- ROOD JP & FH TEST (1968) Ecology of the spiny rat, Heteromys anomalus, at Rancho Grande, Venezuela. American Midland Naturalist 79: 89-102.
- SOKAL RR & FJ ROHLF (1981) Biometry. Second edition, WH Freeman and Company, San Francisco, California.
- STREILEIN KE (1982) The ecology of small mammals in the semi-arid Brazilian Caatinga. III. Reproductive biology and population ecology. Annals of the Carnegie Museum 51: 251-269.
- VALLE CM, MC ALVES, IB SANTOS & JBH VAREJAO (1982) Observações sobre dinâmica de pobulação de Zygodontomys laziurus (Lund, 1841), Calomys expulsus (Lund, 1841) e Oryzomys subflavus (Wagner 1842) em vegetação de cerrado no Vale das Velhas (Prudence de Morais, Minas Gerais, Brasil - 1981) Rodentia = Cricetidae. Revista Lundiana 2: 71-83.