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THE XENARTHRANS OF NICARAGUA

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ABSTRACT. The mammalian fauna of Nicaragua includes seven species in the order Xenarthra, including the brown-throated three-toed sloth (*Bradypus variegatus*) in the family Bradypodidae, Hoffmann's two-toed sloth (*Choloepus hoffmanni*) in the family Megalonychidae, the northern naked-tailed armadillo (*Cabassous centralis*) and nine-banded armadillo (*Dasypus novemcinctus*) in the family Dasypodidae, and the silky anteater (*Cyclopes didactylus*) and northern tamandua (*Tamandua mexicana*) in the family Myrmecophagidae. Additionally, the giant anteater (*Myrmecophaga tridactyla*) in the family Myrmecophagidae is (or was) certainly part of the fauna of Nicaragua but has yet to be documented there. Based on 133 xenarthran specimens available in museums and our observations, we herein review and provide new information on distributions, systematics, morphometrics, and natural history of these species in Nicaragua. Replacement of the milk dentition in *Dasypus novemcinctus* is described and illustrated, documenting the most common adult dental formula of i 0/0, c 0/0, p 7/7, m 1/1 = 32.

RESUMEN. **Los Xenarthra de Nicaragua.** La fauna mamífera de Nicaragua incluye siete especies del orden Xenarthra, incluyendo el perezoso de tres dedos (*Bradypus variegatus*) en la familia Bradypodidae, el perezoso (*Choloepus hoffmanni*) en la familia Megalonychidae, el armadillo zopilote (*Cabassous centralis*) y el cusuco (*Dasypus novemcinctus*) en la familia Dasypodidae y el tapacara (*Cyclopes didactylus*) y el oso hormiguero (*Tamandua mexicana*) en la familia Myrmecophagidae. Además, el oso caballo (*Myrmecophaga tridactyla*) en la familia Myrmecophagidae es (o fue) ciertamente parte de la fauna de Nicaragua pero todavía no ha sido documentado allá. Basado en 133 especímenes de Xenarthra disponibles en museos y nuestras observaciones, revisamos y proveemos información nueva sobre distribuciones, sistemática, morfométrica y la historia natural de estas especies en Nicaragua. El reemplazo de la dentición láctea en *Dasypus novemcinctus* se describe e ilustra, documentando la fórmula dental adulta más común de i 0/0, c 0/0, p 7/7, m 1/1 = 32.

Key words: Mammalia, Nicaragua, Xenarthra, *Bradypus, Cabassous, Choloepus, Cyclopes, Dasypus, Myrmecophaga, Tamandua*

Palabras clave: Mammalia, Nicaragua, Xenarthra, *Bradypus, Cabassous, Choloepus, Cyclopes, Dasypus, Myrmecophaga, Tamandua*

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INTRODUCTION

This paper is one of a series on the mammalian fauna of the Central American country of Nicaragua, which will lead to the publication of a compendium on the mammals of Nicaragua. The current contribution deals with members of the mammalian order Xenarthra—the sloths, armadillos, and anteaters. These unique and ancient mammals are primarily Neotropical in distribution, with only the nine-banded armadillo (*Dasypus novemcinctus*) extending northward into the Nearctic. Thirty species of xenarthrans arranged in four families currently are recognized (Wetzel, 1982; Gardner, 1993; Anderson and Handley, 2001). The systematics and distribution of members of this order have received little attention, with the notable exception of the research of Wetzel and his coworkers (Wetzel and Kock, 1973; Wetzel, 1975, 1980, 1982, 1983, 1985a, 1985b; Wetzel and Mondolfi, 1979). Only seven recent articles, including three faunal overviews (Timm, 1994; Reid, 1997; Timm and LaVal, 2000), two notes (McCarthy et al., 1999; McCain, 2001), and the description and biogeography of a new species (Anderson and Handley, 2001, 2002), have dealt with Central American xenarthrans in the past few decades.

Samuel Bard (1855), an artist-adventurer, provided the first published report of xenarthrans in Nicaragua reporting observations of both the nine-banded armadillo and the naked-tailed armadillo (*Cabassous centralis*) during his travels along the Caribbean Coast in 1854. The first report in the scientific literature of a xenarthran from Nicaragua appears to be that of John Edward Gray in his revision of the sloth family Bradypodidae. The specimen described by Gray (1871: 429) as *Arctopithecus castaneiceps* [= *Bradypus variegatus castaneiceps*] was received from Berthold Seemann who reported that the three-toed sloth was from "Javali gold-mine in the Chontales district of Nicaragua, about 2000 feet above the sea-level." J.A. Allen (1908, 1910), in his two papers on the mammals of Nicaragua, was the first to document the diversity of the Nicaraguan xenarthrans, reporting 19 specimens representing five species from the country. Wetzel (1980) documented the presence of a sixth species —*Cabassous centralis*— in the country based on a single specimen deposited in Zoologisches Museum, Museum für Naturkunde der Humboldt-Universität in Berlin, Germany.

In the winter and spring of 1956, J.R. Alcorn and his family obtained mammals in Nicaragua for the Museum of Natural History at the University of Kansas. Subsequently, from late 1962 until early 1965, L.G. Clark, then associated with the University of Pennsylvania, collected mammals in Nicaragua in connection with studies of leptospirosis; his specimens were divided between the Museum of Natural History at the University of Kansas and the National Museum of Natural History. Between February 1964 and the spring of 1968, several other field parties from University of Kansas lead by J. Knox Jones, Jr., collected both mammals and their ectoparasites in Nicaragua.

As a result of these endeavors, 122 specimens representing five species belonging to the mammalian order Xenarthra were preserved. These specimens combined with 11 others deposited in museum collections made 133 specimens available for this study. In addition to species represented in these collections and documented in the literature, one other species of xenarthran, the giant anteater, almost certainly was represented in the fauna because there are records from countries to the north and south of Nicaragua and a Miskito Indian interviewed by J.K. Jones, Jr. was familiar with it, but this anteater has yet to be documented in the country by a voucher specimen.

METHODS AND MATERIALS

All measurements in the accounts that follow are in millimeters and weights are given in grams (g) or kilograms (kg). Cranial measurements were taken with digital calipers accurate to the nearest 0.1 mm. External measurements are those recorded on specimen labels by the field preparators. Cranial measurements of the sloths were taken in the manner described by Anderson and Handley (2001). Because in tamanduas the premaxillary bone is small and loosely attached to the remainder of the cranium from which it is detached in a number of specimens, it was not included in the measurements condylobasal length and palatal length. Therefore, condylobasal length was taken from the occipital

condyles to the anteriormost point of the maxillary bone and palatal length was taken from the posterior edge of the palatal bone to the anteriormost point of the maxillary bone. The relative age of sloths was determined as described by Anderson and Handley (2001) and for anteaters as described by Wetzel (1975). Statistical analyses were performed using the *StatView*® software package (Sager, 1992). The paired t-test gave standard statistics for each sample and statistical significance of differences in group means. Specimens reported in the Systematics Accounts below are housed in the following museums: Natural History Museum, University of Kansas (KU); National Museum of Natural History (NMNH); Museum of Texas Tech University (TTU). Localities not shown on **Figs. 1-3** to prevent crowding of symbols are indicated by italics in the lists of specimens examined.

SYSTEMATICS ACCOUNTS

Family Bradypodidae
Bradypus variegatus castaneiceps
(Gray, 1871)
Brown-throated Three-toed Sloth,
Perezoso de Tres Dedos

Specimens examined (42) — ATLÁNTICO NORTE: 4 mi NE Bonanza, 800 ft [= 242 m], 1 (KU); Bonanza, 16 (8 KU, 8 NMNH); 3.5 mi SW Bonanza, 780 ft [= 236 m], 1 (KU). ATLÁNTICO SUR: El Recreo, 11 (8 KU, 3 NMNH); *Escondido River*, 1 (NMNH). MATAGALPA: Finca Tepeyac, 10.5 km N, 9 km E Matagalpa, 960 m, 8 (6 KU, 2 NMNH). RÍO SAN JUAN: Greytown [= San Juan del Norte], 2 (NMNH); La Esperanza, 2 (1 KU, 1 NMNH).
Additional records — BOACO: Chontales (Allen, 1908). CHONTALES: Javali (Gray, 1871). MADRIZ: Río Coco (Allen, 1910).

Distribution — The brown-throated three-toed sloth has the widest geographic range of any of the four species in genus *Bradypus*, occurring from Honduras southward throughout most of the tropical areas of South America (Wetzel, 1982, 1985a). The geographic range of the subspecies *Bradypus variegatus castaneiceps* was restricted by Wetzel (1982) to Honduras, Nicaragua, and parts of Costa Rica. McCarthy et al. (1999), in reporting the northernmost records of the species in Honduras, mention some of the specimens reported herein. The three-toed sloth is distributed throughout the mesic Caribbean lowlands of eastern Nicaragua and cooler, but wet central highlands; although widely distributed in the country, museum specimens only partially reflect this distribution (**Fig. 1**).

Systematics — Wetzel and Kock (1973) were the first to show that *B. variegatus* was the appropriate species-level name for this taxon long known as *B. infuscatus*. They distinguished *B. variegatus* from *B. infuscatus* based on the presence of brown hair on the shoulders, neck, throat, and sides of face, lack of foramina in the anterodorsal nasopharynx, larger skull, and reduced mandibular spout (see also Wetzel and de Ávila-Pires, 1980). From the recently described second species of three-toed sloth in Central America, *Bradypus pygmaeus*, occurring only on Isla Escudode Veraguas, Bocas del Toro, Panamá, *B. variegatus* is distinguished by its much larger size (Anderson and Handley, 2001, 2002). We follow Wetzel (1982) in using the subspecific name *B. v. castaneiceps*, originally described by Gray (1871) based on a specimen from Javali, Chontales, Nicaragua, although Anderson and Handley (2001: 25) state "it is premature to recognize subspecies of this wide-ranging and highly variable species."

Morphometrics — **Table 1** gives a comparison of the measurements of nine males and 15 females from Nicaragua in external and cranial measurements. These samples reveal no significant secondary sexual variation in any of these characters. In seven of the 11 cranial measurements, males average larger than females, whereas females are larger in the other four characters. Certainly morphometric analyses of this species may use combined samples of males and females.

Natural history — Three-toed sloths were abundant animals throughout lowland wet forests of Central and South America, occurring from sea level to more than 2400 m (Molina et al., 1986; Reid, 1997). Early naturalists such as Thomas Belt (1874: 47) described the entry into the tropical lowland forest around Santo Domingo, Nicaragua, in the following terms: "we entered the great forest, the black margin of which we had seen for many miles, that extends from this point to the Atlantic. At first the road lay through small trees and brushwood, a second growth that had sprung up

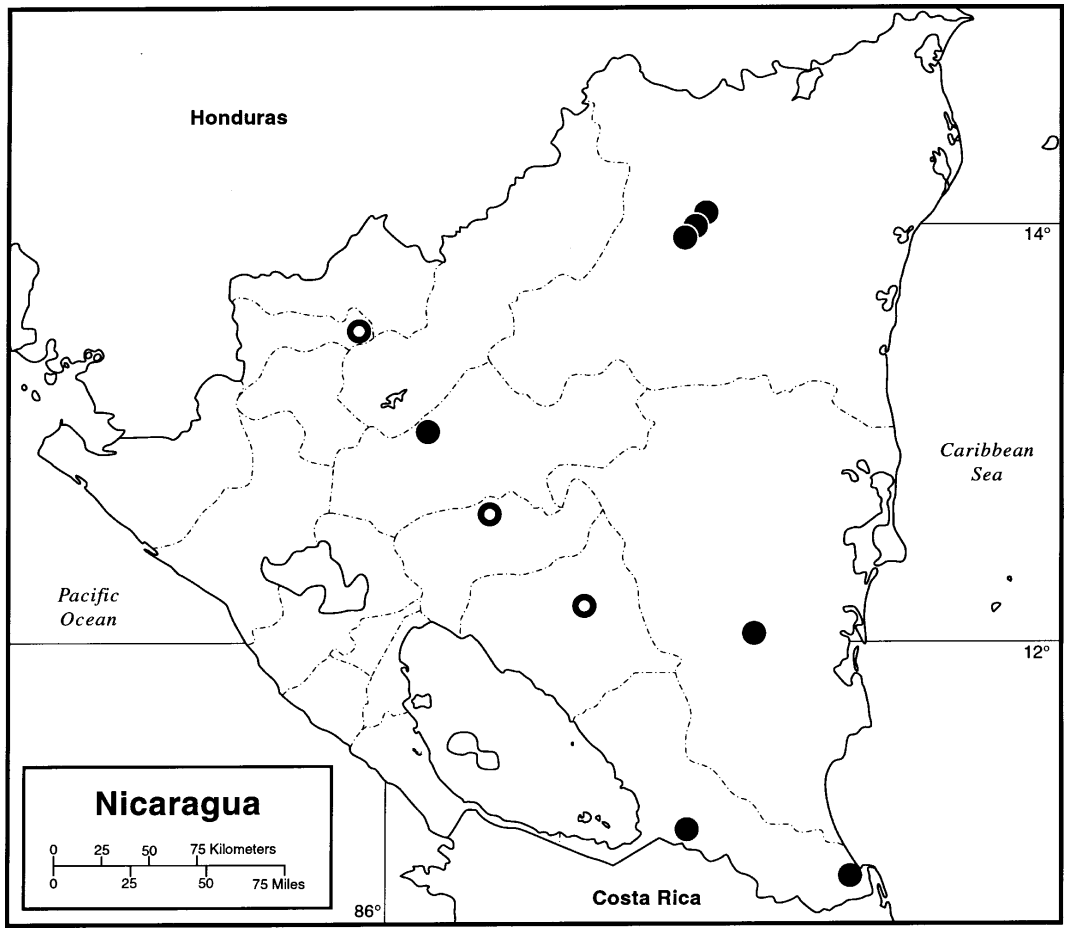

Fig. 1. Map of Nicaragua showing the geographic distribution of *Bradypus variegatus castaneiceps.* Closed circles represent specimens examined and open circles represent literature records.

where the original forest had been cut for maize plantation … we entered the primeval forest. On each side of the road great giant trees tower up, carrying their crowns out of sight amongst a canopy of foliage; lianas wound round every trunk and hung from every bough, passing from tree to tree, and entangling the giants in a great network of coiling cables." At numerous points in the narrative of his stay in Nicaragua, Belt (1874) remarked about seeing the black margin of this eastern primeval forest. Certainly great tropical lowland forests as Belt described are still present in Nicaragua, but during our work in the country, we never observed this black margin of forest from a distance. At least along the western edge of this Caribbean forest many of the areas have been cleared and the forest fragmented, especially in the lower and level areas with the forests being confined to the steep slopes and crests of the hills. In many of these cleared areas, introduced grasses have been planted for grazing cattle. This fragmentation of the original forest has had an impact on the sloth populations in eastern Nicaragua, with extinction of local population certainly occurring. However, populations of three-toed sloths are still present in eastern Nicaragua and in some places, such as the vicinity of El Recreo and Bonanza, seem to be thriving.

The collector of the holotype specimen of *B. v. castaneiceps* at Javali, Dr. Berthold Seemann, provided interesting observations on the indi-

Table 1

External and cranial measurements of the two species of sloths (*Bradypus variegatus* and *Choloepus hoffmanni*) occurring in Nicaragua, comparing secondary sexual variation in each species.

Measurements and statistics	*Bradypus variegatus*		*Choloepus hoffmanni*	
	Males	Females	Males	Females
Total length				
N	7	14	4	13
Mean ± SE	594 ±28.1	590 ±8.2	607 ±25.9	635 ±11.1
Range	(540-750)	(530-632)	(570-680)	(570-710)
Length of tail				
N	6	13	—	—
Mean ± SE	55 ±7.2	55 ±4.1	—	—
Range	(25-70)	(20-65)	—	—
Length of hind foot				
N	8	14	4	13
Mean ± SE	111 ±5.4	120 ±6.9	132 ±4.1	132 ±3.4
Range	(85-132)	(90-145)	(120-137)	(115-153)
Length of ear				
N	6	14	4	13
Mean ± SE	12.5 ±0.9	12.8 ±1.2	26.5 ±0.86	22.8 ±0.95
Range	(10-15)	(7-22)	(25-28)	(15-27)
Greatest length of skull				
N	9	15	5	13
Mean ± SE	80.3 ±0.78	78.7 ±0.69	107.6 ±1.18	104.1 ±1.08
Range	(77.2-85.0)	(75.3-86.5)	(103.8-110.8)	(97.7-111.1)
Anterior zygomatic breadth				
N	8	13	5	14
Mean ± SE	46.8 ±0.32	46.9 ±0.56	67.2 ±0.74	63.3 ±1.26
Range	(45.4-48.3)	(44.4-50.4)	(65.2-68.8)	(58.8-71.3)
Posterior zygomatic breadth				
N	9	15	5	13
Mean ± SE	44.5 ±0.51	43.9 ±0.64	67.9 ±0.31	* 63.6 ±1.04
Range	(41.3-46.2)	(39.5-48.1)	(67.2-68.6)	(58.6-69.3)
Postorbital breath				
N	9	15	5	14
Mean ± SE	25.4 ±0.40	24.9 ±0.41	35.0 ±0.45	33.9 ±0.49
Range	(23.7-26.8)	(23.2-29.3)	(33.8-35.9)	(29.9-36.4)
Length of squamosal process				
N	9	15	5	14
Mean ± SE	29.9 ±0.38	29.2 ±0.62	23.1 ±1.15	22.7 ±0.85
Range	(27.9-31.5)	(24.7-33.4)	(19.5-25.8)	(18.4-28.5)

(Cont.)

Measurements and statistics	*Bradypus variegatus*		*Choloepus hoffmanni*	
	Males	Females	Males	Females
Length of maxillary toothrow				
N	9	15	5	14
Mean ± SE	26.5 ±0.38	25.8 ±0.62	24.1 ±0.35	23.5 ±0.33
Range	(25.1-28.8)	(23.9-29.2)	(22.7-24.5)	(20.3-25.1)
Postpalatal length				
N	9	15	5	14
Mean ± SE	41.7 ±0.80	41.2 ±0.50	47.0 ±0.49	46.3 ±0.52
Range	(39.3-46.4)	(38.0-45.6)	(45.6-48.1)	(41.1-49.9)
Palatal breadth				
N	8	15	5	14
Mean ± SE	17.9 ±0.18	18.1 ±0.27	24.8 ±0.29	24.6 ±0.25
Range	(17.3-18.7)	(15.9-19.8)	(24.1-25.5)	(23.0-26.2)
Depth of braincase				
N	9	15	5	14
Mean ± SE	28.3 ±0.36	28.1 ±0.28	39.9 ±0.50	38.1 ±0.54
Range	(27.0-30.5)	(26.5-29.6)	(38.3-41.1)	(34.8-41.9)
Breadth of antorbital bar				
N	9	15	5	14
Mean ± SE	4.5 ±0.14	4.8 ±0.17	8.0 ±0.28 **	7.0 ±0.17
Range	(3.7-5.1)	(4.1-6.2)	(7.5-9.1)	(5.8-8.0)
Length of descending jugal process				
N	9	15	5	14
Mean ± SE	15.2 ±0.45	15.8 ±0.53	29.4 ±0.58 *	26.4 ±0.73
Range	(13.4-16.8)	(13.4-19.5)	(27.6-30.7)	(21.8-32.2)

* Significantly different at the $P \leq 0.05$ level.
** Significantly different at the $P \leq 0.01$ level.

vidual, which were reproduced by Gray (1871). He noted that the sloth had a "greyish green colour" when captured, but it faded when the skin was preserved and dried. He opined that this green color may have resulted from "the fact that the hair becomes covered with minute cryptogamic organisms, the damp climate and thick gloomy forest being favourable to their growth." We now know he was correct and that individuals of *Bradypus* in Central America are green in color because of a diverse flora of algae, including a blue-green alga, a branched, filamentous red alga, and two species of coccoid green algae growing on their pelage (Wujek and Timpano, 1986). Seemann was able to keep the sloth alive for about a month feeding it leaves of *Cecropia peltata* (Moraceae), which is a short-lived, light demanding tree that dominates early succession in moist tropical forests of Central America and one of the more than 90 food plants used by *Bradypus* (Montgomery, 1983). One night the sloth escaped and was found the next morning about 730 m away. Seemann was puzzled because to

reach that point the sloth needed to cross "a cleared hill, where there were no shrubs nor trees."

The mean weight of a combined sample of 20 individuals representing both sexes is 4.7 kg (3.2–6.1). The sample does not include individuals that we judge to be juveniles (greatest length of skull less than 60 and/or weight 1 kg or less) collected on the following dates: 2 February (58.3; 1 kg), 27 February (254 g), 11 March (58.3; 0.7 kg), 11 March (57.2; 0.9 kg), 8 April (56.1; 0.9 kg), and April (58.3; 0.7 kg). An adult female (weighing 13.5 lbs [= 6.1 kg]; KU 97878) obtained on 11 August 1964 had a single embryo 125 mm in crown–rump length (KU 97879), and a 4-kg adult female (KU 111344) collected at El Recreo on 25 June 1967 had a single embryo 60 mm in crown–rump length (KU 111345). The embryo from the female taken on 11 August (KU 97879) is fully furred and near term. Allen (1908) noted that one of the two specimens collected at Chontales on 20 February was "a young female about one fourth grown."

None of the five individuals from Nicaragua tested for leptospirosis was positive (Clark et al., 1966).

Jones (1965) reported that the Miskito name in the Caribbean lowlands of Nicaragua for this sloth was *siwaiku*. Jones (field notes, 1966) was informed that three-toed sloths were common southwest of Lago de Nicaragua near the Costa Rican border.

Remarks — Gray (1871) gives the type locality for his *Arctopithecus castaneiceps* [= *Bradypus variegatus castaneiceps*] as "Javali gold-mine in the Chontales district of Nicaragua, about 2000 feet above the sea-level." Javali is not shown on modern maps of Nicaragua and at the time of Gray's description Chontales district encompassed most of southeastern Nicaragua. However, Belt (1874) gives an excellent description of the location and setting of Javali in the early 1870s. He had been sent as the Superintendent of the Chontales Mining Company, which was headquartered in Santo Domingo. Belt (1874: 83) describes the Javali Company mines as located within a half-mile of Santo Domingo, which he places as 12°16´N, 84°58´W (1874: 50). Current gazetteers for Nicaragua do not list Javali, but give the location of Santo Domingo at 12°16´N, 85°05´W, which is within the boundaries of the modern department of Chontales. Some recent articles dealing with the history of mining in the Santo Domingo and La Libertad areas of Nicaragua give the alternate spelling for Javali as "Jabalí," but this spelling is not used on maps or the modern gazetteers either.

Chontales and Río Coco are two of the collecting sites visited by William B. Richardson, who obtained specimens for American Museum of Natural History (Allen, 1908, 1910). These and others of Richardson's collecting localities have been difficult to pinpoint with accuracy. Jones and Engstrom (1986: 19) place the locality of "Chontales" in the vicinity of Tierra Azul in the Department of Boaco at approximately 12°41´N, 85°30´W. Jones and Engstrom (1986: 20) believe that the locality "Río Coco" is the same as San Juan de Río Coco, which is located at 13°33´N, 86°10´W in the Department of Madriz. However, Buchanan and Howell (1965) and McCarthy et al. (1999) place Richardson's locality of "Río Coco" at a place known in the past as "Santa Cruz, Río Coco," which is located at 13°27´N, 85°55´W in the Department of Jinotega.

Family Megalonychidae

Choloepus hoffmanni hoffmanni Peters, 1858

Hoffmann's Two-toed Sloth, Perezoso

Specimens examined (29) — ATLÁNTICO NORTE: Bonanza, 2 (1 KU, 1 NMNH). ATLÁNTICO SUR: El Recreo, 25 m, 2 (1 KU, 1 NMNH). BOACO: Santa Rosa, 17 km N, 15 km E Boaco, 1 (KU). GRANADA: La Calera, Nandaime, 1 (NMNH). JINOTEGA: La Trampa, 5.5 km N, 16 km E Jinotega, 2 (1 KU, 1 NMNH). MATAGALPA: Finca Tepeyac, 10.5 km N, 9 km E Matagalpa, 960 m, 16 (11 KU, 5 NMNH); *3 mi ENE Matagalpa*, 1 (KU); Santa María de Ostuma, 1,250 m, 1 (KU). RÍO SAN JUAN: Greytown [= San Juan del Norte], 1 (NMNH). RIVAS: Finca Amayo, 13 km S, 14 km E Rivas, 40 m, 1 (NMNH); 6.9 mi E San Juan del Sur, 1 (TTU).

Additional records — MATAGALPA: Matagalpa (Allen, 1908); Uluce (Allen, 1910).

Distribution — Hoffmann's two-toed sloth is known to occur from Honduras southward

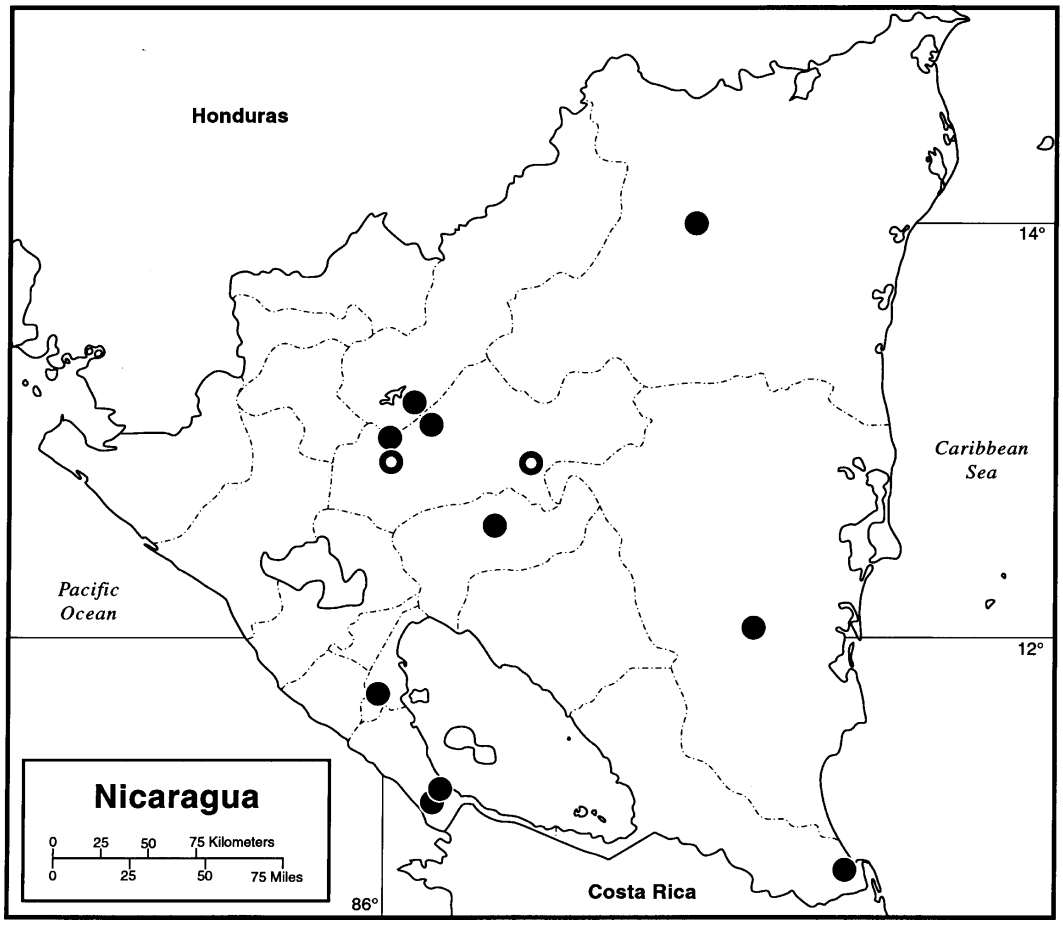

Fig. 2. Map of Nicaragua showing the geographic distribution of *Choloepus hoffmanni hoffmanni*. Closed circles represent specimens examined and open circles represent literature records.

through Central America and into northwestern South America and a disjunct population occurs in Perú, Bolivia, and Brazil east of the Andes (Wetzel, 1982, 1985a; McCarthy et al., 1999). The nominate subspecies occurs in Central America and intergrades with other subspecies in Colombia (Wetzel, 1982). The localities in Nicaragua for all known specimens of *C. hoffmanni* are shown in **Fig. 2**.

Systematics — Peters (1858) described *Choloepus hoffmanni* from Costa Rica based on three specimens. Subsequently, Goodwin (1946) restricted the type locality to Escasú, San José, Costa Rica, but Wetzel and Ávila-Pires (1980) corrected this to Volcán Barba [= Barva], Heredia, Costa Rica, which is listed on the specimen labels. The scientific name *Choloepus hoffmanni* appears to be the only one available for two-toed sloths in Central America. Wetzel (1982) recognized five subspecies within this taxon, with *C. h. hoffmanni* occurring from Honduras southward into Colombia. Gray (1871) gives an early and detailed description for this species based, at least in part, on one specimen from the type series loaned by Peters.

Morphometrics — **Table 1** gives the external and cranial measurement for five male and 14 female *C. hoffmanni* from Nicaragua. Comparing the size of males and females, they differ significantly in three cranial measurements—in each case, males are larger than

females. Posterior zygomatic breadth and length of descending jugal process differ at the $P \leq 0.05$ level and breadth of antorbital bar at the $P \leq 0.01$ level. In all cranial measurements, males average larger than females and even in some of the nonsignificant measurements the means are quite different, indicating that additional measurements may reveal secondary sexual differences with larger samples. In all but two cranial measurements, our specimens of *C. hoffmanni* average much larger than the comparable samples of *Bradypus variegatus*. Length of squamosal process and length of maxillary toothrow are the only measurements in which *Bradypus* average larger than *Choloepus*.

Natural history — Although this species is found primarily at low and mid elevations in Nicaragua, it has been taken as high as 3,300 m in Costa Rica (Molina et al., 1986). As was pointed out by McCarthy et al. (1999), *Choloepus* shares with *Bradypus* the mesic Caribbean lowlands of eastern Nicaragua and the central highlands of the northcentral part of the country. Although these sloths share this large part of Nicaragua, they have been recorded together at only four localities—Bonanza, El Recreo, Finca Tepeyac, and Greytown. The specimens examined also include three individuals (La Calera, near San Juan del Sur, and Finca Amayo) of two-toed sloth from west of Lago de Nicaragua, where *Bradypus* has not been recorded, although it has been recorded just south of the lake. These sites are low in elevation —136, 100, and 34 m, respectively— and relatively dry, with vegetation in many places being grassland with stands of acacia and other thorny bushes and trees. There are relatively well-developed riparian forests with large trees along the streams emptying into Lago de Nicaragua and the Pacific Ocean.

A female taken on 16 August at 6.9 miles E San Juan del Sur contained a single embryo. Three adult females taken at Finca Tepeyac on 7, 9, and 11 August and one at Santa Rosa on 13 July were noted as not being pregnant. Adult males taken at Finca Tepeyac on 7 and 9 August had testes that measured 29 and 25, respectively, in length. A sample of four males had an average weight of 6.7 kg (5.9–7.2), whereas a series of 13 females had an average weight of 5.8 kg (4.7–7.2). The smallest individual in our sample was a female taken at Finca Tepeyac on 12 August weighing 0.91 kg with a total length of 316. A specimen from Matagalpa reported by Allen (1910) was judged to be "in the first pelage" and measuring 220 in total length when captured on 21 December.

Neither of the two individuals from Nicaragua tested for leptospirosis was positive (Clark et al., 1966).

Remarks — Jones and Engstrom (1986: 19) place Richardson's locality of "Uluce" at 12°53´N, 85°37´W in the Department of Matagalpa based on small-scale maps available to them.

Family Dasypodidae
Cabassous centralis (Miller, 1899)
Northern Naked-tailed Armadillo,
Armadillo Zopilote

Specimens examined — None.
Additional records — ATLÁNTICO NORTE: Río Coco [vicinity of Namaka] (Bard, 1855). MANAGUA: Managua (Wetzel, 1980).

Distribution — Northern naked-tailed armadillos are known from as far north as Belize, Guatemala, and eastern Chiapas, México, through Central America into northeastern Colombia and northwestern Venezuela (Wetzel, 1980; McCarthy, 1982; Cuarón et al., 1989). The literature records of this species are plotted on the map in **Fig. 6**.

Systematics — Miller (1899) described *Tatoua* (*Ziphila*) *centralis* [= *Cabassous centralis*] based on a specimen from Chemelecón, Cortés, Honduras, and one from Suerre, Limón, Costa Rica. Both of these specimens previously had been reported and described under other existing names (True, 1895; Allen, 1897). In the same year, Palmer (1899) demonstrated that *Cabassous* held priority over *Tatoua* and thus the appropriate name for this species was *Cabassous centralis*.

Wetzel (1980) was the most recent reviser of the genus *Cabassous* and recognized four living species, maintaining *C. centralis* as a distinct species based on its small size, slender skull, and naked cheeks and ears. *Cabassous*

centralis is a monotypic species (Wetzel, 1980, 1982).

Morphometrics — Wetzel (1980) presented the means of external (10 individuals) and cranial (17 individuals) measurements of *C. centralis*. Selected means of measurements from this table are as follows: total length, 494.9; length of tail, 153.7; length of hind foot, 65.3; length of ear, 33.0; condylonasal length, 78.0; zygomatic width, 40.8; interorbital width, 24.3; palatal length, 45.1; rostral length, 36.9; length of maxillary toothrow, 27.8; length of mandibular toothrow, 25.9.

Natural history — Samuel A. Bard [a pseudonym used by the artist–adventurer Ephraim G. Squier; born 1821, died 1888] (1855: 492–493) wrote "In strolling a little distance from our camp, before supper, I saw a waddling animal …. I hurried forward, and headed it off its course. In attempting to pass me, it came so near that I stopped it with my foot. In an instant it literally rolled itself up in a ball, looking for all the world like a large sea-shell …. I then saw it was an armadillo, that little mailed adventurer of the forest, who, like the opossum, shams death when 'cornered,' or driven in 'a tight place.' I rolled him over, and grasping him by his stumpy tail, carried him into camp. He proved to be of the variety known as the 'three-banded armadillo,' cream-colored, and covered with hexagonal scales. I afterwards saw several other larger varieties, with eight and nine bands. The flesh of the armadillo is white, juicy, and tender, and is esteemed one of the greatest of luxuries." Bard's description of the animal as being "cream-colored, and covered with hexagonal scales," his distinguishing it from the "other larger varieties, with eight or nine bands," and mention of the "stumpy tail" identifies this animal as being a naked-tailed armadillo, *Cabassous centralis*. This is the earliest reference to any xenarthran in Nicaragua of which we are aware and apparently is the first reference to *C. centralis* in the literature. Neither Allen (1908, 1910) nor Wetzel (1980) were aware of the fact Bard had recorded the naked-tailed armadillo in the country. Goodwin (1946: 350) is one of the few modern-day authors to mention that when frightened, this armadillo "rolls its body into a ball, presenting only the protected body armor on the outside." Wetzel (1980) was the first to report a naked-tailed armadillo from Nicaragua based on a specimen, which was from Managua and deposited in the Zoologisches Museum, Museum für Naturkunde der Humboldt-Universität in Berlin, Germany.

McCarthy (1982) surmised that in Belize this species was an inhabitant of the open savannah habitat characterized by grasses and sedges with islands of trees surrounded by pimento palm. It is worth noting that the single specimen from Nicaragua was taken in a drier part of the country dominated by grassland with acacia. In Costa Rica, *C. centralis* occurs from sea level to at least 1,800 m (Timm et al., 1989; Timm and LaVal, 2000). It is a rare species everywhere in the country, but is seen in cloud forest above 1,500 m more frequently than in lowland forests. Timm has observed this distinctive armadillo foraging in leaf litter on a number of occasions in the Monteverde Cloud Forest Preserve, which is the northernmost documented locality of occurrence in Costa Rica. Similar to *Dasypus*, *C. centralis* uses its nose as a probe, frequently poking it into the leaf litter and using its powerful front claws and limbs to clear litter and dig small holes during foraging. Also similar to *Dasypus*, *C. centralis* seems unaware of quiet human observers, and thus can be observed for a considerable period of time from relatively close range.

Dasypus novemcinctus fenestratus
Peters, 1864
Nine-banded Armadillo, Cusuco

Specimens examined (40) — ATLÁNTICO NORTE: Bonanza, 3 (1 KU, 2 NMNH). ATLÁNTICO SUR: El Recreo, 25 m, 12 (8 KU, 4 NMNH). BOACO: Boaco, 350 m, 1 (KU). CHINANDEGA: Hda. San Isidro, El Realejo, 2 (1 KU, 1 NMNH). CHONTALES: Hato Grande, 13 km S, 8 km W Juigalpa, 60 m, 1 (KU). GRANADA: Finca Santa Cecilia, 6.5 km SE Guanacaste, 660 m, 2 (KU); *Mecatepe, 2 km N, 11 km E Nandaime*, 3 (1 KU, 2 NMNH). MANAGUA: Hda. Aztcualpa, 3 (1 KU, 2 NMNH). MATAGALPA: 11 mi SE Dario, 1 (KU); Finca Tepeyac, 10.5 km N, 9 km E Matagalpa, 960 m, 4 (2 KU, 2 NMNH). RÍO SAN JUAN: Greytown [= San Juan del Norte], 1 (NMNH); La Esperanza, 4 (2 KU, 2 NMNH).

RIVAS: Finca Amayo, 13 km S, 14 km E Rivas, 40 m, 3 (KU).
Sight record — RIVAS: Finca Amayo, 13 km S, 14 km E Rivas, 40 m (J. K. Jones, Jr., 21 July 1964).
Additional records — CHONTALES: northeast of San Ubaldo (Belt, 1874). JINOTEGA: Peña Blanca (Allen, 1910). MADRIZ: Río Coco (Allen, 1910). MATAGALPA: Lavala (Allen, 1908).

Distribution — The nine-banded armadillo is known from central Nebraska in the United States (Freeman and Genoways, 1998) to Argentina (Wetzel and Mondolfi, 1979; Wetzel, 1982, 1985b), making it the most widely distributed member of the order. Wetzel (1982) gave the geographic range of *Dasypus novemcinctus fenestratus* as "from Honduras into northern South America." In Nicaragua, the species can be expected throughout the country and can be locally abundant. There are specimens from Greytown on the Caribbean Coast and Finca Amayo and Hacienda San Isidro along the Pacific Coast, and records from the central highlands in the departments of Boaco, Jinotega, Madriz, and Matagalpa. There is documentation of the species in the dry lowlands east of Lago de Nicaragua at Hato Grande and near San Ubaldo and from the heavily agricultural areas between Lagos de Managua and Nicaragua. Bonanza is located on the lower slopes of the central highlands along the western edge of the Caribbean lowlands. The known specimens and a sight record are mapped in **Fig. 3**.

Systematics — Peters (1864) described *Dasypus fenestratus* based on two specimens collected by the German naturalist Carl Hoffmann from Costa Rica. G.M. Allen (1911), in the description of *D. n. hipolites* from the island of Grenada, was the first author to reduce *fenestratus* to subspecific status within *Dasypus novemcinctus.* Allen first applied this trinomial to populations of armadillos from México and Central America. The most recent revisers of this species (Wetzel and Mondolfi, 1979; Wetzel, 1982, 1985b; see also Hall, 1981) retained the trinomial *D. n. fenestratus*, but restricted the geographic range of the subspecies to being from Honduras and El Salvador into South America. Wetzel and Mondolfi (1979) selected a lectotype for *D. fenestratus* and designated San José, San José, Costa Rica, as the type locality.

Morphometrics — Table 2 presents the external and cranial measurements of 14 adult male and seven adult female nine-banded armadillos from Nicaragua. Males and females do not differ significantly in any of the four external and 11 cranial measurements. Males average larger in all but three measurements. Females average larger in length of tail and condylobasal length and the sexes have the same mean values for length of mandible. Among the 11 cranial measurements, the mean values for the sexes differ by more than 1.0 mm only for zygomatic breadth. Thus, in morphometric study of this armadillo, the values for the sexes can be combined for analyses.

Natural history — The nine-banded armadillo has a broad range of habitats in Nicaragua, which corresponds to its broad geographic range. It will be found in the mesic lowland forest of eastern Nicaragua to the dry grass and acacia savannahs of the western lowland. A subadult female was obtained near Boaco on 21 March from local residents who had captured it while they were doing the final clearing of a major area of wet forest in preparation for planting. There also are individuals obtained from the cooler forests of the central highlands in the departments of Jinotega, Madriz, and Matagalpa. Thomas Belt (1874: 39), the noted British geologist and naturalist, traveling in some of the driest parts of the country to east of Lago de Nicaragua between San Ubaldo and Acoyapa in the Department of Chontales in 1868, mentioned seeing nine-banded armadillos stating, "Small armadillos abound near these rocky knolls, and are said to feed on ants and other insects." His party was able to obtain an individual by chasing it "over the cracked and dried-up plain" between the "rocky knolls." Jones (KU field notes, 1966) was informed that armadillos were common near La Virgen southwest of Lago de Nicaragua. In summary, nine-banded armadillos should be expected anywhere in Nicaragua where they can obtain their preferred food of small invertebrates and roots and tubers.

Eight adult male nine-banded armadillos weighed an average of 4.8 kg (4.1–5.9),

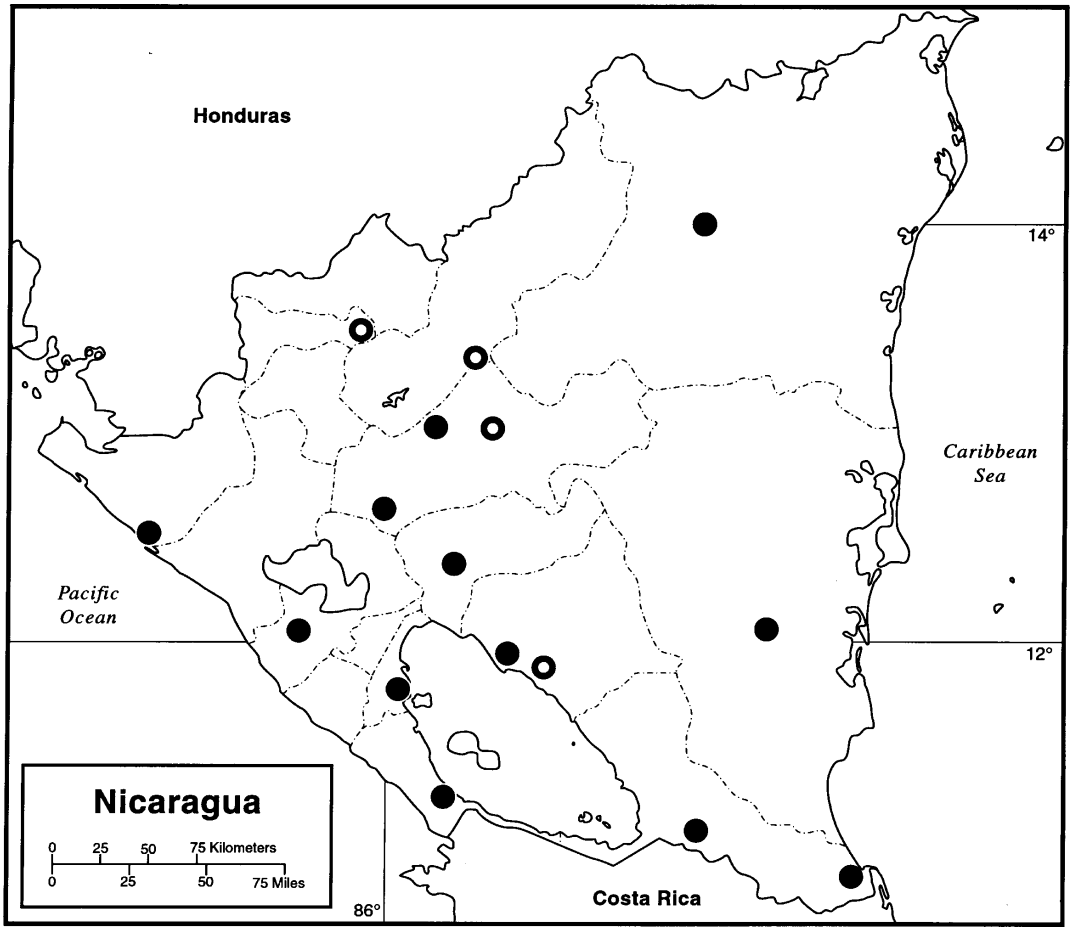

Fig. 3. Map of Nicaragua showing the geographic distribution of *Dasypus novemcinctus fenestratus*. Closed circles represent specimens examined and open circles represent literature records.

whereas six adult females averaged 5.1 kg (4.5–5.9). Two juvenile males were taken on 8 April at Bonanza, with occipitonasal lengths of 67.6 and 67.9 and one weighing 0.68 kg. Three juveniles (two preserved) were captured on 15 June 1966 at Finca Santa Cecilia; the total length and weight of two males are 392 and 398 and 356.2 and 351.7 g, respectively. Juvenile males taken at El Recreo on 18 June weighed 445 g and 469.9 g and were 377 and 394 long, respectively. Two juvenile females were preserved from Finca Amayo where they were found in a burrow along with two other juveniles and the adult female on 22 June 1966; the adult and two juveniles escaped.

Our rather complete ontogenetic series of *D. novemcinctus* from Nicaragua allows us to clearly define the permanent dentition of this species in more detail than has been done previously. The most commonly encountered dental count found in adult Nicaraguan armadillos is eight teeth in each upper and lower toothrow for a total of 32 teeth; however, 12 individuals display missing teeth in at least one of the toothrows. In most cases, it is not possible to determine whether these were lost during life or never erupted, but in the few case that we can determine the tooth appears to be lost in life. In one individual (KU 115219), a tooth bud has split so that there are two nearly iden-

Table 2

External and cranial measurements of the nine-banded armadillo (*Dasypus novemcinctus*) occurring in Nicaragua, comparing secondary sexual variation.

Measurements and statistics	*Dasypus novemcinctus*	
	Males	Females
Total length		
N	8	6
Mean ± SE	807±18.47	785±38.27
Range	(740-885)	(607-860)
Length of tail		
N	8	7
Mean ± SE	359±12.45	365±7.34
Range	(310-421)	(331-393)
Length of hind foot		
N	7	4
Mean ± SE	88.4±4.78	81.8±5.96
Range	(70-106)	(70-97)
Length of ear		
N	7	6
Mean ± SE	41.4±1.00	39.8±1.72
Range	(37-45)	(35-47)
Occipitonasal length		
N	14	7
Mean ± SE	99.0±0.86	98.1±1.12
Range	(91.5-103.4)	(94.2-102.8)
Condylobasal length		
N	13	7
Mean ± SE	89.1±0.72	89.7±1.2
Range	(85.1-92.3)	(84.0-94.6)
Length of nasals		
N	14	7
Mean ± SE	32.4±0.50	32.2±0.51
Range	(29.1-35.1)	(29.8-33.6)
Zygomatic breath		
N	10	6
Mean ± SE	43.1±0.40	41.8±0.66
Range	(40.3-44.6)	(40.2-44.6)
Postorbital breadth		
N	14	7
Mean ± SE	23.5±0.15	23.2±0.37
Range	(22.8-24.6)	(21.6-24.3)

(Cont.)

Measurements and statistics	*Dasypus novemcinctus*	
	Males	Females
Mastoid breadth		
N	13	7
Mean ± SE	28.3±0.19	28.2±0.27
Range	(27.1-29.5)	(27.5-29.6)
Palatal length		
N	14	7
Mean ± SE	64.0±0.65	63.7±0.81
Range	(60.0-67.1)	(60.2-67.2)
Length of maxillary toothrow		
N	13	7
Mean ± SE	24.2±0.54	24.0±0.48
Range	(20.0-26.8)	(21.9-25.8)
Rostral length		
N	14	7
Mean ± SE	59.5±0.84	59.4±1.10
Range	(54.4-63.9)	(55.7-63.9)
Length of mandible		
N	14	7
Mean ± SE	77.9±0.62	77.9±0.99
Range	(74.4-81.8)	(77.1-81.6)
Length of mandibular toothrow		
N	12	7
Mean ± SE	26.0±0.25	25.9±0.28
Range	(24.9-27.8)	(24.3-26.6)

tical teeth at the same location and nine teeth in the toothrow (**Fig. 4**). Because the nine-banded armadillo is homodont, it is not possible to identify the teeth and dental formula. However, there are several individuals in our sample in which the deciduous dentition is present (**Fig. 5**) and others in which this dentition is being replaced. Juvenile individuals have only seven teeth in each toothrow. These seven teeth are deciduous and are replaced by permanent teeth and one tooth without a deciduous precursor is added to the toothrow (**Fig. 5**). This would give adult *D. novemcinctus* in Nicaragua a dental formula of i 0/0, c 0/0, p 7/7, m 1/1 = 32.

Jones (1965: 354) reported that the Miskito name in the Caribbean lowlands for the nine-banded armadillo was "*taiirra* (or *tahira*)."

None of the six individuals from Nicaragua tested for leptospirosis was positive (Clark et al., 1966).

Remarks — Peña Blanca and Lavala are an additional two of Richardson's collecting sites that were determined by Jones and Engstrom (1986). They placed Peña Blanca in the southern part of the Department of Jinotega at 13°15´N, 85°41´W and Lavala (= Savala) at 45 km ENE of Matagalpa based on the determination of Buchanan and Howell (1965: 549).

Family Myrmecophagidae
Cyclopes didactylus dorsalis (Gray, 1865)
Silky Anteater, Tapacara

Specimens examined (4) — ATLÁNTICO NORTE: Bonanza, 1 (NMNH). ATLÁNTICO SUR: 10 km WNW El Recreo, 1 (NMNH). RÍO SAN JUAN: Greytown [= San Juan del Norte], 2 (NMNH).
Additional records — MATAGALPA: Río Grande (Allen, 1908).

Distribution — The species occurs from southern Veracruz and Oaxaca in México through Central America to along the west coast of South America as far south as Ecuador and throughout most of the Amazon Basin (Eisenberg and Redford, 1999; Hall, 1981; Wetzel, 1982, 1985a). Specimens assigned to the subspecies *Cyclopes didactylus dorsalis* are known from Honduras southward into northwestern Colombia and Venezuela (Wetzel, 1982). In Nicaragua, the limited number of specimens is from the Caribbean lowlands and low lying areas in the central portion of the country (**Fig. 6**). McCain (2001) reported that she observed silky anteaters in La Reserva de la Biósfera del Río Plátano in the Caribbean lowlands of northeastern Honduras on several occasions during 1995–1996.

Systematics — *Cyclothurus dorsalis* was described by Gray (1865) based on an unspecified number of specimens from Costa Rica. The type locality was subsequently restricted to Orosi, Cartago, Costa Rica, by Goodwin (1946). Thomas (1900), in the description of a South American form, was the first to use the current name combination *Cyclopes didactylus dorsalis.* Wetzel (1982; see also Hall, 1981) retained the trinomial *C. d. dorsalis* for silky anteaters occurring in Central America from Honduras southward into South America in northwestern Colombia and Venezuela.

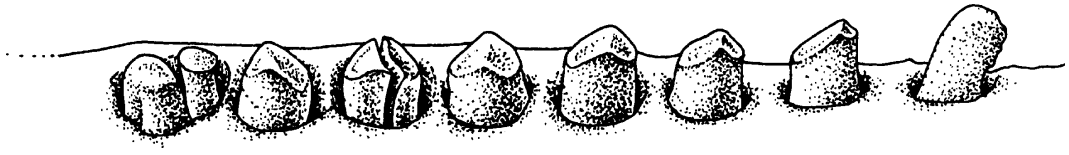

Fig. 4. Left mandibular toothrow of KU 115219, a *Dasypus novemcinctus,* showing nine teeth in the toothrow resulting from the splitting of the tooth bud for the molar tooth. Anterior is to the right.

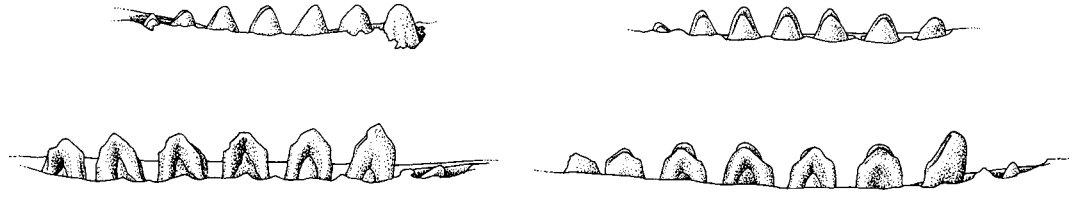

Fig 5. The maxillary (left) and mandibular (right) toothrows of a juvenile (upper) and a subadult (lower) *Dasypus novemcinctus* from Nicaragua. The two toothrows in the upper part of the figure are those of a juvenile individual (KU 111348) showing the seven deciduous upper (left) and lower (right) premolars. The maxillary toothrow at the lower left (KU 108390) shows the deciduous P1 lost and the permanent P1 just emerging and the remaining six deciduous teeth in the process of being replaced by permanent teeth. The mandibular toothrow at the lower right (KU 108390) shows permanent p1–2 present with deciduous p4–7 still being replaced and an eighth tooth in the row, the molar (at the left of the toothrow). Anterior is to the right on all illustrations.

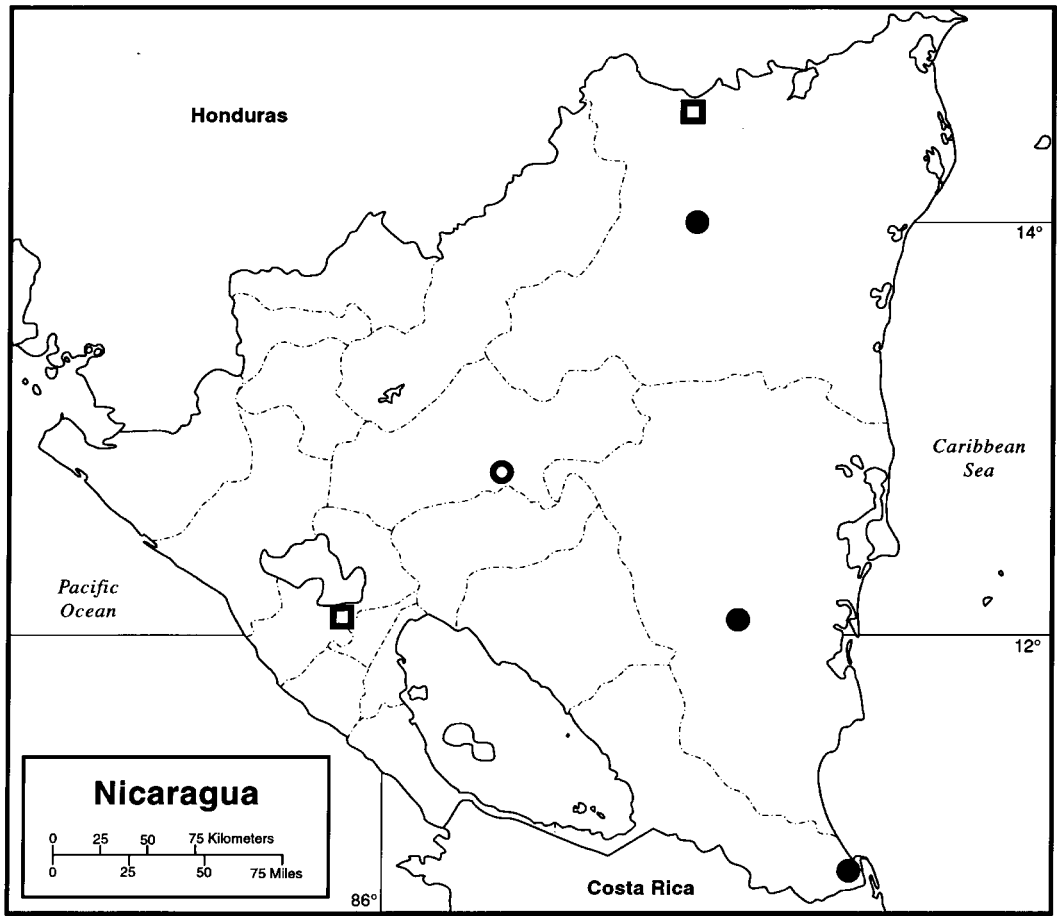

Fig. 6. Map of Nicaragua showing the geographic distribution of *Cabassous centralis* and *Cyclopes didactylus dorsalis*. Closed circles represent specimens examined and the open circle a literature record of *Cyclopes*, while open squares represent literature records of *Cabassous*.

Morphometrics — **Table 3** presents the external and cranial measurements of a male and a female silky anteater from Nicaragua.

Natural history — A total of only five silky anteaters currently are known from Nicaragua, all of which appear to be adults. The records for the species are confined to more heavily forested areas of the Caribbean lowlands of eastern Nicaragua. A male collected on 7 April 1908 from Río Grande at 210 m appears to be from the highest elevation known for the species in Nicaragua (Allen, 1908). Silky anteaters are arboreal, nocturnal, and obligate insectivores, feeding primarily on ants (Montgomery, 1985). Their arboreal habits make them particularly vulnerable to logging and other activities that remove trees and break tropical forests into smaller fragments.

The one individual from Nicaragua tested for leptospirosis was negative (Clark et al., 1966).

Jones (1965) reported that the Miskito name in the Caribbean lowlands of Nicaragua for *Cyclopes didactylus* was *likur*.

Remarks — Río Grande is Richardson's locality that Allen (1908, 1910) placed south of Tuma at an elevation of 700 feet [= 210 m]. Jones and Engstrom (1986) place the collecting site along the Río Grande de Matagalpa near its

Table 3

External and cranial measurements of the two species of anteaters (*Tamandua mexicana* and *Cyclopes didactylus*) occurring in Nicaragua, comparing secondary sexual variation in *Tamandua mexicana*.

Measurements and statistics	*Tamandua mexicana*		*Cyclopes didactylus*	
	Males	Females	NMNH 337712 (M)	NMNH 338772 (F)
Total length			380	375
N	2	4		
Mean ± SE	1035±5.00	1097±31.46		
Range	(1030-1040)	(1050-1190)		
Length of tail			200	195
N	2	4		
Mean ± SE	510±10.00	560±21.21		
Range	(500-520)	(520-610)		
Length of hind foot			30	35
N	3	4		
Mean ± SE	80.0±5.00	85.8±8.55		
Range	(70.0-85.0)	(70.0-108.0)		
Length of ear			11	7
N	3	3		
Mean ± SE	41.7±4.41	43.7±3.67		
Range	(35.0-50.0)	(40.0-51.0)		
Occipitonasal length			44.1	—
N	3	6		
Mean ± SE	124.9±2.14	128.5±2.00		
Range	(121.0-128.4)	(121.1-134.1)		
Condylobasal length			44.4	—
N	3	6		
Mean ± SE	117.7±3.15	124.1±1.77		
Range	(112.5-123.4)	(117.0-128.0)		
Length of nasals			12.0	—
N	3	6		
Mean ± SE	44.9±1.05	46.8±0.70		
Range	(43.2-46.8)	(43.8-48.5)		
Postorbital breath			8.9	8.9
N	3	6		
Mean ± SE	23.9±0.96	23.9±0.24		
Range	(22.0-25.1)	(23.0-24.7)		
Breadth of braincase			22.7	22.5
N	3	5		
Mean ± SE	41.6±0.38 **	39.8±0.24		
Range	(40.9-42.2)	(39.0-40.4)		

(Cont.)

Measurements and statistics	*Tamandua mexicana*		*Cyclopes didactylus*	
	Males	Females	NMNH 337712 (M)	NMNH 338772 (F)
Mastoid breadth			17.4	18.0
N	3	6		
Mean ± SE	35.1±1.06	34.1±0.40		
Range	(33.7-37.3)	(32.6-35.5)		
Palatal length			18.5	—
N	3	6		
Mean ± SE	96.3±2.08 *	102.8±1.43		
Range	(92.6-99.8)	(97.5-106.7)		
Rostral length			13.6	—
N	3	6		
Mean ± SE	60.7±3.12	59.3±1.00		
Range	(56.4-66.8)	(56.6-62.2)		
Length of mandible			29.9	29.5
N	3	6		
Mean ± SE	101.9±1.79	107.4±1.65		
Range	(98.3-103.8)	(101.7-111.9)		

* Significantly different at the $P \leq 0.05$ level.
** Significantly different at the $P \leq 0.01$ level.

confluence with the Río Upa, and located between two other Richardson's collecting sites at Muy Muy and Uluce.

Myrmecophaga tridactyla centralis
Lyon, 1906
Giant Anteater, Oso Caballo

Specimens examined — None.
Additional record — "forest lowlands of the east coast" (Allen, 1910: 94).

Distribution — In Central America, the giant anteater is extremely rare so its exact geographic range is not known. Hall (1981) and Wetzel (1985a) map the species from as far north as Punta Gorda, Belize, following Alston (1879-1882) and Allen (1910), and southeastern Guatemala (Handley, 1950). In South America, the species has a wide distribution in tropical areas. In Nicaragua, giant anteaters can be expected in the tropical lowland forests of the Caribbean lowlands.

Systematics — Lyon (1906) described *Myrmecophaga centralis* based on three specimens from Costa Rica and one from Panamá, with the type locality at Pacuare, Costa Rica. Goldman (1920) was the first author to reduce this taxon to a subspecies of the widespread South American species *Myrmecophaga tridactyla.* This arrangement continues to be followed by recent authors (Hall, 1981; Wetzel, 1985a; Gardner, 1993), although there are so few specimens for study that a rigorous examination is not possible.

Natural history — The only mention of the giant anteater in Nicaragua is a report to Allen (1910: 94) in letters from his field collector William R. Richardson that the species occurs in the "forest lowlands of the east coast." Additionally, Jones (1965) reported that a Miskito Indian familiar with the mammals of eastern Nicaragua had an indigenous name for the giant anteater, *wingku tara*.

Goldman (1920) reported a specimen from Panamá in addition to the earlier record by Lyon (1906). Allen (1910) reported that Salvin had taken a specimen from "near Punta Gorda, on the coast of the Bay of Honduras" (Alston, 1879-1882). This latter record is located in the modern country of Belize and is still considered to be the northernmost Recent record for the species, but more importantly, it documents that the species occurred to the north of Nicaragua as well as to the south.

More recently, Handley (1966) reported an additional specimen from Panamá and stated that the species "is now confined to the less disturbed portions" of the lowlands of the country. In Costa Rica, Timm et al. (1989) report observations of the giant anteater at La Selva in the Caribbean lowlands in 1978–1979 and in Parque Nacional Corcovado on the Osa Peninsula in 1979. Timm et al. (1989) and Timm and LaVal (2000) concluded that the species is either extirpated or at extremely low numbers in Costa Rica. The most recent and thoroughly documented record of a giant anteater in Central America comes from Honduras (McCain, 2001). Her report is based on an individual captured and ultimately released by local Miskito Indians in La Reserva de la Biósfera del Río Plátano in northeastern Honduras in September 1996. The reserve protects a large area of relatively undisturbed lowland tropical rainforest.

It is certain that giant anteaters were members of the mammalian fauna of Nicaragua even though no specimens are available to document its occurrence. In Nicaragua, as elsewhere in Central America, small populations have been reduced through hunting and habitat loss. However, as in Honduras, individuals should be expected in the undisturbed lowland tropical forests of eastern Nicaragua, but it is almost certainly extirpated from the remainder of the country as is true for most of Central America.

Tamandua mexicana chiriquensis
J. A. Allen, 1904
Northern Tamandua, Oso Hormiguero

Specimens examined (18) — ATLÁNTICO NORTE: Bonanza, 2 (1 KU, 1 NMNH). ATLÁNTICO SUR: El Recreo, 25 m, 7 (5 KU, 2 NMNH). CHONTALES: Hato Grande, 13 km S, 8 km W Juigalpa, 1 (KU); Villa Somoza [= Villa Sandino], 3 (2 KU, 1 NMNH). GRANADA: Mecatepe, 2 km N, 11 km E Nandaime, 1 (NMNH). JINOTEGA: La Trampa, 5.5 km N, 16 km E Jinotega, 1 (NMNH). LEÓN: Las Colinas, 4 km WNW Puerto Momotombo, 1 (NMNH). MANAGUA: 6 mi WSW Managua, 1 (KU); 3 mi NNE Sabana Grande, 1 (KU).
Sight record — MATAGALPA: Santa María de Ostuma, 1,250 m (Jones, field notes, 1966).
Additional records — MATAGALPA: Muy Muy (Allen, 1910); Vijagua (Allen, 1910). NUEVA SEGOVIA: Ocotal (Allen, 1908).

Distribution — Northern tamanduas occur from southern San Luis Potosí in eastern México southward through Central America into South America. In South America the species is know from northwestern Venezuela, northern and western Colombia, and southward west of the Andes to northwestern Perú (Wetzel, 1975, 1982, 1985a). The subspecies *Tamandua mexicana chiriquensis* is known to occur from northern Nicaragua southward through the remainder of Central America and into South America (Hall, 1981; Wetzel, 1982). In Nicaragua, the tamandua is present in Caribbean lowlands, Pacific lowlands, east of Lago de Nicaragua, and central and northern highlands (**Fig. 7**). The area where records are lacking for the species are in the wettest lowlands along the Caribbean coast, but it almost certainly occurs throughout the region.

Systematics — The Nicaraguan subspecies of *Tamandua mexicana* was described by Allen (1904) under the name *Tamandua tetradactyla chiriquensis*. This name was used by subsequent authors (Reeves, 1942; Hall and Kelson, 1959) until the revision of the genus by Wetzel (1975). Wetzel (1975) was able to demonstrate that the oldest name available for populations of tamandua with a vested coat pattern in México, Central America, and northwestern South America was *Tamandua mexicana* with a type locality in Tabasco, México. Allen (1908, 1910) was the first author to apply the trinomial *chiriquensis* to Nicaraguan tamanduas.

Morphometrics — **Table 3** gives the external and cranial measurements of three male and six female *T. m. chiriquensis* from Nicara-

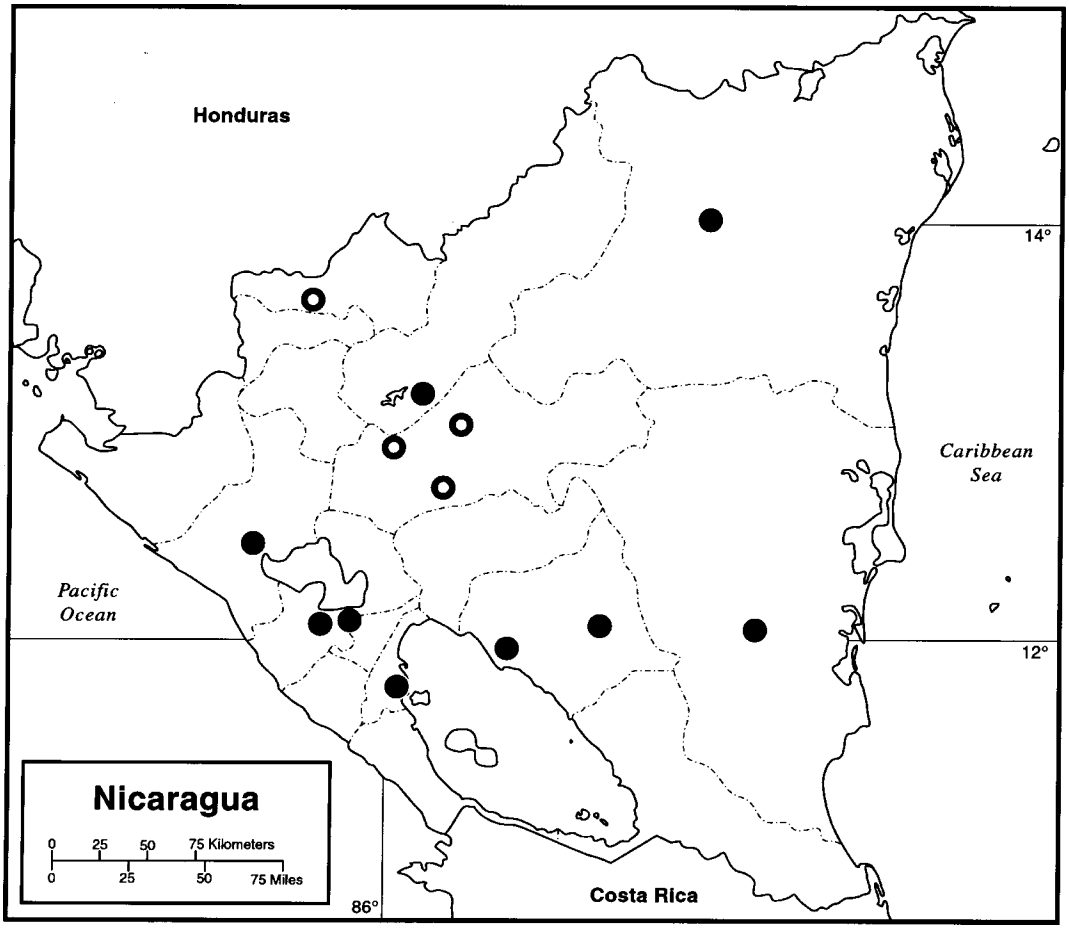

Fig. 7. Map of Nicaragua showing the geographic distribution of *Tamandua mexicana chiriquensis*. Closed circles represent specimens examined and open circles represent literature records.

gua. Female tamanduas average larger than males in all four external measurements, as well as five of the nine cranial measurements. Males average larger than females in three cranial measurements (breadth of braincase, mastoid breadth, and rostral length) and the sexes have the same mean value for postorbital breadth. The differences between the sexes are significant only for palatal length ($P \leq 0.05$) and breadth of braincase ($P \leq 0.01$). However, inspection of the mean differences between the sexes in cranial measurements reveals that in many cases the means are quite distinct (3.6, 6.4, 1.9, 0, 1.8, 1.0, 6.5, 1.4, and 5.5, respectively). We believe that with larger sample sizes many more of the measurements would display significant secondary sexual differences. It also is worthy of note that besides postorbital breadth, the mean differences are the least for the three measurements in which males average larger (breadth of braincase, mastoid breadth, and rostral length). It is particularly noteworthy that males are larger or equal to females in all three measurements of cranial breadth. This would seem to indicate that not only are the crania of males and females different sizes, but that crania also display proportional differences. We recommend not combining data for male and female tamanduas in any study of geographic variation because this could obscure potentially significant trends.

Natural history — Tamanduas can be ex-

pected anywhere in Nicaragua where there is a sufficient supply of its obligate food source of termites and ants. This species is capable of exploiting both terrestrial and arboreal nests of it food sources. The easternmost records of the species in Nicaragua are the seven specimens taken at El Recreo, Atlántico Sur, which is approximately 70 km from the Caribbean coast. The lack of records of tamandua from extreme eastern Nicaragua undoubtedly is the result of the lack of collecting effort. Jones (1966; in litt.) was informed that tamanduas were common southwest of Lago de Nicaragua, near the Costa Rican border. In the Santa María de Ostuma (1,250 m) region, he was told that tamanduas were seen only occasionally, and he examined one skin from there collected by a local hunter.

Three adult male anteaters from Nicaragua had weights of 4.25, 4.25, and 4.5 kg and three adult females had weights of 3.9, 4.1, and 5.1 kg. A juvenile, probably a new born, was picked up by the Alcorns on 24 June 1956 at 3 mi NNE of Sabana Grande (KU 71046). The next smallest individuals in our sample are a female from La Trampa taken on 2 June weighing 1.8 kg and with a condylobasal length of approximately 91.8 and a female from Villa Somoza [= Villa Sandino] taken on 11 June weighing 2.5 kg and with an occipitonasal length of approximately 99.4. A female capture at Hato Grande on 22 April was lactating.

Allen (1910) noted that one of the specimens taken 28 July at Muy Muy was “a young one about a week old.” The other individual taken at the same time was adult female potentially the mother of the juvenile individual. The specimen reported by Allen (1910) from Vijagua was a “half-grown male” taken on 25 March.

The female obtained on 30 November near Hda. Las Colinas was found dead on a road, presumably killed by a motor vehicle. None of the eight individuals from Nicaragua tested for leptospirosis was positive (Clark et al., 1966).

The Miskito name for *T. mexicana* in the Caribbean lowlands is *wingku* (Jones, 1965).

Remarks — Muy Muy is Richardson's locality found on most modern maps of Nicaragua at 12°46´N, 85°38´W. Both Buchanan and Howell (1965: 550) and Jones and Engstrom (1986: 21) agree that Vijagua (= Bijagua) is a small village near Guasaca (13°07´N, 85°41´W) about 35 km NE Matagalpa, Department of Matagalpa.

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