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The Illegal Traffic in Sloths and Threats to Their Survival in Colombia

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Tinka Plese

Introduction

The illegal trade in wildlife is driven by the high demand in national and international urban centers, making wildlife trafficking the third most lucrative criminal enterprise in Colombia, after the trade in weapons and drugs (CITES, 2005; Rodríguez and Echeverry, 2005). Together with the swift and pervasive destruction of tropical forests, this places many of the species reliant on these ecosystems in danger of extinction.

This report is based on our observations at the UNAU Foundation sloth rehabilitation center during its first five years of operation, from 2000 to 2005, in the city of Medellín. Here we show how independent pressures have combined to threaten the survival of sloths in Colombia.

Sloths of Colombia

Three species of sloths are known from Colombia (Wetzel, 1982). The brown-throated three-toed sloth, *Bradypus variegatus* (Schinz, 1825) inhabits both Pacific and Amazonian lowland rainforest and the Caribbean savanna dry forest (pers. obs.) (Fig. 1). Hoffman's two-toed sloth, *Choloepus hoffmanni* (Peters, 1859) is sympatric in the north with *B. variegatus*, sharing the Pacific rainforest and the Caribbean savanna dry forest, but is also found in Andean montane forest (pers. obs.). The southern two-toed sloth, *Choloepus didactylus* (Linnaeus, 1758) is sympatric in the south with *B. variegatus*, sharing the lowland Amazonian rainforest (Wetzel, 1982; Eisenberg, 1989; Emmons and Feer, 1999; Fonseca and Aguiar, 2004) but this species has been little-studied in Colombia. The available habitat of these species is limited primarily by the extent of continuous canopy within natural forest (Montgomery and Sunquist, 1978).

Previous authors have assumed the distribution of *B. variegatus* to include nearly the entire lowland territory of Colombia (Wetzel, 1982; Eisenberg, 1989; Emmons and Feer, 1999; Fonseca and Aguiar, 2004). However, we have developed what we believe to be a more accurate and detailed assessment of its range, based on interviews with local hunters, government officials and other researchers, as well as personal observations and our efforts to track the origin of confiscated animals. Based on this information, we believe that variegated sloths are limited to some areas of the northern Caribbean region, certain localities in the inter-Andean valleys, and the Pacific and Amazonian regions. We have combined presence data from Anderson and Handley (2001) with our own unpublished data to produce a preliminary model of distribution using BIOCLIM (Busby, 1991) and DIVA-GIS (Hijmans, 2005) that we believe presents the probable current distribution of *B. variegatus* (Fig. 2).

C. hoffmanni has a wider distribution, ranging from the northern Caribbean coast to the south along the Pacific coast, as well as in the central Andean regions (Wetzel, 1982). In Colombia there are two distinct phenotypes of *C. hoffmanni*; one is found in lower, warmer areas below 1500 m, while the other is typical of higher and cooler zones between 1500 and 3000 m (Moreno, 2003b). These phenotypes may correspond to the subspecies *C. h. capitalis* and *C. h. agustinus*, respectively (Wetzel, 1982). *C. didactylus* has been reported from the Orinoco and Amazon regions (Wetzel, 1982; Eisenberg, 1989; Emmons and Feer, 1999), but this species has been little studied in Colombia.

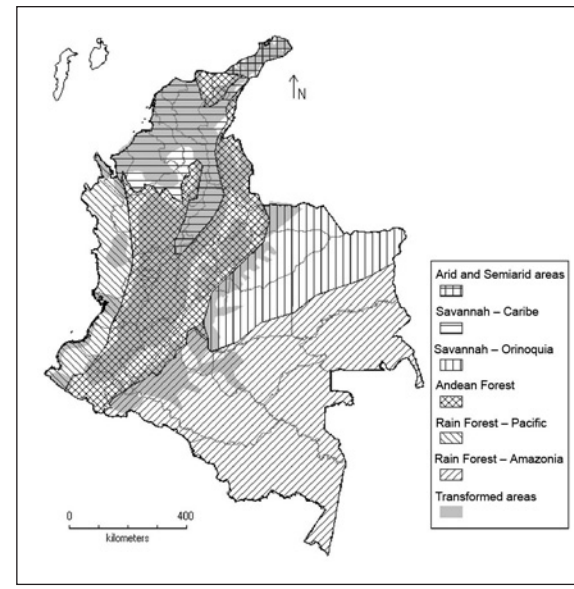

FIGURE 1. Main natural regions of Colombia. Map developed from IAvH (2005a) and IGAC (2002). Arid and semiarid areas correspond to lowlands dominated by xerophytic or subxerophytic vegetation. Savannahs are lowlands with marked dry-wet seasons; they are characterized by shrub vegetation and abundant wetlands. The Andean region is comprised of a great diversity of montane ecosystems with multiple vegetation assemblies, ranging from 500 to 3900 m above sea level. Rainforest is evergreen hygrophilous with exuberant stratified vegetation, rich in lianas and epiphytes. Transformed areas are primarily used for intensive agriculture and ranching (IGAC, 2002).

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Threats to Sloth Survival

Habitat destruction and fragmentation

As with too many tropical species, the greatest threat to the survival of sloths in Colombia is the destruction of their natural habitat (Chiarello, 1999). Owing to the constant expansion of ranching, agriculture and urban areas, over 100,000 ha of natural forest are destroyed every year in Colombia (IDEAM, 2004), with immense wildlife mortality as a direct result.

Sloths sometimes die in large numbers in incidents that go unreported by the media, and unnoticed or ignored by Colombian wildlife agencies and police.[1] One such case was reported in the newspaper *El Colombiano* (Machado, 2002) in Necoclí, Department of Antioquia, where an estimated 600 *B. variegatus* were displaced by the destruction of their habitat, forcing them into open grassland and beaches where they suffered from starvation, dehydration and parasite infestation. People from the local communities took action to rescue the sloths on the beaches themselves, one by one, without assistance from the local authorities (R. Villarta, pers. comm.).

At the sloth rehabilitation center of the UNAU Foundation, we are often called to nearby semi-urban areas to rescue two-toed sloths (*C. hoffmanni*) that have been injured in a variety of ways—hit by cars, stoned by children, or suffering from electrical shocks—as well as others that appear to be dispersing from lost habitat. All these cases are ultimately related to the destruction of remnant patches of natural forests (Moreno, 2003a). We have not had rescue calls for the other two species of sloth; *C. didactylus* and *B. variegatus* do not naturally occur near the city of Medellín where the Foundation is located. We have had similar cases reported by veterinarians, however, and some individuals of these species have been sent to us from regions throughout the country.

In general, *B. variegatus* are more vulnerable than other sloths to habitat disruption. Their reduced mobility, small home range, and their more gregarious and diurnal habits make them more sensitive to forest loss, which may account for their disappearance from many regions of their former distribution.

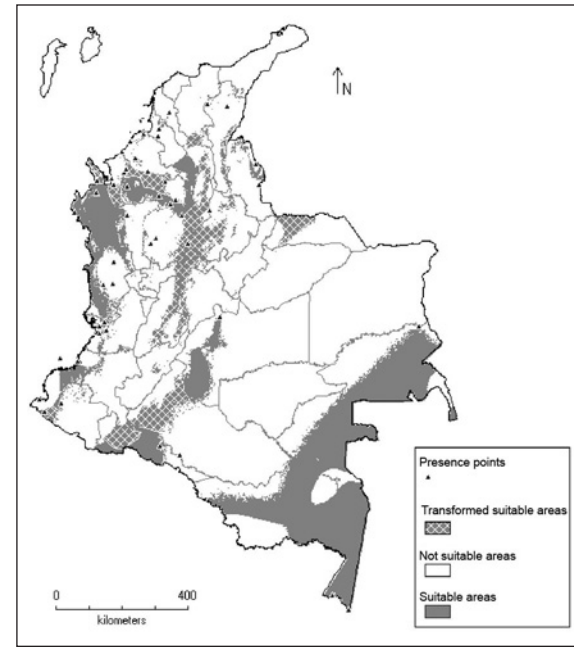

FIGURE 2. Preliminary BIOCLIM model of the current distribution of *B. variegatus* in Colombia.

Unlike other arboreal mammals, a variegated sloth is likely to remain within a tree until it is cut down; this is because their instinctive reaction to a threat is to hold still rather than to flee (pers. obs.). Once on the ground, with no sheltering forest nearby, they are exposed to starvation, predators and hunting. The northern lowland rainforest and northern savannah dry forest have been widely cleared for pasture and croplands (IDEAM, 2004), seriously compromising the survival of *B. variegatus* in those areas. Only in the Pacific lowland rainforest are there still extensive reaches of continuous canopy.

Choloepus hoffmanni, on the other hand, has larger home ranges, is more mobile, nocturnal, solitary and aggressive, and is thus much more adaptable to habitat alteration. We have seen individuals in a diversity of habitats, frequently isolated and disturbed, such as small patches of secondary forest (less than 10 ha) near urban centers. We have also found them in patches of remnant tropical dry forest in the midst of cattle ranches. But *C. hoffmanni* shares the same forest habitat as *B. variegatus*, and so it is exposed to the same threats and alterations. Habitat loss and fragmentation affect the montane phenotype of *C. hoffmanni* in particular (IDEAM, 2004).

There is little published information on *C. didactylus*, but its distribution within Colombia follows the lowland rainforest of the upper Amazon basin (Fonseca and Aguiar, 2004), which so far has suffered compar-

[1] Colombian wildlife agencies are represented locally by "autonomous regional corporations" which have the responsibility of administering all natural resources except fish. There are 30 of these corporations throughout the country, working under the general guidelines established by the Environmental Ministry (Ministerio de Ambiente, Vivienda y Desarrollo Territorial).

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atively little deforestation (IDEAM, 2004). Based on the extent of its remaining habitat, *C. didactylus* may be in the best situation of all the Colombian sloths.

Despite this flexibility, habitat fragmentation is a critical threat for all three species of sloths in Colombia. Their adaptations to an arboreal life make them exceptionally vulnerable when away from the trees, and open reaches of grassland, crops or urban infrastructure become insurmountable barriers for them. Small forest fragments are unlikely to contain viable populations due to the small genetic pool (Groom *et al.*, 2005).

Illegal trade in sloths

Every year in Colombia, hundreds of young two- and three-toed sloths are taken from their mothers by poachers. Traffickers buy young sloths from children, who often take them from deforested areas. The mother sloths are often mistreated and sometimes killed for their meat. This is not limited to sloths alone; any wild animal that can be caught is also used, including monkeys (*Alouatta*, *Ateles*, *Cebus* and *Saguinus*), parrots (*Aratinga*, *Pionus* and *Amazona*), macaws (*Ara*) and other xenarthrans such as *Tamandua* and *Cyclopes*. Once taken from the forest, animals are brought to improvised shelters with inadequate housing, feeding and sanitary conditions, and are sold to Colombians traveling between the interior and the coast on vacation (Moreno, 2003a). The price of a young sloth starts at the local equivalent of US$30, but with a little bargaining one may be bought for less than US$5 (pers. obs.). Neither the sellers nor the buyers understand the nutritional and environmental needs of these animals, and so the stress of their capture and captivity ultimately leads to their deaths. This commerce is strictly illegal; although there are no laws in Colombia that give specific protection to sloths, all wildlife in the country is protected by a general law (Decreto 1608/1978) that prohibits the hunting, possession and traffic of Colombian wildlife.

This trade in sloths is not a new development, but the number of sloths sold on roadsides has risen in recent years. The security on national highways has improved significantly since 2003, bringing greater numbers of seasonal travelers—and hence creating greater opportunities for wildlife traffickers. Thanks in part to extensive educational efforts by the UNAU Foundation, local and national authorities have taken an increasing interest in the issues of sloth welfare, but the trade continues unabated. Sloths appear to be captured and sold mainly in the northern departments of Córdoba, Sucre, Bolívar, Atlántico and Magdalena (Fig. 3, Table 1) (Moreno and Plese, 2004). These departments are rich in natural resources—but they are also undergoing rapid transformation, with wetlands and forests converted for agriculture and cattle farming. A major highway, La Troncal del Norte, leads from the interior to the Caribbean coast, passing through the northern departments and serving as a conduit for potential buyers on vacation. Local authorities are unable to exert much control over the roadside sale of wildlife there, and many sloths change hands during the summer and winter holidays.

In 2004 in the city of Medellín alone—the second largest in the country—local police and wildlife agencies reported the confiscation of 256 mammals (Moreno *et al.*, 2005). That same year, the UNAU Foundation received 102 sloths, of which 81 (79.4%) were *B. variegatus* and 21 (20.6%) were *C. hoffmanni* (Tables 2 and 3). Of these 102 rescued animals, about 70% were newborns or juveniles, with a body weight of less than 700 g. *B. variegatus* is the more appealing species for the wildlife trade; their docile nature and inherent charm, especially in infants and juveniles, make for easy sales to unwary buyers. *C. didactylus* is much less common in this trade; during the five years UNAU has been in operation, we have received only one individual—a juvenile rescued after its mother

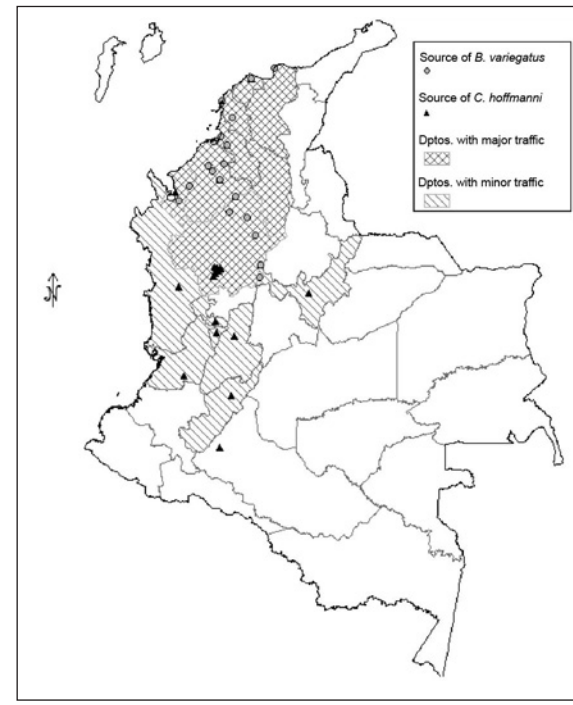

FIGURE 3. Sources of illegal traffic, by department, in *B. variegatus* and *C. hoffmanni* in Colombia. The source symbols represent highway locations or municipalities where sloths were bought. We collected this information based on reports from buyers who later regretted their purchases, and from our personal observations during fieldwork for the UNAU Foundation.

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was killed by a car near the town of Florencia in the Amazon. The areas where *C. didactylus* are found are too remote and have too little tourism for traffic in this species to be common.

To determine the departments where this traffic is most prevalent, we analyzed our records for the 274 sloths admitted to the UNAU Foundation between March 2001 and October 2004. Records without a known purchase site were not used. We also excluded records of adult individuals, as these animals come to the Foundation as result of accidents (road, electrocution) or other encounters. We sorted the remaining 61 records by department (Table 1).

TABLE 1. Departments of origin for young sloths arriving at the UNAU Foundation (March 2001–October 2004).

Department	Qty.	%
Córdoba	25	41%
Antioquia	8	13%
Sucre	7	11%
Atlántico	6	10%
Bolívar	3	5%
Magdalena	3	5%
Huila	2	3%
Risaralda	2	3%
Boyacá	1	2%
Caquetá	1	2%
Chocó	1	2%
Quindío	1	2%
Tolima	1	2%
Total	**61**	**100%**

TABLE 2. Number of sloths received at the UNAU Foundation sloth rehabilitation center in the first five years of its operation.

Year	N° of sloths per year	Cumulative N° of Sloths
2000	8	8
2001	28	36
2002	36	72
2003	103	175
2004	102	277

TABLE 3. Total sloth mortality at the UNAU Foundation rehabilitation center during 2004.

	B. variegatus	*C. hoffmanni*
Admissions	81 (100%)	21 (100%)
Mortality	**68 (84%)**	**52 (52%)**
Survivors	13 (16%)	10 (48%)

The northern departments of Córdoba, Antioquia, Atlántico, Sucre, Bolívar and Magdalena are the source of 85% of the young sloths we have received, most of them victims of a chain of regular traffic. The remaining 15% come from departments of the interior. These are mostly *C. hoffmanni,* and according to testimonies, they were captured in chance encounters. Many of these sloths die unreported in private hands. Very few of them are given to zoos or a rehabilitation center such as UNAU.

Although the police may confiscate sloths at highway checkpoints, or in response to citizen complaints, most of those we have received were voluntarily surrendered by the buyers, concerned by their new pet's failing health—or by the trouble of keeping it alive. To some extent, buyers may also be moved by campaigns undertaken by wildlife agencies and the UNAU Foundation. Not surprisingly, the mortality of these sloths is high.

The annual increase in the number of individuals received at the center results from two factors: first, the consolidation of the rehabilitation center, and its increasing recognition by citizens and wildlife authorities; and second, the increase in the sale of sloths on the northern highways, as the improvements in overall security have brought more vacationers out on the roads.

Rehabilitation

Two factors strongly influence the success of the rehabilitation process. The first is the body weight of the animal upon arrival, which depends on its age. Mortality is very high (about 70%) for individuals weighing less than 700 g, which corresponds to their first five months of life. After this age, their chances for survival improve considerably, and older sloths show about 30% mortality (Table 4).

The second determining factor is the physical condition of new arrivals, which is critical during their first 30 days at the rehabilitation center. Most of the mortality occurs during this period (Table 5), usually as a direct result of the treatment sloths received from poachers, salesmen and unsuspecting buyers. Before a sloth's arrival at the UNAU Foundation's rehabilitation center, it may have been in captivity for some 15 days, during which it was most likely malnourished and badly cared for. If the young sloth experiences a violent separation from its mother and is subsequently mistreated, it is in poor physical condition, often involving dehydration, starvation, trauma and disease.

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A health survey of the 277 sloths treated by the UNAU Foundation showed that respiratory diseases, such as acute or chronic bronchopneumonia and lobar pneumonia, are by far the most common ailment, with 248 cases (90%) in total. Other illnesses include digestive problems such as diarrhea, constipation, tympanism and rumen paralysis, with 14 cases (5%); skin problems caused by fungus, bacteria (*Staphylococcus aureus*) and external parasites such as ticks, lice and mites (e.g., *Demodex canis*), with 8 cases (3%); and human-induced traumas such as nail mutilation, filed-down teeth, contusions, electric shock, burns and other wounds (5 cases; 2%). Nail polish is commonly used on sloths offered for sale: poachers use it to prevent young sloths, with their sharp nails and strong grip, from intimidating potential buyers. Other sellers will sometimes clip the nails instead of polishing them, with results as seen in Fig. 5a. *C. hoffmanni* have sharp, canine-like molars, and even very young individuals are able to bite down hard; thus poachers will sometimes file down the infants' teeth, with consequences that may eventually be fatal. Other generalized traumas are caused by improper confinement and careless maintenance by poachers and buyers alike.

TABLE 4. Sloth mortality by body weight during 2004.

Body Weight (g)	*B. variegatus*	*C. hoffmanni*
200–700	44 (65%)	8 (73%)
> 700	24 (35%)	3 (27%)
Mortality	68 (100%)	11 (100%)

TABLE 5. Sloth mortality by time in rehabilitation during 2004.

Period in rehabilitation (days)	*B. variegatus*	*C. hoffmanni*
< 30	53 (78%)	8 (73%)
> 30	15 (22%)	3 (27%)
Mortality	68 (100%)	11 (100%)

FIGURE 4. A salesman offering a young *B. variegatus* by the road in "La Y," Córdoba. Not knowing otherwise, tourists will often believe the hucksters' claims that sloths are easy to feed and maintain.

Capture myopathy is a complex condition involving physiological and psychological factors generated by stressful handling (Kreeger *et al.*, 2002). Infant and juvenile sloths suffer from immunodepression as a consequence of the trauma of early separation from the mother (Brieva *et al.*, 2000). Often they will also develop digestive problems caused by an improper diet, especially infants that do not have a fully developed digestive system. There is no good substitute for a sloth mother's natural milk. Pulmonary problems may also arise, sometimes due to the inhalation of liquids into the lungs during artificial feeding. Other pulmonary difficulties may develop as well, both from overall stress and from their sudden change in climate—from the warm, lowland rainforests and savannas to the cooler Andean regions where most buyers live. Young sloths may also acquire respiratory ailments from close contact with humans.

Conservation Status

The conservation status currently assigned to Colombian sloths by national and international authorities makes it difficult to enforce their protection. The most recognized authority, the IUCN Red List, classifies *B. variegatus, C. hoffmanni* and *C. didactylus* as LC – Least Concern (IUCN, 2006).

The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) lists *B. variegatus* in Appendix II and *C. hoffmanni* in Appendix III with no other restrictions, while no classification is given to *C. didactylus* (CITES, 2005). Appendix II includes species not necessarily threatened with extinction, but for which trade must be controlled in order to avoid uses incompatible with their survival. Appendix III contains species that are protected in at least one country and which has asked other CITES Parties for assistance in controlling the trade (CITES, 2005).

A report by the World Conservation Monitoring Centre of the United Nations Environment Programme (UNEP-WCMC) on the international trade in wildlife lists only six individuals of *B. variegatus* (1 body, 5 live) for the period 1995–1999, and provides no information on their origin (UNEP-WCMC, 2001). It should be noted, however, that UNEP-WCMC and CITES deal only with the international species trade, and do not address the issues of within-country wildlife commerce. We include

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TABLE 6. Sloth conservation status according to national and international listing authorities.

Organization	*B. variegatus*	*C. hoffmanni*	*C. didactylus*
IUCN Red List (IUCN, 2006)	LC – Least Concern	LC – Least Concern	LC – Least Concern
NatureServe (InfoNatura, 2004)	G5 – Secure	G4 – Apparently Secure	G4 – Apparently Secure
CITES (CITES, 2005)	Appendix II	Appendix III (Costa Rica only)	None
Ministerio de Ambiente, Colombia (2005)	Not listed	Not listed	Not listed

them here to provide an international perspective on the traffic in sloths—and because conservation funds are often conditional on a species being listed by CITES.

A separate measure of conservation status, developed by the NGO NatureServe, lists *B. variegatus* as G5 (Secure) and both species of *Choloepus* as G4 (Apparently Secure) (InfoNatura, 2004). Information from all three threat classification systems is summarized in Table 6. None of the three sloth species is included on the List of Threatened Mammals of Colombia (Ministerio de Ambiente, 2005).

Discussion

The international classifications of sloth conservation status are not representative of the local situation in Colombia. Other countries such as Bolivia, Costa Rica and Brazil face similar threats to their own sloth populations, and have ongoing rehabilitation programs for these species—indicating there is pressure on them as well.

The most recent distribution maps for the sloths, presented by Fonseca and Aguiar (2004), do not differ much from the maps provided by Wetzel (1982). These maps are generalized and do not represent the actual distribution of the three species in Colombia. For example, these sources indicate that *B. variegatus* is present throughout the territory of Colombia, in significant contrast with the preliminary results of our BIOCLIM model (Fig. 2).

Likewise, conservation assessments are sometimes based on isolated reports that may not always be representative of a species' ecology as a whole. Eisenberg and Thorington (1973) reported sloths to comprise as much as 40% of the biomass of mammals on Barro Colorado Island, and suggested that "*Bradypus* exists at the highest numerical density of any large, arboreal mammal" in the Neotropics. However, the situation at Barro Colorado Island is almost certainly different from conditions prevailing across the majority of the species' range. In addition, *B. variegatus* is sometimes gregarious, congregating in large numbers during

FIGURE 5. Frequent traumas on trafficked *B. variegatus*: a. mutilation of the nails; b. severe respiratory disease; c. laceration caused by fungus; d. trauma to the left eye.

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mating seasons and at seasonal feeding grounds, giving a false impression of abundance (pers. obs.).

Thus we would caution researchers, conservationists and decision-makers on the danger of taking these generalizations too literally, as this may lead to unnoticed local extinctions. The current situation of sloths in Colombia may also hold true for other, less-noted species without organizations dedicated to their survival, such as the silky anteater (*Cyclopes didactylus*). At present there are very few organizations in Colombia, perhaps a dozen all told, which are working on the conservation of specific genera.

The Alexander von Humboldt Institute for the Investigation of Biological Resources (IAvH) is a public corporation, linked to the Colombian Ministry of the Environment, which tracks the threat status of all Colombian fauna. The IAvH lists 16 criteria for a species at risk of extinction (IAvH, 2005b). Six of these criteria, we believe, are applicable to *Bradypus* and *Choloepus* in Colombia:

- Species whose populations are known to be declining;
- Species with low population density;
- Species with a reduced ability to disperse to new environments;
- Species that are habitat specialists;
- Species that suffer pressure from overexploitation; and
- Species with close relatives extinct or currently threatened.

The Colombian Ministry of the Environment does not list any of these three sloth species as being of conservation concern (Table 6), probably because there are no long-term studies to demonstrate cause for concern. For Colombia and for the international community, sloths are not focal species because they are not listed as threatened or potentially threatened. There are no formal estimates of sloth densities in Colombia, and this would be the first step in order to present any estimates of the total population.

Funds for species protection are always scarce, and generally go to those species listed as high risk in IUCN categories, while those that are Least Concern or Data Deficient are largely ignored. This circle — in which Data Deficient species receive little attention, and lack of funding precludes new research — traps investigators in a frustrating situation, as they are witness to the worsening situation of many of these species, but are unable to address it themselves.

At a local level, the limited efforts by police and wildlife agencies to control the wildlife trade are of no substantial help. A report from the Procuraduría General de la Nación, the Colombian Attorney General's Office, denounces the lack of legal instruments to regulate the post-confiscation management of wildlife in Colombia, as well as insufficient infrastructure and the lack of reliable statistics on confiscation and illegal traffic (Rodríguez and Echeverry, 2005). This report points out that of 251,776 wild animals confiscated during the period 1996–2004, only 1,639 legal investigations were initiated. Of these, only 45 resulted in a fine, while 263 concluded with a lesser sanction.

Recommendations

Predictive models of species distribution, such as the one we have presented in Fig. 2, are based on easily accessed environmental data and detailed information on species localities (Phillips *et al.*, 2006). These models can be powerful tools that should be used in species conservation assessments and to facilitate decision-making processes. Predictive models are not difficult to develop, and they can be done by researchers or NGOs with desktop computers running freeware or shareware. However, modeling also requires broad-scale information, such as vegetation coverage or ecosystem type, that only government agencies have the resources to gather. Access to this information is often limited, and agreements between institutions are required to take fullest advantage of it.

Threat assessments should take into account the dangers to local populations, recognizing that many genetic, biological and ecological factors are still unknown, especially in the Neotropics. Biodiversity conservation may be most effective when efforts are focused on widespread umbrella species rather than on focal endangered species (Fleishman *et al.*, 2000). This may be the situation with *B. variegatus*, which requires continuous forest canopy to survive; protecting this sloth would extend the same protection to many other species that share its rainforest habitat. Its wide distribution is an added benefit, since its range is continental in scope. Focal species, on the other hand, are generally endemic, limited to small regions and specific habitats. Concentrating efforts on the protection of focal species may create limitations on the overall conservation of biodiversity conservation, and the application of limited funds should be considered in this context.

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Formulación de Dieta en Cautiverio de Serafín del Platanal (*Cyclopes didactylus*) en el Parque Zoológico Huachipa

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Introducción

El serafín del platanal *Cyclopes didactylus* es el representante más pequeño de la familia Myrmecophagidae. Este género ocurre desde el sur de México a Bolivia y sur de Brasil (Nowak, 1991; Eisenberg y Redford, 1999).

El *Cyclopes didactylus* presenta hábitos estrictamente nocturnos; es totalmente arborícola y solitario (Montgomery, 1983; Emmons y Feer, 1999), siendo estas características las que han llevado a que los estudios en campo sean escasos y difíciles de realizar. Asimismo, la mayoría de estos estudios están relacionados con la biología de la especie en su hábitat natural y muy pocos trabajos han sido realizados en cautiverio.

Son escasos los reportes de ejemplares mantenidos en cautiverio (ISIS, 2006), teniendo un promedio de vida de un mes; solo se ha reportado un caso de un ejemplar en el Zoológico de New York que logró sobrevivir un año, cinco meses y 13 días (Meritt, 1971). La dificultad del mantenimiento en cautiverio puede ser causado por la falta de conocimiento sobre la biología y la especificidad de la alimentación.

Se han reportado que comen hormigas, termitas y escarabajos aunque presentan una preferencia por las hormigas (Best y Harada, 1985). Al igual que las otras especies de hormigueros, la dieta en cautiverio es una de las más difíciles de formular y muchas veces deficiencias nutricionales traen consecuencias fatales.

Este trabajo está basado en nuestra experiencia en la crianza de un ejemplar de *Cyclopes didactylus*, el cual es mantenido en cautiverio en el Parque Zoológico Huachipa en Perú, donde reportamos el consumo de las diferentes fórmulas y la composición nutricional de la dieta actual.

Metodología

En la ciudad de Pucallpa, selva amazónica del Perú, se recibió por parte del Instituto Nacional de Recursos Naturales – INRENA un ejemplar de *Cyclopes didactylus*, el cual fue alojado durante dos días en un criadero de la misma ciudad. Durante ese periodo sólo bebió una solución hidratante (Frutiflex 50®) la cual fue ofrecida tres veces al día.

El 17 de marzo del 2005 fue trasladado a la ciudad de Lima y reubicado en el Parque Zoológico Huachipa. Esta fecha fue registrada como el día 1 para todas las tablas de registro. "Maximus," nombre que se le dio al ejemplar, presentaba buena condición corporal, observándose aún la cicatriz umbilical, por lo que se dedujo que se encontraba dentro de la primera semana de vida.

Registró un peso inicial de 60 g y fue ubicado en un recinto con parámetros ambientales controlados (28°C y 98% humedad), siendo monitoreado las 24 horas durante los primeros 56 días. Se elaboraron diez fórmulas alimenticias durante ocho meses, las cuales fueron ajustadas en función al desarrollo del individuo. Del mismo modo, se realizó un registro diario durante 244 días, de los siguientes datos: ganancia de peso, consumo, frecuencia de alimentación, micción y defecación. Para el registro del peso se utilizó una balanza romana (Pesola®) de 100 g, 300 g y 600 g. El consumo fue medido en mililitros utilizando una jeringa de 1 ml, mientras que la frecuencia de micción y defecación fue notada por observación directa.

La descripción de las fórmulas alimenticias, al igual que los períodos de uso, se describen en la Tabla 1.

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FIGURA 1. Crioviales para alimentación.

FIGURA 2. Heces de *Cyclopes didactylus*.

Inicialmente el medio de alimentarlo fue a través de una jeringa de 1 ml; posteriormente se utilizaron crioviales de 2 ml (Fig. 1).

Resultados

Como se ha demostrado, la elaboración de una dieta adecuada en cautiverio en *Cyclopes didactylus* ha sido muy compleja, básicamente por la necesidad de determinar los requerimientos reales de esta especie, y utilizar diferentes insumos que puedan cubrir estas necesidades. Esto ha provocado que se realicen diversas modificaciones en la dieta llegando a un total de diez fórmulas alimenticias, las cuales se fueron elaborando en función a las necesidades fisiopatólogicas que fue presentando "Maximus."

Como se puede observar en la Fig. 3, la curva describe un crecimiento lineal ascendente, a pesar de la dispersión en la curva de consumo. Así mismo existe una baja en el volumen de consumo entre la F5 y F10, que coincide con el periodo en que el animal empezó con pérdida de pelo y blefaritis. Sin embargo a partir de la F10 la curva de consumo, a pesar de su variabilidad, tiende a ser más estable y la pendiente de crecimiento se incrementa.

En la Tabla 2 se presenta la composición nutricional de la F10. Esta fórmula es utilizada hasta la fecha y se estableció como una fórmula de crecimiento cuyo porcentaje de proteína es 37.71% y grasa de 19.03%. Siempre se observó una muy buena aceptación de las fórmulas ofrecidas, de consistencia líquida y sabor ligeramente dulce.

Los primeros 15 días fue estimulado antes de ofrecerle sus alimentos, para orinar y defecar. No se observaron alteraciones en la consistencia de las heces, cuyas características fueron: color verde oscuro, pastosas, inicialmente con una longitud de 0.5–1.0 cm de largo y posteriormente, una longitud de 3–5 cm (Fig. 2). La frecuencia de defecación fue en promedio dos días.

Discusión

El gran desconocimiento de los requerimientos nutricionales de los xenarthra en general y del *Cyclopes didactylus* en particular nos obligaron a la determinación de fórmulas iniciales de alimentación que lograron la supervivencia del individuo. Por la poca información disponible, se estableció inicialmente una fórmula para lactante (F1 y F2) en base a un sustituto lácteo para perros que presentaba un aporte elevado en grasa (40%) y proteína (33%). La intención era alcanzar elevados niveles de proteína en base a la información de la composición nutricional de la dieta de tamandúas, la cual contiene niveles de proteína de 30 a 37% (Pérez Jimeno, 2004).

La F5, F6, F7, F8 y F9 fueron fórmulas que se establecieron por diversos problemas que presentó el individuo, como blefaritis, conjuntivitis y alopecia, recibiendo inicialmente un tratamiento como proceso infeccioso, no observándose mejora. Las primeras fórmulas no aportaban vitaminas, las cuales son imprescindibles en los procesos metabólicos que tienen lugar en la nutrición. La variación en las dietas estuvo dirigida al cambio de suplementos vitamínicos que no afectaran la palatabilidad de la dieta. Priorizamos el aporte de vitaminas A, D, E, C y B observándose una mejoría en los problemas que había presentado.

De acuerdo a dos reportes de muertes de osos hormigueros gigantes, con cuadros semejantes en gatos con deficiencia de taurina (Aguilar *et al.*, 2002), se decidió elaborar la F10 donde se adicionó la taurina en 0.18 g en función a dosis utilizadas en otros zoológicos. Cabe recalcar que la F10 no es una dieta definitiva,

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TABLA 1. Fórmulas establecidas durante la crianza en cautiverio del *Cyclopes didactylus.*

Fórmula	Insumos	Cantidad (g)	Días en cautiverio	Proporción
F1	Mother's Helper	2,000	1–2	
	Solución hidratante (Frutiflex®)	8,000		
F1	Mother's Helper	2,000	3–10	
	Solución hidratante (Frutiflex®)	4,000		
F2	Mother's Helper	2,000	11–16	
	Agua	4,000		
F3	Mother's Helper	5,300	17–22	3 (F2):1 (F3)
	Promod	2,000		
	Aceite de girasol	2,500	23–27	2 (F2):1 (F3)
	Carbonato de calcio	0,100		
	Levadura de cerveza	0,100	28–41	1 (F2):1 (F3)
	Agua	10,000		
F4	Mother's Helper	7,000	42–71	
	Promod	0,800		
	Aceite de girasol	0,800		
	Carbonato de calcio	0,050		
	Levadura de cerveza	0,050		
	Agua	20,000		
F5	Mother's Helper	7,000	72–92	
	Promod	1,200		
	Aceite de girasol	0,800		
	Carbonato de calcio	0,200		
	Levadura de cerveza	0,050		
	VMD-SUPERVITAMINS	0,030		
	Agua	20,000		
F6	Mother's Helper	4,000	93–106	
	Promod	4,000		
	Aceite de girasol	0,500		
	Levadura de cerveza	0,100		
	VMD-SUPERVITAMINS	0,030		
	Pecutrín	0,400		
	Agua	20,000		
F7	Mother's Helper	4,000	107–110	
	Promod	4,000		
	Aceite de girasol	0,500		
	Levadura de cerveza	0,050		
	VMD-SUPERVITAMINS	0,030		
	Pecutrín	0,400		
	Duo CVP-K	0,500		
	Agua	25,000		
F8	Mother's Helper	4.000	111–122	
	Promod	4.000		
	Aceite de girasol	0.500		
	Levadura de cerveza	0.050		
	Pecutrín	0.400		
	Duo CVP-K	0.500		
	VMD-AMINOVIT	0.030		
	Agua	25.000		

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TABLA 1, *continuación*

Fórmula	Insumos	Cantidad (g)	Días en cautiverio	Proporción
F9	Mother's Helper	4.000	123–145	
	Promod	4.000		
	Aceite de girasol	0.500		
	Levadura de cerveza	0.050		
	Pecutrín	0.400		
	VMD-AMINOVIT	0.030		
	Selenio	2.000		
	Agua	25.000		
F10	Mother's Helper	4.000	146–244	
	Promod	4.000		
	Aceite de girasol	0.500		
	Levadura de cerveza	0.050		
	Pecutrín	0.400		
	VMD-AMINOVIT	0.030		
	Selenio	2.000		
	L-Taurina	0.180		
	Agua	25.000		

Mother's Helper: fórmula lactea para cachorros, Lambert Kay. Promod: suplemento proteico, Abbott Laboratorios SA. Levadura de cerveza, *Saccharomyces cerevisiae*, Lab. H.A. Knop. Pecutrín, suplemento mineral, Bayer Químicas Unidas SA. VMD-AMINOVIT, vitaminas y aminoácidos en polvo, Semeru Perkasa Permai. Selenio: mineral, GNC. L-Taurina: aminoácido, GNC.

TABLA 2. Composición nutricional – Fórmula 10 (F10).

Nutrientes	Unidades	Fórmula F10
Agua	Porcentaje	1.11
Energía	kcal/g	0.40
Proteína	Porcentaje	37.71
Fibra	Porcentaje	0.01
Grasa	Porcentaje	19.03
Ac. Linolénico	Porcentaje	2.98
Vitaminas		
Biotina	ppm	0.05
Folacina	ppm	1.40
Niacina	ppm	56.40
Acido Pantoténico	ppm	27.68
Riboflavina	ppm	11.03
Tiamina	ppm	5.86
Vit A	UI/g	38.06
Vit B6 piridoxina	ppm	4.25
Vit C	ppm	67.96
Vit D3	UI/g	4.53
Vit E	mg/Kg	53.73
Vit K (menadiona)	ppm	4.08
Aminoácidos		
Arginina	Porcentaje	0.69
Cistina	Porcentaje	0.67
Histidina	Porcentaje	0.52
Isoleucina	Porcentaje	1.67

Nutrientes	Unidades	Fórmula F10
Aminoácidos, *continuación*		
Lisina	Porcentaje	2.49
Metionina	Porcentaje	0.60
Fenilalanina	Porcentaje	0.97
Tirosina	Porcentaje	0.89
Treonina	Porcentaje	0.01
Triptofano	Porcentaje	0.51
Valina	Porcentaje	1.61
Taurina	Porcentaje	0.58
Minerales		
Ceniza	Porcentaje	2.45
Ca	Porcentaje	0.91
Fósforo	Porcentaje	0–69.00
Potasio	Porcentaje	0.01
Magnesio	Porcentaje	0.04
Sodio	Porcentaje	0.08
Cloro	Porcentaje	0.06
Hierro	ppm	77.51
Zinc	ppm	114.34
Manganeso	ppm	104.23
Cobre	ppm	25.07
Yodo	ppm	1.09
Cobalto	ppm	1.09
Selenio	ppm	2.27

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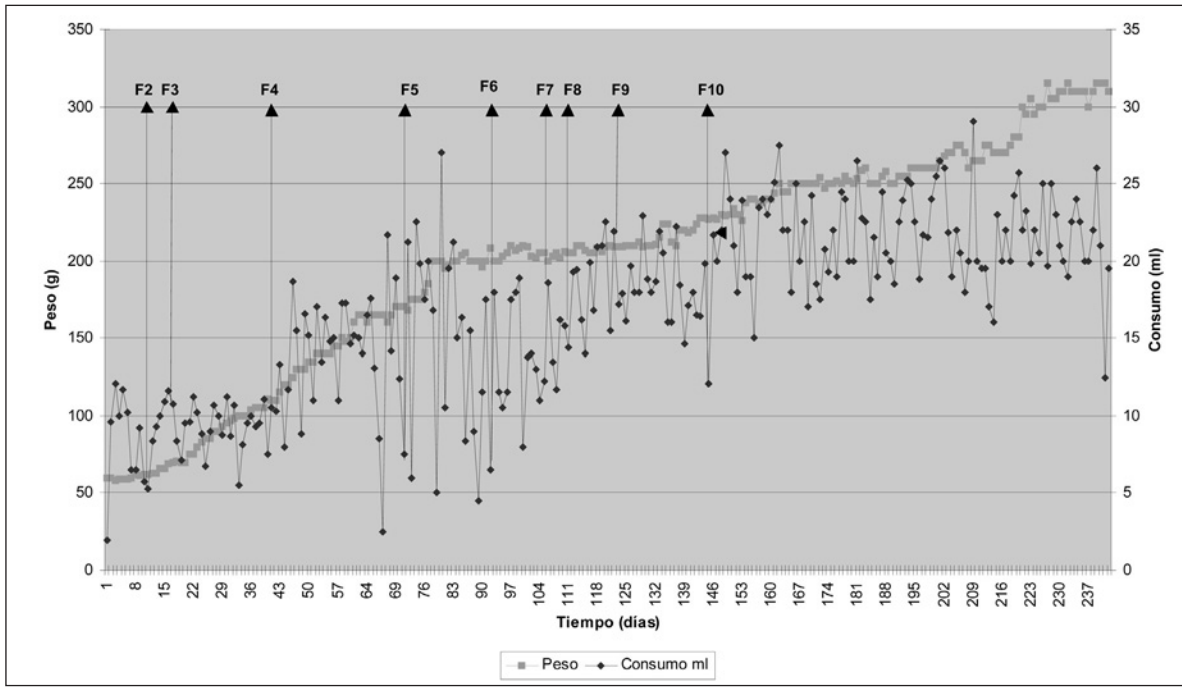

FIGURA 3. Ganancia de peso vs. consumo de *Cyclopes didactylus.*

sin embargo sí puede ser utilizada como una dieta durante el crecimiento en esta especie, siendo necesario formular una nueva dieta para el mantenimiento del animal adulto.

Se han observado secreciones oleosas de color marrón adheridas en el pelo de la región perigenital que podrían tener relación con los niveles de grasa de la dieta, debido a que estos disminuyeron cuando el porcentaje de grasa fue menor en las dietas. Sin embargo, no podemos afirmar que esta secreción pueda ser natural ya que no se cuenta con información sobre el tema.

El manejo personalizado es la clave del éxito en la crianza de este ejemplar. Igualmente el control periódico de la evolución del animal, mediante registros de peso, biometría y consumo, así como la observación de cambios anatómicos y de conducta manejo, han permitido el éxito en la crianza de este ejemplar.

Recomendaciones

Se recomienda reducir el número de dietas (F1, F2, F4, F10) con dietas para un individuo lactante y en crecimiento. Es importante tomar en cuenta la palatabilidad y la consistencia de la fórmula así como la forma en que se ofrece el alimento. El manejo de la alimentación es una parte crucial del procedimiento de crianza del infante. Es esencial el intercambio de información entre las instituciones y personas que se han involucrado en la crianza de esta especie, a fin de establecer protocolos estándares que nos permitan detectar las fallas más recurrentes en sus fases iniciales.

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Registro de Medidas y Pesos del Tubo Digestivo de un Ejemplar de *Chaetophractus villosus*

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Beatriz Quse
Gustavo Gabriel Gachen

Introducción

Dentro del género *Chaetophractus* existen tres especies de armadillos (*C. vellerosus, C. villosus* y *C. nationi*) distribuidos en la Argentina, Paraguay y Bolivia. El *Chaetophractus villosus* (peludo) habita desde el oeste del Paraguay y zonas adyacentes en Bolivia, hasta el sur de la provincia de Santa Cruz en Argentina, excepto en la cordillera (Parera, 2002). Dentro de la familia Dasypodidae, el peludo es uno de los más generalistas en cuanto a sus hábitos alimenticios ya que durante el invierno la mitad de su dieta consiste en materia de origen vegetal, mientras que la mayor parte del año se alimenta principalmente de insectos y otros invertebrados, algunos vertebrados pequeños y de carroña (Bolkovic *et al.*, 1999; Nowak, 1999; Superina, 2000). Estos animales cavan debajo de las carcasas de ganado o animales silvestres e incluso dentro de ellas obteniendo ejemplares adultos y larvas de insectos (Bolkovic *et al.*, 1999).

En cautiverio se adaptan a dietas compuestas por alimento balanceado para perros y/o gatos (dietas bajas en agua), frutas y vegetales, carne de caballo, huevos, etc. (Ratajszczak y Trzesowska, 1997).

Según un estudio de Greegor (1975) sobre *Chaetophractus vellerosus,* esta especie puede distribuirse en los hábitats secos donde otros armadillos no podrían desarrollarse, debido a que son bastante independientes de los alimentos suculentos. Esto es así ya que pueden subsistir con dietas bajas en agua debido a la mayor eficiencia de sus riñones en el uso de este nutriente.

Los mamíferos muestran una amplia variedad en sus aparatos digestivos en relación a sus dietas. Es así como los Edentata, que son principalmente comedores de insectos, tienen mandíbulas con músculos débiles en comparación con los carnívoros, dientes morfológicamente similares entre sí y una lengua larga, tubular y protráctil (Stevens y Hume, 1995).

El estómago de los Dasypodidae es bastante simple; solo consta de una porción de epitelio escamoso estratificado y una mucosa glandular pilórica (Stevens y Hume, 1995). (Ver estómago en Fig. 3.) Un rasgo especial de los xenartros es que en la región pilórica tienen fuertes músculos para triturar los insectos ingeridos (Superina, 2000).

El objetivo del presente trabajo es registrar pesos y medidas del tubo digestivo de un ejemplar de *Chaetophractus villosus* en cautiverio, sirviendo como datos de base para futuros trabajos en nutrición comparativa, tareas de rehabilitación, y alimentación manual con sonda para ejemplares en recuperación. Por lo tanto, durante la necropsia de una hembra de esta especie perteneciente a la colección de animales de Temaikèn se realizó dicho registro.

Materiales y Métodos

Nuestro estudio se realizó en una hembra adulta de 420 mm de largo y 3.887 g de peso corporal y en buenas condiciones digestivas. El ejemplar tuvo que ser intervenido quirúrgicamente debido a una fractura de su caparazón, pero murió a los pocos minutos del inicio de la intervención como consecuencia de una excesiva inhalación de halotano producida por fallas en el equipo de anestesia inhalatoria.

Inmediatamente se realiza la necropsia correspondiente separándose los distintos órganos vinculados con el tubo digestivo, y se toman medidas morfométricas de los mismos en milímetros con un centímetro de tela. Para el registro de peso de los órganos con contenido se utilizó una balanza de precisión de 1 g (Moretti®, 5 kg x 1g).

El cuerpo, la cabeza y la cola del animal fueron medidos dorsalmente y en forma directa. El ancho de la cabeza fue tomada a la altura de la base de las orejas. El largo de la cavidad bucal (suelo de la boca)

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fue registrado desde los incisivos hasta el inicio de la faringe, y el ancho a nivel de la articulación mandibular; la lengua extendida fue medida dorsalmente. El ancho del caparazón fue tomado a la altura de la sexta banda siguiendo la curvatura. La cola fue medida en su base considerándose el diámetro. Tanto el esófago como los intestinos fueron medidos en forma directa. El estómago fue registrado teniendo en cuenta su curvatura mayor.

CUADRO 1: Medidas y pesos registrados de una hembra de peludo *(Chaetophractus villosus)* durante su necropsia.

	Peso (g)	Largo (mm)	Ancho (mm)
Cuerpo			
Cabeza		100	110
Tronco		320	370
Cola		130	80 (diámetro)
Total	3887	550	—
Tubo Digestivo			
Boca		70	40
Lengua		90	SD
Esófago	26	160	SD
Estómago	85	160*	130
Intestino delgado	66	2420	SD
Ciego	36	85	SD
Intestino grueso-recto	41	385	SD
Total	**254**		

* Curvatura mayor.
SD: sin datos

FIGURA 1. Cavidad abdominal de *Chaetophractus villosus.*

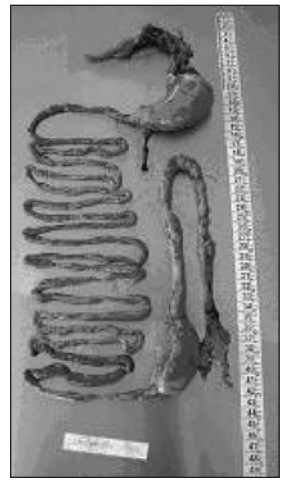

FIGURA 2. Tubo digestivo de *Chaetophractus villosus.*

FIGURA 3. Estómago de *Chaetophractus villosus.*

Todos los órganos del tubo digestivo presentaban apariencia macroscópica normal. Había restos de alimento en proceso de digestión tanto en estómago como en intestinos.

La dieta de este animal consistía en alimento balanceado para perros Eukanuba® de mantenimiento para adultos extrusado, manzana y banana. El perfil nutricional de la dieta era de 23% de proteína cruda (MS) y 15% de grasa (MS).

Resultados

El TD del ejemplar desde la boca al ano tenía un largo total de 3.280 mm y un peso de 254 g. Las medidas y pesos de sus órganos están detallados en el Cuadro 1. El largo del tubo digestivo fue de 7,8 veces el largo del cuerpo y su peso con contenido fue del 6,53% de su peso corporal. El contenido estomacal fue de 49 g, equivalente al 1,26% del peso del animal.

El intestino delgado fue de 5,7 veces el largo del cuerpo y el 1,6% de su peso, y el intestino grueso fue 0,91 veces el largo del cuerpo y el 1,9% del peso (incluyendo el ciego).

En la Fig. 1 se aprecia parte del aparato digestivo todavía en la cavidad corporal, y en la Fig. 2 vemos el tubo digestivo extirpado del animal.

Discusión

Si bien los datos publicados por Nowak (1999) detallan como peso promedio de esta especie 2.020 g, el peso promedio de los nueve ejemplares de Temaikèn durante los años 2002, 2003 y 2004 fue de 3.398 g. El peso promedio de este individuo en particular fue de 3.407 g durante el mismo período, acercándose más a los 4.500 g considerado por Vizcaíno y Milne (2001) como peso promedio de sus ejemplares. En la misma referencia se consideran largo de cabeza y cuerpo de 220 y 440 mm, respectivamente, siendo el largo de cola un valor entre los 75 y 175 mm, rango en el cual se encuentran las medidas del ejemplar en estudio, a excepción de la medida de la cabeza.

Si bien algunos edentados como los perezosos (*Choloepus hoffmanni* y *Bradypus torquatus*) no poseen ciego (Gilmore *et al.*, 2001) y otros como el *Dasypus septemcinctus* tiene dos ciegos cortos (Stevens y Hume, 1995), en el *Chaetophractus villosus* este órgano está

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bastante desarrollado, siendo de 85 mm de largo en la hembra en estudio. Esto pareciera ser parte de las adaptaciones de esta especie a consumir mayor cantidad de material vegetal que otras dentro de su mismo grupo, y por ende a digerir mayor cantidad de fibra.

Los osos hormigueros (*Myrmecophaga tridactyla*) son insectívoros estrictos y tienen un intestino delgado que es siete veces el largo del cuerpo y un intestino grueso similar en longitud al cuerpo. Opuestamente a lo que se podría deducir, debido a que el peludo es más omnívoro en cuanto a sus hábitos alimenticios, el intestino delgado y el grueso del peludo en estudio es en relación al cuerpo relativamente más corto (5,7 y 0,91 veces el largo del cuerpo) que el de los osos hormigueros (7 y 1 veces el largo del cuerpo respectivamente) y el de las mulitas (*Dasypus sabanicola*) (8,29 y 0,825 veces el largo del cuerpo respectivamente), según datos de Stevens y Hume (1995). Considerando otros omnívoros podríamos citar al oso negro (*Ursus americanus*), cuyo intestino es aproximadamente diez veces el largo del cuerpo, sin distinción entre intestino medio y grueso (Stevens y Hume, 1995). No obstante, para poder determinar la razón por la cual el peludo tiene intestinos relativamente cortos, teniendo en cuenta sus hábitos alimenticios, deberíamos tener más datos que confirmen estas dimensiones. Ya que si estos datos se repitieran podríamos suponer que estamos frente a un animal que solo consume hierbas cuando no tiene otros alimentos disponibles, es decir un verdadero oportunista.

Conclusiones

Dado el carácter preliminar de la información obtenida a través de un único individuo, se hace necesario en el futuro contar con más ejemplares — provenientes tanto del cautiverio como de la naturaleza — a los efectos de establecer valores promedio para la especie, sexo y grado de madurez de los individuos.

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A Range Extension for the Yellow Armadillo, *Euphractus sexcinctus* Linnaeus, 1758 (Xenarthra: Dasypodidae), in the Eastern Brazilian Amazon

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Marcus Emanuel Barroncas Fernandes
Maria Claudene Barros
Horácio Schneider

Introduction

Euphractus sexcinctus, the yellow or six-banded armadillo, is the largest of the five species of euphractine armadillos, also known as the hairy armadillos (Wetzel, 1985; Eisenberg and Redford, 1999). Yellow armadillos are distinguished by short ears and a flattened head that becomes triangular toward the snout, protected by large plates with patchy fur (Nowak, 1999). The upper body is light yellow, bronze or red-

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dish, with six to eight mobile bands on the carapace. An adult animal's head and body measure approximately 401–495 mm, and it weighs 3.2–6.5 kg. Its tail is short and cylindrical, with plates arranged in two to four separate bands at the base. All five toes on each paw have claws, the second of which is the longest (Nowak, 1999).

The geographic distribution of *E. sexcinctus* covers much of eastern South America, ranging from the southern mouth of the Amazon through all of southeastern Brazil, and extending into Uruguay, Paraguay and northeastern Argentina, as well as eastern and central Bolivia (Wetzel, 1985; Redford and Wetzel, 1985; Emmons and Feer, 1997; Eisenberg and Redford, 1999). *E. sexcinctus* also occurs in the savannas of Sipaliwini in Suriname, and of Paru in the Brazilian state of Pará. Together the records in these two savanna regions constitute what has been thought to be a disjunct population, separated by hundreds of kilometers from the main distribution to the southeast (Silva Júnior and Nunes, 2001).

Silva Júnior *et al.* (2001) recorded *E. sexcinctus* from 27 localities in the state of Maranhão, between the Rios Gurupí and Parnaíba, in the region known as "Pré-Amazônia Maranhense." From northernmost Brazil, Silva Júnior and Nunes (2001) added four additional localities for this species in the state of Amapá, immediately to the north of the mouth of the Rio Amazonas. It is important to note that these records by themselves do not confirm a continuous distribution of *E. sexcinctus* in the Brazilian states of Amapá, Pará, Maranhão and Piauí. Here we record this species from the region between the Rios Tocantins and Gurupí in Pará, and suggest its continuous distribution in the Brazilian Amazon.

Methods

Data collection and morphological characterization

We identified *E. sexcinctus* from animals that had been hunted by local people in the municipalities of Bragança, Ourém, Augusto Corrêa, and Vizeu in the state of Pará, and in Bocaina in the state of Piauí (Table 1). Local residents donated the specimens during interviews carried out when we were conducting mammal surveys in this region. From the six animals donated to us, it was only possible to preserve the carapace and skull of a single specimen, now in the Zoological Collection of the Campus of Bragança in Bragança, Pará, under the field number *196PA*. Only blood and muscle tissue could be collected from the other five specimens. We identified these individuals from the information provided in Emmons and Feer (1997), Eisenberg and Redford (1999), Nowak (1999), and Silva Júnior and Nunes (2001).

Molecular characterization

We used molecular markers to confirm the morphological identification of *E. sexcinctus* and examine intraspecies similarities of the sampled animals. We chose *Dasypus novemcinctus* and *Cabassous unicinctus* as outgroups, and obtained the sequences from a sample collected in the state of Pará and another sample supplied by GenBank, respectively. The GenBank accession numbers for *C. unicinctus* are AF232016 (cytochrome *b*) and Z48940 (16S rRNA).

For the molecular characterization, two mitochondrial genes with different rates of evolution were chosen: cytochrome *b* (protein coding gene) and 16S rRNA (ribosomal RNA). Genomic DNA was extracted from small quantities of blood or ear tissue of the collected specimens. DNA extraction was performed in accordance with the conventional phenol-chloroform extraction protocol modified from Sambrook and Russell (2001).

TABLE 1. New locality records for *Euphractus sexcinctus*. Mesohabitat: 1 = clear-cut region, located between an urban area and mangrove; 2 = small fragments of secondary forest and salt marshes associated with mangroves; 3 = clear-cut region with small fragments of secondary forest; 4 = Caatinga region.

Specimen Code	Location	Coordinates	City/State	Ecosystem	Mesohabitat
E.sex. 194PA	Bacuriteua	46°44'22.8"W, 00°58'23.4"S	Bragança/PA	Dry Land	1
E.sex. 196PA*	Salinas Farm	46°40'11.5"W, 00°55'21.3"S	Bragança/PA	Mangrove	2
E.sex. 73PA	Gavião Real Farm	47°06'52"W, 01°33'07"S	Ourém/PA	Dry Land	3
E.sex. 17PA	PA - 454	46°38'06"W, 01°01'18"S	Augusto Corrêa/PA	Dry Land	3
E.sex. 36PA	PA - 242	46°08'24"W, 01°11'48"S	Vizeu/PA	Dry Land	3
E.sex. 33PI	Malhada	41°19'21"W, 06°56'33"S	Bocaina/PI	Caatinga	4

* Carapace and skull preserved.

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Fragments of nearly 600 base-pairs of both 16S and cytochrome *b* genes were isolated by PCR (Polymerase Chain Reaction), using the oligonucleotides described by Palumbi *et al.* (1991) and Smith and Patton (1993), respectively. DNA was sequenced using the ABI Prism™ Dye Terminator Cycle Sequencing Ready Reaction kit (Applied Biosystems, USA), on an ABI 377 (Perkin Elmer) automated sequencer. PCR and sequencing procedures were conducted in accordance with those described by Barros *et al.* (2003).

Phylogenetic analysis

Sequences were aligned and edited with BIOEDIT (Hall, 1999) and ClustalX (Thompson *et al.*, 1997). The phylogenetic analyses were performed with a series of programs, including DAMBE (Xia and Xie, 2001), Modeltest (Posada and Crandall, 1998), MEGA2 (Kumar *et al.*, 2001) and PAUP* (Swofford, 1998). Cluster significance was estimated by Bootstrap analysis (Felsenstein, 1985).

Results

The nucleotide sequences of the DNA fragments were approximately 600 base pairs for each of the two genes we examined (16S and cytochrome *b*). All sequences were submitted to GenBank (Accession Numbers DQ243709–DQ243724). The nucleotide divergence matrix, built according to the Kimura two-parameter model for the two gene segments examined, showed a divergence of less than 3%. Genetic distances among

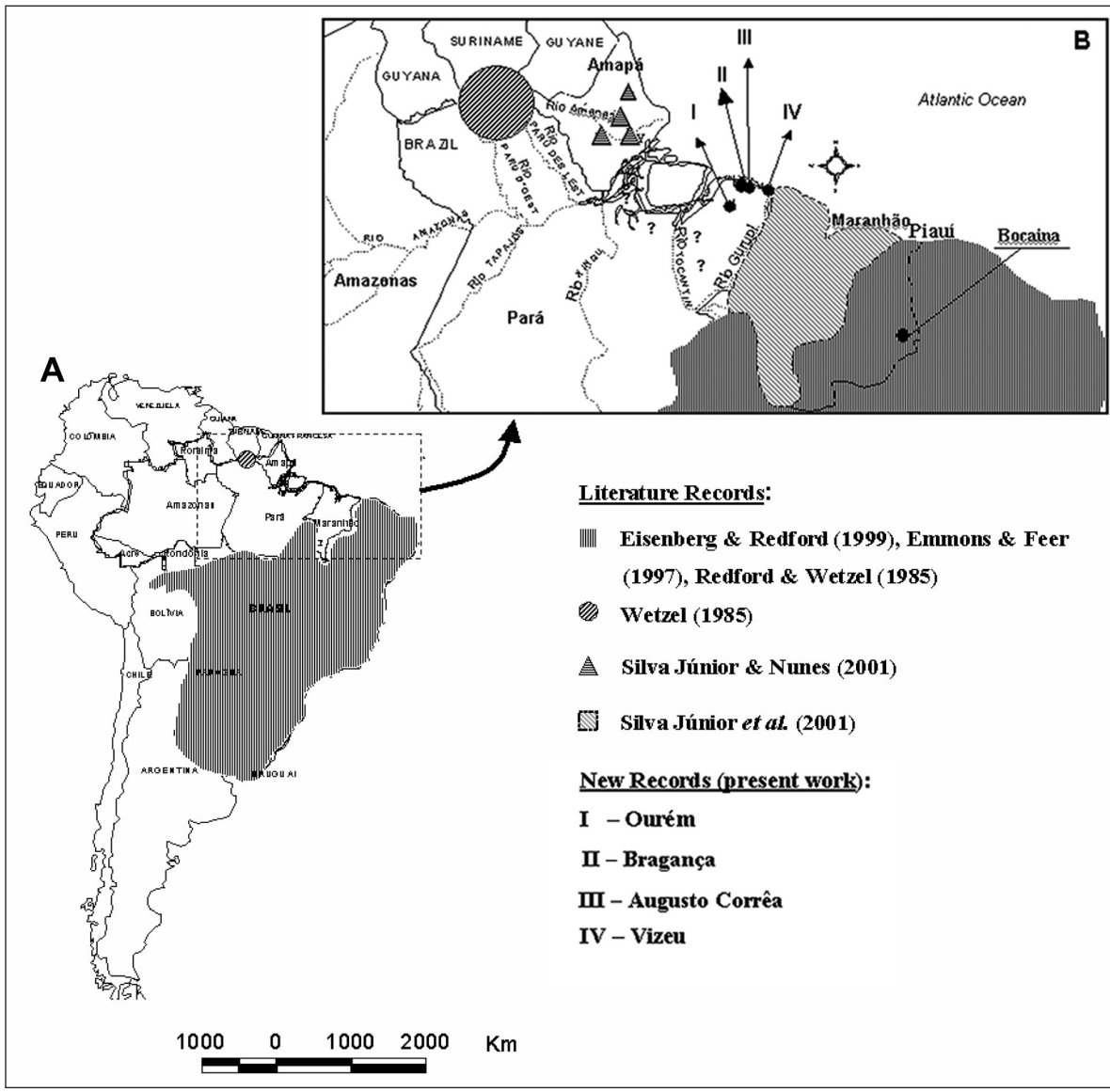

FIGURE 1. Geographic distribution of *E. sexcinctus* in South America (a) and the new records which expand this species' distribution northward in the Brazilian Amazon (b).

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E. sexcinctus specimens captured in different habitats ranged from 0.2 to 1.3% for the cytochrome *b* gene and from 0.6 to 2.8% for the 16S rRNA (Tables 2 and 3). The distance approach among species using cytochrome *b* resulted in divergences slightly above 22% for the *E. sexcinctus* and *D. novemcinctus* specimens, whereas the comparative analysis with *C. unicinctus* produced values ranging from 21–24.7% (Table 2). The same approach using 16S rRNA resulted in lower values, which averaged 15.6% between *E. sexcinctus* and *D. novemcinctus*, while *C. unicinctus* averaged less than 11.1% (Table 3).

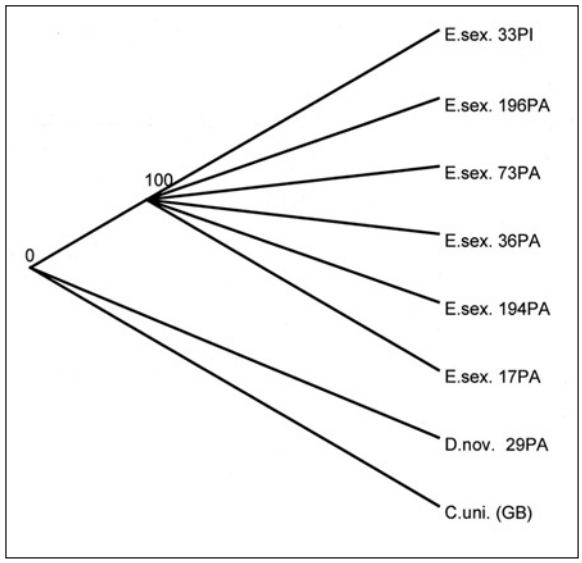

FIGURE 2. Neighbor-joining tree of a partial fragment of cytochrome *b*, with *D. novemcinctus* and *C. unicinctus* as outgroups. The high bootstrap values support the validity of this topology.

The four methods for performing the phylogenetic analysis (Maximum Parsimony, Neighbor-Joining, Minimum Evolution and Maximum Likelihood) generated trees of identical topology. Specimens of *E. sexcinctus*—regardless of origin, gene segment analyzed, or different methods of analysis—were always included in the same clade (Fig. 2) with high statistical support (bootstrap = 100%), matching the low divergence values found in individuals of this genus. Similarly, a high genetic divergence was found among the three different genera, a fact that was also confirmed by the relationships within the resulting phylogenetic trees.

Discussion

The degree of divergence among the five individuals of *Euphractus sexcinctus* was much less than that among the three armadillo genera. The strong similarity among these five individuals, acquired from dif-

TABLE 2. Distance method analysis of mitochondrial cytochrome *b* gene for *E. sexcinctus, D. novemcinctus* and *C. unicinctus.*

Cytochrome *b*	E. sexc. 33PI	E. sexc. 17PA	E. sexc. 194PA	E. sexc. 36PA	E. sexc. 73PA	E. sexc. 196PA	D. nove. 29PA	C. unic. GB
E. sex. 33PI	-							
E. sex. 17PA	0.002							
E. sex. 194PA	0.004	0.002						
E. sex. 36PA	0.002	0.000	0.002					
E. sex. 73PA	0.013	0.011	0.013	0.011				
E. sex. 196PA	0.004	0.002	0.004	0.002	0.013			
D. nov. 29PA	0.226	0.229	0.232	0.229	0.238	0.226		
C. uni. (GB)	0.213	0.210	0.213	0.210	0.218	0.207	0.247	-

TABLE 3. Distance method analysis of the mitochondrial 16S rRNA gene for *E. sexcinctus, D. novemcinctus* and *C. unicinctus.*

rRNA 16S	E. sexc. 194PA	E. sexc. 73PA	E. sexc. 196PA	E. sexc. 36PA	E. sexc. 33PI	E. sexc. 17PA	D. nove. 29PA	C. unic. GB
E. sex. 94PA	-							
E. sex. 73PA	0.019							
E. sex. 96PA	0.009	0.015						
E. sex. 36PA	0.019	0.028	0.017					
E.sex. 33PI	0.009	0.017	0.006	0.015				
E.sex. 17PA	0.011	0.017	0.006	0.019	0.009			
D.nov. 29PA	0.155	0.163	0.150	0.166	0.153	0.147		
C.uni. (GB)	0.104	0.111	0.099	0.114	0.101	0.102	0.143	-

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ferent localities and ecosystems, suggests that the Rio Gurupí is not a barrier to gene flow in the *Euphractus* populations of this region.

These new locality records support the suggestion of Silva Júnior and Nunes (2001) that the disjunct range of *E. sexcinctus* may be an artifact of undersampling, rather than a genuine division. The records we present here extend its known distribution to the interfluve between the Rios Tocantins and Gurupí. Taken together with the localities presented by Silva Júnior and Nunes (2001) and Silva Júnior *et al.* (2001), it seems likely that *E. sexcinctus* is continuously distributed at least to the southern margin of the mouth of the Rio Amazonas. Additional surveys between the Rios Tocantins and Xingu may provide evidence of a much broader total range than had been previously assumed.

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Research Questions on the Behavior and Ecology of the Giant Armadillo (*Priodontes maximus*)

Dennis A. Meritt Jr.

Between 1972 and 1982, five giant armadillos (*Priodontes maximus*) resided for varying periods in an off-exhibit area at the Lincoln Park Zoo in Chicago, Illinois. They included three males which came from Guyana and two females from Bolivia, all received as wild-caught young adults. Together they were the subjects of observations by animal care staff and volunteer docents, who made almost daily observations on the overall activity, food consumption, and general behavior of the giant armadillos. Zoo personnel also recorded weights and body measurements at regular intervals, as well as basic physiologic values such as body temperature and respiratory rates. The presence of *Priodontes* in the collection stimulated a number of communications, visits and inquiries from individuals and organizations interested in its natural history and behavior. Together with field excursions to giant armadillo habitat in the Chaco of Paraguay and northern Argentina (Meritt, 1973), these captive armadillos prompted the development of a detailed life history outline—one that summarized research questions related to this species, noted information not readily available or missing from the literature, and listed life history traits which are still unknown (Meritt, unpubl. ms.).

A recent field excursion to the Chaco of Paraguay, and an increase in research projects in Argentina and Paraguay, has prompted me to update and expand this outline, which is meant to serve as a guide for those studying this, the largest of the living armadillos (Ceresoli and Fernandez-Duque, 2004; Porini, 1999, 2001). Many of the study topics posed here will only be answered through the detailed study of animals in the wild, but others may be addressed through the diligent observation of animals already held in various Argentine zoos, or those under investigation in private wildlife reserves. It is my hope that anyone intending to work with *Priodontes*, or those already doing so, will consider the questions raised in this outline. I encourage anyone who is able to provide answers to any of these questions to publish their results; and likewise I welcome any additions to this list, based on the life history and behavior of the giant armadillo.

A thorough search of the literature demonstrates just how little is known about this species. Burmeister (1867a, 1867b) provided early anatomical information on the giant armadillo, including notes on its skeleton. Benirschke and Wurster (1969) provided the first chromosome count for this species, while Carter (1983) and Carter and Encarnação (1983) conducted a census of its burrows in the Serra da Canastra, Brazil. Parera (2002) provided a brief review of the status, distribution, habitat and diet of the species in Argentina, but little else is known directly, although some inferences may be made from the related forms of *Cabassous* and what is known about their natural history and behavior.

One may hypothesize that *Priodontes* is generally solitary, except during periods of sexual receptivity. While the number of young per litter is unknown, in at least two *Cabassous* species there is usually only a single offspring (pers. obs.). The gestation period is unknown, but thought to be similar to *Cabassous*; the period of maternal care is not known, and the role, if any, of the male in the rearing and protection of the young is also unknown. At the Lincoln Park Zoo, captive female *Cabassous* with developing offspring were not in the company of a male (pers. obs.) so it is not possible to make any inferences about the male's role, or even his possible threat to the offspring. Strikingly, no juvenile *Priodontes* have been discovered in the field, nor found their way into captive management. Various species of *Cabassous* have been confused for immature *Priodontes* at one time or another (pers. obs.) and have even been offered for sale by animal dealers. Whether the evidence is physical or photographic, however, none of these supposed giant armadillos have been proven to be *Priodontes*. Even in habitat known to support them, where giant armadillo activity has been demonstrated and field studies have been carried out, no young have ever been witnessed.

Our understanding of the habitat preferences of giant armadillos is also imprecise. While the present distribution of *Priodontes* has been adequately mapped, both individuals and populations are patchy in their distribution, and may be limited to islands of preferred habitat. In the Chaco of Paraguay, for example, where *Priodontes* is known and occasionally captured,

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they are most often encountered in riparian habitat or in similar areas with loose, sandy-loam soil. It appears that *Priodontes* in the Paraguayan Chaco prefers soil with a loose composition and near adequate water supplies, as well as necessary food such as insects, fruit and carrion (pers. obs.). Captive individuals have consumed a variety of meat and meat-based diet formulas (Meritt, 1977). Recent dietary studies have made a significant contribution to identifying the type of insect material sought by *Priodontes*, and provided additional insights to its habitat requirements in a very different ecosystem, the Cerrado of Brazil (Anacleto and Marinho-Filho, 2001).

Although *Priodontes* is widespread in its geographic distribution, and found in a variety of tropical ecosystems throughout South America, it is nowhere as common as the range maps would imply. Often only individual animals, rather than populations, are found in what might seem to be prime habitat. For native people across the continent, *Priodontes* is the armadillo of choice for food whenever available; given its adult mass (as much as 40 kg), one individual makes for a significant source of protein for a subsistence hunter and his family. Thus it is hunted wherever it may be found, and in some habitats it may represent the single largest source of meat (Leeuwenberg, 1997; Meritt, in prep.).

A Checklist of Research Questions for "Tatu Carreta," "Tatu-Canastra," the Giant Armadillo (*Priodontes maximus*)

Activity Schedule
- When are animals active?
- What time of day/night?
- When is the male active?
- When is the female active?
- Are animals more active when it is hot?
- Are animals more active when it is cold?
- What is the ideal ambient temperature for activity?
- How long are animals active?
- Is there a difference in activity between seasons? (Winter, spring, summer, wet season, dry season)
- What is the distance traveled each day?
- Does it vary with the seasons?

Mating Behavior
- How often do the animals show reproductive behavior?
- When and what time of year? Weekly? Monthly? Seasonally?
- How long is the period of sexual receptivity/activity?
- Describe reproductive behaviors—Sniff? Touch? Follow? Chase? Push? Claw? Mount? Vocalize? Urinate? Erection? Vulvar secretion? Vulvar swelling? Change in vulvar color?

Feeding Habits
- What foods do they eat? Plants? What parts of plants? Animals? What kinds of animals? Insects? Eggs?
- Do they prefer special foods? Ants? Termites? Bird's eggs? Roots? Fruits? Carrion?
- How often? Daily? Twice in a 24-hr period? More? Less?
- Are there seasonal foods that they look for in nature? If so, what are they?
- What keys or attracts the animal to its food? Location? Smell? Texture/Consistency?

Burrowing
- Do they choose special places for their burrows?
  1. Temporary resting places?
  2. Permanent home?
  3. In sand/loose soil?
  4. In banks?
  5. At the base of trees?
  6. Where?
  7. Near water?
  8. For permanent use?
  9. For nesting only?
  10. How many entrances?
- How can one tell if a burrow is active?
- What are burrow measurements? Entrance hole size? Tunnel diameter? Tunnel depth? Tunnel length?

Nesting and Nursing
- Is the nest burrow any different?
- Is there a true nest? Nest material?
- How many young are born/litter? Sexes? Same sex? Mixed sex?
- How often? Once each year? More?
- What time of year?
- During what season(s)?
- What do the young look like?
- How much do they weigh? Measurements?
- Are their eyes open?
- Ears open?
- Covered with hair?
- Claws hard or soft?
- Shell (carapace) hard or soft?
- Teeth present?
- Can they crawl? Walk? Stand? Vocalize?
- Are the young with the male and female, or the mother alone?
- What is the role of the male?

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- Nursing position of mother? Female on back? Female on side? Which side?
- How often do they nurse?
- Do they have nipple preferences?
- How often do they nurse each 24 hours?
- For how long each session?
- Do they nurse during the day or at night?
- More by day? (0600–1800 hrs) or by night? (1800–0600)
- How many days, weeks, months spent nursing?
- When do they begin solid food? What age?
- What kind of food is it?
- When are they first left alone? What age?
- Where are they left?
- When are they first out of their burrow?
- With a parent or alone?
- How long and how far?
- When do they become independent?
- Do they seek their own territory?
- Are they forced to seek their own territory?
- Is it away from their mother or their parents?
- How far? Remote (= some distance) or in adjacent territory?

Sleeping Patterns

- In each 24-hour period, how long does the animal:
  1. Sleep?
  2. Rest? (Awake but inactive)
  3. Be active?
- When sleeping, what body position is it in?
  1. Fetal?
  2. On its back?
  3. On its stomach?
  4. On its side?
  5. Which side?
- When sleeping, does the animal
  1. Vocalize? (Wheeze or snore?)
  2. Shake or tremble?
  3. In the case of males, have erections?
  4. Paw or claw in the air?
  5. Curl and uncurl the body?

Foraging and Elimination

- When foraging, does the animal
  1. Sniff the air?
  2. Stand on hind legs?
  3. Dig in soil?
  4. Grab at food with claws?
  5. Attempt to bury and save food?
- How often does the animal:
  1. Urinate? What is the volume?
  2. Defecate? What is the amount and consistency?
- Is this elimination done separately or together?
- Is this done in a toilet or latrine area that is used more than once?
- Where is this area located?
- Does the animal attempt to bury its waste? Or cover it?
- When active, how often does the animal stand up on its hind legs?
- When this happens, what else is the armadillo doing?
  1. Sniffing?
  2. Looking in a particular direction?
  3. Hold its foreclaws to its chest?
  4. Moving its head?
  5. Opening or closing its mouth?
  6. Walking forward?
  7. Clawing at an object or in the air?
  8. Closing its eyes?
- Can you track armadillos by following:
  1. Their trail?
  2. Places where they searched for food?
  3. Toilet areas?
  4. Temporary burrows?
  5. Claw marks?
  6. Scent or odor?

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A Reference List of Common Names for the Edentates

Mariella Superina
John M. Aguiar

Edentates are found in every country of the Western Hemisphere except Canada and the smaller Caribbean islands. This panoramic distribution has brought them into contact with a profusion of languages, and some widespread species have been known by many dozens or hundreds of indigenous names. The ascent of European languages to continental dominance has given rise to many more — some of them adaptations of prior native terms, and others entirely new.

Two of these latecomer tongues, Spanish and Portuguese, overlay virtually the entire range of the edentate order, and together they encompass more local and regional variants than any other extant language. Spanish common names in particular are myriad, diverse and frequently confusing; the suite of terms in one country may be entirely distinct from another — and the same name may be used for different species in several different areas. This is not to say that pandemonium reigns: experienced researchers know the terrain, and field biologists are familiar with the local names where they work. But for those searching through reports or making comparisons from afar — or those who are simply new to the field — aligning the common and Latin names may take a great deal of paging through far-flung references.

We have done some paging ourselves, and here we share the results of our efforts: a compilation of the established common names in the major languages of Neotropical science, together with as broad a selection of current local names as we could assemble. We also present a sampling of the hundreds of indigenous names which still survive throughout Central and South America, in recognition of the many peoples and cultures who first gave names to the edentates.

This is an expansive list, but it is by no means exhaustive in any of these languages; a truly comprehensive document would want a lifetime of ethnographic surveys throughout the hemisphere. Instead we have tried to compile, in a workable matrix, the names which have already been included in a variety of field guides, monographs, articles and other publications. Not all versions of each name have been listed here; many indigenous languages are only spoken, not written, and countless variants may stem from dif-

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ferences in transcription and pronunciation. Rather than list a dense tangle of infinite detail, we have tried to create a useful index of active common names, in hopes of providing an easy but thorough reference guide.

For the Latin names we follow the working taxonomy of the Edentate Specialist Group, as presented in Fonseca and Aguiar (2004), which itself follows the taxonomy of *Mammal Species of the World*, Second and Third Editions (Wilson and Reeder, 1993, 2005). We have listed the species names in alphabetical order within each of the three major divisions of the Xenarthra; this is a linguistic rather than a phylogenetic display, and no particular taxonomic arrangement is implied.

For the English common names, we rely primarily on Wilson and Cole's *Common Names of Mammals of the World* (2000), which tracks the taxonomy presented in Wilson and Reeder (1993). We use these names as our default standard, and they are presented first in the tables below. These names are generally used by the other major sources, but in cases where they provide different terms we have cited them individually. Superina (2000) adds several sensible variants which we felt should be included, and Duff and Lawson's recent book, *Mammals of the World: A Checklist* (2004) is a valuable secondary source.

There appears to be no Spanish counterpart to Wilson and Cole (2000), so for the primary names in Spanish we have relied on *Neotropical Rainforest Mammals* by Emmons and Feer (1997), and the three volumes of *Mammals of the Neotropics* by Eisenberg and Redford (1989, 1992, 1999). Emmons and Feer in particular give a wealth of names in more than a dozen languages, although their focus excludes most of the armadillos. We have also referred to Gene Montgomery's 1985 volume on *The Evolution and Ecology of Armadillos, Sloths, and Vermilinguas*.

We have drawn the Portuguese names from several sources, primarily Fonseca *et al.* (1996) and Emmons

TABLE 1. Sloths.

Latin	English	Spanish	Local names in Spanish	Portuguese
Bradypus pygmaeus	pygmy sloth (Anderson and Handley, 2001); pygmy three-toed sloth (Duff and Lawson, 2004)	perezoso pigmeo	perico (Pn)	preguiça-pigmeu (Aguiar and Fonseca, in review)
Bradypus torquatus	maned three-toed sloth; maned sloth (Eisenberg and Redford, 1999)	perezoso de tres dedos	n/a	aí-pixuna, preguiça-preta (Emmons and Feer, 1997); preguiça-de-coleira (Fonseca *et al.*, 1994)
Bradypus tridactylus	pale-throated three-toed sloth; pale-throated sloth (Eisenberg and Redford, 1999)	perezoso de tres dedos	pereza de tres dedos guayanesa (Ve)	aí, preguiça-de-bentinho (Emmons and Feer, 1997); preguiça-de-tres-dedos (Fonseca *et al.*, 1996)
Bradypus variegatus	brown-throated three-toed sloth; brown-throated sloth (Eisenberg and Redford, 1999)	perezoso de tres dedos	perezoso bayo (Ar); perico (Bo); mono perezoso, perico ligero (CA, Mex); perica ligera (CR); perezoso de tres dedos de garganta café, perezoso de tres uñas (Ec); perico lerdo (Ho); pelejo (Pe); pereza de tres dedos común (Ve)	preguiça-de-bentinho (Emmons and Feer, 1997); preguiça-marmota (Redford, 1994); preguiça-comum (Lara-Ruiz and Srbek-Araujo, 2006)
Choloepus didactylus	Southern two-toed sloth; Linnaeus's two-toed sloth (Wilson and Reeder, 2005)	perezoso de dos dedos	perico ligero (Co); perezoso amazónico de dos uñas (Ec); cucala (Ho); pelejo (Pe)	preguiça real, unau (Emmons and Feer, 1997)
Choloepus hoffmanni	Hoffmann's two-toed sloth	perezoso de dos dedos	perico ligero (Co); perica ligera (CR); perezoso de dos uñas de occidente (Ec); cucala, perico lerdo (Ho); pelejo (Pe); pereza cara amarilla, pereza de dos dedos zuliana, pereza lanuda (Ve)	preguiça real, unau (Emmons and Feer, 1997)

Abbreviations: Ar=Argentina; Bo=Bolivia; CA=Central America; Co=Colombia; CR=Costa Rica; Ec=Ecuador; Ho=Honduras; Mex=Mexico; Pn=Panama; Pe=Peru; Ve=Venezuela.

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and Feer (1997), supplementing with other publications whenever possible. For German and French names, we have consulted *Grzimeks Enzyklopädie Säugetiere* (1988), while the Dutch names are taken principally from Father A. M. Husson's *Mammals of Suriname* (1978), supplemented by Emmons and Feer. Local and indigenous names appear in a wide spectrum of sources, including field guides, journal articles, monographs, Red List compilations and miscellaneous volumes.

But this is no final document: we hope this first effort will encourage our readers, especially those who live and work in the field, to contribute the common names they have encountered for edentates in any language. Comments in Spanish may be sent to Mariella Superina at <mariella@superina.ch>, and in English and Portuguese to John Aguiar at <j.aguiar@conservation.org>. We plan to establish an online, searchable database of edentate common names, to be made available on the website for the Edentate Specialist Group (<http://www.edentata.org>), and we look forward to augmenting this list manyfold with additions from yourselves.

Acknowledgements: Many of the sources we used are difficult to find outside of their country of origin, and we owe a particular debt of gratitude to Anthony Rylands for access to his extensive personal library. A special note of thanks must also go to Dr. Courtney Shaw, Senior Reference Librarian at the U. S. National Museum of Natural History, who provided a valuable text which no one else owned, just when it was needed the most. Thanks are likewise due to Sérgio Maia Vaz, of the Mammal Section at the Museu Nacional in Rio de Janeiro, for his time and efforts in finding additional Portuguese names. We also extend our appreciation to Dr. Jim Sanderson of CABS for his enthusiasm on behalf of the edentates and his interest in their common names. Finally, we are grateful to the authors of all our sources, both well-known and obscure, for making the effort to document the many names of the edentates.

German	French	Dutch	Indigenous names
Kragenfaultier	bradype a collier		Tupí-Guaraní: aí-igapó (Emmons and Feer, 1997)
Ai, Dreifinger-Faultier	aï, bradype, paresseux tridactyle; mouton paresseux (Emmons and Feer, 1997)	Ai, Drieteenluiaard, Drievingerige Luiaard, Zonluiaard	Boruca: cha, tsä; Bribri: mon, sakura, seri, sëlë; Guayana: aí; Guaymi: ku; Kariña: kupirisi; Makushi: kuwaran; Pemón: kuaran, kwaran; Saramaca: sonlori; Sranan-tongo: sonloiri; Warao: buraca
Braunkehl-Dreifinger-Faultier			Amahuaca: puzze; Barí: arijkbá; Cashinahua: naii; Chiquitano: noborobosh; Chocó: bucha; Guaraní, Quichua: aí aí; Kuna: ibku; Mayan: q'oral; Miskito: siwaiku; Sharanahua: itunai; Yanomami: ehu, ihama
Unau, Zweifinger-Faultier	paresseux didactyle, unau commun	Tweeteenluiaard, Tweevingerige Luiaard	Amahuaca: puzze; Cashinahua: naii; Kariña: aipaula; Makushi: tenupi; Pemón: nupi; Quichua: intillama; Saramaca: skapoeloiri; Sharanahua: puzze; Sranan-tongo: skapoeloiri; Tupí-Guaraní: aí; Yanomami: shimi
Hoffmann's Zweifinger-Faultier	unau d'Hoffmann		Barí: ayaamá; Boruca: cha, tsä; Bribri: seri, siná, suhna, suno; Guaymi: ku; Quichua: intillama; Tawahka: um; Tupí-Guaraní: aí

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TABLE 2. Anteaters.

Latin	English	Spanish	Local names in Spanish	Portuguese
Cyclopes didactylus	silky anteater; pygmy anteater (Eisenberg and Redford, 1999); two-toed anteater (Wetzel, 1985)	cíclope	osito oro, serafín de Santa Cruz (Bo); angelito (Co); ceibita (CR); flor de balsa, serafín, serafín de platanar (Ec); osito melero, perezocito, perico lerdo (Ho); miquito de noche (Mex); gato balsa, tapacara (Pn); intepelejo, serafín (Pe); osito hormiguero enano, oso dormilón, perico ligero (Ve)	tamanduá-i (Fonseca *et al*., 1996); tamandua-í (Emmons and Feer, 1997)
Myrmecophaga tridactyla	giant anteater; ant bear (Be)	oso hormiguero	gran hormiguero, oso hormiguero común, oso hormiguero mayor, oso hormiguero real, tamanduá bandera; oso bandera, oso comilón (Bo); oso caballuno, oso hormiguero palmero, oso pajizo (Co); oso caballo (CR, Ho, Pn); oso hormiguero gigante (CR); oso banderón, tamanduá de occidente (Ec); tamandua de bandera (Ec, Pe); hormiguero gigante, oso palmero (Ve)	papa-formigas, tamanduá-açú, tamanduá-bandeira (Emmons and Feer, 1997); tamanduá cavalho (Chebez, 1994)
Tamandua mexicana	northern tamandua; banded anteater (Janzen, 1983); ant bear (Be)	tamanduá	hormiguero arborícola (CA); oso amarillo, susurete, tamanduá (Co); oso colmenero, oso hormiguero, oso jaceta, oso mielero (CR); oso melero, perico ligero (Ho); brazo fuerte, oso hormiguero común (Mex); osito hormiguero norteño (Pe); osito melero zuliano (Ve)	tamanduá-mirim
Tamandua tetradactyla	southern tamandua; yellow tamandua (Husson, 1978); collared anteater (Grzimek, 1988)	tamanduá	hormiguero chico, oso melero (Ar); oso hormiga, oso hormiguero rubio (Bo); oso colmenero (Co, Ec, Pe); oso hormiguero amazónico, shibi, shihuí (Pe); oso hormiguero, osito melero común (Ve)	mambira, tamanduá-colete, tamanduá-mirim (Emmons and Feer, 1997); melete, mixila (Olmos, 1995); tamanduá de coleira (Machado *et al*., 1998)

Abbreviations: Arg=Argentina; Be=Belize; Bo=Bolivia; CA=Central America; Co=Colombia; CR=Costa Rica; Ec=Ecuador; Hon=Honduras; Mex=Mexico; Pe=Peru; Pn=Panama; Ve=Venezuela.

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German	French	Dutch	Indigenous names
Zwergameisenbär	myrmidon; lèche main (Emmons and Feer, 1997)	Dwergmiereneter, Kleinste Miereneter, Wespeneter	Amahuaca: cama; Cashinahua: busa; Kariña: wailili; Maya: kisin, woyotz; Miskito: likur; Sranan-tongo: likan, likanoe; Tawahka: wísurh; Tupí-Guaraní: tamanduá-í; Yanomami: masihoto
Grosser Ameisenbär	grand fourmilier; tamanoir (Emmons and Feer, 1997)	Grote Miereneter, Mierenbeer; Reuzenmeiereneter (Emmons and Feer, 1997)	Abipón: heteyré, heteyreé; Amahuaca: shao; Ayoreo: yajogue; Barí: nokchibá; Boruca: tejong, tsing; Bribri: nai uhrí, ti uri; Cashinahua: xae; Chiquitano: nupaichavishti, paichabish; Garífuna: liwa; Guaraní: ñurumí, tamanduá, tamanduá-guazú, tamiguasu, yaquí, yurumí; Guaymi: meen, mengkri, misuli; Guisnaí: soolaj; Kariña: tamanoa; Machiguenga: shiani; Makushi: tamanowa; Mataco: sulaj; Mayan: zam hool; Miskito: wingu tara; Pech: corauya; Pemón: warema; Pilagá: pottai; Saramaca: tamanúa, tamanwa; Sharanahua: shall; Sranan-tongo: tamanúa; Tawahka: dánka-takálvas; Toba: pota'e; Tupi: tamanduá-guasú; Warao: eburearane; Yanomami: shikahami; Yaruro: arigurí
Nördlicher Tamandua	tamandua mexicain		Barí: baakakai, kajkai; Kuna: sugachu; Mayan: chab; Miskito: wingku; Tawahka: kárquin
Südlicher Tamandua	tamandua à quatre doigts; tamandou (Emmons and Feer, 1997	Termieteneter, Mierenfluiter, Kleine Miereneter; Boom-miereneter (Emmons and Feer, 1997)	Amahuaca: wii; Ayoreo: yajoguena; Boruca: tejong, tsing; Bribri: uhrí, uri; Cashinahua: bi; Chiquitano: nopoés, opoema; Guaraní: caguaré, kaaguaré, tamimí; Guaymi: meen, misuli; Makushi: woiwa; Pemón: woiwo; Saramaca: mirafroiti; Sharanahua: wii; Sranan-tongo: mirafroiti; Toba: potay laté; Tupi: tamandua-í, tamanduá-mirín; Warao: tandui; Yanomami: shoko; Yaruro: tóarigurír

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TABLE 3. Armadillos.

Latin	English	Spanish	Local names in Spanish	Portuguese
Cabassous centralis	northern naked-tailed armadillo	cabasú, tatú de rabo molle	armadillo zopilote, cusuco venenoso, pitero de uña (CA); armadillo hediondo (Co); armado de zopilote (CR); armadillo rabo de carne de occidente, rabo de carne, rabo de molle (Ec); cusuco, timba, tumbo armado (Ho); armadillo rabo de puerco, morrocoy (Pn); cachicamo morrocoy, cuspa montañera zuliana, cuspita (Ve)	tatu-de-rabo-mole (S. M. Vaz, *in litt.*)
Cabassous chacoensis	Chacoan naked-tailed armadillo	cabasú chico	cabasú chaqueño, tatú-ai menor (Ar)	
Cabassous tatouay	greater naked-tailed armadillo	tatú-ai mayor	cabasú grande, tatú-ai mayor (Ar); tatú de rabo molle (Ur)	tatu rabo-mole (Redford, 1994); tatu-do-rabo-mole-grande (Machado *et al*., 1998)
Cabassous unicinctus	southern naked-tailed armadillo	cabasú de orejas largas	metecito, peji, peji cola blanda, pejichi llorón (Bo); armadillo rabo de trapo (Co); armadillo rabo de carne Amazónico, cachicambo rabo de carne, lugubre, tatú-iba (Ec); armadillo de cola desnuda, carachupa (Pe); cuspa, cuspa montañera común, cuspa rabo blando (Ve)	cabassú, tatu-de-rabo-mole, tatu-rabo-de-couro (Emmons and Feer, 1997); tatu-de-rabo-mole-pequeno (Machado *et al*., 1998); tatu-bola (S. M. Vaz, *in litt.*)
Chaetophractus nationi	Andean hairy armadillo	quirquincho andino	peludo, quirquincho de la puna (Pe)	
Chaetophractus vellerosus	screaming hairy armadillo; small hairy armadillo (Superina, 2000)	piche llorón	mulita, peludo chico, quirquincho chico (Ar); tatú llorón (Bo)	
Chaetophractus villosus	large hairy armadillo; larger hairy armadillo (Superina, 2000); big hairy armadillo (Wilson and Reeder, 2005)	peludo; quirquincho grande (Superina, 2000)	tatú pecho amarillo (Bo)	
Chlamyphorus retusus	Chacoan fairy armadillo; greater fairy armadillo (Superina, 2000)	pichiciego chaqueño	armadillo de Burmeister, pichiciego grande (Ar); coseveru, culo tapado (Bo)	
Chlamyphorus truncatus	pink fairy armadillo; lesser pink fairy armadillo (Redford and Eisenberg, 1992); lesser fairy armadillo (Superina, 2000)	pichiciego menor	antiquirquincho, armadillo truncado menor, guargualate, Juan calado, pichiciego, pichihormiguero, tatú de abrigo (Ar)	
Dasypus hybridus	southern long-nosed armadillo; southern lesser long-nosed armadillo (Superina, 2000)	mulita; mulita orejuda (Superina, 2000)	mulita chica, mulita pampeana (Ar)	tatuíra, tatu-mulita (S. M. Vaz, *in litt.*)

Note: some common names are used for several species, including armadillo (English and Spanish), cachicamo, mulita and quirquincho (Spanish), tatu (Portuguese), Gürteltier (German) and tatou (French).

Abbreviations: Arg=Argentina; Be=Belize; Bo=Bolivia; CA=Central America; Co=Colombia; CR=Costa Rica; Ec=Ecuador; Hon=Honduras; Mex=Mexico; Pe=Peru; Pn=Panama; Py=Paraguay; Ur=Uruguay; Ve=Venezuela.

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German	French	Dutch	Indigenous names
Nördliches Nacktschwanz-Gürteltier			Barí: douró; Guaraní: tatú-aí; Maya: wai-wech; Tawahka: tákan tákan
Chaco-Nacktschwanz-Gürteltier			Guaraní: tatú-aí
Grosses Nacktschwanz-Gürteltier			Guaraní: tatú-aí
Nacktschwanz-Gürteltier	cabassou (Emmons and Feer, 1997)	Cabassou, Naaktstaart Gordeldier	Chiquitano: nopeish; Guaraní: tatú-aí
Anden-Borstengürteltier			
Weisshaar-Gürteltier			Ayoreo: chacajami; Guaraní: tatukirisi, tatundovivi, taturavuku
Braunhaar-Gürteltier			Ayoreo: pajotague; Guaraní: taturakapeyu
Burmeister-Gürtelmull	chlamyphore de Burmeister		Guaraní: tatujeikuarajoya; Izoceño: tatujeikurajoyava
Kleiner Gürtelmull	chlamyphore tronqué		
Südliches Siebenbinden-Gürteltier			Guaraní: tatú-mbiricá

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TABLE 3. Armadillos, *continued*

Latin	English	Spanish	Local names in Spanish	Portuguese
Dasypus kappleri	great long-nosed armadillo; Kappler's armadillo (Anderson, 1997); greater long-nosed armadillo (Superina, 2000)	armadillo de Kappler, mulita de Kappler	tatú quinze quilos (Bo); armadillo aracacho, cachicamo grande, jusachula (Co); armadillo narizón, tatú-peba grande (Ec); carachupa (Pe); cachicamo gigante, cachicamo guayanés, cachicamo montañero gigante (Ve)	tatu canastra, tatu quinze quilos (Emmons and Feer, 1997); tatu-tinga (S. M. Vaz, *in litt.*)
Dasypus novemcinctus	nine-banded armadillo; common long-nosed armadillo (Superina, 2000); dilly (Be)	cachicamo, mulita grande, tatú	tatú negro (Ar); tatú mula, toche (Bo); cachicamo (Co); armadillo narizón común, cachicambo, mulita (Ec); cusuco, pitero (Ho); tochi (Mex); carachupa (Pe); tatú (Ur); cachicamo montañero (Ve)	tatu-galinha (Fonseca *et al.*, 1996); tatu-verdadeiro (Olmos, 1995); tatu preto (Parera, 2002); tatuetê, tatu-folha, tatu-nove-bandas, tatu veado (S. M. Vaz, *in litt.*)
Dasypus septemcinctus	seven-banded long-nosed armadillo; Brazilian lesser long-nosed armadillo (Superina, 2000); seven-banded armadillo (Wilson and Reeder, 2005)	mulita chica	mulita común, tatú-mulita (Ar); tatú chico, tatú de siete bandas (Bo)	tatú mirim (Wetzel and Mondolfi, 1979); muleta, tatu-mula (Redford, 1994); tatu-china (Olmos, 1995); tatuí (Fonseca *et al.*, 1996)
Dasypus yepesi	Yepes' long-nosed armadillo; Yunga's lesser long-nosed armadillo (Superina, 2000)	mulita de Mazza	mulita de Yepes (Ar)	
Euphractus sexcinctus	six-banded armadillo; yellow armadillo (Emmons and Feer, 1997)	gualacate, peludo	gualacate, gualincho, tatú colorado, tatú mano amarilla, tatú poyú (Ar); peji, peji grande, quirquincho de seis bandas, tatú iris (Bo); peludo (Ur)	tatu-peba, tatu-peludo
Priodontes maximus	giant armadillo	tatú carreta, tatú gigante	gran tatú de los bosques, priodonte, priodonte gigante (Ar); pejiche, pejichi (Bo); jusa trueno, ocarro (Co); armadillo gigante, armadillo trueno, cutimbo, tatú gigante (Ec); carachupa gigante, carachupa maman, kintéro, yungunturu (Pe); cachicamo gigante, cuspa, cuspa gigante, cuspa grande, cuspón (Ve)	tatu-açú, tatu-canastra
Tolypeutes matacus	southern three-banded armadillo	quirquincho bola	mataco, mataco bola (Ar); corechi, tatú bola (Bo); tatú bolita (Pa)	tatu-bola
Tolypeutes tricinctus	Brazilian three-banded armadillo	tatú-bola	n/a	tatu-bola
Zaedyus pichiy	pichi	piche	blanquito, piche patagónico, pichi pagagónico, quirquincho (Ar)	

Abbreviations: Arg=Argentina; Be=Belize; Bo=Bolivia; CA=Central America; Co=Colombia; CR=Costa Rica; Ec=Ecuador; Hon=Honduras; Mex=Mexico; Pe=Peru; Pn=Panama; Py=Paraguay; Ur=Uruguay; Ve=Venezuela.

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German	French	Dutch	Indigenous names
Kappler-Weichgürteltier	tatou de Kappler; grand tatou (Emmons and Feer, 1997)		Cashinahua: panu; Saramaca: maka kapasi; Sranan-tongo: maka-kapasi;Yanomami: prushiima
Neunbinden-Gürteltier	tatou à neuf bandes (Emmons and Feer, 1997)	Gewone Kapasie, Langstaart Gordeldier, Negenbandig Gordeldier, Negengordelig Gordeldier	Amahuaca: cazta; Ayoreo: hajamei; Barí: ojsokba; Carib: kaikán; Cashinahua: yaix; Chiquitano: nutaconsh, tacoorsh; Chocó: tro; Garífuna: guasigamu; Guaraní: tatuakuti, tatueté, tatú-hú; Kuna: ugsi; Maya: mail chan, wech; Miskito: tahira, ukmik taira; Pech: patan waá; Sharanahua: catstahua; Sranan-tongo: kapasi; Tawahka: úkmik; Warao: jabaca; Yanomami: opo, oyorowahirimi; Yaruro: igoró
Nördliches Siebenbinden-Gürteltier	tatou à sept bandes		
Yungas-Gürteltier			
Sechsbinden-Gürteltier	tatou à six bandes; tatou jaune (Emmons and Feer, 1997)	Zesbandig Gordeldier	Ayoreo: gatodejai; Chiquitano: nopeish, ropeish; Guaraní: tatú-podyu, tatú poyú, tatuguasu
Riesengürteltier	cabassou, tatou géant (Emmons and Feer, 1997)	Reuzengordeldier	Amahuaca: cazta; Ayoreo: jochacai; Carib: mauraimá; Cashinahua: panku; Chiquitano: noshisisiris, opeish; Guaraní: tatú-guazú, tatu mborevi; Pilagá: napnalú; Sharanahua: catstahua; Sranan-tongo: granmankapasi; Tupi: tatú-asú; Yanomami: waka
Kugelgürteltier	tatou à trois bandes		Ayoreo: auco; Chiquitano: muñacarsh, nuiñacash; Guaraní: tatú apepú, tatú-pará, taturapua; Tupi-Guaraní: tatú-apará
Dreibinden-Kugelgürteltier	tatou à trois bandes		
Zwerggürteltier	tatou nain		Araucanian: kumtrü

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Appendix I: Citations by Country

Argentina (Ar): Chebez, 1994, 1996; Diaz and Ojeda, 2000; Guiñazú Rawson de Arentsen, 1956; Parera, 2002; Vizcaíno, 1997. **Bolivia** (Bo): Anderson, 1997; Cuéllar, 2001; Cuéllar S. and Noss, 2003; Ergueta S. and Morales, 1996. **Brazil** (Br): Aguiar and Fonseca, in review; Fonseca *et al.*, 1994; Fonseca *et al.*, 1996; Lara-Ruiz and Srbek-Araujo, 2006; Machado *et al.*, 1998; Olmos, 1995; Redford, 1994. **Central America** (CA): Reid, 1997. **Colombia** (Co): Moreno and Plese, 2006. **Costa Rica** (CR): Carillo *et al.*, 2002; Gómez, 2001; Janzen, 1983. **Ecuador** (Ec): Tirira S., 1999; Tirira S., 2001. **Honduras** (Ho): Marineros and Gallegos, 1998. **Mexico** (Me): Reid, 1997. **Panama** (Pn): J. Ledbetter, pers. comm. **Peru** (Pe): Leite Pitman *et al.*, 2003; Pacheco *et al.*, 1995. **Suriname** (Su): Husson, 1978. **Uruguay** (Ur): Fallabrino and Castiñera, 2006. **Venezuela** (Ve): Linares, 1998. References covering more than one country: Duff and Lawson, 2004; Eisenberg and Redford, 1999; Eisenberg, 1989; Emmons and Feer, 1997; Grzimek, 1988; Montgomery, 1985; Redford and Eisenberg, 1992; Reid, 1997; Simpson, 1941; Superina, 2000; Wetzel and Mondolfi, 1979; Wilson and Cole, 2000; Wilson and Reeder, 2005.

Appendix II: Citations by Group

Sloths: Aguiar and Fonseca, in review; Cuéllar S. and Noss, 2003; Diaz and Ojeda, 2000; Emmons and Feer, 1997; Fonseca *et al.*, 1994; Fonseca *et al.*, 1996; Gómez, 2001; Grzimek, 1988; Lara-Ruiz and Srbek-Araujo, 2006; Leite Pitman *et al.*, 2003; Linares, 1998; Marineros and Gallegos, 1998; Moreno and Plese, 2006; Pacheco *et al.*, 1995; Redford, 1994;

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Reid, 1997; Tirira S., 1999. **Anteaters**: Chebez, 1994, 1996; Cuéllar S. and Noss, 2003; Emmons and Feer, 1997; Ergueta S. and Morales, 1996; Gómez, 2001; Grzimek, 1988; Janzen, 1983; Leite Pitman *et al.*, 2003; Linares, 1998; Machado *et al.*, 1998; Marineros and Gallegos, 1998; Olmos, 1995; Pacheco *et al.*, 1995; Redford, 1994; Reid, 1997; Simpson, 1941; Tirira S., 2001. **Armadillos**: Anderson, 1997; Chebez, 1994, 1996; Cuéllar, 2001; Cuéllar S. and Noss, 2003; Diaz and Ojeda, 2000; Eisenberg, 1989; Eisenberg and Redford, 1999; Emmons and Feer, 1997; Ergueta S. and Morales, 1996; Fallabrino and Castiñera, 2006; Fonseca *et al.*, 1996; Gómez, 2001; Grzimek, 1988; Guiñazú Rawson de Arentsen, 1956; Linares, 1998; Machado *et al.*, 1998; Marineros and Gallegos, 1998; Olmos, 1995; Parera, 2002; Redford, 1994; Reid, 1997; Simpson, 1941; Superina, 2000; Tirira S., 2001; Vizcaíno, 1997; Wetzel and Mondolfi, 1979.

Appendix III: Indigenous Languages by Country

Argentina: Abipón, Guaraní, Pilagá, Toba, Wichí Lhamtés; **Bolivia**: Ayoreo, Chiquitano, Guaraní; **Brazil**: Guaraní, Tupí; **Central America**: Chocó, Maya; **Chile**: Araucanian; **Colombia**: Barí; **Costa Rica**: Boruca, Bribri; **Ecuador**: Quichua; **Honduras**: Garífuna, Pech, Tawahka; **Nicaragua**: Mískito; **Panama**: Guaymi, Kuna; **Paraguay**: Ayoreo, Guaraní; **Peru**: Amahuaca, Cashinahua, Machiguenga, Sharanahua; **Surinam**: Saramaccan, Sranan-Tongo, Wayana; **Venezuela**: Barí, Kariña, Makushi, Pemón, Warao, Yanomami, Yaruro. *Note*: some names listed here, such as Chocó, Guaraní, and Tupí, more properly refer to language groups rather than individual languages. The online edition of the *Ethnologue* (Gordon, 2005), published by the Sumner Institute of Linguistics, proved invaluable for checking these languages.

FIELD NOTES

Comportamento Potencialmente Reprodutivo da Preguiça-comum, *Bradypus variegatus* (Xenarthra, Bradypodidae): Observações de Campo

As preguiças (Família Bradypodidae e Megalonychidae) são consideradas animais solitários, cuja interação social se restringe à associação mãe-filhote que ocorre durante os primeiros meses de vida dos infantes (Queiroz, 1995; Chiarello *et al.*, 2004; Lara-Ruiz e Chiarello, 2005). Para o gênero *Bradypus*, relatos de outras interações decorrentes de observações na natureza se restringem ao registro de comportamento agonístico entre dois indivíduos adultos (Beebe, 1926) e observações de campo de animais compartilhando uma mesma árvore durante atividades de alimentação e repouso (dados não publicados, P. Lara-Ruiz).

A presente comunicação relata observações associadas ao comportamento reprodutivo de *Bradypus variegatus*, realizadas em uma área de preservação (ca. 350 hectares) de propriedade da Empresa Aracruz Celulose, localizada no Município de Sooretama no Espírito Santo, Brasil. (Essa área é uma Reserva Legal; Lei 7.803, de 18 de julho de 1989.) Ressalta-se que relatos de comportamento reprodutivo do gênero *Bradypus* na natureza são ausentes na literatura científica.

Em setembro de 2005 foi visto um indivíduo adulto com padrão de pelagem característico de macho: a porção intraescapular com pelagem alaranjada interrompida por linha mediana irregular enegrecida, composta por pêlos de menor comprimento (Beebe, 1926). O espécime estava atravessando uma das estradas internas à área de preservação, deslocando-se da margem direita para a esquerda do fragmento (08:20 hrs). O indivíduo foi capturado para coleta de material destinado a análises genéticas e, durante manipulação, foi detectada a vocalização de um segundo indivíduo em área próxima (08:45 hrs). Com base em experiências anteriores, a vocalização foi reconhecida como pertencente a um indivíduo do gênero *Bradypus*. De acordo com observações de espécimes de *Bradypus torquatus* em semi-cativeiro, fêmeas em período reprodutivo ("cio") emitem vocalizações que atraem machos (comunicação pessoal, V. L. de Oliveira). Considerando que a vocalização ouvida pudesse estar relacionada a um comportamento reprodutivo, o macho capturado foi solto (08:55 hrs) e seu deslocamento foi monitorado. O espécime se deslocou poucos metros para o interior do fragmento, onde permaneceu até a detecção de uma segunda vocalização (09:40 hrs), depois da qual reiniciou o deslocamento (ca. 10 m em linha reta em direção ao local de origem da vocalização). Após este deslocamento o espécime permaneceu no mesmo local, em comportamento de procura, que foi caracterizado pela realização de movimentos repetitivos da cabeça e farejamento.

Durante o acompanhamento do macho foi detectado um segundo indivíduo (10:05 hrs), em árvore a aproximadamente 10 m do ponto de observação, identificada como o local de origem das vocalizações. O segundo indivíduo não apresentava coloração ala-

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ranjada no dorso, coincidindo com a descrição das fêmeas de *Bradypus variegatus* (Beebe, 1926; Eisenberg e Redford, 1999). Este animal também foi acompanhado. Durante o período de observações o segundo espécime realizou atividades de deslocamento (curtas distâncias, permanecendo na mesma árvore ou vizinhas), repouso e alimentação. Ressalta-se que a fêmea apresentava porte maior em comparação com o macho, coincidindo com o dimorfismo sexual em tamanho registrado para o gênero (Lara-Ruiz e Chiarello, 2005). No decorrer das quatro horas seguintes de monitoramento simultâneo dos dois espécimes, não foram observados comportamentos de deslocamento, repouso ou alimentação realizadas pelo macho, não tendo sido também registrados outros eventos de vocalização do espécime considerado fêmea.

No dia seguinte (09:25 hrs), os dois indivíduos foram encontrados na mesma área, estando o macho em árvore localizada na margem direita da estrada, e a fêmea na mesma árvore de registro no dia anterior. Os espécimes se encontravam a uma distância de aproximadamente 15 metros em linha reta. No terceiro dia de observações (14:30 hrs), os dois indivíduos foram detectados compartilhando a mesma árvore durante atividades de alimentação (local de registro da fêmea no primeiro e segundo dias). Este fato contesta a suposição de que o deslocamento do macho para a margem direita da estrada, realizado no dia anterior, pudesse indicar seu afastamento da área. Outras observações foram obtidas no dia seguinte (12:06 hrs), destacando que o macho foi novamente registrado na margem direita da estrada, estando a fêmea na mesma árvore dos registros anteriores. Os espécimes se encontravam a uma distância de aproximadamente 20 metros em linha reta.

Semelhanças detectadas no padrão de coloração dorsal do macho observado ao longo dos quatro dias (Fig. 1) suportam a consideração de que os registros efetuados estão atribuídos a um mesmo indivíduo. Padrões individuais de coloração da mancha intraescapular para machos adultos de *Bradypus variegatus* foram relatados por Beebe (1926) e Goffart (1971).

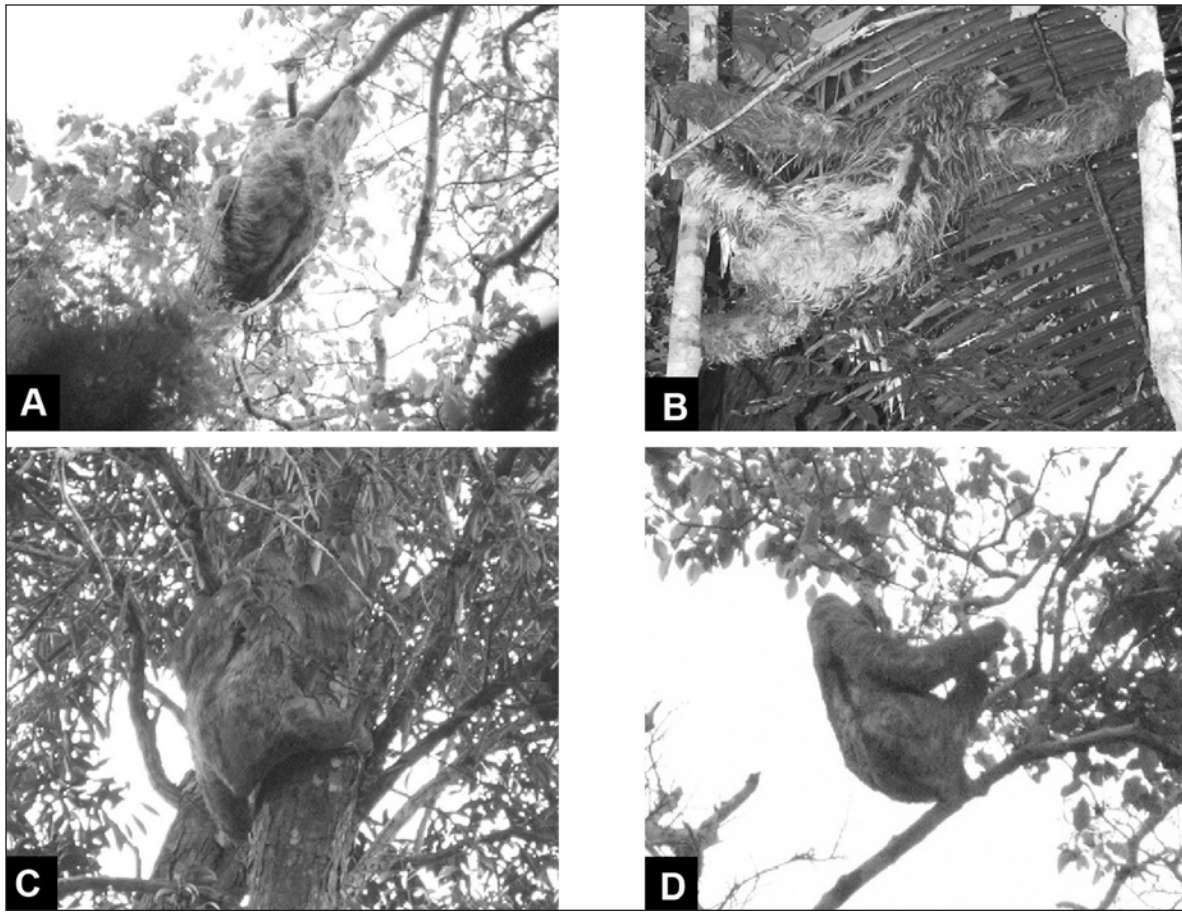

FIGURA 1. Padrão de pelagem e coloração da fêmea (A) e macho (B) adultos de *Bradypus variegatus,* destacando a semelhança no padrão de coloração dorsal do macho observado em dias consecutivos (B a D), suportando a consideração de que os registros efetuados estejam relacionados a um mesmo indivíduo.

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Caso seja confirmada a utilização de sinais vocais por fêmeas de *Bradypus variegatus* na atração dos machos, conforme observado para *Bradypus torquatus* em semi-cativeiro, as observações descritas acima estariam relacionadas ao comportamento reprodutivo da espécie, constituindo o primeiro registro deste comportamento na natureza. Neste caso, as observações realizadas indicariam que as interações sociais ocorridas durante o período de reprodução destes animais não são restritas ao momento da cópula, estando associadas a um maior período de contato macho-fêmea durante o qual os animais permanecem na mesma área, chegando a compartilhar a arvore de repouso e alimentação. As interações observadas durante o período relatado indicam que estes animais geralmente solitários podem apresentar períodos de interações sociais de vários dias de duração. O fato é mais relevante ainda considerando que existem poucas observações de interações entre indivíduos adultos na natureza, sendo que estas normalmente são efetuadas em regiões com densidades populacionais excessivamente altas, relacionadas com restrita disponibilidade de habitat florestado adequado para o uso.

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Mating Behavior of the Northern Tamandua (*Tamandua mexicana*) in Costa Rica

The mating behavior of several anteater species has been documented under zoo conditions (Sanmarco, 1985; Moeller, 1990; Coleman, 2003), but observations have yet to be made in the wild. No descriptions have been published on the mating behavior of *Tamandua mexicana* under any conditions, although it is the most common anteater in Central America (Lubin, 1983).

Northern tamanduas are medium-sized animals (4–6 kg) that feed on ants and termites (Montgomery, 1985a, 1985b); they range from eastern Mexico to northwestern Venezuela, Colombia, Ecuador and Peru (Wetzel, 1975, 1982, 1985; Fonseca and Aguiar, 2004). Macdonald (1995) speculated that *T. mexicana* may mate in the fall, but the few reports available suggest that mating is aseasonal (Lubin, 1983). Estrus cycles have not been reported for *T. mexicana*, but its close relative *T. tetradactyla* has estrus cycles lasting between 35 and 42 days (Sanmarco, 1987; Hay *et al.*, 1994). Silveira (1969) reported that gestation in tamanduas is approximately 130–150 days, but data from a zoo birth of *T. tetradactyla* suggests that gestation could be as short as 85 days (Sanmarco, 1987). *T. mexicana* are solitary but their home ranges, which are approximately 25 ha (Montgomery, 1985b), may overlap (Lubin *et al.*, 1977).

While hiking on a beach in Corcovado National Park, Costa Rica (08°29′N, 83°36′W), at 11:21 hrs on 1 February 2005, I witnessed a pair of *T. mexicana* engaging in mating behavior. Standing at a distance of five meters, I observed the pair interacting for over five minutes, during which two copulations occurred.

As I approached, I noticed one tamandua (later assumed to be female) searching for insects on top of a fallen log, which protruded onto the beach from beneath the shadowed understory of the forest. A second tamandua (later assumed to be male) emerged from the forest along the top of the same log. When the male encountered the female he first smelled her rump, and then followed her while she searched for insects, pacing back and forth on the log several times. As the male followed the female he swatted her rump with his forelimbs (Fig. 1a), and on several occasions he straddled the female and scrambled over her.

He then turned to face her, grabbing and holding her head for a short time (Fig. 1b), and then scrambled

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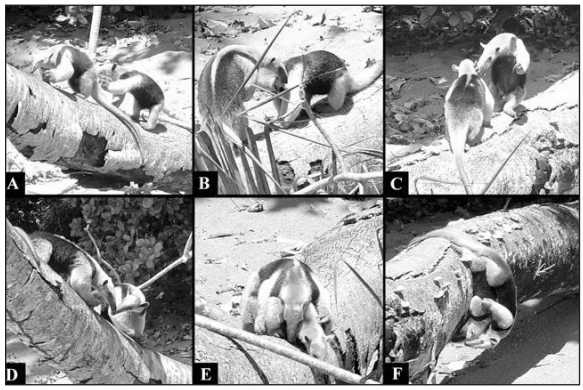

FIGURE 1. Apparent courtship and mating behavior between two northern tamanduas (*Tamandua mexicana*) on a beach in Corcovado National Park, Costa Rica.

over her again. Both tamanduas remained on top of the log during the entire encounter, foraging and feeding on insects. The female acted antagonistically towards the male, attempting to avoid and flee from him. Twice both tamanduas reared up on their back legs facing each other, aggressively swinging their foreclaws (Fig. 1c). Several times the tamanduas paused to sniff each other's noses for 5–10 seconds (Fig. 1d). Twice the male mounted the female dorsally, despite her attempts to flee, and achieved copulations. Each copulation was brief (10–30 seconds) with approximately two minutes between them.

During the first copulation, the male mounted the female on top of the log and used his forelimbs to restrain her by holding her neck and forelegs (Fig. 1e). The second time the male mounted the female as she attempted to dismount the log. He grabbed her with his forelimbs, holding the log with his prehensile tail, and mounted her on the side of the log (Fig. 1f). Finally the male straddled the log and slid down the length of its incline, walking into the forest and leaving my field of view. The female continued to search for insects on the fallen log for another eight minutes before departing into the forest as well.

The dorso-ventral mating behavior of *Tamandua mexicana* is different from the behavior typical of at least two other Neotropical xenarthrans. The two-toed sloth (*Choloepus didactylus*) mates in a ventral-ventral manner (Burton, 1976) and giant anteaters (*Myrmecophaga tridactyla*) mate with the female lying on her side (Moeller, 1990). However, other aspects of the mating behavior of the giant anteater are consistent with my observations of *T. mexicana*. The male giant anteater follows the female during courtship and occasionally paws and sniffs her, while both sexes continue to forage and feed (Shaw *et al.*, 1987). Likewise during courtship the male and female exchange blows and pinches (Moeller, 1990), and engage in "face-to-face embraces" similar to *T. mexicana* (Coleman, 2003). The onset of aggression and copulation seem to coincide in *Tamandua tetradactyla* (Meritt, 1976), as observed here with *T. mexicana*. Mating in *T. tetradactyla* is preceded by both sexes engaging in mutual inspection, "gentle boxing," cuddling, and following each other; a male *T. tetradactyla* will show interest in a female by sniffing, grooming, and following her (Sanmarco, 1985).

These observations of *T. mexicana* suggest that the strong forelimbs and tail may aid males in copulating with unwilling females. The prehensile tail provides stability during arboreal locomotion (Montgomery and Lubin, 1977; Lubin, 1983) but it may also aid in stabilizing the males during mating. Taylor (1978, 1985) has discussed the functional morphology of the tamandua's powerful forelimbs in the context of opening termite mounds, but my observations suggest that the forelimbs may also play a role in a male's ability to manipulate the position of the female during mating. Northern tamanduas find their prey by scent (Montgomery, 1985), and my observations suggest that scent may also be important during mating, perhaps to identify potential mates and assess their receptivity. The male *T. mexicana* may have been scent-marking both the female when he scrambled over her, and the log when he slid down it. I was unable to find additional information on scent glands and scent-marking in tamanduas for comparison. To my knowledge this is the first account of mating behavior in *T. mexicana* and the first account of any anteater mating in the wild.

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New Information on Population Declines in Pink Fairy Armadillos

The conservation status of the pink fairy armadillo (*Chlamyphorus truncatus*) was extensively discussed during the recent IUCN Edentate Species Assessment Workshop (Fonseca and Aguiar, 2004). The near-total lack of data on its natural history and population dynamics, however, made it extremely difficult to assess. Fresh information from the field now suggests that its current classification as Near Threatened (IUCN, 2006) should be reconsidered.

In March 2006, I assisted a film crew in their search for pink fairy armadillos in Mendoza Province, Argentina. The documentary will be the opening film in a new television series, "Nick Baker's Weird Creatures," produced by Icon Films in association with the British Natural History Museum, and to be aired concurrently on Channel 5 (UK) and Animal Planet. Although our efforts to trap, track, or observe a live pink fairy armadillo were unsuccessful, our interviews with local people provided new and important information on the abundance of this species—information that needs to be considered to ensure that its conservation status is accurately assessed. There is no doubt that this information requires confirmation by scientific methods. But in the absence of long-term ecological research, we are obliged to listen to

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the careful observations of local people, who are often an excellent source of information on native fauna and flora.

More than a decade ago, Roig (1995) reported a considerable reduction in sightings of *C. truncatus* in Mendoza between 1985 and 1995, and he warned that its wild populations might have suffered significant declines. In recent years this trend has been confirmed by locals in Mendoza, but it seems that sightings have never been very frequent—at least over the past several decades. One farm worker, Chani, who has worked in rural areas of San Rafael for most of his forty-five years, reported that he has seen about a dozen pink fairy armadillos in his entire life—and Chani is famous for having seen more pink fairy armadillos than anyone else in the region.

Although the geographic range of *C. truncatus* encloses a relatively large area in central Argentina (Fonseca and Aguiar, 2004), it should be noted that the pink fairy armadillo is restricted to small patches with specific soil types, such as loose sand dunes. The area with the most sightings—a *Chlamyphorus* "hotspot," as it were—lies near Monte Comán, where they appear to be relatively abundant. It should be noted, however, that "relatively abundant" involves no more than two or three sightings per year: one pink fairy armadillo was killed by a domestic cat about eight months ago (M. Lucero, pers. comm.), one was seen crossing a road in January 2006 (G. Ferraris, pers. comm.), and one had been raiding an earthworm farm over the course of several months in 2004 (G. Gonzalez, pers. comm.). Other recent sightings have been reported from east of Ñacuñán (Chani, pers. comm.); Corral de Lorca (G. Gonzalez, pers. comm.); to the south of El Nihuil (Rojas family, pers. comm.); and the Lavalle Desert in northeastern Mendoza (Mr. Molina, pers. comm.). The pink fairy armadillo's situation in protected areas looks no more promising: not a single individual has been observed for a decade in the provincial reserve of Bosques de Telteca in northern Mendoza (G. Ferraris, pers. comm.), nor has one been seen by researchers at the MAB Reserve Ñacuñán for 18 years (V. Roig, pers. comm.). Ironically, three weeks before we drove through the area, a seven-year-old boy captured a live pink fairy armadillo in the middle of the village of Ñacuñán and released it in the Reserve (Brian, pers. comm.).

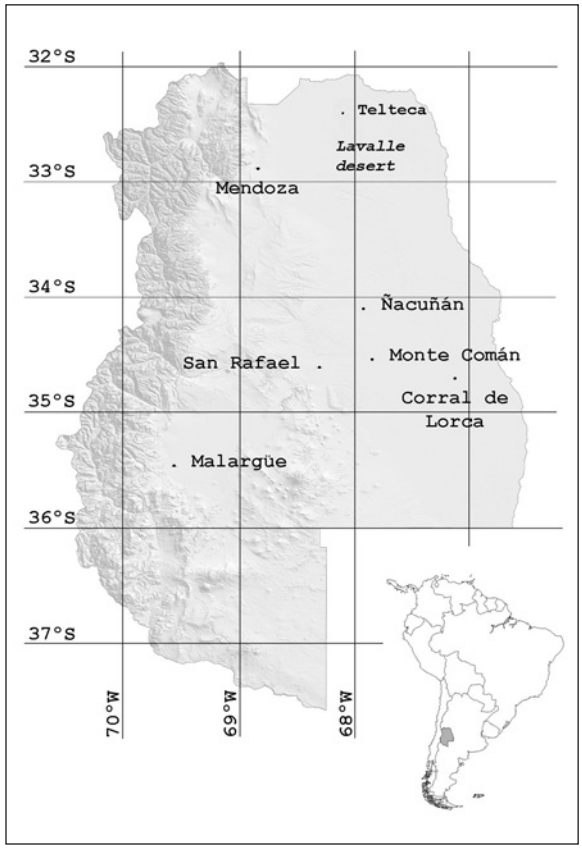

FIGURE 1. Map of Mendoza Province, Argentina. Recent pink fairy armadillo sightings have been reported from the Lavalle Desert and rural areas around Ñacuñán, Monte Comán, and Corral de Lorca.

The story of the Rojas family is a good example of the accounts we heard from many locals throughout the region, including Mr. Day and his neighbors living in the Lavalle Desert; Mr. Lucero and his colleagues in the Monte Comán area; and Mr. Ponzina and Mr. Manzano, of the Department of Natural Renewable Resources, in the area around Corral de Lorca. The Rojas family has lived on their farm south of El Nihuil for almost 100 years. The mother, now 85 years old, told us that when her sons were boys, they often caught and released pink fairy armadillos in the nearby sand dunes. According to Mrs. Rojas, they would only catch these odd creatures to watch them, but never killed them, "because these little animals don't do any harm." This opinion is shared by many locals, and suggests that persecution for cultural reasons is not the main cause of the recent population declines.

The last tracks were observed around September 2005, and the last sighting dates back to over a year ago, when a drowned pink fairy armadillo was found in an irrigation ditch. (The amazingly well-preserved dead animal is now a family treasure.) Mrs. Rojas and her sons confirmed that sightings were much more frequent 10 to 20 years ago—but they could not give an explanation for the population decline, as pink fairy armadillos are not used as a protein source, and

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therefore not the target of poachers. The Rojas family suggested that a disease—perhaps an epidemic similar to the "pichi plague" that has affected *Zaedyus pichiy* in their area—could have decimated local populations of *C. truncatus* as well.

This species may also be finely susceptible to environmental stress; sudden changes in environmental temperature have been known to kill *C. truncatus* (Roig, 1971). Pink fairy armadillos have very low survival rates in captivity; many individuals have died during the transport from the point of capture to the captive facility, while others survived only a few hours to days in captive conditions. This extreme sensitivity has been attributed to stress or inappropriate environmental conditions, both by researchers (V. Roig, pers. comm.) and locals (e.g., Chani, pers. comm.). Without knowing more of this species' autecology, it will be difficult to determine which factors determine the survival of pink fairy armadillos in captivity: light, temperature, soil quality, or absence of external factors such as soil vibrations—or something else entirely unexpected. These same factors could also negatively affect *C. truncatus* in the wild, if their natural habitat is altered by human encroachment or global changes—and may already have caused the population declines reported by so many local people.

These reports from the inhabitants of rural Mendoza sketch a worrisome portrait of *C. truncatus* in the wild. It is entirely possible that other pink fairy armadillos have been observed by different locals in recent years; distances are large in rural Mendoza, and communication is difficult at best. But it is unlikely that a large population of pink fairy armadillos would exist somewhere in Mendoza without our becoming aware of it. In five years of fieldwork on *Zaedyus pichiy*, I have visited some of the remotest corners of Mendoza Province and talked to countless locals about armadillos of every kind. My interest—call it obsession—in seeing a live pink fairy armadillo keeps me asking everyone I meet—locals, anti-poaching patrols, and rangers—about sightings of *C. truncatus*. Despite my constant questioning, and a network of volunteers who promised to contact me in case of a sighting, I still haven't been able to see a single live individual of this rarest and oddest of armadillos. Given its exceptional rarity, and the clear declines which so many local people have reported, I wonder whether the pink fairy armadillo's current Red List status of Near Threatened does not, in fact, dangerously underestimate the threat this species is facing—and whether a classification as Vulnerable would be more realistic. If anyone has more information on any aspect of the distribution or population ecology of pink fairy armadillos, I would be more than interested in a dialogue.

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An Agonistic Encounter Between Two Giant Anteaters (*Myrmecophaga tridactyla*)

On the afternoon of 2 July 2005, during a field excursion in the center of the Brazilian Pantanal (18°59′S, 56°39′W), we had the opportunity to witness and photograph the unusual presence of four giant anteaters in the same two-hectare patch of open scrub grassland. All four animals were adult-sized but of unknown sex. Two of them were foraging separately, walking in parallel some 50 m apart; throughout the encounter they ignored each other and the other two anteaters (Fig. 1a). These latter two, however, became involved in an agonistic encounter, which followed the pattern of an injury-producing fight as described by Shaw *et al.* (1987). While foraging, their paths drew near to each other; when they were approximately 10 m apart, one of them apparently detected the other by scent and walked directly towards it (Fig. 1b), producing a long, deep "harrrr" sound. Both animals began to circle one another with tails raised (Fig. 1c), and after about a minute the aggressor began striking with its forepaw at the other animal's face (Figs. 1d and 1e). This lasted only a few seconds. When the attacked animal fled, the aggressor chased it for over 100 m with its tail raised and piloerected (Fig. 1f), and then resumed foraging nearby.

Although Shaw *et al.* (1987) frequently observed agonistic behavior among free-ranging giant anteaters in Serra da Canastra National Park in central Brazil, to our knowledge it has not been reported in field studies elsewhere.

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FIGURE 1. a. Two of the four giant anteaters seen foraging near each other, indicated by a white arrow. These two apparently ignored the presence of the others. 1b–1f. Sequence of the agonistic encounter (see text). Note (in Figure 1d) the raised forepaw of the aggressor.

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Chasing Behavior in Yellow Armadillos, *Euphractus sexcinctus*, in the Brazilian Pantanal

The behavior of the yellow armadillo, *Euphractus sexcinctus* (Linnaeus, 1758), has not been well

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documented. This species is primarily solitary, except during the breeding season and in the case of mother and young. Several yellow armadillos have also been seen gathered around the carcass of a dead animal, feeding on maggots and carrion (Moeller *apud* Nowak, 1999).

On the afternoon of 27 October 2003, during fieldwork in the Brazilian Pantanal (18°59′S, 56°39′W), we observed three yellow armadillos chasing each other through grassy scrub at the edge of a forested area. The animals were running at high speed in single file, less than a meter apart from one another (Fig. 1). We witnessed similar behavior on 10 November 2004, in which up to eight yellow armadillos were involved in a similar chase. Although the number of animals actively chasing varied from moment to moment, as many as eight individuals were seen together at one time, forming a single long and weaving line.

The animals continued this behavior for over an hour, appearing and disappearing among the denser vegetation in an area of no more than one hectare. We found several open-earth burrows nearby, located in the grassy scrub near the more densely vegetated area. Several of the burrows showed evidence of recent activity, with fresh dirt scattered at the entrance.

Aggression in armadillos typically consists of chases, in which one animal displaces another by running after it, and of fights, in which chases lead to physical contact (McDonough, 1994). During fieldwork in Alabama, USA, Breece and Dusi (1985) witnessed adult nine-banded armadillos (*Dasypus novemcinctus* Linnaeus, 1758) chasing juveniles on five occasions over 35 minutes. The threat of injury gives a fight greater risk than a chase (see Loughry *et al.*, 2002). In fights between nine-banded armadillos, the combatants balance on their hind feet and tails and claw at one another with their front feet; they also claw at the sides of their opponents with their hind feet while rolling and flipping one another in a ventral-ventral position (McDonough, 1994). This fighting behavior has not been reported in yellow armadillos, but it may occur in a similar form.

FIGURE 1. Yellow armadillos (*Euphractus sexcinctus*) in full chase, 27 October 2003, in the Brazilian Pantanal (18º59′S, 56º39′W). Photo: Arnaud L. J. Desbiez.

In nine-banded armadillos, adult males and females are most aggressive during the breeding season. Male aggression may ensure exclusive access to females as well as suppressing reproductive behavior by younger males. In females, aggressive behavior may be due to competition for limiting resources during pregnancy and lactation, and may also stimulate dispersal of young from the previous year (McDonough, 1994). Female aggression has been associated with lactation in yellow armadillos (McDonough and Loughry, 2003).

During the breeding season male armadillos will avidly follow the females and, among nine-banded armadillos, they will forage together for several days (McDonough and Loughry, 2003). Male nine-banded armadillos may be polygynous, mating with two or three females each breeding season, while females generally mate with only a single male (McDonough and Loughry, 2001). In the three-banded armadillo (*Tolypeutes tricinctus* [Linnaeus, 1758]), an observation of one female followed by two males has been recorded (Marinho-Filho *apud* Guimarães, 1997). When the more distant male tried to approach the female, the closer male put himself between the female and the hopeful interloper. Whenever the farther male managed to get close to the female, her defender would jump onto the intruder, the two of them rolling and flipping one another across the ground (Marinho-Filho *apud* Guimarães, 1997).

It is unclear whether the chasing behavior we observed in these yellow armadillos may have a reproductive function—allowing access to a mate, or maintaining an exclusive mate—or to defend territories or food resources. As all the animals we observed were of a similar size, however, the chases we witnessed probably had nothing to do with the dispersal of young. Both of these observations were made at the beginning of the rainy season, in October and November. The local people, the *pantaneiros*, believe that these chases involve several yellow armadillo males in pursuit of females that are ready to breed, and so chasing may be a way for males to compete for females. To

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fully understand this behavior, however, will require more information on the sex, age and reproductive status of the individuals involved.

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Extension of the Distribution of *Cabassous unicinctus* in Santa Cruz, Bolivia

The southern naked-tailed armadillo, *Cabassous unicinctus*, has been reported from northern Bolivia in the Departments of Pando, Beni, and northern Santa Cruz. The two southernmost localities for the species in Bolivia are both in Santa Cruz: at 16°40′S, 63°45′W, 80 km north of San Carlos, and 14°45′S, 60°35′W, 52 km south of Campamento Los Fierros. Only four specimens have been recorded

FIGURE 1. An adult female southern naked-tailed armadillo, *Cabassous unicinctus,* walking across an unpaved road.

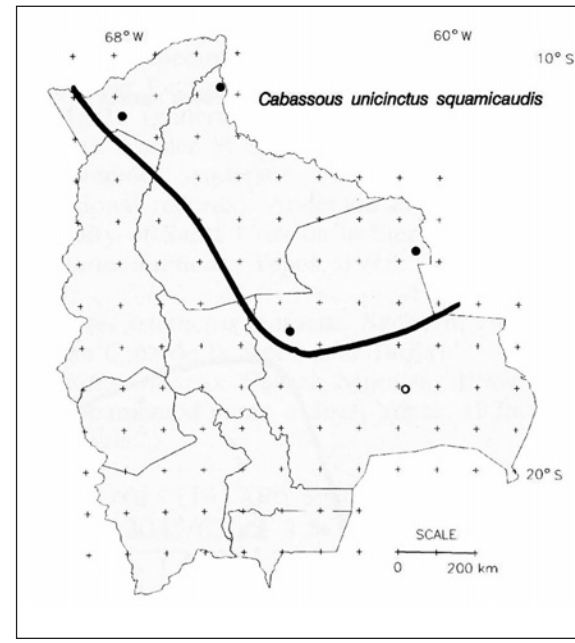

FIGURE 2. Distribution of *Cabassous unicinctus* in Bolivia; the open circle represents the new locality reported here. (Original image courtesy of the American Museum of Natural History, reproduced and modified with permission of the AMNH Library.)

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from Bolivia to date, all of which Anderson (1997) ascribes to the subspecific form *C. u. squamicaudis* (Lund, 1842).

On 3 March 2001, at 14:00 hrs, an adult female was observed walking across the unpaved road that runs from San Jose de Chiquitos to Tucavaca Field Camp (Bolivia-Brazil gas pipeline), in the Department of Santa Cruz at 18°05.723′S, 60°49.996′W (378 m asl). No measurements could be taken, nor were any special features evident (Fig. 1). The vegetation of the area is Chiquitano transitional forest—dry forest transitional between the Chaco and Cerrado biogeographical provinces. Annual precipitation is 800 mm and the average annual temperature is 26°C.

This sighting is a new locality for this species, and extends its known distribution more than 300 km to the southeast towards the Bolivian border with Paraguay (Fig. 2).

Acknowledgements: Thanks to the American Museum of Natural History Library for permission to modify and reproduce Fig. 2, originally published as Fig. 514 from Anderson (1997).

Leonardo Maffei, Casilla 3800, Santa Cruz, Bolivia.

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NEWS

Edentates in the 2006 IUCN Red List

The *IUCN/SSC 2006 Red List of Threatened Species* was launched online in May 2006, covering a total of 16,119 species categorized as Vulnerable, Endangered or Critically Endangered. There are now 784 species officially considered to be Extinct, with an additional 65 which exist only in cultivation or captivity. In 2003, by comparison, the Red List included 12,259 species threatened with extinction, with 762 officially extinct and 58 lost from the wild.

In addition to its broad coverage of terrestrial species, the 2006 Red List added assessments of selected marine species, in particular the sharks and rays, of which at least 20% are threatened with extinction. Freshwater fish are in a far worse situation—of 252 species endemic to the Mediterranean region, a full 56% are now classified in threatened categories. A total of 7,725 animal species are now recognized as threatened, including 12% of birds, 32% of amphibians and 42% of turtles and tortoises.

Of the 4,856 mammal species assessed, 1,093 (23%) were classified as threatened with extinction, of which 583 are Vulnerable, 348 are Endangered and 162 are Critically Endangered, with an additional 70 Extinct and four Extinct in the Wild. The edentates, fortunately, contribute very little to these ominous totals: only six species are threatened, with another seven species classified as Near Threatened, two as Data Deficient, and 16 as Least Concern.

The most recently described edentate, the pygmy sloth *Bradypus pygmaeus*, is by far the most threatened, now classified as Critically Endangered. The maned sloth (*Bradypus torquatus*) remains Endangered, while *Chaetophractus nationi*, *Dasypus pilosus*, *Priodontes maximus* and *Tolypeutes tricinctus* are considered Vulnerable. Several species were downgraded from their prior status: the pink fairy armadillo (*Chlamyphorus truncatus*) changed from Endangered to Near Threatened, the giant armadillo (*Priodontes maximus*) moved from Endangered to Vulnerable, and both the giant anteater (*Myrmecophaga tridactyla*) and the greater fairy armadillo (*Chlamyphorus retusus*) shifted from Vulnerable to Near Threatened. Some of these changes resulted from application of the most recently revised Red List criteria (IUCN, 2001) and may not reflect actual improvements to conditions in the wild.

These most recent assessments are the result of the 2004 Edentate Species Assessment Workshop, led by Dr. Gustavo Fonseca and with expert contributions from Agustín Abba, Teresa Anacleto, Adriano Chiarello, Erika Cuéllar, Paula Lara-Ruiz, Jim Loughry, Dennis Meritt Jr., Flávia Miranda, Gustavo Porini, Anthony B. Rylands, Rafael Samudio Jr., Mariella Superina and Sergio Vizcaíno.

Craig Hilton-Taylor, Red List Programme Officer, Species Survival Programme, 219c Huntingdon Road, Cambridge CB3 0DL, UK, **Gustavo A. B. da Fonseca** and **John M. Aguiar**, Center for Applied Biodiversity Science, Conservation International, 1919 M Street NW, Suite 600, Washington, DC 20036, USA.

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TABLE 1. Conservation status and main threats to the extant edentates, based on the 2004 Edentate Species Assessment Workshop and the 2006 IUCN/SSC Red List of Threatened Species. All species have been assessed against the 2001 IUCN criteria.

Species	1996 Status	2006 Status	Primary Threats
Bradypus pygmaeus	NE	CR B1ab(i,ii,iii)	hunting, minimal range
Bradypus torquatus	EN A1cd	EN B1ab(i,ii,iii)	population fragmentation
Bradypus tridactylus	LR	LC	hunting, habitat loss
Bradypus variegatus	LR	LC	hunting, habitat loss
Cabassous centralis	DD	DD	habitat loss and degradation
Cabassous chacoensis	DD	NT	hunting, habitat loss
Cabassous tatouay	LR/nt	LC	hunting, habitat loss
Cabassous unicinctus	LR	LC	hunting, habitat destruction
Chaetophractus nationi	VU A1d	VU A2d	intense hunting and habitat loss
Chaetophractus vellerosus	LR	LC	hunting
Chaetophractus villosus	LR	LC	hunting
Chlamyphorus retusus	VU A1c	NT	intense persecution, habitat loss
Chlamyphorus truncatus	EN A1abcd	NT	habitat loss
Choloepus didactylus	DD	LC	hunting, habitat loss
Choloepus hoffmanni	DD	LC	habitat loss
Cyclopes didactylus	LR	LC	habitat loss
Dasypus hybridus	LR	NT	intense hunting and habitat loss
Dasypus kappleri	LR	LC	unknown
Dasypus novemcinctus	LR	LC	hunting
Dasypus pilosus	VU B1+2c	VU B1ab(iii)	habitat loss
Dasypus sabanicola	DD	LC	hunting
Dasypus septemcinctus	LR	LC	unknown
Dasypus yepesi	NE	DD	unknown
Euphractus sexcinctus	LR	LC	hunting, habitat destruction
Myrmecophaga tridactyla	VU A1cd	NT	hunting, fire, highway mortality, habitat loss, persecution
Priodontes maximus	EN A1cd	VU A2cd	hunting, habitat loss
Tamandua mexicana	LR	LC	fire, habitat loss, highway mortality
Tamandua tetradactyla	LR	LC	fire, hunting, habitat loss, highway mortality
Tolypeutes matacus	LR/nt	NT	hunting, habitat loss
Tolypeutes tricinctus	VU A1bcd	VU A2bc	hunting, habitat loss
Zaedyus pichiy	DD	NT	hunting, habitat loss and degradation

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The Aviarios Sanctuary

Aviarios del Caribe was created by Luis Arroyo and Judy Avey-Arroyo in 1972 with the purpose of protecting 96 hectares of lowland tropical rainforest on the Caribbean coast of Costa Rica. We rescued our first orphaned infant sloth in 1992. Since then our focus has been primarily on rescuing and caring for both kinds of sloths native to Costa Rica, *Bradypus variegatus* and *Choloepus hoffmanni*.

This interest was born not just from the curiosity and admiration sloths inspire in those who take the time to truly understand them, but more importantly because of the lack of information available on them, despite their remarkable ability to adapt and survive from prehistoric times. Over the years, as we grew and expanded our focus, the rescue center became known as the Aviarios Sanctuary.

The sanctuary also responded to the need to educate people about these animals, and to protect sloths from

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a variety of threats caused by human intervention. As word got around, more and more sloths were brought to the center: baby sloths falling from their mothers, or orphaned because their mothers were killed — hit by cars, stoned or beaten by people, attacked by dogs, or electrocuted when crossing power cables — as well as adult sloths that managed to survive such horrific accidents, but were in need of medical attention, food, rehabilitation, and/or long-term care.

Through the years we have compiled a considerable amount of new information on sloth habitat, behavior, nutrition, anatomy, physiology, pathologies and reproduction, gathered from our own experience — much of it trial and error — as well as feedback from others working with this remarkable animal. All of this gives us a great amount of practical and theoretical knowledge on both species of sloth found in Costa Rica.

Our successes have encouraged us formulate a new plan in our work with sloths: to become the first sloth sanctuary focused on rescue, research and education. Our mission and vision are:

Mission:
"To consolidate our Sanctuary as an agency that promotes and implements the protection and rehabilitation of sloths in Costa Rica, through the observation, study, care and analysis of animals in recovery; to promote actions that raise people's awareness and to facilitate education in order to improve the welfare and quality of life of these two species."

Vision:
"To be an integrated agency operating for the protection and rehabilitation of sloths, especially through study, research and exchange of knowledge that permits the development of scientific information on the species; to promote educational actions on the importance of sloths in our habitat."

Our general objectives are, first and foremost, to rescue and rehabilitate sloths with special needs that are referred to our sanctuary, and to explore every alternative to improve their welfare and quality of life. Although many adult sloths have been reintroduced to the wild, we cannot do the same for the orphaned infants which we rescue and hand-raise. Until we are able to teach them how to survive in the wild as well as a mother sloth, we must consider alternative solutions, such as placing them on loan to qualified institutions, either in Costa Rica or other countries, as ambassadors for the rainforests of the Neotropics.

In addition, we will continue to study the behavior, lifestyle, physiology and pathology of sloths through research and the exchange of information. We hope to promote respect for sloths among people near and far, and we disseminate information on their importance to our environment, stimulating scientific and social interest in them with the support of those organizations involved in, and responsible for, environmental protection. In particular, we are working to expand our school-aged environmental education program to include children not only from our immediate area, but from throughout Costa Rica and beyond, in order to bring a greater understanding of and admiration for these extraordinary and fascinating animals to the future generations of our world.

We have invested considerable material and human resources into this purpose, and today, on the southern Caribbean coast of Costa Rica, we have 96 hectares of privately owned and protected primary and secondary forest, plus a building housing a medical clinic, nursery, a laundry room and a kitchen for the preparation of the sloths' special diet. We also have a separate building with an area for community outreach and educational activities, and, most importantly, the resident *Bradypus* and *Choloepus* sloths that need us — and teach us — every single day.

Over the years we have received many other animals as well, which we have cared for to the best of our abilities. Some of these animals have been successfully released into the wild; others have died or have been relocated to other rehabilitation centers. We have treated two other species of edentates, the silky anteater (*Cyclopes didactylus*) and the northern tamandua (*Tamandua mexicana*). Other species of mammals which have been brought to us include the mantled howler monkey (*Alouatta palliata*), olingo (*Bassaricyon gabbii*), kinkajou (*Potos flavus*), jaguarundi (*Herpailurus yagouaroundi*), margay (*Leopardus wiedii*), ocelot (*Leopardus pardalis*), Mexican hairy porcupine (*Coendou mexicanus*) and paca (*Agouti paca*). We have also cared for a number of tropical birds, including rainbow-billed toucan (*Ramphastos sulfuratus*), chestnut-mandibled toucan (*Ramphastos swainsonii*), collared aracari (*Pteroglossus torquatus*), pomerine jaeger (*Stercorarius pomarinus*), parasitic jaeger (*Stercorarius parasiticus*), brown pelican (*Pelecanus occidentalis*), and slaty-tailed trogon (*Trogon massena*). At this writing, one rainbow-billed toucan and four kinkajous are still in residence with us.

Much still needs to be done. The clinic is in desperate need of essential veterinary equipment, from basic

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TABLE 1. Number of animals received from 1990 to December 31, 2005. (Numero de animales recibidos desde 1990 hasta 31 diciembre 2005.)

Year (Año)	*Choloepus hoffmanni*	*Bradypus variegatus*	Other (Otros)	Total For Year (Total en el año)
1990	0	0	1	1
1992	2	0	0	2
1994	0	1	0	1
1995	0	0	2	2
1996	1	0	2	3
1997	2	1	1	4
1998	6	0	0	6
1999	4	3	3	10
2000	9	4	1	14
2001	9	2	0	11
2002	13	8	2	23
2003	17	4	2	23
2004	23	10	2	35
2005	37	13	13	63
Total				**198**

TABLE 2. Total population of animals in the sanctuary as of December 31, 2005. (Población total de animales en el santuario hasta 31 diciembre 2005.)

Species (Especie)	Quantity (Cantidad)
Choloepus hoffmanni	60
Bradypus variegatus	15
Miscellaneous other (mammals and birds)	5

supplies — stethoscopes, overhead lamps, surgical scissors — to expensive devices such as autoclaves, centrifuges, and ultrasound and hemogram machines. In the immediate future we will develop a protocol for universities and researchers from around the world who would be interested in joining our medical team to carry out research and education projects at the sanctuary. We are committed to our continuing education of the public, and to sharing information on our progress so that our mission and vision become a reality.

We invite anyone interested in learning more about our project or sharing their experiences in the management of sloths to contact us: **Judy Avey-Arroyo**, Project Director, and **Franscisco Arroyo Murillo**, Chief Veterinarian, Aviarios Sanctuary, 1 Km. Norte Puente Río Estrella, Penshurt, Limón, Costa Rica, or P. O. Box 569-7300, Limón, Costa Rica. E-mail: <aviarios@costarica.net>.

Una Introducción a Aviarios Sanctuary

Aviarios del Caribe fue creado por Luís Arroyo y Judy Avey-Arroyo en 1972 con el propósito de proteger 96 hectáreas de bosque tropical lluvioso de la costa caribeña de Costa Rica. En 1992 rescatamos al primer huérfano perezoso infante. Desde ese momento nos hemos enfocado principalmente en el rescate y cuido de las dos especies de perezoso propias de Costa Rica, el *Bradypus variegatus* y *Choloepus hoffmanni.*

El interés nació no sólo de la ternura y la inspiración que producen estos seres vivos para quienes se toman el tiempo de apreciarlos verdaderamente; si no sobre todo de la falta de información que existía con relación a ellos a pesar de ser una especie con antecedentes históricos de adaptación y permanencia admirables. El centro de rescate se empieza a conocer como Aviarios Sloth Sanctuary (Aviarios, Santuario de Perezosos). El santuario también responde a la necesidad de educar a las personas acerca de estos animales y de proteger a los perezosos de las diferentes amenazas, especialmente relacionadas con la intervención del ser humano.

Con el pasar del tiempo han sido más y más el número de animales referidos (ver Tabla 1); bebés que caen de su madre o huérfanos a causa de la muerte de madres atropelladas, agredidas a pedradas por personas, atacadas por perros o electrocutadas por cables eléctricos, además de los adultos que sobreviven estos acciden-

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tes y requieren de atención médica, alimentación y cuidados.

A través de los años hemos recopilado cantidades considerables de información nueva acerca del hábitat, comportamiento, nutrición, anatomía, fisiología, patologías y reproducción, aprendido por experiencias propias—generalmente a prueba y error—así como la retroalimentación con otras personas que han trabajado con estos maravillosos animales. Esto nos brinda un gran conocimiento teórico y práctico acerca de ambas especies para compartir.

Nuestro éxito en el trabajo con estos animales nos ha impulsado a reformular nuestra propuesta de trabajo para con los perezosos de una forma integral, constituyéndonos como el primer centro de perezosos enfocado en los temas de rescate, investigación y educación con la siguiente misión y visión:

Misión:
"Que nuestro santuario se consolide como un ente promotor y ejecutor de la protección y rehabilitación del perezoso en Costa Rica; mediante la observación, el estudio, cuido y análisis de los animales en recuperación. Para promover procesos de concientización social y educativa en pro del bienestar y calidad de vida de estas especies."

Visión:
"Ser un centro integrado trabajando en la protección y rehabilitación de perezosos, especialmente mediante el estudio, la investigación e intercambio de conocimientos que permitan el desarrollo científico de estas especies. A la vez que se promueven procesos de educación e importancia de los perezosos en nuestro hábitat."

Nuestros objetivos generales son, en primer lugar, rescatar y rehabilitar los perezosos referidos al Aviarios Sanctuary con necesidades especiales y activar diferentes alternativas de ambiente que promuevan su bienestar y calidad de vida. Aunque se han reintroducido muchos perezosos adultos a su hábitat natural, no podemos hacer lo mismo con los perezosos huérfanos que rescatamos y criamos artificialmente. Hasta poder enseñarles a sobrevivir en estado silvestre, tenemos que considerar alternativas—como entregarles en préstamo a instituciones calificadas, sea en Costa Rica u otros países, para que sean embajadores del bosque tropical lluvioso del Neotrópico.

Adicionalmente, seguiremos estudiando el comportamiento, estilos de vida, fisiología y patología de los perezosos mediante la investigación, recolección de datos e intercambio de conocimientos. Esperamos poder promover el respeto hacia los perezosos en el ser humano, y damos a conocer su importancia histórica en nuestro medio ambiente incentivando el interés científico y social hacia ellos, con el apoyo de los diferentes organismos involucrados y encargados de la protección ambiental. En especial, estamos trabajando para extender nuestros programas de educación ambiental para alcanzar no solo a los niños de áreas cercanas, sino de todo Costa Rica y el mundo para así tener un mayor entendimiento y admiración hacia estos extraordinarios y fascinantes animales en las futuras generaciones.

Para el cumplimiento de los mismos hemos invertido recursos materiales y humanos contando hoy en día en la costa caribeña sur de Costa Rica con un total de 96 hectáreas de bosque primario y secundario protegido, una clínica para la atención médica y cuidados especiales, y una cocina para la preparación de la dieta especial de los perezosos, además de un espacio para la proyección comunitaria y educativa y lo más importante, los *Bradypus* y *Choloepus* que residen en el centro que nos necesitan—y nos enseñan—día a día.

En los últimos años también hemos recibido muchas otras especies de animales que hemos cuidado lo mejor que pudimos. Algunos de esos animales fueron liberados exitosamente; otros murieron o fueron trasladados a otros centros de rehabilitación. Cuidamos de otras dos especies de edentados, el cíclope (*Cyclopes didactylus*) y el tamanduá (*Tamandua mexicana*). Otros mamíferos que fueron llevados a nuestro centro incluyen monos aulladores (*Alouatta palliata*), olingos (*Bassaricyon gabbii*), micos de noche (*Potos flavus*), yaguarundíes (*Herpailurus yagouaroundi*), tigrillos (*Leopardus wiedii*), ocelotes (*Leopardus pardalis*), puercos espín (*Coendou mexicanus*) y pacas (*Agouti paca*). También hemos cuidado de varias especies de aves tropicales, incluyendo tucanes (*Ramphastos sulfuratus* y *R. swainsonii*), arasaris collarejo (*Pteroglossus torquatus*), págalos pomarinos (*Stercorarius pomarinus*), págalos parásitos (*Stercorarius parasiticus*), pelícanos (*Pelecanus occidentalis*), y trogones grandes (*Trogon massena*). Al momento de escribir esta nota, siguen bajo nuestro cuidado un tucán pico iris y cuatro micos de noche.

No obstante, sabemos que aún nos falta mucho más por lograr: el equipamiento de la clínica, por ejemplo. Entre nuestros planes para un futuro cercano está el desarrollo de protocolos para universidades e investigadores de todo el mundo que estén interesados en formar parte de nuestro equipo médico para avanzar

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en los proyectos de investigación y educación continua, y sobre todo la oportunidad y la asesoría para compartir públicamente nuestros avances para hacer de nuestra Misión y Visión sueño cumplido!

Invitamos a todas las personas que deseen saber más sobre nuestro proyecto o que quieran compartir sus experiencias en el mantenimiento de perezosos, a corresponder con nosotros: **Judy Avey-Arroyo**, Co-fundadora y Directora del Proyecto, y **Franscisco Arroyo Murillo**, Veterinario Regente, Aviarios Sanctuary, 1 Km. Norte Puente Río Estrella, Penshurt, Limón, Costa Rica, o P. O. Box 569-7300, Limón, Costa Rica. Correio electrónico: <aviarios@costarica.net>.

The Biology of the Xenarthra

Twenty-one years after the first true synthesis of edentate research, a book project is underway that promises to become the new standard reference for our field. *The Biology of the Xenartha*, edited by Sergio Vizcaíno and Jim Loughry, is now under consideration by the University Press of Florida, with an estimated release in late 2007. Its appearance will be most welcome, and long overdue: the volume edited by Gene Montgomery appeared in 1985, and was itself based on the proceedings of a symposium held in 1979. Projected to be over seven hundred pages in length, the forthcoming volume is intended to be a panoramic survey of current research, drawing on the expertise of the majority of the active xenarthran community. This book (tome, even) promises to be the most comprehensive volume yet assembled on edentate research, and we expect it will prove invaluable to a new generation of students and researchers alike.

Here we present a tentative table of contents to indicate its scope, which includes contributions from the field, the museum and the laboratory in equal measure. For more information, please contact either of the editors: **Sergio Vizcaíno**, Departamento Científico Paleontología Vertebrados, Museo de La Plata, Paseo del Bosque s/n, 1900 La Plata, Argentina, e-mail <vizcaino@museo.fcnym.unlp.edu.ar>, and **Jim Loughry**, Department of Biology, Valdosta State University, Valdosta, Georgia 31698-0015, USA, e-mail <jloughry@valdosta.edu>.

Tentative contents: 1. Xenarthran biology: Past, present, and future – S. F. Vizcaíno and W. J. Loughry. Part 1: Phylogeny. 2. Recent advances and future prospects in xenarthran molecular phylogenetics – F. Delsuc and E. J. P. Douzery; 3. Morphology-based investigations of the phylogenetic relationships among extant and fossil xenarthrans – T. J. Gaudin and H. G. McDonald. Part 2: Fossil Xenarthra. 4. Fossil history of sloths – H. G. McDonald and G. De Iuliis; 5. Paleogeographic distribution and anatomical adaptations in Peruvian megatheriine ground sloths (Xenarthra: Megatherioidea) – F. Pujos; 6. Evolution of the Vermilingua: An overview – H. G. McDonald, S. F. Vizcaíno and M. S. Bargo; 7. The evolution of armored xenarthrans and a phylogeny of the glyptodonts – J. C. Fernicola, S. F. Vizcaíno and R. A. Fariña; 8. Form, function and paleobiology in xenarthrans – S. F. Vizcaíno, M. S. Bargo and R. A. Fariña. Part 3: Living Xenarthra: Physiology and Genetics. 9. Armadillos and dimorphic pathogenic fungi: Ecological and evolutionary aspects – E. Bagagli and S. de M. G. Bosco; 10. Leprosy – R. W. Truman; 11. The spleen of the armadillo: Lessons of organ adaptation – E. B. Casanave and E. J. Galíndez; 12. The use of armadillo clones from the genus *Dasypus* as experimental models to investigate the source of physiological variability – P. Boily; 13. The physiology of two- and three-toed sloths – D. Gilmore, D. F. Duarte and C. Peres da Costa; 14. Sperm evolution in dasypodids – P. D. Cetica and M. S. Merani; 15. Reproductive biology of the nine-banded armadillo – R. D. Peppler; 16. Reproductive parameters and placentation in anteaters and sloths – K. Benirschke; 17. Placentation in armadillos, with emphasis on development of the placenta in polyembryonic species – A. C. Enders; 18. Sequencing the armadillo genome – J. Chang and J. Adams; 19. Chromosomal studies in the Xenarthra – W. Jorge and H. R. J. Pereira Jr.; 20. Genes and demes: Population genetic analyses of the Xenarthra – P. A. Prodöhl, W. J. Loughry and C. M. McDonough. Part 4: Living Xenarthra: Conservation. 21. Conservation status of the Xenarthra – J. M. Aguiar and G. A. B. da Fonseca; 22. Maintenance of Xenarthra in captivity – M. Superina, F. Miranda and T. Plese; 23. Exploitation of xenarthrans by the Guaraní-Isoseño indigenous people of the Bolivian Chaco: Comparisons with hunting by other indigenous groups in Latin America, and implications for conservation – A. J. Noss, R. L. Cuéllar and E. Cuéllar. Part 5: Living Xenarthra: Ecology and Behavior. 24. Anteater behavior and ecology – F. H. G. Rodrigues, Í. M. Medri, G. H. B. de Miranda, C. Camilo-Alves and G. Mourão; 25. Sloth ecology: An overview of field studies – A. G. Chiarello; 26. Behavioral ecology of armadillos – C. M. McDonough and W. J. Loughry; 27. Xenarthrans of the Paraguayan Chaco – D. A. Meritt Jr.; 28. Ecology and conservation of three species of armadillos in the Pampas region, Argentina – A. M. Abba and M. H. Cassini; 29. Biology and ecology of armadillos in

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the Bolivian Chaco – E. Cuéllar; 30. The natural history of the pichi, *Zaedyus pichiy*, in western Argentina – M. Superina.

Cyclopes didactylus in Captivity

Three silky anteaters are now being successfully hand-raised and maintained in captivity. Two animals are currently being cared for in a zoo in the outskirts of Lima, Peru. The Huachipa Zoo was able to rescue an orphaned male, now named Maximus, while he was so young that he still had his umbilicus attached. Maximus was successfully weaned onto a formula developed by the zoo's nutritionist and clinical staff (see Ledesma *et al.*, this issue). At 14 months, he is the longest-lived captive silky anteater on record. In addition, a female was recently flown from the Peruvian Amazon to the Huachipa Zoo for rehabilitation. She was started on the formula two weeks ago and has adjusted well so far. A third animal has been kept at the Aviarios Sanctuary in Costa Rica (see Avey-Arroyo and Murillo, this issue). Email contact between the Peruvian and Costa Rican researchers has greatly facilitated the effort of rehabilitating the Central American individual. A fourth animal was rescued two months ago by a rehabilitation group in Medellín, Colombia, but it died shortly thereafter. The fact that information is flowing freely and helping these rare and delicate specimens is a testament to the impact and future of global communications, as well as effective networking between interested professionals.

Prospective Research Assistant for Sloth and Anteater Studies

Laura Cisneros has recently graduated from Michigan State University with a BS in Zoology and an interest in graduate studies, with an emphasis on ecology, evolution and animal behavior. Between now and graduate school, she would like to gain research experience with Neotropical mammals; she has a particular interest in fieldwork with sloths or anteaters, and she would like to hear about projects focusing on any of these species.

Laura is currently in the field at the Cocha Cashu research station in Peru, assisting with a project on the ecology and behavior of spider monkeys. She will be available for future projects between September 2006 and June 2007. If you are looking for a field assistant, or have a colleague with a position available, Laura would be glad to hear of it at <cisnero7@msu.edu>. Her CV will be available on the website for the Edentate Specialist Group at <http://www.edentata.org>.

Preliminary Organization of the First Conference on Xenarthran Conservation

An informal group of xenarthran specialists and supporters is working to organize the First International Conference on the Conservation of Xenarthra, to be held in 2007 somewhere in Latin America. The proposal has awakened the interest of many field biologists, conservationists, zoo biologists, and veterinarians. Several sites have been considered with regard to their cost and accessibility, as well as the necessary infrastructure for a large conference. To date, Colombia, Argentina, Brazil and Peru have all shown interest in hosting the meeting, but the potential cost for Latin American participants has made Lima, Peru the most likely venue.

We welcome all input, especially proposals of program themes for discussion. Please send your comments and ideas to Mariella Superina at <mariella@superina.ch>.

New PAX TAG Chair Elected

John Gramieri, Mammal Curator at the San Antonio Zoo, has recently been elected chairman of the Pangolin, Aardvark and Xenarthran Taxon Advisory Group (PAX TAG) of the American Zoo and Aquarium Association (AZA). This TAG covers a number of important taxa, each facing unique challenges and deserving of genuine progress. There is a great deal of work as well as many exciting opportunities that will face the members of a new Steering Committee, who will be elected from the Institutional Representatives of interested AZA zoos. AZA's Taxon Advisory Groups serve as committees of expert advisors and provide a forum for discussing husbandry, veterinary, ethical and other issues that apply to entire taxa. In particular, they examine animal management techniques based on scientific studies, help to develop animal care and husbandry guidelines, and establish priorities for management, research and conservation.

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Conservation Project for the Giant Anteater (*Myrmecophaga tridactyla*) — Zoológico de Florencio Varela, Argentina and ARTIS Zoo, Amsterdam, The Netherlands

Staff at the Zoológico de Florencio Varela (Buenos Aires, Argentina) have begun a cooperative project with the ARTIS Zoo (Amsterdam, The Netherlands) on the conservation of the giant anteater (*Myrmecophaga tridactyla*). The project has received approval from local wildlife authorities as well as the Zoo Associations of Buenos Aires (AZBA), Argentina (AZARA) and Latin America (ALPZA). The project is recognized by the European Endangered Species Program (EEP) of the European Association of Zoos and Aquaria (EAZA). The project entails development of a captive breeding program (a first birth took place on May 13, 2005), rehabilitation of animals rescued from the wild, and the establishment of an educational center for the conservation of the giant anteater. Field research is part of the next phase. For further information please contact Dr. Guillermo Pérez Jimeno, scientific advisor, at <tamandua@arnet.com.ar>.

Proyecto de Conservación Oso Hormiguero Gigante (*Myrmecophaga tridactyla*) — Zoológico de Florencio Varela, Argentina y ARTIS Zoo, Ámsterdam, Países Bajos

En el Zoológico de Florencio Varela, Buenos Aires, Argentina se ha comenzado a desarrollar un proyecto de conservación del oso hormiguero gigante (*Myrmecophaga tridactyla*). El mismo se lleva a cabo entre el citado zoo y el ARTIS Zoo, Ámsterdam, Países Bajos. El proyecto ya cuenta con el reconocimiento de las autoridades de fauna locales, la Asociación de Zoológicos de Buenos Aires (AZBA), la Asociación de Zoológicos y Acuarios de la República Argentina (AZARA), la Asociación Latinoamericana de Parques Zoológicos y Acuarios (ALPZA) y el EEP (Programa Europeo de Especies en Peligro, según sus siglas en inglés). En el marco del proyecto se desarrolla un programa de reproducción en cautiverio, con su primer nacimiento el día 13 de mayo de 2005 y un centro de educación para la conservación del oso hormiguero gigante. En la segunda etapa se desarrollarán investigaciones a campo. Si desea comunicarse con el proyecto puede dirigirse a MV Guillermo Pérez Jimeno, asesor científico, <tamandua@arnet.com.ar>.

RECENT PUBLICATIONS

Books

Ecologia e História Natural da Mata Atlântica, por Athayde Tonhasca Jr. 2005. Editora Interciência, Rio de Janeiro, Brasil. 198pp. ISBN 8571931305. R$50,00. Após séculos de desmatamento, restam hoje menos de 10% do conjunto de ecossistemas que constitui a Mata Atlântica. A acentuada redução de área, aliada a sua imensa riqueza biológica e altos níveis de endemismo, fazem da Mata Atlântica uma das prioridades mundiais para preservação. Mais ainda, estes ecossistemas têm valor inestimável na prestação de serviços ecológicos tais como armazenamento de água, controle da erosão e ciclagem de minerais. Por estas razões, a Mata Atlântica representa rico patrimônio cutural, estético, biológico e econômico dos brasileiros. No entanto, apesar de oficialmente protegida pela Constituição, a Mata Atlântica continua a ser devastada, vítima da especulação imobiliária, extração ilegal de madeira, captura de animais, poluição e atividades agropecuárias. Esta obra faz um apanhado das informações científicas sobre a fauna, flora, ecologia, conservação e regeneração das florestas neotropicais e da Mata Atlântica, reunindo estudos de caso e farta bibliografia. Estas informações irão auxiliar professores e estudantes de cursos em Ciências Biológicas e Ambientais, assim como pessoas interessadas em ecologia e conservação, a conhecer alguns componentes destes ecossistemas e suas intrincadas relações ecológicas. *Para comprar:* visite <http://www.editorainterciencia.com.br> ou ligue para (21) 2581–9378 / 2241–6916.

Mammal Species of the World, Third Edition, edited by D. E. Wilson and D. M. Reeder. 2005. The Johns Hopkins University Press, Baltimore. 2000 pp. ISBN 0801882214 (hardback, two volumes), US$125.00. Wilson and Reeder's *Mammal Species of the World* is the classic reference book on the taxonomic classification and distribution of the more than 5,400 species of mammals that are known to exist today. The third edition includes detailed information on nomenclature and, for the first time, common names. Each entry covers type locality, distribution, synonyms, and major reference sources. The systematic arrangement of information indicates evolutionary relationships at both the ordinal and the family level. This indispensable reference work belongs in public and

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academic libraries throughout the world, and will be a valuable resource for every biologist who works with mammals. *Available from:* The Johns Hopkins University Press, 2715 North Charles Street, Baltimore, Maryland 21218-4363, Phone: (410) 516-6900, Fax: (410) 516-6968. Orders: 1-800-537-5487, Fax: (410) 516-6998. More information online at <http://www.press.jhu.edu>.

Manual de Huellas de Algunos Mamíferos Terrestres de Colombia, por José Fernando Navarro y Javier Muñoz. 2000. Edición de Campo, Medellín. 136 pp. Este libro está hecho para brindar información básica sobre mamíferos neotropicales. Describe e ilustra 33 especies de mamíferos de las que se pueden encontrar con mayor probabilidad sus rastros en el campo. Para cada una de ellas se incluyen ilustraciones de sus huellas con medidas aproximadas y dimensión de la pisada, una descripción de la especie, su taxonomía y nombres vernáculos con los cuales se la conoce en Colombia, datos ecológicos y de distribución, entre otros. Este libro está hecho para ser llevado al campo; puede ser utilizado por profesionales, naturalistas aficionados, estudiantes y el público en general. Con esta publicación se pretende generar el interés por el conocimiento y la conservación de nuestros mamíferos amenazados. Mas información: <http://www.humboldt.org.co>.

Noninvasive Study of Mammalian Populations, by W. E. Evans and A. V. Yablokov. 2004. Pensoft Publishers, Sofia, Bulgaria. 142 pp. ISBN 9546422045 (hardback), €37.80. Although it is a tenet of particle physics that nothing can be observed without its being altered by the observer, biologists have long sought to do precisely that. Apart from their theoretical interest, noninvasive techniques have particular value for the conservation of threatened and endangered species. Written by two specialists in marine mammal research, this book is an expanded English-language version of an earlier monograph published in Russian. As such it is written from a distinctly Russian perspective, in particular with its emphasis on phenetics—a Russian school of evolutionary thought based on the "phene," which the authors define as "any discreet [sic] phenotypic character" which may be used to explore the frequencies of genotypes in a population. Although their expertise in cetacean biology inevitably inclines this book towards the ocean realm, much of what they detail may be applied to terrestrial mammals as well. *Available from:* Pensoft Publishers, Geo Milev Str., No 13a, 1113 Sofia, Bulgaria, Tel: +359-2-870-42-81, Fax: +359-2-870-42-82, e-mail: <pensoft@mbox.infotel.bg>. More information available at <http://www.pensoft.net>.

Patterns of Behavior: Konrad Lorenz, Niko Tinbergen, and the Founding of Ethology, by Richard W. Burkhardt Jr. 2005. The University of Chicago Press, Chicago. 648pp. ISBN 0226080900 (paperback, $29.00). This book traces the scientific theories, practices, subjects, and settings integral to the construction of a discipline pivotal to our understanding of the diversity of life. Central to this tale are Konrad Lorenz and Niko Tinbergen, 1973 Nobel laureates whose research helped legitimize the field of ethology and bring international attention to the culture of behavioral research. Demonstrating how matters of practice, politics, and place all shaped "ethology's ecologies," Burkhardt's book offers a sensitive reading of the complex interplay of the field's celebrated pioneers and a richly textured reconstruction of ethology's transformation from a quiet backwater of natural history to the forefront of the biological sciences. *Contents*: Acknowledgments; Introduction; Theory, Practice, and Place in the Study of Animal Behavior; 1. Charles Otis Whitman, Wallace Craig, and the Biological Study of Animal Behavior in America; 2. British Field Studies of Behavior: Selous, Howard, Kirkman, and Huxley; 3. Konrad Lorenz and the Conceptual Foundations of Ethology; 4. Niko Tinbergen and the Lorenzian Program; 5. Lorenz and National Socialism; 6. The Postwar Reconstruction of Ethology; 7. Ethology's New Settings; 8. Attracting Attention; 9. Tinbergen's Vision for Ethology; 10. Conclusion: Ethology's Ecologies. *Available from:* The University of Chicago Press, 1427 E. 60th Street, Chicago, Illinois 60637, USA, Tel.: 773.702.7700, Fax: 773.702.9756, and online at <http://www.press.uchicago.edu>.

Phylogeny and Conservation, edited by Andy Purvis, John L. Gittleman and Thomas Brooks. 2005. Conservation Biology Series #8, Cambridge University Press, New York. 431pp. ISBN 0521532000 (paperback, $60.00). Phylogeny is a potentially powerful tool for conserving biodiversity. This book explores how it can be used to tackle questions of great practical importance and urgency for conservation. Using case studies from many different taxa and regions of the world, the volume evaluates how useful phylogeny is in understanding the processes that have generated today's diversity—and the processes that now threaten it. This book will be of great value to researchers, practitioners and policy-makers alike. *Contents*: 1. Phylogeny and conservation – A. Purvis, J. L. Gittleman and T. M. Brooks, p.1. Part 1: Units and currencies. 2. Molecular phylogenetics for conservation biology – E. A. Sinclair, M. Pérez-Losada and K. A. Crandall, p.19; 3. Species: Demarcation and diversity – P.-M. Agapow, p.57; 4. Phylogenetic units and currencies above and below the species level

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– J. C. Avise, p.76; 5. Integrating phylogenetic diversity in the selection of priority areas for conservation: Does it make a difference? – A. S. L. Rodrigues, T. M. Brooks and K. J. Gaston, p.101; 6. Evolutionary heritage as a metric for conservation – A. Ø. Mooers, S. B. Heard and E. Chrostowski, p.120. Part 2: Inferring evolutionary processes. 7. Age and area revisited: Identifying global patterns and implications for conservation – K. E. Jones, W. Sechrest and J. L. Gittleman, p.141; 8. Putting process on the map: Why ecotones are important for preserving biodiversity – T. B. Smith, S. Saatchi, C. Graham, H. Slabbekoorn and G. Spicer, p.166; 9. The oldest rainforests in Africa: Stability or resilience for survival and diversity? – J. C. Lovett, R. Marchant, J. Taplin and W. Küper, p.198; 10. Late Tertiary and Quaternary climate change and centres of endemism in the southern African flora – G. F. Midgley, G. Reeves and C. Klak, p.230; 11. Historical biogeography, diversity and conservation of Australia's tropical rainforest herpetofauna – C. Moritz, C. Hoskin, C. H. Graham, A. Hugall and A. Moussalli, p.243. Part 3: Effects of human processes. 12. Conservation status and geographic distribution of avian evolutionary history – T. M. Brooks, J. D. Pilgrim, A. S. L. Rodrigues and G. A. B. da Fonseca, p.267; 13. Correlates of extinction risk: Phylogeny, biology, threat and scale – A. Purvis, M. Cardillo, R. Grenyer and B. Collen, p.295; 14. Mechanisms of extinction in birds: Phylogeny, ecology and threats – P. M. Bennett, I. P. F. Owens, D. Nussey, S. T. Garnett and G. M. Crowley, p.317; 15. Primate diversity patterns and their conservation in Amazonia – J. M. Cardoso da Silva, A. B. Rylands, J. S. da Silva Júnior, C. Gascon and G. A. B. da Fonseca, p.337; 16. Predicting which species will become invasive: What's taxonomy got to do with it? – J. Lockwood, p.365. Part 4: Prognosis. 17. Phylogenetic futures after the latest mass extinction – S. Nee, p.387; 18. Predicting future speciation – T. G. Barraclough and T. J. Davies, p.400. *Available from:* Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211, USA, Fax: 1-212-691-3239. General Address (Orders & Customer Service): Cambridge University Press, 100 Brook Hill Drive, West Nyack, NY 10994-2133, USA, Tel: 1-845-353-7500, Fax: 1-845-353-4141. Website: <http://www.cup.org>.

The Rise of Placental Mammals: Origins and Relationships of the Major Extant Clades, edited by Kenneth D. Rose and J. David Archibald. 2005. The Johns Hopkins University Press, Baltimore. 280 pp. ISBN 080188022X (hardback), US$95.00. From shrews to blue whales, placental mammals are among the most diverse and successful vertebrates on Earth. Arising sometime near the Late Cretaceous, this broad clade of mammals contains more than 1,000 genera and approximately 4,400 extant species. Although much studied, the origin and diversification of the placentals continue to be a source of debate. Here paleontologists Kenneth D. Rose and J. David Archibald have assembled some of the world's leading authorities to provide a comprehensive and up-to-date evolutionary history of placental mammals. Focusing on anatomical evidence, the contributors present an unbiased scientific account of the initial radiation and ordinal relationships of placental mammals, representing both the consensus and significant minority viewpoints. This book will be valuable to students and researchers in mammalogy, paleontology and evolutionary biology. Two chapters in particular focus on the edentates: "Xenarthra and Pholidota," by K. D. Rose, R. J. Emry, T. J. Gaudin and G. Storch, and "Molecular evidence for major placental clades," by M. S. Springer, W. J. Murphy, E. Eizirik and S. J. O'Brien. *Available from:* The Johns Hopkins University Press, 2715 North Charles Street, Baltimore, Maryland 21218-4363, Phone: (410) 516-6900, Fax: (410) 516-6968. Orders: 1-800-537-5487, Fax: (410) 516-6998. More information online at <http://www.press.jhu.edu>.

What Makes Biology Unique? Considerations on the Autonomy of a Scientific Discipline, by Ernst Mayr. 2004. Cambridge University Press, New York. 246 pp. ISBN 0521841143 (hardback), US$30.00. This collection of new and revised essays argues that biology is an autonomous science rather than a branch of the physical sciences. Ernst Mayr, widely considered the most eminent evolutionary biologist of the 20th century, offers insights on the history of evolutionary thought, critiques the conditions of philosophy to the science of biology, and comments on several of the major developments in evolutionary theory. Notably, Mayr explains that Darwin's theory of evolution is actually five separate theories, each with its own history, trajectory and impact. Ernst Mayr, commonly referred to as the "Darwin of the 20th century" and listed as one of the top 100 scientists of all-time, was at the time of publication Professor Emeritus at Harvard University. *What Makes Biology Unique?* is the 25th book he wrote during his long and prolific career. *Contents*: Preface: What is there at issue?; Introduction; 1. Science and sciences; 2. The autonomy of biology; 3. Teleology; 4. Analysis or reductionism; 5. Darwin's influence on modern thought; 6. Darwin's five theories of evolution; 7. Maturation of Darwinism; 8. Selection; 9. Kuhn's scientific revolutions; 10. Another look at the species problem; 11. The origin of man; 12. Are we alone in this vast universe?; Glossary. *Available from:* Cambridge University Press, 40

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MEETINGS

2006

Ecology in an Era of Globalization: Challenges and Opportunities for Environmental Scientists in the Americas, 8–12 January 2006, Merida, Mexico. This conference will be held at the Fiesta Americana Hotel in Merida and is co-hosted by the Universidad Autónoma de Yucatán and the Centro de Investigaciones Científicas de Yucatán. Abstracts should address one of the meeting's three subthemes: invasive species, human migration, and production. The

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invasive species subtheme includes such topics as dispersal of invasive plant and animal species, emerging diseases, and resistance of local ecosystems to invasive species and disease. The human migration subtheme includes the environmental effects of international and local emigration and immigration on recipient and source areas. Potential topics include infrastructure development needs and impacts, effects on land cover, and land-use impacts. The production subtheme focuses on ecosystem transformations, including land-use change required to produce goods and services for human use. Potential topics include the effects of changes in forest and agricultural policy on economies, biodiversity, and ecosystems throughout the Americas, in terrestrial, marine, and freshwater systems. We particularly welcome reports of projects that are interdisciplinary and that consider the need to communicate with broad audiences. For more information or to submit an abstract, visit <http://www.esa.org/mexico>. Deadline for abstract submissions: 16 September 2005.

First General Information Symposium for Two- and Three-Toed Sloths, 19–22 July 2006, Aviarios Sanctuary, Limón, Costa Rica. The first symposium on the practical aspects of sloth biology and rehabilitation in Mesoamerica, this meeting will introduce participants to the Aviarios Sanctuary and the lessons they have learned during their many years of operation. The symposium program includes presentations on the biology, captive maintenance and medical management of sloths, with an emphasis on caring for sloths in the sanctuary setting. The symposium package includes round-trip bus transportation from San José, meals and lodging in the nearby town of Cahuita, and a day trip to Cahuita National Park, as well as a tour of the Aviarios facilities and an outing on the Río Estrella. Deadline for registration is 1 June 2006. For more information contact Judy Avey, Project Director, Aviarios Sanctuary, 1 Km. Norte Puente Río Estrella, Penshurt, Limón, Costa Rica, or P. O. Box 569-7300, Limón, Costa Rica, e-mail: <aviarios@costarica.net>.

1st European Congress of Conservation Biology, 22–26 August 2006, Eger, Hungary. The European Section of the Society for Conservation Biology is determined to promote the development and use of science for the conservation of European species and ecosystems, and to make sure that conservation policy is firmly underpinned by the best available scientific evidence. This keystone congress will bring together a wide array of academics, policymakers, students, NGO representatives, and biodiversity managers from throughout Europe and beyond. For more information, see the Congress website at <http://www.eccb2006.org> or contact András Báldi, Chair of the Local Organising Committee, at <baldi@nhmus.hu>.

VII Congreso Internacional sobre Manejo de Fauna Silvestre en la Amazonía y América Latina, del 3 al 7 de septiembre de 2006, Ilhéus, Bahia, Brasil. El VII Congreso Internacional sobre Manejo de Fauna Silvestre en la Amazonía y América Latina enfocará su atención en los estudios y programas de manejo que actualmente están siendo ejecutados en la Amazonía y en Latinoamérica, con el propósito de evaluar los resultados alcanzados y las limitaciones encontradas en la conducción de los mismos. Una de sus principales metas será expandir el enfoque del evento a los más amplios aspectos del manejo de fauna en toda Latinoamérica. El VII Congreso Internacional sobre Manejo de Fauna Silvestre en la Amazonía y América Latina incluirá conferencias magistrales, mesas redondas, secciones temáticas con presentaciones orales libres, exposiciones en posters, simposios, workshops, cursos durante y posteriores al congreso, y excursiones pos-congreso. Las áreas temáticas que se abordarán en este evento serán: conservación *in situ* y áreas naturales protegidas, conservación *ex situ* de fauna silvestre, preservación y recuperación de hábitats, metodologías aplicadas para el manejo de fauna silvestre con comunidades, criterios para el uso sustentable de fauna silvestre, indicadores de sustentabilidad, etología aplicada al manejo, medicina veterinaria de la conservación, fisiología y ecología, producción en criaderos, comercio, política y legislación de fauna silvestre. Apreciaremos el apoyo de diversas instituciones. Existen posibilidades de instalación de stands institucionales para difusión y ventas. Para mayor información: <http://www.viicongresso.com.br>.

I Congresso Sul-Americano de Mastozoologia, 05 a 08 de outubro de 2006, Gramado, Rio Grande do Sul, Brasil. A Sociedade Brasileira de Mastozoologia (SBMz), a Sociedad Argentina para el Estudio de los Mamíferos (SAREM) e a Asociación Boliviana de Investigadores de Mamíferos (ABIMA) vêm convidar a todos os interessados a participarem do I Congresso Sul-Americano de Mastozoologia. Devido ao aumento do número de trabalhos sobre mamíferos observados nos últimos congressos brasileiros, argentinos e bolivianos de mastozoologia e, tendo como objetivo promover o desenvolvimento de pesquisas abrangendo problemáticas trans-nacionais, decidiu-se em comum acordo, organizar um congresso que reúna todos os profissionais e interessados pelo tema em um único e específico encontro. O I Congresso Sul-Americano de Mastozoologia tem como objetivos

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principais: 1) reunir a comunidade de mastozoólogos que atuam em genética, ecologia, sistemática, comportamento, morfologia, fisiologia, evolução, conservação, paleontologia e outros campos das ciências biológicas relacionados a mamíferos, propiciando a apresentação e discussão de trabalhos em andamento e fomentando a integração dos diferentes grupos; 2) incentivar a congregação de estudantes e profissionais envolvidos no estudo e na preservação de mamíferos sul-americanos; 3) promover o contato e a integração entre as sociedades nacionais, bem comojunto a entidades governamentais e privadas; 4) divulgar o conhecimento sobre a fauna de mamíferos junto ao público em geral; e 5) zelar pelos padrões éticos e científicos da mastozoologia na América do Sul. As propostas de workshops, palestras e mini-cursos poderão ser enviadas desde já, até 15 de abril, para o seguinte e-mail: <csmz2006@ufrgs.br>. O preço de inscrição assim como as modalidades e datas limites para submissão de resumos, para comunicações orais e para pôsters, estarão disponíveis no site <http://www.ufrgs.br/csmz2006>, a partir do dia 17 de abril de 2006. As inscrições serão aceitas exclusivamente por internet.

2007

6th Zoos & Aquariums Committing to Conservation Conference, 26–31 January 2007, Houston, Texas. ZACC is a bi-annual event that promotes the role of zoos and aquariums in supporting conservation activities worldwide, both at their institutions and in the field. Conference participants include representatives from zoological institutions, international conservation organizations, local non-governmental organizations, government agencies, funding agencies and, most importantly, field biologists and conservationists. Presentations at the 2007 ZACC will highlight both ongoing projects and new initiatives that offer opportunities for institutional support. There will be a major focus on field-based initiatives that have already established links to zoos and aquariums, as well as promising candidates for such partnerships. In addition, the program will feature presentations related to the organization, management, and support of zoo-based and aquarium-based conservation programs. The full conference registration fee ($195) will include icebreaker event, all sessions, breaks, lunches, conference proceedings, zoo day transport, zoo day lunch and dinner. All funds raised above conference costs will be allocated to the conservation fund for this conference. The deadline for submitting paper and poster abstracts is September 1, 2006. Abstracts submitted electronically should be addressed to <bkonstant@houstonzoo.org> and to <priger@houstonzoo.org>. Abstracts submitted as hard copy should be addressed to: 2007 ZACC Conference, Attn: Bill Konstant, Director of Conservation and Science, Houston Zoo, 1513 North MacGregor, Houston, Texas 77030, USA. For more information, see the conference website at <http://www.houstonzoo.org/ZACC>.

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