

MAMMALS FROM EJIDO RANCHITOS, COLIMA, MEXICO

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ABSTRACT—The state of Colima in western Mexico is part of the transition zone between the two biogeographic regions of America, the Nearctic and the Neotropical. The state has particularly high mammalian diversity (128 species) and is in the area with the greatest concentration of endemic species in Mexico (25%). As a result, there is intrinsic scientific interest in the study of mammals of Colima. However, the mammalian fauna has received only limited attention to date. There is no published comprehensive inventory of mammals of Colima and only a few detailed reports of the species that occur at any given location within the state have been published. As a contribution to the knowledge of mammals present in Colima, data were compiled on the mammals of Ejido Ranchitos, municipality of Minatitlán, and the species were characterized. We recorded 35 species, 9 monotypic and 26 polytypic, gathering information on natural history and reproductive condition for each. These represent 27.3% of species of mammals known from Colima and 7.4% of the total for Mexico. Eleven species were endemic, comprising 31.4% of species captured for Ejido Ranchitos and 6.5% of the endemic species for Mexico. Nonvolant mammals exhibited three reproductive patterns: continual polyestrous (10 species, 28.6%), seasonal polyestrous (4, 11.4%), and seasonal monoestrous (3, 8.6%). Reproductive patterns for bats were seasonal monoestrous (7 species, 20.0%), asynchronous continual polyestrous (7, 20.0%), bimodal polyestrous (2, 5.7%), continual polyestrous (1, 2.9%), and asynchronous monoestrous (1, 2.9%). Three of the species we examined (*Heteromys spectabilis*, *Neotoma mexicana tenuicauda*, and *Peromyscus hylocetes*) have not been reported previously for Colima. Overall, Ejido Ranchitos supports a diverse fauna of small-sized and medium-sized mammals.

RESUMEN—El estado de Colima se localiza en el oeste de México y forma parte de la zona de transición entre las dos grandes regiones biogeográficas del continente americano, la Neártica y la Neotropical. Este estado tiene una alta biodiversidad de mamíferos (128 especies) y se encuentra dentro del área con mayor concentración de especies endémicas (25%) de México. Como resultado, existe un interés científico en el estudio de los mamíferos de Colima. Sin embargo, esta fauna ha recibido poca atención a la fecha y no existe un inventario completo. Sólo unos pocos reportes detallados de las especies en ciertas localidades en el estado han sido publicados. Por esto, deseamos contribuir al conocimiento de los mamíferos del estado de Colima y para tal fin realizamos un inventario del ejido Ranchitos, municipio de Minatitlán. Registramos 35 especies, 9 monotípicas y 26 politípicas, y reunimos información de su historia natural y condición reproductiva. Estas especies representan 27.3% de las especies conocidas de mamíferos para Colima y 7.4% del total para México. Once especies fueron endémicas y representan 31.4% del total capturado y 6.5% de las especies endémicas de México. Los mamíferos no voladores exhibieron tres patrones reproductivos: poliestro continuo (10 especies, 28.6%), poliestro estacional (4, 11.4%) y monoestro estacional (3, 8.6%), mientras que los murciélagos presentaron cinco patrones reproductivos: monoestro estacional (7 especies, 20.0%), poliestro continuo asincrónico (7, 20.0%), poliestro bimodal (2, 5.7%), poliestro continuo (1, 2.9%) y monoestro asincrónico (1, 2.9%). Capturamos tres nuevas especies (*Heteromys spectabilis*, *Neotoma mexicana tenuicauda*, y *Peromyscus hylocetes*) para el estado de Colima. En conclusión, el ejido Ranchitos alberga una gran diversidad de mamíferos de tamaño pequeño y mediano.

Mexico is an exceptional country in biodiversity and endemism, with 475 species of terrestrial mammals and 169 endemic species (Ramírez-Pulido et al., 2005), which includes 8.8% of the total mammal species in the world (Wilson and Reeder, 2005). The relatively large number of species results from presence of species of tropical and temperate origin, as well as the diverse topography of the country and the influence of maritime currents. In mammalian diversity, Mexico occupies the third place in the world (Ceballos and Oliva, 2005), and the southeastern region of Mexico and the Pacific coast, especially the area encompassing the states of Nayarit to Michoacán, have a particularly high concentration of endemic species, ca. 25% of the total (Ramírez-Pulido and Müdespacher, 1987; Fa and Morales, 1993; Ceballos and Oliva, 2005).

The fact that the Pacific coast is a hotspot for mammalian diversity makes it important that we develop a full understanding of the fauna. In particular, there have been relatively few studies of the mammals of Colima. There are reports on distribution of several species, but most are for bats. Villa-Ramírez (1966) listed 37 species of bats in Colima in an inventory of bats of Mexico, Kennedy et al. (1984) published a list of the bats of Colima, particularly from Playa de Oro and El Cóbano, García Ruiz (2000) registered 40 species of mammals for western Colima, Alcántara Quintana (2001) listed 29 species of bats and rodents of Tecomán, Sánchez-Hernández et al. (2002) reported 13 new records of bats, and González-Ruiz et al. (2004) included records of three more species of rodents for the state. As a result of these investigations, the overall list of mammals from Colima includes 128 species, which represent 26.9% of the 475 species for Mexico. Given the importance of the state of Colima as a result of it being in a zone with great diversity and that most locations have received scant attention, our objectives were to conduct a detailed taxonomic inventory of the small-sized and medium-sized mammals of Ejido Ranchitos in Colima, and to contribute to the knowledge of natural history of these mammals. We also have documented the occurrence of three species that previously had not been recorded in Colima.

MATERIALS AND METHODS—Study Area—Ejido Ranchitos is in the physiographic province of the Sierra Madre del Sur, subprovince of the Sierras of the Coast of Jalisco and Colima (Instituto Nacional de Estadística, Geografía e Informática, 1996). The climate is semiwarm and subhumid, with rains in summer. Temperature averages

14.3°C for the year; December is the coldest month (10.6°C) and May the warmest (17.1°C). Based on data for 1987–1994 at El Terrero (19°26'46"N, 103°57'05"W, 2,210 m), mean annual precipitation was 1,309 mm, with none in March to 266 mm in August (Instituto Nacional de Estadística, Geografía e Informática, 1996). Trapping sites were close to the Río Juluapan in the Armería-Coahuayana hydrologic region in the Armería River Basin (Instituto Nacional de Estadística, Geografía e Informática, 1996).

The dominant vegetation was tropical deciduous forest with little alteration of the natural environment. Representative plants included guácima (*Guazuma ulmifolia*) and resin (*Bursera bipinnata*). A zone of oaks (*Quercus*) and acacias (*Acacia*) was close to the study localities. Part of the area was dedicated to agriculture, with corn (*Zea mays*) and coffee (*Coffea arabica*) being the main crops (Instituto Nacional de Estadística, Geografía e Informática, 1996). Overall, we set traps within an area of ca. 60 km².

Trapping—We trapped at three localities that were geographically close to one another in the municipality of Minatitlán: 1) 3 km NW Ranchitos, 19°25'27.47"N, 103°59'14.25"W, 1,650 m; 2) 2 km NW Ranchitos, 19°25'04.65"N, 103°58'49.83"W, 1,650 m; and 3) 1 km NW Ranchitos, 19°24'41.82"N, 103°58'25.41"W, 1,550 m (Fig. 1). Trapping occurred 31 December 1997–5 January 1998, with 25 people participating. We used 900 Sherman traps/night, for an overall effort of 4,500 trap-nights. We set traps in transects with intertrap distances of 10–15 m, depending on surface terrain. Traps were baited in the afternoon with oats and checked in the morning. We also set five Tomahawk traps for medium-sized mammals near natural watering places or where animal feces or tracks were observed; these traps were baited with sardines or tuna.

We set 15 mistnets (12 by 2.6 m) for bats for 5 nights (total of 75 net-nights). These were set before dusk near watercourses or in vegetation, and checked at intervals until 2400 h; some were left open all night.

Preparation of Specimens and Samples—We preserved skins, skulls, and sometimes skeletons, in addition to some ectoparasites and samples of tissue from heart, muscle, kidney, liver, and embryos. Specimens were deposited in the Instituto de Biología of the Universidad Nacional Autónoma de México, The Museum at Texas Tech University, and the Sam Noble Oklahoma Museum of Natural History at the University of Oklahoma. Standard measurements were taken, and we noted sex, age, habitat, and reproductive condition. We recorded whether females were pregnant and measured the lengths of embryos; for males, we recorded length and width of testes.

Taxonomy—We have based the taxonomy and sequence of names on Wilson and Reeder (2005), but have retained *Artibeus intermedius* as separate from *A. lituratus*, and *Dermanura* as separate from *Artibeus*. While Simmons (2005) did not recognize *A. intermedius* as a species, or even as a subspecies of *A. lituratus*, we judge there to be ample supporting evidence—based on the literature as well as our own experience—to recognize *A. intermedius* as a separate species. Our treatment is supported by Wilson's (1991) evaluation of the nomenclatorial status of the taxon and by Ramírez-

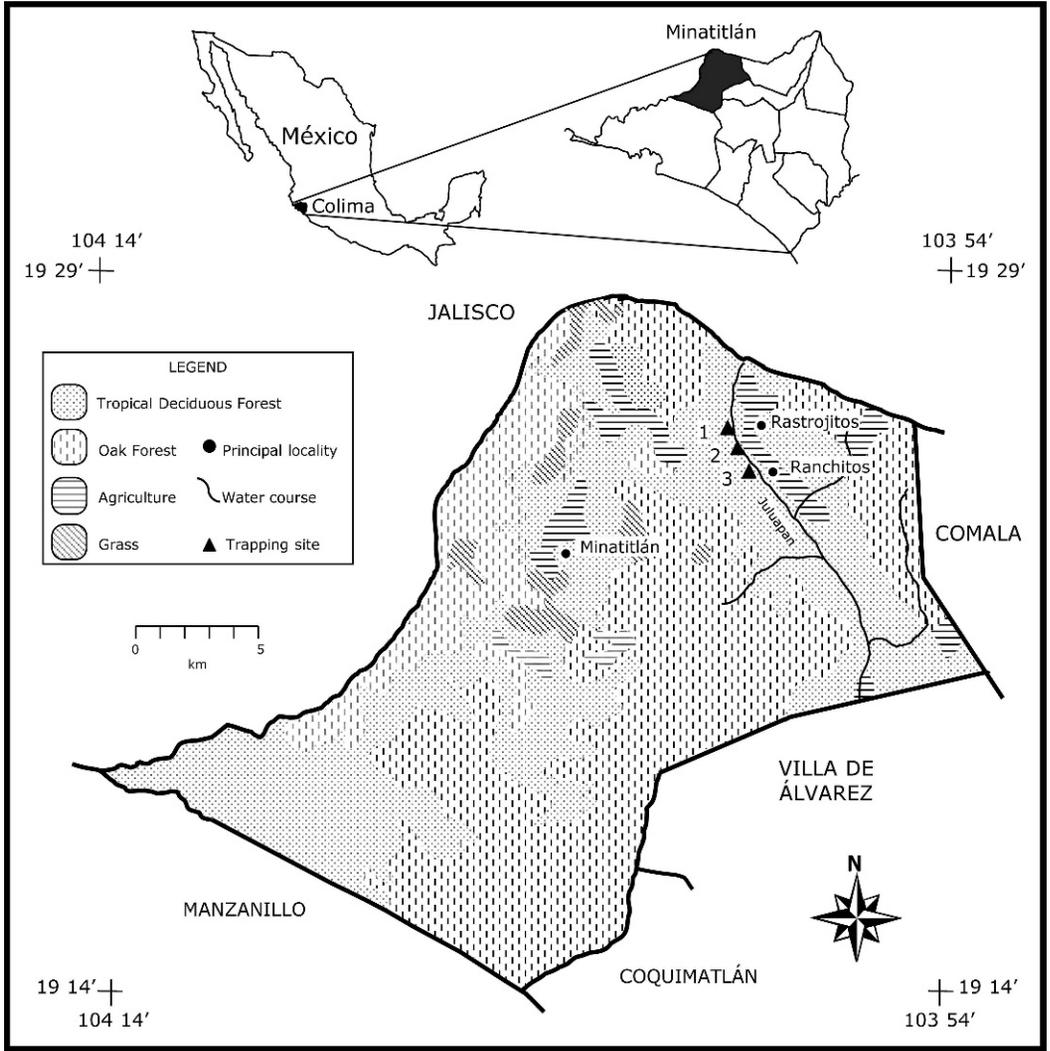


FIG. 1—Locations of trapping sites where mammals were studied at Ejido Ranchitos, Colima, Mexico. Inset map indicates location of Colima in Mexico (upper left) and municipality of Minatitlán (upper right) in Colima.

Pulido et al. (2005), who included the species in their treatment of the mammals of Mexico and of the state of Colima. Simmons (2005) did not recognize *Dermanura* as generically separate from *Artibeus*, but we follow the approach of Owen (1987) and several subsequent authors (e.g., Baker et al., 2003; Ramírez-Pulido et al., 2005); further justification for recognition of *Dermanura* is provided in Ramírez-Pulido et al. (2005). In addition to the above-listed modifications to the species list of Wilson and Reeder (2005), we here treat *Liomys* as being part of *Heteromys*, following Hafner et al. (2007). Subspecific designations throughout are from Ramírez-Pulido et al. (2005).

RESULTS—Richness—We collected 699 specimens, including 23 from locality 1, 18 from

locality 2, and 658 from locality 3. These represent five orders, 10 families, 26 genera, and 35 species (Table 1), which include 27.3% of the total reported for the state of Colima (128 species; Ramírez-Pulido et al., 2000; Sánchez-Hernández et al., 2002; González-Ruiz et al., 2004), as well as 7.4% of the terrestrial native mammals of Mexico (475 species; Ramírez-Pulido et al., 2005). The orders Didelphimorphia, Soricomorpha, and Carnivora had 1 species (2.85%) each, Rodentia 14 species (40.0%), and Chiroptera 18 species (51.4%).

The best-represented family for nonvolant mammals was Cricetidae with nine genera, and

TABLE 1—Systematic list of mammals from Ejido Ranchitos, Colima, Mexico.

Taxon	Locality ^a			Endemicity and risk ^b	Reproductive pattern ^c
	1	2	3		
Order Didelphimorphia					
Family Didelphidae					
<i>Tlacuatzin canescens</i>	1			Endemic	SM
Order Soricomorpha					
Family Soricidae					
<i>Megasorex gigas</i>	2			Endemic/threatened	SM
Order Chiroptera					
Family Phyllostomidae					
Subfamily Desmodontinae					
<i>Desmodus rotundus murinus</i>	1				ACM
Subfamily Glossophaginae					
<i>Anoura geoffroyi lasiopyga</i>	3				SM
<i>Glossophaga commissarisi hespera</i>	1				CP
<i>Glossophaga soricina handleyi</i>	5				ACP
<i>Leptonycteris nivalis</i>	1		1	Threatened	SM
Subfamily Stenodermatinae					
<i>Sturnira lilium parvidens</i>	47		1		ACP
<i>Artibeus jamaicensis triomylus</i>	135		1		ACP
<i>Artibeus lituratus palmarum</i>	15		6		ACP
<i>Artibeus intermedius intermedius</i>	10				BP
<i>Dermanura azteca azteca</i>			1		ACP
<i>Dermanura phaeotis nana</i>	12				ACP
<i>Dermanura tolteca hespera</i>	33				ACP
<i>Chiroderma salvini scopaeum</i>	2	1			BP
Family Mormoopidae					
<i>Pteronotus parnellii mexicanus</i>	1				SM
Family Molossidae					
<i>Cynomops mexicanus</i>	1			Endemic/protected	SM
Family Vespertilionidae					
Subfamily Vespertilioninae					
<i>Lasiurus blossevillii teliotis</i>	6				SM
<i>Lasiurus intermedius intermedius</i>	3				SM
Subfamily Myotinae					
<i>Myotis albescens</i>	2			Protected	SM
Order Carnivora					
Family Procyonidae					
<i>Procyon lotor hernandezii</i>	1				SM
Order Rodentia					
Family Sciuridae					
<i>Spermophilus annulatus annulatus</i>	3			Endemic	CP
Family Heteromyidae					
<i>Heteromys pictus pictus</i>	41	3			SP
<i>Heteromys pictus plantinarenis</i>	30	2	2		SP
<i>Heteromys spectabilis</i>	26	3	2	Endemic/protected	SP
Family Cricetidae					
Subfamily Neotominae					
<i>Baiomys musculus musculus</i>	76		2		CP
<i>Neotoma mexicana tenuicauda</i>	1				SP
<i>Osgoodomys banderanus banderanus</i>	100	4	2	Endemic	CP
<i>Peromyscus hyllocetes</i>	1			Endemic	CP

TABLE 1—Continued.

Taxon	Locality ^a			Endemicity and risk ^b	Reproductive pattern ^c
	1	2	3		
<i>Peromyscus spicilegus</i>	2	3		Endemic	CP
<i>Reithrodontomys fulvescens nelsoni</i>	21				CP
Subfamily Sigmodontinae					
<i>Oligoryzomys fulvescens lenis</i>	2				CP
<i>Oryzomys melanotis colimensis</i>	23	1	3	Endemic	CP
<i>Sigmodon alleni</i>	27	1	1	Endemic	SP
<i>Sigmodon mascotensis</i>	23			Endemic	CP
Subfamily Tylomyinae					
<i>Nyctomys sumichrasti colimensis</i>			1		CP
Total	658	18	23		

^a Number of specimens indicated for three localities: (1) 3 km NW Ranchitos, 19°25'27.47"N, 103°59'14.25"W, 1,650 m; (2) 2 km NW Ranchitos, 19°25'04.65"N, 103°58'49.83"W, 1,650 m; (3) 1 km NW Ranchitos, 19°24'41.82"N, 103°58'25.41"W, 1,550 m.

^b Risk according to Norma Oficial Mexicana NOM-059-ECOL-2001 (Secretaría de Medio Ambiente y Recursos Naturales, 2002).

^c Reproductive pattern: ACM, asynchronous continual monoestrous; ACP, asynchronous continual polyestrous; BP, bimodal polyestrous; CP, continual polyestrous; SM, seasonal monoestrous; and SP, seasonal polyestrous.

two of these—*Peromyscus* and *Sigmodon*—had two species each. The family Heteromyidae had one genus, *Heteromys*, with two species. For bats, the family Phyllostomidae was the best represented with 8 genera and 13 species, followed by Vespertilionidae with 2 genera and 3 species. The families Mormoopidae and Molossidae each had one genus represented. The genera with the greatest richness were *Artibeus* and *Dermanura*, each with three species, while the genera *Glossophaga* and *Lasiurus* had two species each. Remaining genera were represented by a single species.

Relative Abundance—We captured 406 (58.1%) specimens of the order Rodentia, 2 (0.3%) of Soricomorpha, 1 (0.1%) of Didelphimorphia, 1 (0.1%) of Carnivora, and 289 (41.3%) of Chiroptera. The most abundant species of nonvolant mammals were *Osgoodomys banderanus* (106 specimens, 15.2%), *Heteromys pictus* (78, 11.2%), *Baiomys musculus* (78, 11.2%), *Heteromys spectabilis* (31, 4.4%), *Sigmodon alleni* (29, 4.1%), *Oryzomys melanotis* (27, 3.9%), *Sigmodon mascotensis* (23, 3.3%), and *Reithrodontomys fulvescens* (21, 3.0%; all order Rodentia). We obtained ≤5 specimens for the other species of rodents. The one or two specimens for the orders Soricomorpha, Didelphimorphia, and Carnivora reflect, in part, that our trapping approach was less suited for these groups, but also that they were less

abundant than rodents. For bats, the most abundant species were *Artibeus jamaicensis* (136 specimens, 19.4%), *Sturnira lilium* (48, 6.9%), *Dermanura tolteca* (33, 4.7%), *A. lituratus* (21, 3.0%), *D. phaeotis* (12, 1.7%), *A. intermedius* (10, 1.4%), and *Lasiurus blossevillii* (6, 0.8%); <5 specimens were caught for other species.

Reproductive Patterns—Based on field data from Colima and adjacent regions, as well as literature sources, we determined reproductive patterns. Those for nonvolant mammals were continual polyestrous (10 species, 28.6%), seasonal polyestrous (4, 11.4%), and seasonal monoestrous (3, 8.6%). Reproductive patterns for bats were seasonal monoestrous (7, 20.0%), asynchronous continual polyestrous (7, 20.0%), bimodal polyestrous (2, 5.7%), continual polyestrous (1, 2.9%), and asynchronous monoestrous (1, 2.9%).

SPECIES ACCOUNTS—*Tlacuatzin canescens*—Specimen, 1♂. One young male (scrotal testes 3 by 2 mm) was trapped on a branch of a tree. This species occurs in different types of vegetation in dry-tropical regions (Armstrong and Jones, 1971). The gestation period for this species is only a few days in length (Sánchez-Hernández and Romero-Almaraz, 1995a).

Megasorex gigas—Specimens, 2♂. One had abdominal testes (2 by 1 mm). This shrew was captured in Sherman traps placed at the edge of

a stream. It has been found in tropical deciduous forest and arid areas close to watercourses (Davis, 1957).

Desmodus rotundus murinus—Specimen, 1♀. Implantation of an embryo had occurred recently (2 by 1 mm). Reproductive pattern is asynchronous continual monoestrous (Sánchez-Hernández and Romero-Almaraz, 1995b). Occurs in warm climates, occupying tropical deciduous forest, secondary vegetation, cultivated areas, and pasturelands.

Anoura geoffroyi lasiopyga—Specimens, 3 (1♂, 2♀). The male had scrotal testes (7 by 4 mm). Females were reproductively inactive. Reproductive pattern is seasonal monoestrous, with activity at the end of the humid season (Wilson, 1979). Occurs in dry tropical regions. In forests of temperate zones, they inhabit caves and mines.

Glossophaga commissarisi hespera—Specimen, 1♂. The male had scrotal testes (3 mm). This species occurs in western Mexico from central Sinaloa and southwestern Durango southward at least to Colima (Webster and Jones, 1993). Reproductive pattern is continuous polyestrous. Occupies different types of vegetation in tropical areas, including xeric thorn forest, deciduous forest (pristine and disturbed), and pine-oak forest (Webster and Jones, 1993).

Glossophaga soricina handleyi—Specimens, 5 (1♂, 4♀). The male had inguinal testes. For females, two were reproductively inactive and two were lactating. Reproductive pattern is asynchronous continual polyestrous. Specimens were captured in semi-evergreen forest and areas of secondary vegetation. This species inhabits all types of vegetation in tropical zones. Practically any type of hollow, cave, or structure made by humans serves as a refuge for the species.

Leptonycteris nivalis—Specimens, 2♂. Specimens had scrotal testes (6 by 5 and 7 mm). They were captured in tropical deciduous forest. Reproductive pattern is seasonal monoestrous (Pfrimmer Hensley and Wilkins, 1988). This species inhabits tropical forests. In temperate zones, it inhabits warm caves and deep mines.

Sturnira lilium parvidens—Specimens, 48 (23♂, 25♀). For males, 22 had scrotal testes (3 by 2, 3 by 2, 4, 4, 4, 4, 4 by 3, 5, 5, 5, 5, 5, 5 by 2, 5 by 4, 5 by 4, 6, 6, 6 by 4, 7, 8, and 13 mm), and 1 had inguinal testes. For females, 4 had one embryo (2.5, 3 by 2, 3 by 2, and 3 by 2 mm) and 21 were reproductively inactive. Reproductive pattern is asynchronous continual polyestrous (Sánchez-Her-

nández et al., 1986). The species inhabits mature forest, secondary vegetation, and fragmented tropical areas.

Artibeus jamaicensis triomylus—Specimens, 136 (54♂, 82♀). For males, 43 had scrotal testes (3, 4, 4, 4, 4, 4, 4, 4, 4 by 3, 5, 5, 5, 5, 5 by 3, 6, 6, 6, 6.5, 7, 7, 7, 7 by 5, 8, 8, 8, 8 by 6, 8 by 6, 8 by 6, 8 by 7, 9, 9, 9, 9, 9 by 6, 10, 10, 10, 10 by 7, 10 by 8, 11 by 8, and 14 mm), 1 had abdominal testes, and 3 had inguinal testes. For females, 58 had one embryo (one not measured, 5, 5, 5 by 4, 6, 6, 6, 6, 6 by 4, 6 by 5, 7, 7, 7, 8, 8, 9, 9, 9, 9 by 7, 9 by 8, 10, 10, 10, 11, 12, 12, 12 by 11, 14, 14, 14 by 11, 15, 15, 15, 15, 16, 17, 18, 19, 19, 19, 19 by 15, 20, 20, 20, 20 by 15, 20 by 18, 21, 21, 21, 21, 21, 21 by 16, 22, 22, 24, 24 by 15, 26, and 26 by 17 mm) and 17 were reproductively inactive. Reproductive pattern is asynchronous continual polyestrous (Sánchez-Hernández et al., 1990). It was the most commonly captured species of bat at Ejido Ranchitos. This species takes shelter under branches of leafy trees or palm trees, and in tree hollows, as well as in buildings, tunnels, and caves.

Artibeus lituratus palmarum—Specimens, 21 (16♂, 5♀). For males, 15 had scrotal testes (5, 7, 7, 7, 7, 7, 7 by 5, 7 by 5, 8, 8, 8 by 6, 8 by 6, 9, 9, and 9 mm). For females, four had one embryo (7 by 5, 9, 10, and 22 mm). Reproductive pattern is asynchronous continual polyestrous (Sánchez-Hernández et al., 1985). This species inhabits tropical deciduous forest, roosting in the canopy or under foliage of palms.

Artibeus intermedius intermedius—Specimens, 10 (7♂, 3♀). All males had scrotal testes (4 by 3, 6, 6, 7, 7, 8, and 9 mm). For females, two had one embryo (6 and 12 mm) and one was reproductively inactive. Specimens were captured in oak forest near a watercourse and in a tropical deciduous forest. Reproductive pattern is bimodal polyestrous. This taxon roosts in caves and in tree foliage (Sánchez-Hernández and Romero-Almaraz, 1995b).

Dermanura azteca azteca—Specimen, 1♀. The female was reproductively inactive. This species is rare and distributed in temperate forests where it occupies small caves and hollows in trees. Reproductive pattern is asynchronous continual polyestrous with 2 pregnancies/year (C. Sánchez-Hernández, in litt.).

Dermanura phaeotis nana—Specimens, 12 (6♂, 6♀). All males had scrotal testes (4, 4 by 3, 4 by 3, 5 by 3, 5 by 4, and 6 by 5 mm). Females had one embryo each (15, 17, 17, 19, 19, and 21 mm).

Occurs in subtropical and tropical deciduous forests where it takes shelter in caves, under leaves of banana trees, in hollows of trees, or in foliage. Reproductive pattern is asynchronous continual polyestrous, with 3 breeding periods/year (Sánchez-Hernández and Romero-Almaraz, 1995b).

Dermanura tolteca hespera—Specimens, 33 (16♂, 17♀). All males had scrotal testes (4, 4, 4, 4, 5, 5, 5, 5, 5, 5 by 3, 6, 6, 6 by 4, 7 by 5, and 8 mm). For females, 13 had one embryo (4, 4 by 3, 4 by 4, 6, 6, 6 by 5, 7, 7, 7, 7 by 5, 8, and 14 mm) and 4 were reproductively inactive. Reproductive pattern is asynchronous continual polyestrous. The species has been captured in buildings and among tropical and subtropical vegetation of evergreen forests (Sánchez-Hernández and Romero-Almaraz, 1995b).

Chiroderma salvini scopaeum—Specimens, 3 (2♂, 1♀). For males, one had scrotal testes (4 by 3 mm). The female was reproductively inactive. Reproductive pattern is bimodal polyestrous (Wilson, 1979). It inhabits pine forest, tropical deciduous forest, and secondary vegetation. The species takes shelter in tree foliage in small groups or as solitary individuals.

Pteronotus parnellii mexicanus—Specimen, 1♂. The male had scrotal testes (4 by 3 mm). Reproductive pattern is seasonal monoestrous (Guerrero, 1994). This species often occurs in colonies with thousands of individuals and seldom is captured in mistnets. They have been captured in tropical deciduous forest, in semi-evergreen and evergreen forests, in pastureland, and over water bodies (Sánchez-Hernández and Romero-Almaraz, 1995b).

Cynomops mexicanus—Specimen, 1♀. The female had signs of ovulation. It was captured in a mistnet placed under a bridge that spanned the Río Juluapan. This species takes shelter on branches of trees and in rock crevices. These bats are solitary or in colonies of 50–75 individuals (Goodwin and Greenhall, 1961).

Lasiurus blossevillii teliotis—Specimens, 6 (5♂, 1♀). For males, one had abdominal testes and four had testes in the uropatagium (3, 3, 3 by 2, and 4 mm). The female was reproductively inactive. Reproduction takes place August–September; females give birth to 1–5 young, and they have >2 teats (LaVal and LaVal, 1979). The species is solitary, inhabiting pine-oak forest where it takes shelter in foliage of trees, in bushes, and occasionally in caves (Kunz, 1982).

Lasiurus intermedius intermedius—Specimens, 3♂. Males had testes in the uropatagium (6 by 3, 7, and 8 by 3 mm). Reproductive pattern is seasonal monoestrous, and 2–4 young are born (Baker and Dickerman, 1956). This taxon inhabits tropical deciduous and evergreen forest where it takes shelter in foliage. In Colima, it has been captured in banana plantations and near water bodies (Villa-Ramírez, 1966).

Myotis albescens—Specimens, 2♂. One of the males had testes 2 mm long. Reproductive pattern is seasonal monoestrous. It is a protected species according to Norma Oficial Mexicana NOM-059-ECOL-2001 (Secretaría de Medio Ambiente y Recursos Naturales, 2002). We captured it in a mistnet over a watercourse in semideciduous forest.

Procyon lotor hernandezii—Specimen, 1. One skull of an adult was found in the area of study. Historically, this species occupied places of natural vegetation, but now it also can be found in secondary vegetation, in suburban areas, and close to water bodies. Reproductive pattern is seasonal monoestrous with a gestation period of 63 days (Nowak and Paradiso, 1983).

Spermophilus annulatus annulatus—Specimens, 3 (1♂, 2♀). The male had scrotal testes 20 mm in length, and the two adult females were reproductively inactive. There have been pregnant females in Colima in February (Hooper, 1955a), lactating in May, and inactive in July (Téllez-Girón et al., 1997). This species is endemic in western Mexico (between Nayarit and Guerrero) and is common in the flat western zones in Colima, frequently seen among rocks and at edges of highways. It inhabits disturbed zones where it can be abundant (Goldman, 1951; Téllez-Girón et al., 1997).

Heteromys pictus pictus—Specimens, 44 (20♂, 24♀). For males, 11 had scrotal testes (6, 8, 9 by 5, 14, 14, 14 by 8, 16, 16, 18, 20 by 12, and 23 mm), 4 had abdominal testes, and 3 had inguinal testes. For females, 1 had two embryos (8 mm), 1 had four embryos (4 mm), 3 were lactating, 1 was postlactating, and 15 were reproductively inactive. Specimens were captured in traps inside or at the edge of corn fields and along paths. Reproductive pattern is seasonal polyestrous (McGhee and Genoways, 1978). This species occupies a variety of vegetation from xerophytic and tropical deciduous forest to oak-pine forest.

Heteromys pictus plantinarenensis—Specimens, 34 (12♂, 22♀). For males, five had scrotal testes (6

by 4, 9, 14, 15, and 15 by 9 mm), four had abdominal testes, and three had inguinal testes. Females were reproductively inactive. These animals were captured in corn fields, tropical deciduous forest, and altered zones. Reproductive pattern is seasonal polyestrous (Eisenberg, 1963). This species occurs in oak forest, tropical deciduous forest, deserts, and other xerophytic areas (Genoways and Jones, 1973).

Heteromys spectabilis—Specimens, 31 (12♂, 19♀). Of the males, seven had scrotal testes (14, 16, 20, 20 by 11, 21 by 12, 22, and 22 mm), one had abdominal testes, and two had inguinal testes. For females, 3 had three embryos (7, 8, and 22 by 13 mm), 2 had four embryos (19 and 14 mm), 2 were postlactating, and 12 were reproductively inactive. This taxon was captured in altered zones of tropical deciduous forest, thickets, and corn fields. This is the first published record for the species in Colima.

Baiomys musculus musculus—Specimens, 78 (33♂, 45♀). For males, 6 had abdominal testes and 26 had scrotal testes (3, 3 by 2, 4, 4, 4, 4 by 3, 4.5, 5, 5, 5, 5, 5 by 3, 5 by 3, 5 by 3, 5 by 4, 6, 6, 6 by 4, 6 by 4, 7, 8 by 4, 9, and 13 mm). Of the females, 31 were reproductively inactive, 11 were pregnant, 1 had two embryos (14 mm in length), 9 had three embryos (one not measured, 6, 9, 10, 13 by 11, 14 by 11, 17 by 12, 21, and 21 mm), 1 had four embryos (10 by 8 mm), and 3 were lactating. They were trapped in corn fields and in natural vegetation. This rodent is typical of tropical dry zones (Hooper, 1955b; Packard, 1960). In Colima, *B. musculus* often occurs in habitats with relatively dense ground cover and at least a partially open canopy (Schnell et al., 2008). Its reproductive pattern is continual polyestrous with a decline in breeding during winter and spring (Packard and Montgomery, 1978).

Neotoma mexicana tenuicauda—Specimen, 1♀. The adult female represents the first record for the state. Ellerman (1940:476) cited a record by Merriam (1892) of the species (under *N. ferruginea tenuicauda*) from the "North Slope of Sierra Nevada of Colima, state of Colima, México." However, as stated by Merriam (1892), the north slope is in the state of Jalisco. The species typically is found in places with stones, rocky slopes, or cliffs (Birney and Jones, 1971). Females breed January–August, with two litters annually. They have 1–3 young/litter after an average gestation period of 33 days (Olsen, 1968; Cornely and Baker, 1986).

Osgoodomys banderanus banderanus—Specimens, 106 (62♂, 44♀). For males, 54 had scrotal testes (6, 8, 8 by 5, 8 by 6, 9, 9, 9, 10, 10, 10 by 9, 11, 11, 11 by 9, 12, 12 by 7, 12 by 7, 13, 14, 14, 14, 14 by 7, 14 by 8, 15, 15, 15, 15, 15, 15, 15 by 9, 16, 16, 16 by 8, 16 by 9, 16 by 10, 17, 17, 17, 17, 17, 17 by 10, 17 by 10, 18, 18, 18, 18, 18 by 11, 19, 19, 19 by 10, 20, 21, and 21 by 9 mm), 3 had abdominal testes, and 1 had inguinal testes. For females, 23 were reproductively inactive, 4 were pregnant, 1 with one embryo (29 mm) and 3 with two (10, 13, 27 by 17 mm), 5 were lactating and pregnant, 3 of these with two embryos (6 by 5, 9 by 8, 38 by 12 mm), 1 with three (4 by 2 mm) and 1 with four (7 by 4 mm), and 6 were lactating. Reproductive pattern is continual polyestrous (Mendoza Durán and Miranda, 2002). This species is endemic of Mexico and occurs from Nayarit to Guerrero on the Pacific coast (Hall, 1981).

Peromyscus hylocetes—Specimen, 1♂. The male had scrotal testes (12 mm in length). This is a common species in oak-pine (*Quercus-Pinus*) forest and stoney zones, but also can be found at edges of cultivation. It has a continual polyestrous reproductive pattern (Núñez-Garduño and Pastrana, 1990). This is the first report of the species in Colima.

Peromyscus spicilegus—Specimens, 5 (2♂, 3♀). One of the males had scrotal testes (9 by 7 mm). For females, one was reproductively inactive, one had one embryo (15 mm in length), and one was lactating. We captured them in traps placed in corn fields. Reproductive pattern of this taxon is continual polyestrous. This species occupies a variety of habitats ranging from humid tropical lowlands to moist montane regions. Most populations are restricted to regions west of the Sierra Madre Occidental and to elevations of 15–1,980 m (Bradley et al., 1996).

Reithrodontomys fulvescens nelsoni—Specimens, 21 (11♂, 10♀). Of the males, two had abdominal testes and seven had scrotal testes (3, 3, 5, 5 by 3, 8, 9, and 11 by 6 mm). Of the females, four had three embryos (5, 5, 11, 11 mm in length), two had four embryos (5, 14 mm in length), one was pregnant and lactating (7 by 5 mm embryo), one was lactating but not pregnant, and one was reproductively inactive. This species occurs in natural zones fragmented with pastures and in regions with long dry seasons (Hooper, 1952). Reproductive pattern is continual polyestrous (Packard, 1968).

Oligoryzomys fulvescens lenis—Specimens, 2 (1♂, 1♀). The male had scrotal testes (3 mm) and the female was reproductively inactive. This record represents the second for Colima. Previously, Hooper (1955a) reported the species from Paso del Río. This taxon has a polyestrous reproductive pattern, with litters averaging six young (Jones et al., 1974). The species occurs in temperate, semitropical (Hall and Villa R., 1949), and semiarid zones in areas fragmented with grasslands and xerophytic vegetation (Nowak and Paradiso, 1983).

Oryzomys melanotis colimensis—Specimens, 27 (19♂, 8♀). For males, 1 had inguinal, 2 had abdominal, and 15 had scrotal testes (4, 4 by 3, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 7, 7 by 4, 7 by 4, and 8 mm). For females, three were reproductively inactive, three had four embryos (7, 13, 16 mm), one had five embryos (21 mm), and one had six embryos (22 mm). Reproduction takes place throughout the year (Haiduk et al., 1979). This is an endemic species in Mexico and is distributed from southern Sinaloa and Tamaulipas to Yucatan (Hall, 1981). It occupies zones of mature forest and in areas with secondary vegetation (Ingles, 1959).

Sigmodon alleni—Specimens, 29 (10♂, 19♀). For males, two had inguinal testes, three had abdominal testes, and three had scrotal testes (8 by 4, 9, and 15 mm). For females, 1 had three embryos (45 mm), 1 had four (14 mm), 2 had five (17 and 19 mm), 1 was lactating and had four embryos (9 mm), and 12 were reproductively inactive. Specimens were captured in open places, close to cultivation, and in natural areas fragmented with grass and shrubs. This species occupies tropical deciduous forest and humid pine-oak forest, preferring moist slopes covered with vines and shrubs, in tropical or mixed tropical-boreal situations (Baker, 1969). Breeding takes place in the warmest months; gestation is 87 days (Baker, 1969).

Sigmodon mascotensis—Specimens, 23 (7♂, 16♀). For males, four had scrotal testes (9, 9, 10 by 5, and 17 mm), and two had abdominal testes. For females, one had two embryos (7 mm), one had four, one had five (7 mm), two had six (10 and 12 mm), and eight were reproductively inactive. This species was captured in open and level places close to cultivated fields and in areas between vegetation types. This species is endemic in Mexico and distributed from southern Sinaloa to Guerrero (Hall, 1981). Reproduction

is year round and gestation is 27 days; nests are built with grass or bark (Baker, 1969).

Nyctomys sumichrasti colimensis—Specimen, 1♀. A postlactating female was trapped on a branch of a tree. This species lives extensively in trees and occurs in deciduous tropical forest. Reproduction is throughout the year. In captivity, *N. sumichrasti* has 1–3 young/litter after a gestation period of 30–38 days (Birkenholz and Wirtz, 1965).

DISCUSSION—We registered 11 endemic species including one didelphimorph (*Tlacuatzin canescens*), eight rodents (*Spermophilus annulatus*, *Peromyscus hylocetes*, *P. spicilegus*, *Osgoodomys banderanus*, *Oryzomys melanotis*, *Sigmodon alleni*, *S. mascotensis*, and *Heteromys spectabilis*), one soricomorph (*Megasorex gigas*), and one bat (*Cynomops mexicanus*). These represent 31.4% of the 35 mammalian species captured at Ejido Ranchitos, 34.4% of the 32 endemic species of mammals recorded for Colima, and 6.5% of the 169 endemic species of mammals reported for Mexico (Ramírez-Pulido et al., 2005). Further trapping effort at Ejido Ranchitos, particularly at other times of the year, could result in capture of additional endemic species.

Five species we detected at Ejido Ranchitos have been designated as being at some level of risk of extinction according to the Norma Oficial Mexicana NOM-059-ECOL-2001 (Secretaría de Medio Ambiente y Recursos Naturales, 2002). *Heteromys spectabilis*, *Cynomops mexicanus*, and *Myotis albescens* are special protection, while *Megasorex gigas* and *Leptonycteris nivalis* are designated as threatened.

Comparing total number (35) of species recorded for Ejido Ranchitos with those for the state of Colima (128 species) and country (475 species) suggests that mammalian diversity is high at Ejido Ranchitos, particularly considering that we only had three trapping locations and trapped for 5 nights. The large number of endemic species found at Ejido Ranchitos can be explained in part by seasonal migration of some species into the area and the restriction of others to tropical western forests of the country.

We know little about basic ecology of many species of small mammals in this global hotspot for biodiversity. Thus, there is a need for additional studies in local areas such as Ejido Ranchitos. This is an important locality for the state of Colima, not only for biodiversity and the

large number of endemic species that it supports, but also because it is a relatively pristine area. It is near the city of Colima, meaning that Ejido Ranchitos potentially could be subjected to environmental degradation in the future unless action is taken to minimize such threats. Therefore, consideration should be given to establishing a protected area at or near Ejido Ranchitos to promote conservation of its rich biological diversity.

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