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Front Cover Photo:
Southern Tamandua (*Tamandua tetradactyla*). Photo ©Haroldo Castro, Conservation International

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ARTICLES

A Localidade Tipo da Preguiça-de-Coleira, *Bradypus torquatus* Illiger, 1811 (Xenarthra, Bradypodidae)

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Introdução

A preguiça-de-coleira, *Bradypus torquatus* Illiger, 1811, é uma espécie típicamente florestal, endêmica do Brasil, cuja distribuição geográfica se restringe à Mata Atlântica nos Estados do Rio de Janeiro, Espírito Santo, extremo nordeste de Minas Gerais, Bahia e Sergipe. Nos últimos anos, a espécie tem sido objeto de diversos estudos (Pinder, 1993; Chiarello, 1998a, 1998b; Chiarello, 2001).

Material e Métodos

O presente estudo é baseado em bibliografia e espécimes conservados em instituições científicas, particularmente no Museum für Naturkunde der Humboldt, Universität zu Berlin (ZMB). São analisadas evidências históricas sobre a origem do material utilizado na descrição original da espécie, com a proposta da restrição de sua localidade tipo.

FIGURA 1. Distribuição geográfica da preguiça-de-coleira, *Bradypus torquatus.* A indicação Cametá é utilizada apenas como referência à etiqueta do espécime ZMB 1895.

Resultados e Discussão

No começo do século XIX, o conde Johan Centurius von Hoffmannsegg conseguiu autorização do governo português para enviar ao Brasil um colecionador de espécies botânicas e zoológicas. Até então, Portugal mantinha a Colônia parcialmente fechada aos visitantes estrangeiros. Esse colecionador era Friederich Wilhelm Sieber que, entre 1800 e 1812, coletou material científico na região do baixo Amazonas (Cametá, Gurupá, Monte Alegre, Santarém e Óbidos) (Pinto, 1979).

"(...) Pela mesma época, em que lhe chegavam do Pará as remessas de Sieber, mantinha o conde de Hoffmannsegg ativa correspondência com o Dr. Francisco Agostinho Gomes, com quem estreitara laços de amizade na época que este digno filho da Bahia estudava leis na Universidade de Coimbra, recebendo dele a promessa agora cumprida, de lhe enviar material zoológico de sua terra natal." (Pinto, 1979). As remessas de material científico feitas por Gomes foram realizadas entre 1801 e 1807. Além da Bahia, Agostinho Gomes também coletou em Pernambuco (Papavero, 1971).

O produto das coletas desses colecionadores, somado aos "exemplares doados pelo Gabinete de História Natural de Lisboa", formaram "o núcleo do Museu de Zoologia da Universidade de Berlim, fundado em 1810, por iniciativa de Hoffmannsegg e de seu primeiro diretor, Johan Karl Wilhelm Illiger, mastozoólogo que publicou, em 1811 e 1815, sinopses dos conhecimentos sobre mamíferos, na época, incluindo os dados recém obtidos sobre a fauna brasileira" (Ávila-Pires, 1974). Illiger (1811), ao descrever a preguiça de coleira ("*collari nigricante, capite rufescente, plantis capite longioribus*"), menciona "Gomes" como tendo observado o animal no Brasil ("*a naturae studiossimo Gomes in Brasilia detecta*...").

Existem atualmente depositados no Museum für Naturkunde quatro exemplares de *Bradypus torquatus*. O primeiro (ZMB 1895: pele) foi recebido por Hoffmannsegg e acha-se com etiqueta indicando ser procedente de Cametá, Pará; o segundo (ZMB 1896: pele e esqueleto) encontra-se rotulado com indicação "Brasilien" e o terceiro (ZMB 1898: pele e crânio) possui registro "Bahia". Estes foram recebidos por Olfers e Kähne, respectivamente. Há ainda um exemplar (ZMB 4391: montado) com procedência "Brasilien", associado ao nome "Hagenbeck" (Renate Angermann, *in litt*.).

Segundo a Dra. Angermann, "...we can not exclude the possibility that the locality Cametá for this specimen [ZMB 1895] is incorrect because the catalogue entrance was first Bahia than corrected to Cametá, both in PETERS handwriting". (O nome Peters se refere ao nome do ex-diretor do Museu de Berlim, Wilhelm Peters.)

Ávila-Pires (1967), ao restringir a localidade tipo do ouriço-preto, *Chaetomys subspinosus* (Rodentia), levanta, baseado nas críticas do Professor Erwin Stresemann ao tratamento que era dispensado às coleções do Museu de Berlim pelos primeiros curadores, a possibilidade de ter havido troca de etiquetas envolvendo o exemplar-tipo, já que era bastante improvável que a mencionada espécie que habita uma "região característica por seus endemismos" (sudeste da Bahia) pudesse ser assinalada no Pará (Cametá) ou qualquer outra área da Amazônia.

Voss e Angermann (1997) tecem considerações sobre a questão da perda ou descarte das eti-

TABELA 1. Relação de espécimes de *B. torquatus* colecionados no Estado da Bahia.

Museu / No.	Procedência	Sexo	Data	Coletor	Material
MNRJ					
10981	Ilhéus	-	-	-	Pele e crânio
11204	Ilhéus	Fêmea	11.08.1944	J. Moojen	Pele e crânio
11206	Fazenda Pirataquissé, B. Vitória, Ilhéus	Macho	14.01.1944	G.I.P.	Pele e crânio
11375	Urucutuca, Aritaguá, Ilhéus	Fêmea	07.10.1944	G.I.P.	Pele e crânio
23896	Urucutuca, Aritaguá, Ilhéus	-	07.10.1944	G.I.P.	Pele
23933	Ilhéus	-	-	-	Crânio
MZUSP					
3506	Itabuna	Fêmea	1919	E. Garbe	Pele e crânio
3507	Itabuna	Macho	1919	E. Garbe	Pele e crânio
ZMB					
1898	"Bahia"	-	-	-	Pele e crânio
SMNS					
488	"Bahia"	Fêmea	1853	Glocker	Crânio, esqueleto
1562	"Bahia"	-	1875	Schneider	Crânio
MHNG					
323/48	"Bahia"	-	1843	Gautier	Crânio
450/76	"Provavelmente Bahia"	-	1853	Blanchet	Crânio, esqueleto
USNM					
259473	Itabuna	Fêmea	1919	E. Garbe	Pele e crânio

Abreviações: **MNRJ** – Museu Nacional, Rio de Janeiro; **MZUSP** – Museu de Zoologia da Universidade de São Paulo, São Paulo; **ZMB** – Museum für Naturkunde der Humboldt, Universität zu Berlin, Berlin; **SMNS** – Staatliches Museum für Naturkunde Stuttgart, Stuttgart; **MHNG** – Museum d'Histoire Naturelle, Genève; **USNM** – National Museum of Natural History, Washington, DC.

quetas originais que acompanhavam os espécimes de mamíferos doados por Hoffmannsegg ao Museum für Naturkunde. Levantam também a impossibilidade de se atribuir a Sieber a autoria de coletas de espécimes de Hoffmannsegg na região da Floresta Atlântica (por exemplo, o tipo de *Bradypus torquatus*).

Entre 1978 e 1981, foi realizado um inventário objetivando verificar a presença de espécimes de *Bradypus torquatus* conservados em instituições científicas. Esse levantamento possibilitou a localização de 73 exemplares, distribuídos em 18 museus. Com exceção do espécime do Museum für Naturkunde (ZMB 1895), não existe nenhum outro com indicação de ser procedente da região amazônica. Pelo menos em seis desses museus foi detectada a presença de indivíduos procedentes do Estado da Bahia (Tabela 1).

Wetzel e Ávila-Pires (1980), baseados somente na distribuição geográfica da espécie, restringiram a localidade tipo de "*Scaeopus torquatus*" à "Atlantic drainage of Bahia, Espírito Santo, and Rio de Janeiro".

Em 1991, foi constatado junto à Superintendência Estadual do Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA), na Bahia, a existência de diversos registros envolvendo observação na natureza ou a caça de espécimes de *B. torquatus* em algumas localidades próximas à capital baiana. Entre esses locais figuravam São Sebastião do Passé, Catu, Morro de São João, Nossa Senhora das Candeias, Base Naval de Aratu e Cajazeira. Essas informações indicam que, do mesmo modo que outras espécies foram obtidas por Gomes próximas a Salvador (por exemplo, os tipos de *Chaetomys subspinosus* e *Coendou insidiosus*), não seria impossível que *B. torquatus* também não o fosse.

Conclusões

Considerando todas as evidências, deve-se reconhecer a forte possibilidade da descrição de Illiger ter sido baseada na pele recebida por Hoffmansegg (ZMB 1895) que, ao contrário do que se supõe, não procede do baixo Amazonas (Cametá), mas da Bahia. Embora não se conheça informações mais detalhadas que possam precisar o lugar onde o espécime foi obtido, acredita-se baseado na ocorrência da preguiça-de-coleira no Recôncavo Baiano que é perfeitamente possível que o mesmo possa ter sido coletado nessa região.

Assim sendo, proponho que a localidade-tipo de *Bradypus torquatus* Illiger, 1811 seja restringida aos arredores de Salvador, Estado da Bahia, Brasil.

Agradecimentos

Aos curadores Renate Angermann (Museum für Naturkunde der Humboldt, Universität zu Berlin), François J. Baud (Museum d'Histoire Naturelle), Fritz Dieterlen (Staatliches Museum für Naturkunde Stuttgart) e Greg Blair (National Museum of Natural History) pelas informações sobre os espécimes de *Bradypus torquatus* conservados nas respectivas coleções. Ao Dr. Ulisses Caramaschi (Museu Nacional / UFRJ) pela leitura do texto e sugestões. À bibliotecária Solange P. Lyrio Gomes pelo auxílio no levantamento bibliográfico e preparação da tabela.

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Lista de Localidades de Captura de Xenartros sob Ameaça de Extinção no Brasil

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Em 1998, foi iniciado um levantamento sobre as localidades de captura de quatro espécies de xenartros relacionados na Lista Oficial das Espécies da Fauna Brasileira Ameaçadas de Extinção, Portaria No. 1.522, de 19 de dezembro de 1989. Foram examinados 163 espécimes conservados em três instituições: Museu Nacional da Universidade Federal do Rio de Janeiro (MNRJ), Museu de Zoologia da Universidade de São Paulo (MZUSP), São Paulo e Museu Paraense Emílio Goeldi, Belém (MPEG).

Classe: Mammalia
Ordem: Xenarthra

Família: Bradypodidae

***Bradypus torquatus* Illiger, 1811, Preguiça-de-coleira**
Status: IUCN (1996) – Em perigo

Bahia: Fazenda Pirataquissé, Banco da Vitória, Ilhéus (MNRJ 11206); Urucutuca, Aritaguá, Ilhéus (MNRJ 11395, 23896); Ilhéus (MNRJ 10981, 11204, 23933); Itabuna (MZUSP 3506, 3507)
Espírito Santo: Alto das Tabocas, Santa Teresa (MNRJ 5632); Santa Teresa (MNRJ 5884, 5899); C. Bof. Paganinni, Ibiraçu (MNRJ 23921); "Espírito Santo" (MNRJ 3882, 23920)
Rio de Janeiro: Serra de Macaé (MZUSP 2806); Gruçaí, São João da Barra (MZUSP 10074)
Procedência desconhecida: 4 espécimes
TOTAL: 20 espécimes

Família: Dasypodidae

***Priodontes maximus* (Kerr, 1792), Tatu-canastra**
Status: IUCN (1996) – Em perigo

Acre: Seringal Oriente, proximidades de Taumaturgo (= Marechal Taumaturgo), rio Juruá (MPEG 980)
Pará: Belterra (MNRJ 24109); Taperinha, Santarém (MPEG 4674, 4675); Santarém (MPEG 981, 1000); Vila do Bravo, rio Tocantins (MZUSP 13492); Reserva Biológica de Trombetas (MZUSP 19995); Posto Indígena Aukre (MPEG 22827, 22839); Posto Indígena Kô Kraimôrô, Gorotire, rio Xingú (MPEG 22859)
Amapá: Oiapoque (MNRJ 24092)
Maranhão: Fazenda Cipó Cortado, margem esquerda do rio Pindaré, Amarante do Maranhão (MPEG 22688)
Mato Grosso: Chavantina, rio das Mortes (MNRJ 32696); alto rio Cururu (MNRJ 32697); Rodovia Transpantaneira (MZUSP 12854)
Mato Grosso do Sul: Porto Murtinho (MNRJ 1323)
Goiás: Rio São Miguel (MNRJ 1325); Mineiros (MNRJ 24477)
Procedência desconhecida: 10 espécimes
TOTAL: 29 espécimes

***Tolypeutes tricinctus* (Linnaeus, 1758), Tatu-bola**
Status: IUCN (1996) – Vulnerável

Piauí: Mangueira do João Paulo, Parque Nacional da Serra da Capivara (MNRJ 30393)
Ceará: Serra dos Cariris Velhos (MNRJ 1503)
Bahia: Bom Jesus da Lapa (MNRJ 4257, 4292, 4294); Barra, rio São Francisco (MZUSP 2654, 3134, 3135, 3136, 3137); Juazeiro, rio São Francisco (MZUSP 2655, 2656, 2657); Santa Rita de Cássia, rio Preto (MZUSP 8576); Central (MNRJ 29404, 51651); Fazenda Boa Vista, Palmas de Monte Alto (MPEG 22026); "Sul da Bahia" (MNRJ 32440)
Procedência desconhecida: 5 espécimes
TOTAL: 23 espécimes

Família: Myrmecophagidae

***Myrmecophaga tridactyla* Linnaeus, 1758, Tamanduá-bandeira**
Status: IUCN (1996) – Vulnerável

Roraima: Caracaraí, baixo rio Mucajaí (MPEG 1741); Rio Catrimani (MZUSP 13682); Lagoa do Pacú, Surumú, Pacaraima (MNRJ 59103); Fazenda União, Surumú, Pacaraima (MNRJ 59104)
Amazonas: Canaçari, rio Amazonas (MZUSP 5273)
Rondônia: Matas do Piroculuina, rio Guaporé (MNRJ 2684)
Pará: Fazenda Pascoval dos Melo, Ilha de Marajó (MPEG 596); Soure, Ilha de Marajó (MPEG 1454); Ilha de Marajó (MPEG 413, 565, 1246, 1455, 4234); Taperinha, Santarém (MPEG 4658, 4659, 4660); Caracoal Grande (MPEG 4661); Cachoeira Porteira, Oriximiná, alto rio Trombetas (MPEG 10211); Foz do Curuá (MZUSP 5454), Fordlândia (MZUSP 19958); Posto Indígena Aukre (MPEG 22834); Posto Indígena Kô Kraimôrô, Gorotire, rio Xingu (MPEG 22828)
Amapá: Seringal Boa Fortuna, igarapé Rio Branco, afluente direito do rio Maracá, Mazagão (MPEG 1652, 1662)
Maranhão: Barra do Corda (MZUSP 8002)
Mato Grosso: Porto Jacaré, alto rio Xingú (MNRJ 23945); Serra Tapirapoan (MNRJ 2332)
Mato Grosso do Sul: Porto do Sapé, rio Pardo (MZUSP 3727); Rio Pardo (MZUSP 7484, 7485, 7486, 7487); Fazenda Leblon, Aquidauana (MZUSP 7789); Maracaju (MNRJ 5073, 24828); Fazenda Paredão (MZUSP 6893)
Goiás: Cana Brava (MZUSP 4132); Proximidades de Jataí (MNRJ 28801); Proximidades da Usina Hidrelétrica de Corumbá, Caldas Novas (MNRJ 37561); Proximidades do Parque Nacional das Emas (MNRJ 53699)
Minas Gerais: Cambuquira (MNRJ 1586)
Espírito Santo: Rio Doce (MZUSP 2415, 2416)
São Paulo: Itararé (MZUSP 1170, 1172, 1173); São João da Boa Vista (MZUSP 4064); Mirandópolis (MZUSP 7480); Itapura (MZUSP 24255); "São Paulo" (MZUSP 3337)
Rio Grande do Sul: São Lourenço (MZUSP 24254)
Procedência desconhecida: 40 espécimes
TOTAL: 91 espécimes

Agradecimentos
Aos doutores Suely A. Marques Aguiar (MPEG) e Mário de Vivo (MZUSP) pelas facilidades para examinar o material conservado nas respectivas instituições.

Giant Anteater *(Myrmecophaga tridactyla)* Health Care Survey

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Santa Barbara Zoological Gardens, 500 Ninos Drive, Santa Barbara, California 93103, USA.

Introduction
The Giant Anteater Survey is comprised of four separate sections designed to target specific questions and issues involved in the overall care and management of the giant anteater (*Myrmecophaga tridactyla*). The four sections of this survey and their status in terms of completion are as follows: 1) Health Care – results compiled;

[1] Now at the San Diego Zoo, 2920 Zoo Drive, San Diego, California 92101.
[2] Now in the program for Pre-Veterinary Medicine at the University of California, Santa Barbara.

2) Diet – results compiled; 3) Housing – survey questionnaire to be distributed by September 2001; and 4) Neonatal Care – survey questionnaire to be distributed by December 2001. Due to the shortage of published information on these topics, the Giant Anteater Survey is an opportunity to share valuable information and experiences among institutions that maintain giant anteaters in their collections.

The primary purpose of the Health Care section was to catalogue medical problems faced by the giant anteater in captivity and to list their corresponding treatment strategies. This first survey section was sent to 24 institutions (22 in the United States and two in Europe) in January 2001. Of the 24 institutions, 19 responded with a plethora of medical records and necropsy reports. The living population of giant anteaters represented in this sample consisted of 25 males, 24 females, and two unsexed individuals. The population of deceased giant anteaters consisted of 20 males, 27 females, and 11 unsexed individuals.

It is important to note that the Health Care survey results should not be mistaken for a comprehensive list of every medical problem/ treatment strategy experienced by each responding institution. In many cases medical records and necropsy reports were incomplete or unclear. Every attempt was made on our part to ensure that the data were presented as accurately as possible with the information provided by the 19 responding institutions. It is our hope that the results of the survey will help create a greater awareness and better understanding of some of the medical challenges and treatment strategies giant anteaters experience in captivity.

Graphs Explained

A series of seven graphs were created to illustrate the survey results for the following four topics: 1) Current ages of living male/female anteaters; 2) Anteater ages at time of death; 3) Body weights of living male and female anteaters; and 4) Frequencies of occurrence for 40 separate medical problems. All the information is current up to 15 February, 2001 when compilation of the survey data was begun.

Figure 1 illustrates the ages of 25 male and 24 female anteaters housed in 19 separate institutions at the time. The graph shows a population with ages covering a wide spectrum, from neonates and juveniles to adults. The majority of the represented population was under 10 years of age. Of the 49 individuals, only 18% were over 10 years old.

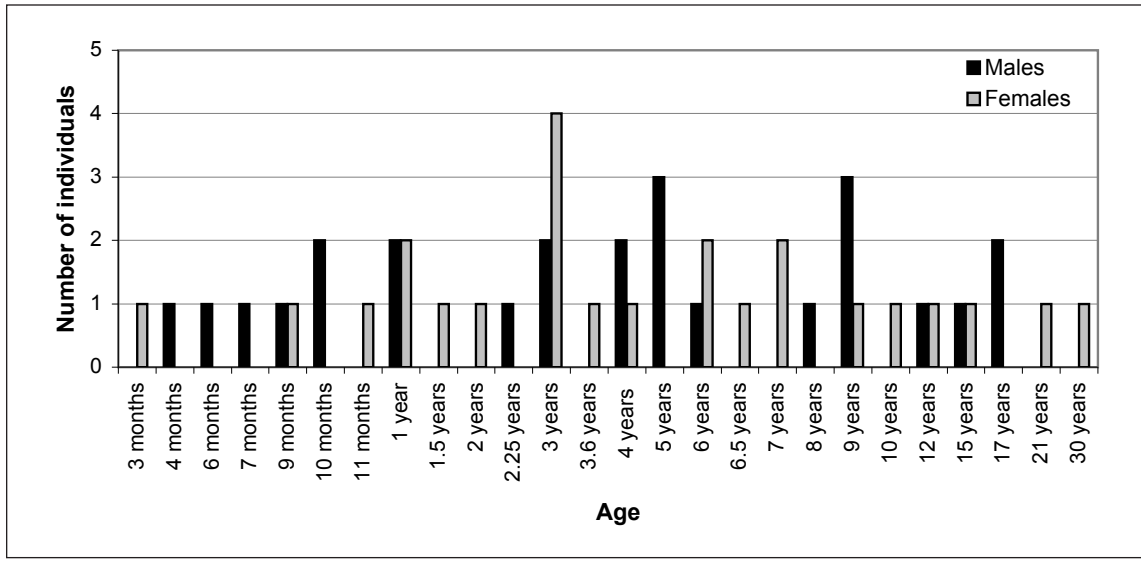

FIGURE 1. Live anteater ages: 25 males / 24 females.

Figure 2 displays of all the known ages at death of the 20 males, 27 females, and 11 unsexed individuals that died at the 19 responding institutions. (The ages of five males and five females at time of death were not provided and thus were not included.) The graph indicates a high infant mortality rate, with 22 individuals (46% of the deceased population) dying within the first six days of birth. Of those that died in the first six days, 68% died in less than 24 hours. The infant mortality rate is therefore highest on the first day of life.

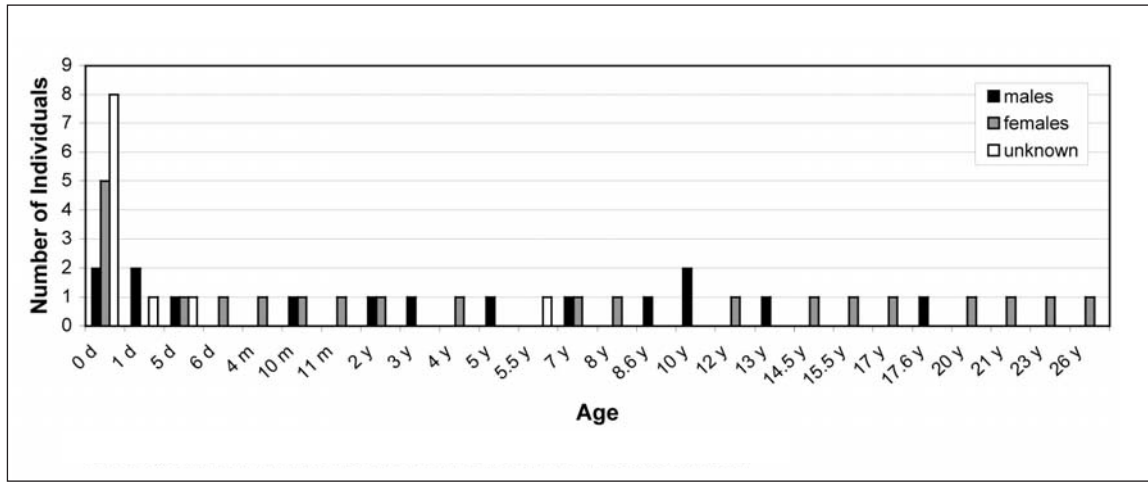

FIGURE 2. Anteater ages at death: 15 males / 22 females / 11 unknown.

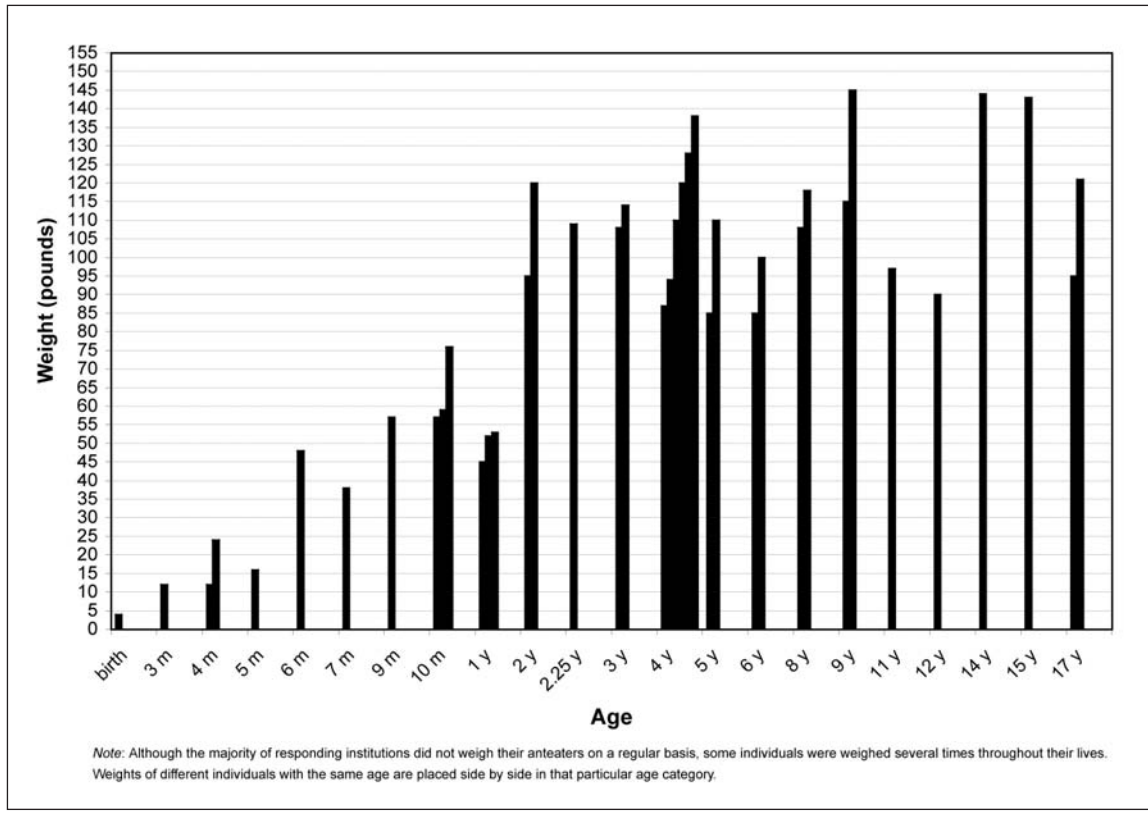

FIGURE 3. Body weights (n = 39) by age of the 25 living males represented in this survey.

Figure 3 illustrates the body weights by age of the 25 living males represented in this survey, and displays how individual body weights may vary dramatically even when the individuals are the same age. For example, it depicts six individual males that are each four years old, yet their body weights range from 138 to 87 pounds. In fact, in the 11 instances where two or more male anteaters shared the same age, their weights varied from seven pounds to 51 pounds. The reasons for these large weight variations of same-aged individual males remain undetermined, due in part to a lack of consistent individual weights over a significant period of time. In most reported cases, the health of the individuals at the time of weighing was not recorded or provided.

Figure 4 displays the body weights by age of 23 of the 24 living females in the survey. Overall female body weights are quite similar to those of the males. Comparing the males and females that share the same age (three months, four months, nine months, one year to six years, eight years) we see that in many cases the females are heavier than the males by five to 15 pounds.

There are significant weight fluctuations between same-aged females just as there were between same-aged males. The largest female weight deviation is seen in the two-year-old category, with one female weighing 84 pounds and another weighing 141 pounds. Of the nine age categories where two or more females shared the same age, four contained individuals that varied in weight between five and 60 pounds. Unfortunately, as with the males, the reasons for these weight variations in same-aged females remain undetermined because of a lack of consistent measurements of individual body weights over

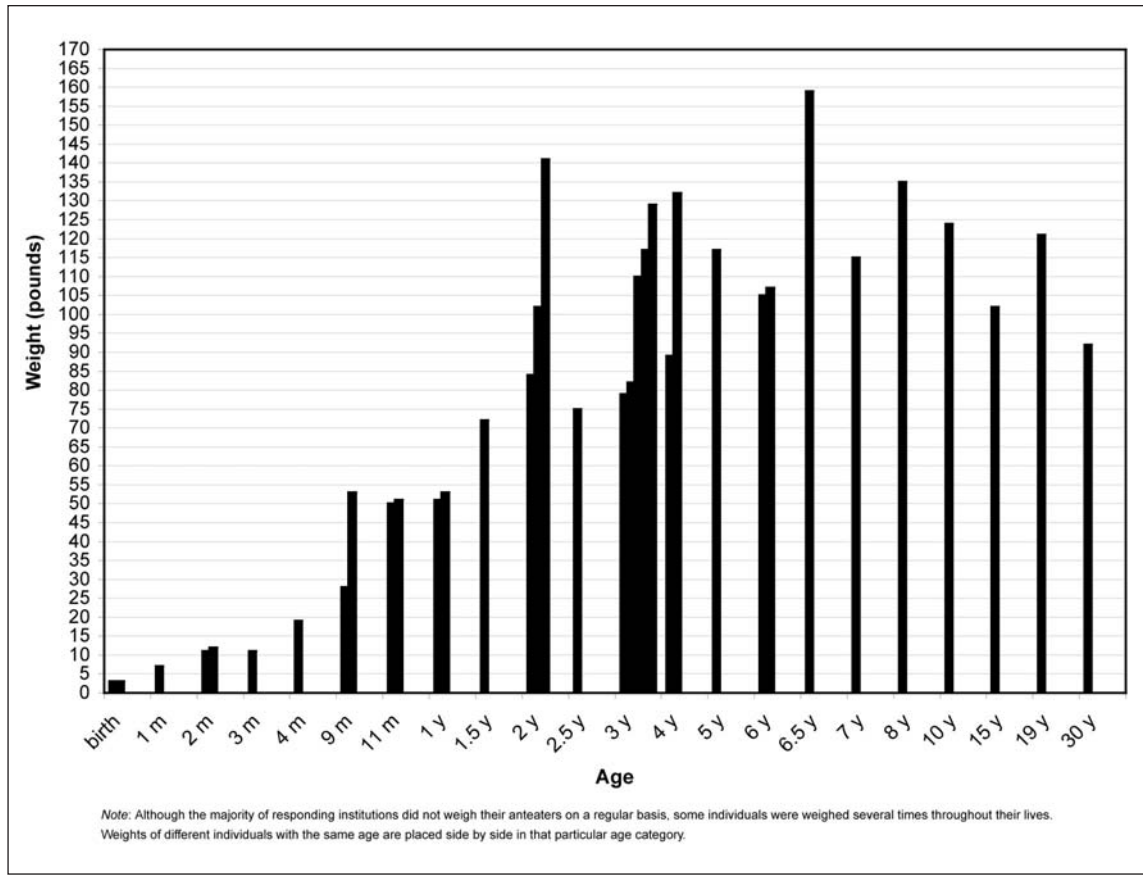

FIGURE 4. Body weights (n = 35) by age of the 24 living females represented in this survey.

time, as well as a scarcity of data concerning the health issues of specific individuals at the time of weighing.

From the survey of medical problems we produced a series of three graphs (Figures 5a, -b, and -c), representing 45 males, 51 females, and 11 unsexed individuals. They are based entirely on the medical records and necropsy reports provided by the 19 responding institutions. The population of giant anteaters represented in these graphs consists of a total of 107 living and dead individuals. Forty medical problems are presented, along with their corresponding frequencies of occurrence. The section "Medical Problems Interpreted" provides additional information regarding each medical problem, including the number of individuals affected, the percentage of the surveyed population (107 individuals) affected, age trends, causes, symptoms, and treatment strategies. The number in parentheses next to the medical problem in the graph corresponds to its number in the list. It is important to remember that this information is based strictly on the data provided by the 19 responding institutions. In several instances the medical records and necropsy reports were incomplete or unclear. We have tried to be as accurate as possible with the data provided.

Medical Problems Interpreted
Surveyed Population: 107 individuals

1. **Vitamin K Deficiency**
   Number of individuals reported: 9.10 (18% of population). The average age of these vitamin K-deficient anteaters was five and a half years. Six individuals were over the age of 10 years when this deficiency was noted. The remaining 13 individuals were under four years old when diagnosed.
   Causes: Most commonly a result of a lack of vitamin K in the diet. This results in decreased ability for blood to clot.
   Symptoms: Spontaneous bleeding is observed either from the nose, genitalia, or rectum. Blood may also be found in the urine and/or stool. Typically, only one or two of these symptoms is observed in any one individual.
   Treatment Strategies: a) Supplement vitamin K in the diet in either powder (K-SOL) or liquid form on a daily basis. b) Add Yunnan

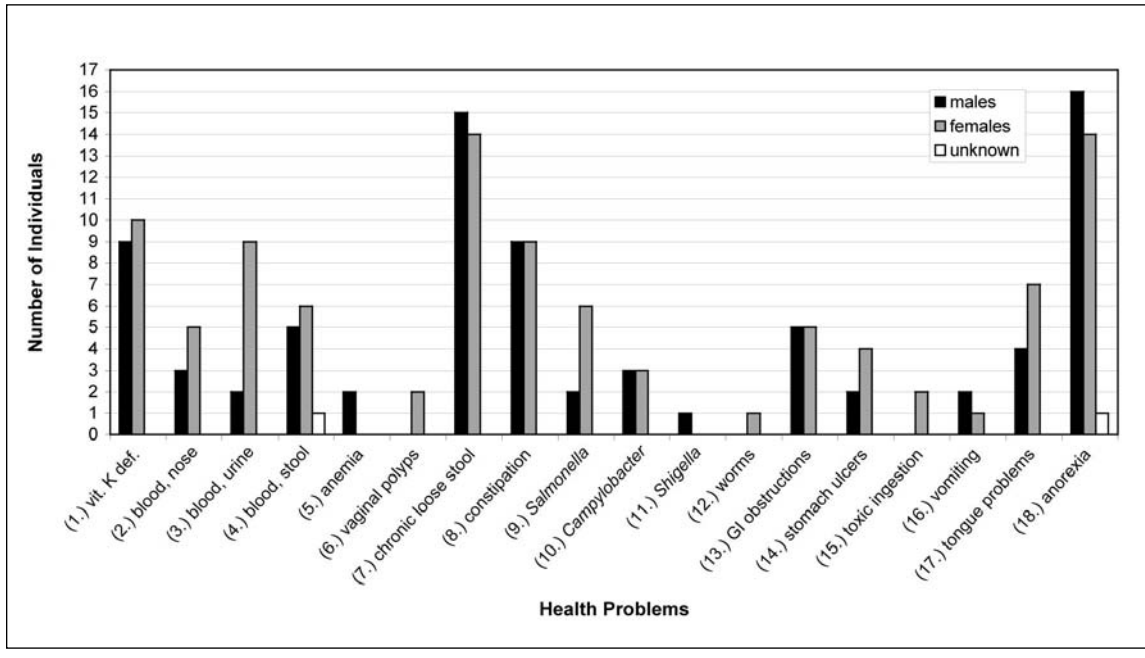

FIGURE 5A. Medical Problems: 45 males / 51 females / 11 unknown.

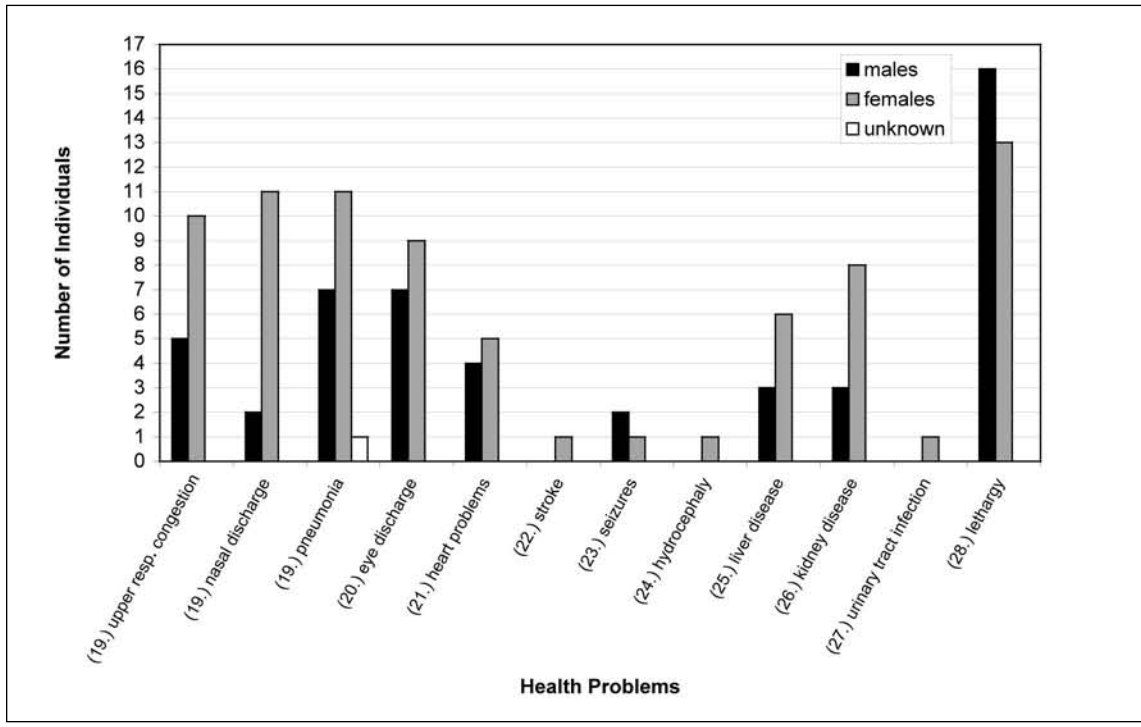

FIGURE 5B. Medical Problems, continued: 45 males / 51 females / 11 unknown.

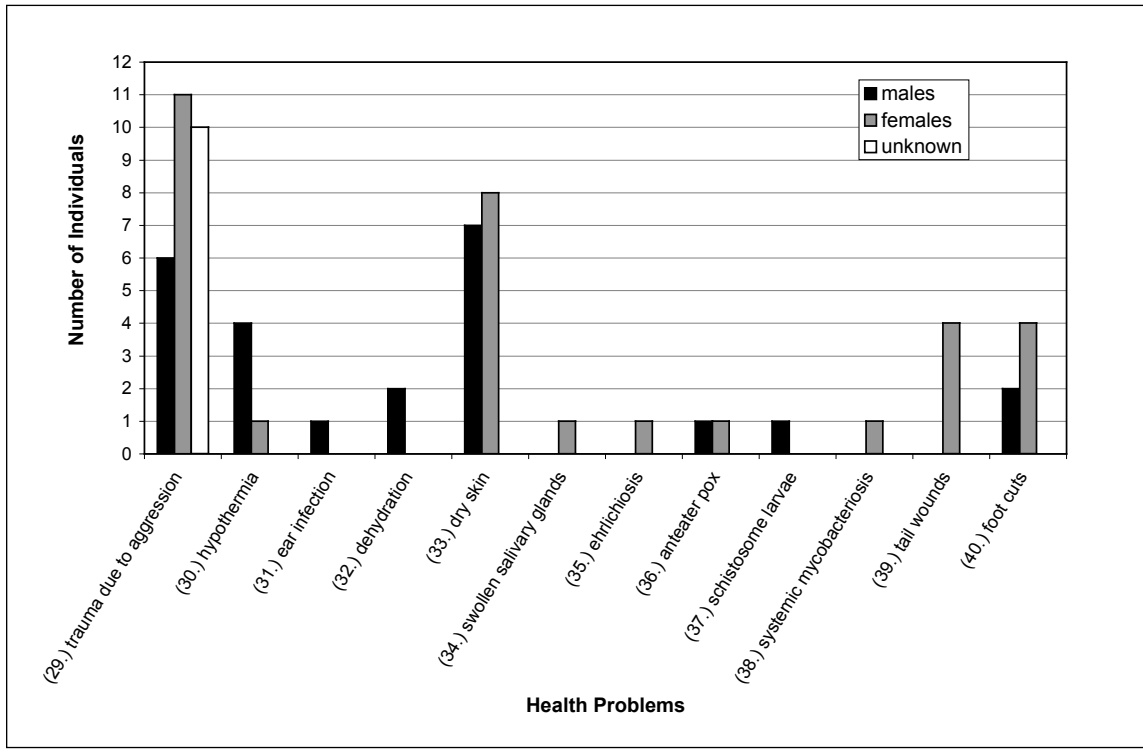

FIGURE 5C. Medical Problems, continued: 45 males / 51 females / 11 unknown.

Paiyao, a Chinese herb, to the diet in addition to vitamin K supplements to promote blood clotting. c) Change food components of vitamin K-deficient diet and include Leaf-Eater biscuits, which are high in vitamin K.

2. **Nosebleeds**
Number of individuals reported: 3.5 (7% of population). The average age of these individuals was 11 years. Only two were one year old. The other six were between eight years and 27 years old.
Causes: a) Vitamin K deficiency. b) Trauma to nasal region either through aggression or contact with electrified wire.
Symptoms: Bleeding from nose.
Treatment Strategies: a) If diagnosed as vitamin K deficiency – see "Vitamin K deficiency treatment strategies." b) Trauma – no treatment administered.

3. **Blood in Urine**
Number of individuals reported: 2.9 (10% of population). Nine of these individuals were between the ages of two and four years. The other two individuals were over 12 years old.
Causes: a) Vitamin K deficiency. b) Estrus cycle. c) Urinary tract infection.
Symptoms: Urine has a reddish-brown tinge.
Treatment Strategies: a) If diagnosed as vitamin K deficiency – see "Vitamin K deficiency treatment strategies." b) Estrus cycle – no treatment. Typically occurs every four to seven weeks and may last five to 10 days. c) Urinary tract infection – antibiotic treatment.

4. **Blood in Stool**
Number of individuals reported: 5.6.1 (11% of population). Of the ages provided, six individuals were between five and 12 years old and three were between one and two years old.
Causes: a) Vitamin K deficiency. b) GI tract obstruction. c) GI tract infection.
Symptoms: Stools are darker than usual and are tarrier in appearance.
Treatment Strategies: a) If diagnosed as vitamin K deficiency – see "Vitamin K deficiency treatment strategies." b) If diagnosed as GI tract obstruction – see "GI tract obstruction treatment strategy." c) GI tract infection – antibiotic therapy.

5. **Anemia**
Number of individuals reported: 2.0 (2% of population). Ages: One year and 11 years old.
Causes: a) Excessive bleeding due to vitamin K deficiency. b) Internal bleeding from stomach ulcer(s).
Symptoms: Lethargy.
Treatment Strategies: a) If diagnosed as vitamin K deficiency – see "Vitamin K deficiency treatment strategies." b) Stomach ulcer(s) – no treatment listed.

6. **Vaginal Polyps**
Number of individuals reported: 0.2 (2% of population). Ages: 12 years and 29 years.
Causes: Undetermined.
Symptoms: Small polyps visible on perimeter of vulva. The 29-year-old female's polyps increased slightly over the span of one year.
Treatment Strategy: No treatments listed.

7. **Chronic Loose Stool**
Number of individuals reported: 15.14 (27% of population). The average age of these individuals at onset of symptoms was four years. Of the ages provided, only three were between eight and 14 years of age. The other 16 individuals were between the ages of one and four years.
Causes: a) Diet – A diet high in cereal grains (dog kibble) along with lactose (milk products) can create osmotic changes in the lower gut, thus promoting loose stool. b) Bacterial/parasitic infection in GI tract – *Salmonella, Campylobacter, Shigella*, worms. c) Ingestion of toxic substance.
Symptoms: Stool is consistently pasty to liquid in consistency.
Treatment Strategies: a) Diet – change diet ingredients to Leaf-Eater/dry cat food. Leaf-

Eater is high in cellulose, which mimics the chitin ingested by free-ranging giant anteaters. Cellulose/chitin provides gut fill and promotes fecal consistency. Dry cat food is meat-based and is easier to digest than products like dog kibble, which are high in cereal grains. Eliminate lactose (milk products) from diet. b) One institution reported adding peat dust to the diet to promote fecal consistency. c) Bacterial/parasitic infection of GI tract – eliminate meat products in diet to prevent bacterial infections such as *Salmonella*. Antibiotic treatment was necessary in most cases. d) Ingestion of toxic substance – see "Ingestion of toxic substances treatment strategies."

8. **Constipation**
Number of individuals reported: 9.9 (17% of population). The average age of these individuals was four and a half years. Nine individuals were between one and three years old.
Causes: a) GI tract obstruction. b) Lack of fiber in diet.
Symptoms: Absence of stool. Lethargy reported on occasion.
Treatment Strategies: Several institutions reported cases of constipation that lasted two or three days and then corrected themselves without treatment. a) Provide a pool – this encourages defecation. b) Enema. c) Add supplements to diet – mineral oil, laxatone, cat lax, Metamucil, psyllium fiber. d) Alter substrate in exhibit – sand and woodchips caused more impaction problems than dirt substrate. e) Provide more enrichment – this may encourage individuals not to ingest as much substrate.

9. ***Salmonella***
Number of individuals reported: 2.6 (7% of population). The average age of these individuals was approximately 10 years. Only two individuals were under four years of age.
Causes: Contaminated food products – any meat in the diet is a potential risk. Occasionally found on unwashed fruit.
Symptoms: Diarrhea/dehydration/abdominal pain.
Treatment Strategies: a) Administer antibiotic therapy in most cases. b) In two cases diarrhea subsided in a couple of days and individuals no longer tested positive for *Salmonella*. c) Remove meat from diet and wash all fruit before feeding.

10. ***Campylobacter***
Number of individuals reported: 3.3 (6% of population). The average age of these individuals was six years, with the youngest being one year old and the oldest reported at 14 years.
Causes: Contaminated substrate – infected fecal material gets into the soil.
Symptoms: Chronic diarrhea.
Treatment Strategies: a) Administer antibiotic therapy. b) UV light kills these bacteria if the top layers of soil are repeatedly turned over and exposed.

11. ***Shigella***
Number of individuals reported: 1.0 (1% of population). Age: Five years.
Cause: Not listed.
Symptoms: Diarrhea, blood in stool, decreased appetite, lethargy.
Treatment Strategy: No treatment listed – symptoms persisted for two months but the anteater improved on its own.

12. **Worms**
Number of individuals reported: 0.1 (1% of population). Age: Five years.
Cause: Undetermined.
Symptoms: Diarrhea.
Treatment Strategy: Administer Nemex Wormer.

13. **GI Tract Obstructions**
Number of individuals reported: 5.5 (10% of population). The average age of these individuals was six years old. Four individuals were between one and three years old with the remaining between seven and 15 years of age.
Causes: Ingestion of foreign body – hairball, sand, wood chips, 2 x 6 cm piece of plastic, gauze, string.

Symptoms: Extreme lethargy, acute anorexia for more than a few days, abdominal pain, dehydration, constipation. One report indicated that the stool was still passing but feces were much smaller than normal and consisted of green, mucoid strings.
Treatment Strategies: a) Obstructions were fatal for six out of the 10 reported cases. b) Sand and wood chip impactions were successfully treated with repeated enemas and laxatives added to the diet. c) Surgery to remove obstruction.

14. **Stomach Ulcers**
Number of individuals reported: 2.4 (6% of population). The average age of these individuals was seven, with the youngest at one year and the oldest at 12 years.
Causes: a) Parasites. b) Weak immune system due to other medical problems.
Symptoms: Prolonged anorexia, abdominal pain, lethargy, weight loss, blood in stool, anemia.
Treatment Strategy: None listed. All cases were reported upon necropsy. Stomach ulcers were listed as the primary cause of death for two individuals. In the other four cases, stomach ulcers were a contributing cause of death.

15. **Toxic Ingestion**
Number of individuals reported: 0.2 (2% of population). Ages: 10 months and two years.
Causes: a) Ingestion of dye, cement, and glue. b) Ingestion of rat poison.
Symptoms: Rat poison – extreme lethargy, labored breathing, abdominal pain when palpated, bleeding from nose/rectum.
Treatment Strategy: Activated charcoal – used to treat ingestion of dye, cement, and glue. The case of ingestion of rat poison was fatal. The animal died in two days, before treatment could be attempted.

16. **Vomiting**
Number of individuals reported: 2.1 (3% of population). Ages: One year, two years, and four years.
Causes: No causes were determined.
Symptoms: In two of the cases, the animals continued to eat normally. In the third case anorexia existed while symptoms persisted.
Treatment Strategy: Animals put under observation – no treatment administered.

17. **Tongue Problems**
Number of individuals reported: 4.7 (10% of population). Of the ages provided, the average age of these individuals was nine years. The youngest was three years old.
Causes: In each reported case, the cause was diet-related. The stringy material found in ground-up horsemeat acted like a noose around the animal's tongue and prevented blood circulation.
Symptoms: a) Anorexia – animal shows interest in food but does not actually eat it. b) Excessive salivation – mouth held open with tip of the tongue hanging out. c) Tongue discoloration – tongue turns lighter in appearance due to a lack of circulation.
Treatment Strategies: a) Surgery to remove obstruction on tongue. b) Remove excessively stringy types of meat (such as horsemeat) from the diet.

18. **Anorexia**
Number of individuals reported: 16.14.1 (29% of population). This was the most common problem reported by the 19 institutions. The average age of these individuals was six years. Of those provided, nine individuals were between one and three years old and 14 were between five and 14 years old.
Causes: a) The causes of anorexia are numerous and varied. Anorexia was associated with every major medical problem listed. In numerous cases, no cause was determined for loss of appetite. b) Temperature – three institutions reported changes in environmental temperatures as a contributing factor for anorexia. When environmental temperatures dropped into the low 50s °F or increased into the 100s °F, anorexia was noted. c) Stress – heightened stress levels seemed to promote anorexia.

Symptoms: Loss of appetite – depending on the accompanying medical problem, this symptom lasted for as little as two days and as long as four months. In the cases where no cause was determined, symptoms only persisted for one day to 10 days. Anorexic symptoms persisting longer than two weeks were usually associated with other medical problems such as GI tract obstructions, GI tract infections, stomach ulcers, tongue problems, pneumonia, heart problems, liver disease, kidney disease, and hypothermia.

Treatment Strategies: a) In cases where symptoms lasted for a week to 10 days, no treatment was necessary. Animal was observed and seemed to improve on its own. b) Increase environmental temperature – several institutions located in cold climates noted that supplemental heat encouraged their anteaters to eat regularly. Temperatures in the mid-70s °F to 80s °F seemed to be effective. c) Warm-water baths were reported to help stimulate anteater appetites even for the more medically-challenged individuals.

19. **Upper Respiratory Congestion: 5.10 (14% of population). Nasal Discharge: 2.11 (12% of population). Pneumonia: 7.11.1 (18% of population)**

Number of individuals reported: As the above numbers indicate, these respiratory-related problems seem to afflict females much more than males, by a ratio of 2:1. The ages of these individuals were scattered. The youngest anteater reported suffering from pneumonia was five days old, while the oldest was 28 years. Of the 11 individuals of known age suffering upper respiratory congestion, six were under two years old. Of the 11 individuals of known age reported experiencing nasal discharge, five were under two years old. Lastly, of the 13 individuals of known age reported with pneumonia, seven were under two years old, and of these, four were less than six days old.

Causes: a) Nasal discharge/Upper respiratory congestion – exposure to consistently cold (below mid-50s °F), wet environments. In one case a female was reported chronically congested for 10 years and no causes were determined. b) Pneumonia – bacterial infection/septicemia or untreated upper respiratory congestion. Of the 19 cases reported, pneumonia was listed as either the primary or associated cause of death for 12.

Symptoms: a) Nasal discharge/Upper respiratory congestion – visible discharge from nose, abnormal/strained breathing sounds, occasional reports of lethargy. b) Pneumonia – anorexia, lethargy, a few reports of coughing observed. The majority of these cases were reported as difficult to detect, the symptoms not being obvious.

Treatment Strategies: a) Nasal discharge/Upper respiratory congestion – in three reports of nasal discharge, symptoms disappeared within one week with no treatment. Other treatments: antibiotics (Baytril), increase holding temperatures up to 70s °F, keep holding area dry, use humidifier. b) Pneumonia – the seven individuals that survived their bout of pneumonia were all kept in a warm (>70 °F) and dry environment, and all were treated with antibiotics. One case reported that the only antibiotic they found successful was Naxcel.

20. **Eye Discharge**

Number of individuals reported: 7.9 (15% of population). Of the ages provided, nine individuals were between one and four years old and four individuals were between 10 and 12 years of age.

Causes: a) Stress. b) Allergic reaction. c) Cold air.

Symptoms: Generally, a milky white substance exudes from the eye region.

Treatment Strategies: a) Observation – symptoms commonly reported to fade over one week. b) Allergic reaction – change bedding / apply Fusidic Acid eye ointment.

21. **Heart Problems**

Number of individuals reported: 4.5 (8% of population). The average age of these individuals was 10 years. The youngest indi-

vidual reported was three years old while the oldest was 21 years of age.
Causes: Not listed – all heart-related problems were diagnosed upon necropsy.
Symptoms: Two to 10 days before death – anorexia, lethargy, edema in neck region, and blood in stool.
Treatment Strategy: Not listed – all cases were fatal as diagnosis was made in necropsy.

22. Stroke
Number of individuals reported: 0.1 (1% of population). Age: 28 years.
Causes: Undetermined.
Symptoms: Lethargic, unable to stand, unresponsive to stimuli, blood in stool, and bloody vaginal discharge. There was temporary partial paralysis of the front left side of the body. Onset of symptoms was immediate.
Treatment Strategy: Initial treatment – place on oxygen, administer subcutaneous fluids, administer series of antibiotics (TMS, Baytril, Penicillin), vitamin K injection. Secondary treatment – physical therapy for one year to regain adequate use of front left leg.

23. Seizures
Number of individuals reported: 2.1 (3% of population). Ages reported: Eight years and 27 years.
Causes: a) Contact with electrified fence. b) Undetermined – other two cases.
Symptoms: Disorientation, shaking, loss of bodily functions. Onset is immediate.
Treatment Strategy: Not listed.

24. Hydrocephaly
Number of individuals reported: 0.1 (1% of population). Age: 17 years.
Causes: Infection by *Cryptococcus neoformans*.
Symptoms: Not listed.
Treatment Strategy: Not listed – proved fatal.

25. Liver Disease
Number of individuals reported: 3.6 (8% of population). Of the ages provided, the average was 17 years old. The youngest reported anteater was eight years while the oldest was 26 years.
Causes: Not listed. Of the nine reported cases, there were five in which kidney disease was also a factor.
Symptoms: Anorexia, lethargy that becomes progressively worse to the point that they are unable to stand.
Treatment Strategy: Not listed – proved fatal in each case.

26. Kidney Disease
Number of individuals reported: 3.8 (10% of population). The average age of these individuals was 14 years. The youngest reported was seven years old while the oldest was 21.
Causes: Not listed – of the 11 cases, there were five in which liver disease was also a factor.
Symptoms: Anorexia, extreme lethargy, whole-body edema.
Treatment Strategy: Not listed – kidney disease was either the primary cause of death or a contributing cause in all 11 instances.

27. Urinary Tract Infection
Number of individuals reported: 0.1 (1% of population). Age: Two years.
Causes: Not listed.
Symptoms: Hematuria, diarrhea, and anorexia/weight loss.
Treatment Strategy: Antibiotics.

28. Lethargy
Number of individuals reported: 16.13 (27% of population). The ages of these individuals were evenly spread out. A cluster of eight individuals was between one and three years old. The remaining 21 individuals showed no significant age clusters. The oldest reported case was 30 years old.
Causes: Like anorexia, the causes of lethargy are numerous and varied. Lethargy was a symptom of practically every major medical problem. In several cases, no cause was diagnosed for lethargic behavior. In each instance of lethargy, anorexia was also

reported. Low environmental temperatures (below mid-50s °F) were also listed as a cause of lethargy.

Symptoms: Drowsiness or indifference to external stimuli. These symptoms varied from mild to extreme depending on the severity of other associated medical problems. In the cases where no cause was determined, symptoms remained mild and lasted no more than 10 days. Lethargic behavior persisting longer than two weeks or increasing in severity over a short time period usually indicated the presence of a more serious medical problem.

Treatment Strategies: a) In cases where symptoms remained mild for a week to 10 days, no treatment was necessary. Once animal started eating again, lethargic behavior regressed. b) Temperature – supplemental heating proved effective in a few cases if temperatures could be increased to more than 70 °F.

29. Trauma Due to Aggression

Number of individuals reported: 6.11.10 (25% of population). Of these 27 individuals, 22 were under six days of age. All 22 infants died as a result, making this the number one cause of death for neonates.

Causes: a) Neonatal cases – mother and/or father inflicted fatal wounds to offspring. In six of these 22 cases (over one-quarter of those reported) the mother appeared to be acting normally and cared for the neonate. However, by the fifth or sixth day, the dam had killed her baby. Upon necropsy of each infant, a serious medical problem was detected, such as pneumonia or under-developed lungs. This may or may not have some bearing on the reasons behind the dam's aggressive behavior toward the neonate. Unfortunately many infants did not have necropsies performed when cause of death was trauma. b) Adult cases – aggression leading to physical injury or death was reported in situations involving breeding or introductions.

Symptoms: Lacerations/puncture wounds over body.

Treatment Strategies: a) Neonatal cases – separate sire from dam before birth and keep separate. Males have a long history of aggression towards infants in captive situations. Monitor interaction between neonate and dam as much as possible. From reported survey data, most neonatal trauma-induced deaths occurred within six days of birth. b) Adult aggression – not listed.

30. Hypothermia

Number of individuals reported: 4.1 (5% of population). Two of these individuals were under three days old and the other three were between one and 10 years of age.

Causes: Exposure to cold temperatures (< 50 °F).

Symptoms: Anorexia – individual in a state of torpor and unresponsive to external stimuli. Onset of symptoms is rapid.

Treatment Strategy: Proved fatal for two neonates. Other three adult individuals recovered when placed in warm environment (> 70 °F).

31. Ear Infection

Number of individuals reported: 1.0 (1% of population). Age: One year.

Cause: Not listed.

Symptoms: Bloody discharge from ears, unstable when walking.

Treatment Strategy: Medicated ear drops.

32. Dehydration

Number of individuals reported: 2.0 (2% of population). Age: Seven and eight years.

Causes: Not listed.

Symptoms: Lethargy, anorexia.

Treatment Strategy: Administer subcutaneous fluids. Individuals improved in a couple of days.

33. Dry Skin

Number of individuals reported: 7.8 (14% of population). Nine individuals were between one year and three years old when condition was reported. The other six individuals were between 12 and 30 years old.

Causes: Dietary deficiency? Climate? No cause proven yet.

Symptoms: Persistent dry flaky skin, especially around the forehead, neck, shoulders and ridge of back.
Treatment Strategies: a) Topical treatments – E45 cream, Aloe Heal cream, Bath Oil. b) Dietary supplements – Vitamin E, DermCaps, Omega 3 fatty acid capsules, Platinum Performance supplement. c) Humidifier placed in enclosure.

34. **Swollen Salivary Glands**
Number of individuals reported: 0.1 (1% of population). Age: 29 years.
Causes: Undetermined.
Symptoms: Visible enlargement of salivary glands on underside of neck. Very soft and fluid-filled to the touch. Eventual rupture causing discharge of saliva-like substance. Fresh new skin found underneath.
Treatment Strategy: Keep area clean with dilute Nolvasan.

35. **Ehrlichiosis**
Number of individuals reported: 0.1 (1% of population). Age: Eight years.
Causes: Tick-borne disease affecting white blood cells.
Symptoms: Abnormal bleeding tendencies.
Treatment Strategy: Antibiotic therapy – doxycycline monohydrate.

36. **Anteater Pox**
Number of individuals reported: 1.1 (2% of population). Ages: Three and four years.
Causes: Not listed.
Symptoms: Lesions resembling chronic dermatitis were found in multiple sites on feet and neck.
Treatment Strategy: No treatment listed. Poxvirus is a localized disease that regresses spontaneously.

37. **Schistosome Larvae**
Number of individuals reported: 1.0 (1% of population). Age: Four years.
Causes: Parasitic skin infection.
Symptoms: Larvae were found in a lesion resembling dermatitis on the animal's head.
Treatment Strategy: Praziquantel.

38. **Systemic Mycobacteriosis**
Number of individuals reported: 0.1 (1% of population). Age: Four years.
Causes: Infected wound created by aggressive male.
Symptoms: Inguinal wound that would not heal. Infection spread to peritoneal cavity.
Treatment Strategies: Multiple surgeries, aggressive debridement, and antibiotic therapy (Isoniazid). All efforts were unsuccessful, and the animal was euthanized.

39. **Tail Wounds**
Number of individuals reported: 0.4 (4% of population). Ages reported: 23 and 29 years.
Causes: Animal lying down near wall creates abrasions on lateral sides of tail base.
Symptoms: Raw areas on lateral sides of tail where it meets body.
Treatment Strategy: Clean area regularly with dilute Nolvasan and apply Panalog Cream or Triple Antibiotic ointment.

40. **Foot Cuts**
Number of individuals reported: 2.4 (6% of population). Average age was four years.
Causes: a) Excessively dry skin that cracks open. b) Trauma due to aggression.
Symptoms: Pads of feet are raw and/or bloody.
Treatment Strategy: Oral – Vitamin K; topical – Triple Antibiotic ointment.

Reported Anteater Weight Fluctuations

Table 1 provides information on weight loss reported by eight institutions currently housing giant anteaters. This dataset includes the sex of the individual, age, original body weight, quantity of weight lost, the time it took to lose weight, and causes behind weight loss. These weight fluctuations are all primarily a result of an individual experiencing certain medical problems.

TABLE 1. Weight loss and its causes in four male and six female giant anteaters, *Myrmecophaga tridactyla.*

Sex	Age in years	Starting weight	Weight lost	Time span	Cause
Male	14	140 lbs	14 lbs	20 days	Anorexia due to tongue constriction from piece of horsemeat.
Male	8	111 lbs	10 lbs	7 months	Peritonitis.
Male	8	108 lbs	15 lbs	4 months	Occurs only in the summer season as appetite declines.
Male	5	138 lbs	15 lbs	2 months	Not listed.
Female	14.5	81 lbs	15 lbs	4 months	Kidney disease.
Female	12	101 lbs	23 lbs	< 2 months	Diagnosed with kidney/liver disease. Experienced prolonged periods of anorexia during time span.
Female	9	149 lbs	25 lbs	6 months	Kidney disease.
Female	3	143 lbs	23 lbs	8 months	Individual deemed overweight and put on a diet.
Female	2	141 lbs	10 lbs	6 months	Hematuria and chronic diarrhea.
Female	1.7	70 lbs	15 lbs	2 months	Sand impaction caused anorexia.

Conclusions

The medical challenges surrounding giant anteaters (*Myrmecophaga tridactyla*) are numerous and varied. The results of the Health Care Survey provide insight into the frequencies of occurrence, age trends, causes, symptoms, and treatment strategies for 40 distinct medical problems that the 19 respondents have experienced with the giant anteaters in their collections. The following paragraphs summarize the top five most commonly reported medical issues involving a combined living and deceased giant anteater population of 107 individuals.

Anorexia and lethargy

The two most commonly reported medical problems were anorexia and lethargy, affecting 29% and 27% of the surveyed population respectively. In each report of an individual exhibiting lethargic behavior, anorexia was also noted. In most cases anorexia and lethargy turned out to be symptoms of much larger medical issues, including GI obstructions, respiratory ailments, heart problems, and liver/kidney disease. In several instances anorexia and lethargy were attributed to low environmental temperatures (below mid-50s °F). However, there were a few cases in which no causes could be determined for anorexic or lethargic behavior, and in a week or two the individual fell back into its normal habits.

Chronic loose stool

Chronic loose stool tied with lethargy as the second most commonly reported problem, affecting 27% of the surveyed population. The majority of affected giant anteaters were between one and four years of age at the onset of the symptoms. There is no question that diet is responsible for many of these cases. In several instances the treatment strategy employed was to alter the ingredients of the diet in order to aid in digestion. The traditional diet of ground-up horsemeat, dog kibble, and yogurt has proven time and again to instigate chronic loose stool. The second section of our survey, reported below, focuses on these diet-related issues, and results are still being compiled for future distribution.

Trauma due to aggression

The third most common medical problem reported, and perhaps the most fatal, was trauma due to aggression, affecting 25% of the surveyed population. Of the 27 individuals reported, 22 were under six days of age. All 22 neonates died as a result of wounds inflicted by the dam and/or sire, bringing the infant mortality rate up to 46%. However, the neonatal death rate dramatically decreased after the first six days of life. The reasons behind this remain undetermined based on the survey data provided.

Respiratory ailments
The fourth most commonly reported medical problem consisted of respiratory ailments including pneumonia, upper respiratory congestion, and nasal discharge. Generally these ailments seemed to predominantly affect female individuals under the age of two years. The majority of reported causes centered on the cold/wet environments some of these giant anteaters were exposed to. In the cases where temperatures were reported, the definition of cold was considered to be below the mid-50s °F. In the situations where pneumonia developed, the fatality rate was nearly 60%. Practically all the respondents that had dealt with these respiratory ailments agreed that providing a warm (> 70 °F) and dry environment was important in preventing the onset of respiratory-related problems.

Vitamin K deficiency
The fifth most frequently reported medical problem experienced by the giant anteater was vitamin K deficiency, affecting 18% of the 107 individuals surveyed. The spontaneous bleeding from the rectum, genitalia, and/or nose caused by this deficiency was generally due to a nutritionally incomplete diet. Altering the dietary components to include Leaf-Eater biscuits high in vitamin K was one solution frequently employed. The alternative used by several facilities was to add vitamin K supplements to the nutritionally incomplete diet.

After sorting through all the medical records provided by the 19 respondents, a pattern began to emerge. Those institutions that weighed their anteaters on a regular basis (i.e., at least once per month) appeared to have greater success recognizing any potential medical problems earlier on. Because anorexia is such a prevalent symptom in so many medical problems anteaters experience, weight loss usually occurs as a result. Being able to recognize this is key, especially for those institutions that do not monitor dietary intake of individual anteaters. Just from a visual inspection, it is difficult to accurately judge whether or not an anteater has lost weight, because its body hair and robust ribcage can mask weight loss easily. Anorexia, weight loss, and lethargy are three symptoms that we as anteater caretakers can easily observe and monitor. When we see them occur in unison, this should serve as a red flag indicating that closer scrutiny is required in order to determine if a medical problem is arising or if it is nothing at all.

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The information provided by these facilities has shed some light on the basic trends in medical problems experienced by giant anteaters in captivity. In conjunction with these illnesses, we have also gained valuable insight into the treatment strategies employed by the respondents in their attempts to provide the best care possible to the giant anteaters in their collection. We are especially grateful to Mike Flint, the General Curator and Giant Anteater Studbook Keeper at Reid Park Zoo. Mike's interest and support regarding this survey has helped immensely in encouraging others to participate and share information about the giant anteaters in their

collections. Lastly, we want to acknowledge "Anna", a twelve-year-old giant anteater, who brought us to the realization of just how mysterious and amazing a creature this edentate species can be.

Giant Anteater (*Myrmecophaga tridactyla*) Diet Survey

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Introduction

The Giant Anteater Survey is comprised of four separate sections designed to target specific questions and issues involved in the overall care and management of the giant anteater *(Myrmecophaga tridactyla)*. The four sections to this survey and their status in terms of completion are as follows: 1) Health Care – results compiled and distributed July 2001; 2) Diet – results compiled; 3) Housing – results in process of being compiled for distribution; and 4) Neonatal Care – survey questionnaire to be distributed at a later date. Due to the shortage of published information on these topics, the Giant Anteater Survey creates an opportunity to share valuable information and experience among institutions that maintain giant anteaters as part of their collection.

The primary purpose of the Diet section was to look at the trends in giant anteater diets currently being fed in captivity. In addition, behavioral enrichment items as well as types of vitamin and mineral supplements used in the daily diet are discussed. The information presented is based on the survey responses provided by 21 of 24 institutions currently housing giant anteaters.

It is important to note that the Diet Survey Results are designed to simply present what different institutions choose to feed giant anteaters in their collections. No outside research on nutritional values or overall diet-related health concerns were performed on the authors' part unless noted. It is our hope that the results of the Diet Survey will provide a better understanding of the nutritional needs of the giant anteater and how different institutions might attempt to meet these requirements.

Graphs Interpreted

Four graphs were created to illustrate the survey results for the following four topics: 1) Individual food items in diet; 2) Staple diets; 3) Vitamin and mineral supplements; 4) Behavioral enrichment items. The information is current up to May 15, 2001, when compilation of the survey data was begun.

Individual food items in the diet

Figure 1 represents the individual food ingredients comprising the anteater diets at 21 institutions housing giant anteaters. These ingredients do not represent behavioral enrichment items or "treats" given to the anteaters. Instead, these individual food items are fed in various combinations with one another to create a daily diet. As the graph indicates, the three most common ingredients used in the anteater diet include Leaf-Eater, dry dog food, and dry cat food. In comparison, the rest of the food items listed are not used as broadly by the 21 respondents. An interesting finding was the predominance of Leaf-Eater in giant anteater diets. Of the 21 responding institutions, 67% incorporated Leaf-Eater in their diets. Some of the respondents indicated that the reason for this was because Leaf-Eater is naturally high in vitamin K, something captive anteaters tend to become deficient in. Also, Leaf-Eater is high in cellulose, which is reported to provide gut fill, thus promoting fecal consistency (Edwards, n.d.). Many of the respondents indicated that the addition of Leaf-Eater to the daily diet helped alleviate some of the problems with chronic loose stool that have become common with captive giant anteaters.

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[2] *Now in the program for Pre-Veterinary Medicine at the University of California, Santa Barbara.*

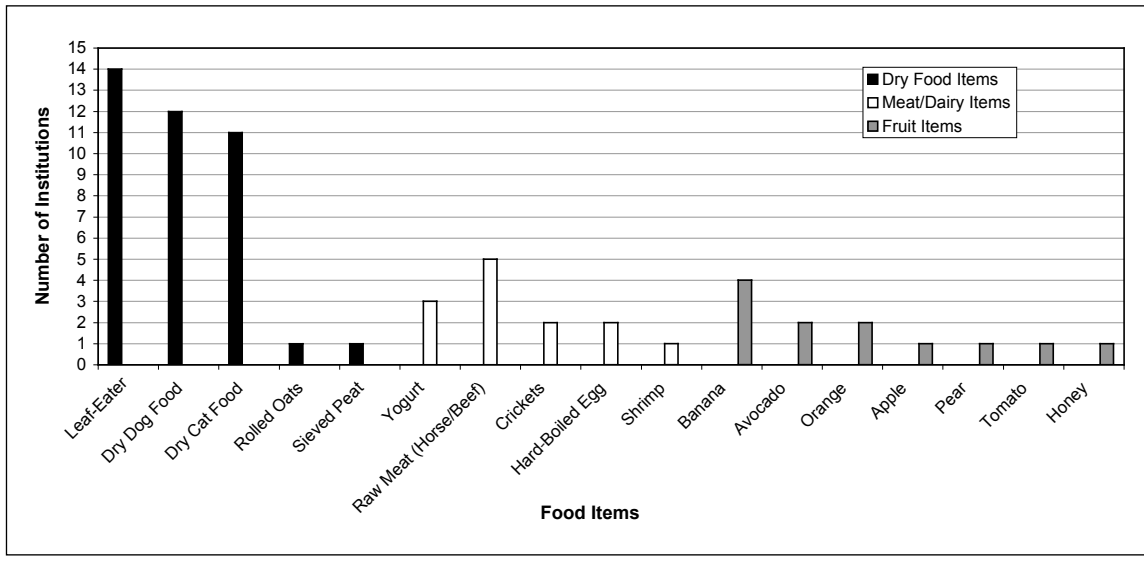

FIGURE 1. Individual food items in giant anteater diet as reported by 21 institutions.

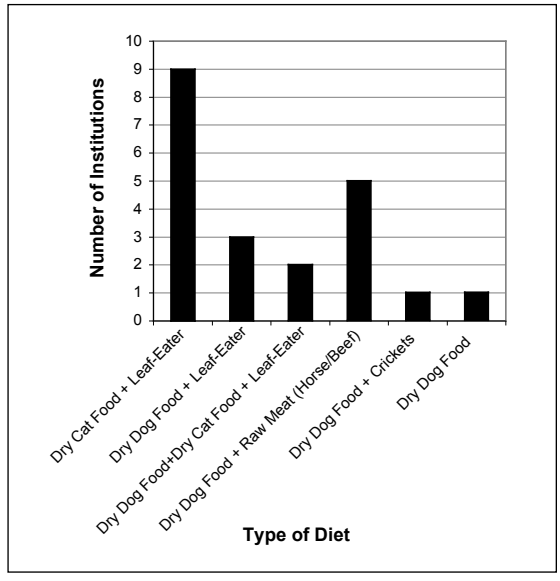

FIGURE 2. Base ingredients combined to form the foundation of each anteater diet type and their frequency of use.

Staple Diets

Figure 2 depicts the base ingredients combined to form the foundation of each anteater diet type and their frequency of use by the 21 responding institutions. As indicated by the graph, the majority of institutions (43%) are using the Leaf-Eater/dry cat food diet formulated by Mark Edwards, Society Nutritionist for the San Diego Zoological Society. Looking at the graph, we see two variations of this diet used with less frequency, incorporating either dry dog food with Leaf-Eater or dry cat food and dry dog food with Leaf-Eater. Of the 21 respondents, 24% fed the more traditional anteater diet of dry dog food combined with raw horsemeat or raw beef. An interesting note to this graph is the frequency with which dry dog food is used as a base ingredient. About half of the 21 respondents made use of dry dog food either by itself or in combination with Leaf-Eater and dry cat food or with raw meat. Dry dog food is reported to be high in cereal grains, making digestion more difficult for giant anteaters and possibly contributing to a lack of fecal consistency (Edwards, n.d.). Dry cat food has been recommended as a substitute because it is meat-based and thus more easily digestible for the carnivorous anteater (Edwards and Lewandowski, 1996). Unfortunately from the survey data, it is difficult to determine why half of the respondents continue to make use of dry dog food as a dietary base ingredient.

Vitamin and Mineral Supplements

Figure 3 presents the dietary supplements used by the 21 responding institutions. Of the 21 respondents, 38% did not provide any vitamin or mineral supplements to the giant anteater diet. Of these eight institutions, seven were feeding the Leaf-Eater/dry cat food diet. In fact, only

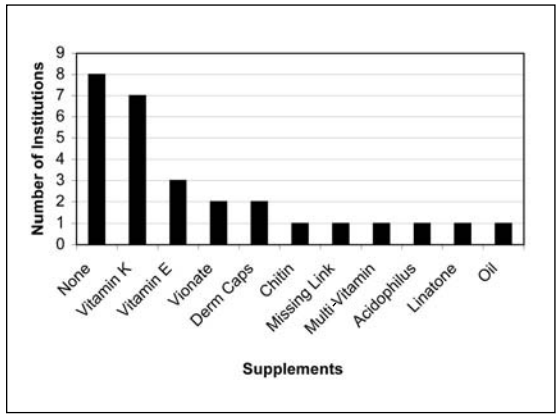

FIGURE 3. Dietary supplements used.

four of the 14 institutions incorporating Leaf-Eater in the anteater diet provided vitamin K as a supplement. According to Mark Edwards, with the Leaf-Eater/dry cat food diet, "all nutrients, including vitamin K, are provided in optimal quantities and ratios to the estimated requirements of these specialist feeders" (Edwards, n.d.). From the survey data, the seven institutions that fed the more traditional anteater diet of either dry dog food or dry dog food with raw meat were more likely to provide additional dietary supplements including vitamin K, vitamin E, Vionate, chitin, Missing Link, or multi-vitamins.

Behavioral enrichment items

Figure 4 portrays a variety of behavioral enrichment items that 20 of the 21 responding institutions provide their giant anteaters on a random basis. The items have been broken down into the following four categories: insects, fruit, objects, and other food items. The three most frequently used items are oranges, avocado, and crickets and bananas tying for third. According to the respondents, the items listed in this graph are not considered part of the staple diet. Instead, they are used as reinforcement for training or as behavioral enrichment tools used to stimulate the animal to explore its enclosure and, in many instances, to promote natural behaviors such as digging or tearing things apart in search of food items.

Summary

The survey results indicate that the captive giant anteater diet is becoming more standardized than it was in the past. From the information provided by the respondents, there is a predominance of three base ingredients used in various combinations with each other to create the staple diet for all the surveyed institutions. The three ingredients consist of Leaf-Eater, dry cat food, and dry dog food. The traditional anteater diet of dry dog food, raw meat, and yogurt no longer appears to be the standard version. Those institutions that phased out raw meat from their diets reported doing so because of the risk of bacteria and parasites such as *Salmonella* occasionally found in raw beef or horsemeat. Several institutions reported

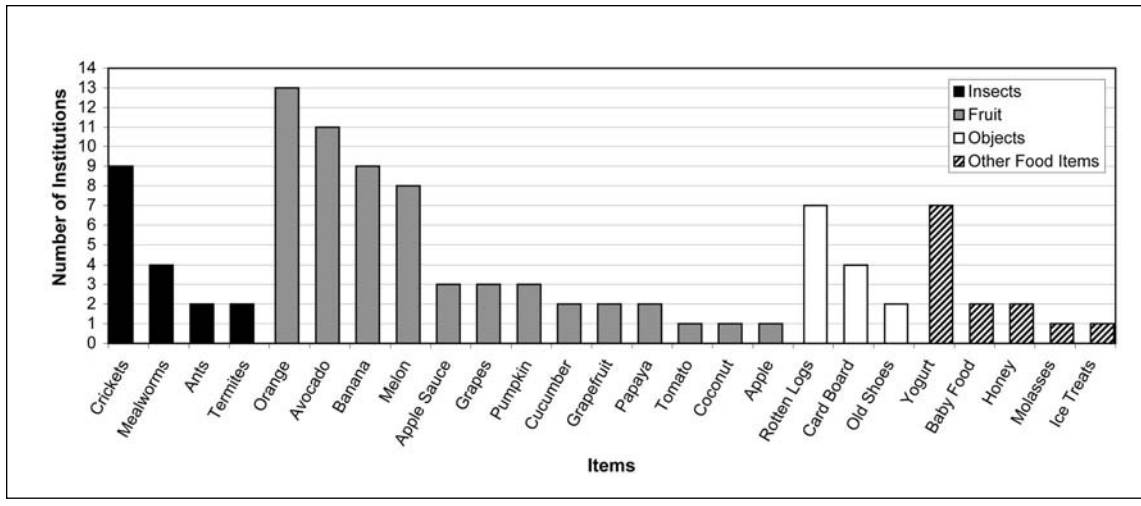

FIGURE 4. Behavioral enrichment items.

either reducing or eliminating the use of yogurt as part of the staple diet because of the possibility of excess lactose from the yogurt increasing moisture levels in the GI tract, thus promoting loose stool. Out of the 21 respondents, only five institutions reported feeding the dry dog food/raw meat diet, and only three institutions continued to incorporate yogurt as part of the daily diet.

The new trend in giant anteater diets seems to be the diet formulated by Mark Edwards consisting of dry cat food and Leaf-Eater mixed together in a one-to-one ratio. This diet was reported by six institutions to have aided in the promotion of increased fecal consistency. Also, the Leaf-Eater/dry cat food diet meets all the nutritional requirements of giant anteaters, including vitamin K, with no need for additional supplementation (Edwards and Lewandowski, 1996). This was evident in the survey data, as those institutions feeding the Leaf-Eater/dry cat food diet tended to use fewer or no vitamin/mineral supplements when compared to the diets not including Leaf-Eater or dry cat food.

One of the challenges in preparing a giant anteater diet is developing a version that can be eaten by an animal that has no teeth and uses its tongue to acquire food. From the survey data provided, 67% of the respondents added enough water to their diets to create an "oatmeal" consistency while 24% chose to liquefy their anteater diets. Only one of the respondents reported feeding their diet (Leaf-Eater/dry cat food) in its dry form after crushing the ingredients into an edible size.

The daily feeding schedule of the 21 respondents varied little; 86% provided the anteater diet twice a day, in the morning and again in the afternoon or evening. From the survey data, 33% of the responding institutions reported monitoring the daily dietary intake of their giant anteaters as best they could. In some instances anteaters shared a diet in the morning, thus making it difficult to accurately record the quantity consumed individually. However, these institutions separated their anteaters overnight and were able to accurately record the individual amount consumed in the evening. As indicated in the "Health Care Survey Results," monitoring daily dietary intake of giant anteaters is the best way to determine the presence and duration of anorexia, a common symptom of some of the larger medical issues giant anteaters may experience in captivity.

Acknowledgments

We would like to take this opportunity to thank the 21 institutions that participated in the Diet Section of the giant anteater survey. Those institutions include: Chaffee Zoological Gardens (Fresno, California); San Francisco Zoological Gardens (San Francisco, California); Santa Barbara Zoological Gardens (Santa Barbara, California); San Diego Zoo (San Diego, California); Jacksonville Zoological Gardens (Jacksonville, Florida); Disney's Animal Kingdom (Lake Buena Vista, Florida); Brevard Zoo (Melbourne, Florida); Honolulu Zoo (Honolulu, Hawaii); Brookfield Zoological Park (Brookfield, Illinois); Rolling Hills Refuge Wildlife Conservation Center (Salina, Kansas); Audubon Park Zoological Gardens (New Orleans, Louisiana); Detroit Zoological Institute (Detroit, Michigan); Cleveland Metroparks Zoo (Cleveland, Ohio); Columbus Zoological Gardens (Columbus, Ohio); Oklahoma City Zoological Gardens (Oklahoma City, Oklahoma); Philadelphia Zoological Gardens (Philadelphia, Pennsylvania); Nashville Zoo (Nashville, Tennessee); Houston Zoological Gardens (Houston, Texas); San Antonio Zoo (San Antonio, Texas); Caldwell Zoo (Tyler, Texas); and London Zoo (London, England). The information provided by these facilities has provided some insight into the different trends of captive giant anteater diets and the reasons behind some of the food choices used, as each institution attempts to provide the best nutrition possible to the anteaters in their collection.

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Crianza Artificial y Manejo Reproductivo de los Tamanduá *(Tamandua tetradactyla)* en el Jardín Zoológico de Rosario, Argentina

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Resumen
El 16 de setiembre de 1996, un tamanduá (*Tamandua tetradactyla*) huérfano de 735 gramos de peso, extraído de su ambiente natural, fue entregado al Jardín Zoológico Municipal de Rosario, Argentina. Debió ser estabilizado debido a sus malas condiciones generales; luego se comenzó la crianza artificial del mismo. Más tarde se lo juntó con una hembra de la especie perteneciente a esta Institución para lograr la reproducción. En marzo de 1999 se detectó una posible preñez, y para mayo la hembra abortó una pareja de mellizos. No existe más que una referencia bibliográfica de mellizos para la especie. En este artículo se describen tanto el manejo de crianza artificial como el manejo reproductivo, comparándolo con referencias bibliográficas.

Summary
On 16 September, 1996, an orphan wild lesser anteater (*Tamandua tetradactyla*), weighing 735 grams, was brought to the Rosario Zoo, Argentina. Immediate medical treatment was required because of its poor general condition, and it was then hand-reared. It was subsequently put in with a female lesser anteater for breeding. Pregnancy was suspected in March 1999, but two months later, the female aborted a pair of twin fetuses. Only one reference to a twin birth in *T. tetradactyla* can be found in literature. In this article, the hand-rearing of this anteater and its reproductive management are described and compared with information in the literature.

Introducción
Los tamanduá (*Tamandua* spp.) pertenecen al orden Xenarthra (= Edentata), Infraorden Vermilingua (Glass, 1985; Wetzel, 1985). Se reconocen dos especies, *T. tetradactyla* y *T. mexicana* (Wetzel, 1985). *T. mexicana* se distribuye naturalmente en el extremo sudeste de la meseta mexicana hasta Sudamérica al oeste de los Andes, noroeste de Venezuela y noroeste de Perú. *T. tetradactyla* se encuentra habitando Sudamérica al este de los Andes desde Venezuela hasta Argentina y norte de Uruguay (Wetzel, 1985). Su dieta se basa en termitas y hormigas, variando las especies según la época del año y la disponibilidad. Sus hábitos son crepusculares o nocturnos.

A pesar de que ya en 1854 se registra la presencia de un ejemplar de tamanduá en cautiverio en el London Zoo, Reino Unido, tuvieron que pasar más de cien años para lograr el éxito reproductivo de la especie en cautiverio. En el International Zoo Yearbook (1-23) se registraron sólo 4 partos de esta especie entre los años 1959 y 1981, todos ellos en el Lincoln Park Zoo, EEUU (Vogt y Becker, 1987). Hay *et al.* (1994) señalan que desde 1984 y hasta 1994 se registraron 12 nacimientos en cautiverio. En Europa los Zoológicos de Barcelona, España, y Krefeld y Dortmund, en Alemania, los han criado con éxito en los últimos tiempos (C. Enseñat, com. pers.; P. Vogt, com. pers.).

En 1999 en el Jardín Zoológico Municipal de Rosario, Santa Fe, Argentina se registró un aborto de mellizos. En la literatura no figuran éxitos reproductivos para la especie en Argentina.

Crianza artificial
El 16 de septiembre de 1996, llegó al Jardín Zoológico Municipal de Rosario un ejemplar macho de tamanduá de manos de un particular

que lo había mantenido en su poder por una semana, después de haberlo "encontrado" abandonado en el norte de la Provincia de Santa Fe, Argentina. Basados en Sanmarco (1987) y Encke (1992), se dedujo que el ejemplar debía tener aproximadamente un mes de vida.

El bebé, que fue apodado "*Junior*", se encontraba hipotérmico y deshidratado en extremo, a consecuencia de los cuidados rudimentarios a los que se lo había sometido. Su peso era de 735 g. De forma inmediata se le administró calor colocándolo entre las ropas de los cuidadores. Cuando la temperatura se hubo estabilizado y el reflejo de succión recuperado, se le ofreció un biberón de Solución de Ringer con Lactato, entre 30° y 35° C de temperatura, el que se repitió a las 3 y 6 hs, *ad libitum*. Luego se le comenzó a suministrar leche de bajo tenor en lactosa con Solución de Ringer con Lactato en partes iguales, durante el resto del primer y segundo día. Al tercer día ya se le suministraba solamente la leche de bajo tenor en lactosa, 35 cc cada cuatro horas, entre las 8 am y las 8 pm.

En el zoológico de Krefeld, Alemania se utilizó leche maternizada para gatos (Esbilac®) durante 24 días, para realizar la crianza de un bebé huérfano de 2 días de vida y 470 g de peso. Suministraban el biberón de 6 a 8 veces por día entre las 6 am y las 12 pm. En total el bebé consumía entre 40 y 100 ml/d. Cada mamada duraba de 8 a 10 min (Encke, 1992).

Durante la noche se lo alojaba en una jaula de alambre tejido de 1,2 m de diámetro y 1,5 m de alto dentro del área de hospitalización, por no contar el zoo con área de cuarentena propiamente dicha. Dada la época del año – primavera – no fue necesario brindar una fuente externa de calor, ya que la temperatura oscila entre los 12° y 28° C en esa estación. En el piso de la jaula se colocaba paja cama y se le proveyó de un muñeco de peluche, al que él se aferraba después de un período en el que chillaba e intentaba salir de la jaula para volver a los brazos de su cuidador, cada vez que se lo dejaba.

Al cabo de siete días se comenzó a suministrar una papilla con la siguiente fórmula:

1/2	Banana
1/2	Manzana
100 g	Carne vacuna magra
40 g	Alimento para bebés (Nestúm Tres Cereales®, Nestlé)
1	Yema de huevo crudo
10 mg	Vitamina K
40 g	Leche con bajo contenido en lactosa
1 medida	Vionate S® (Complejo vitamínico-mineral, Novartis)
350 g	Agua (tibia)

Además se continuaba con un biberón por día de leche de bajo tenor en lactosa. A partir del mes de marzo, cuando contaba con unos 6 meses de edad, se lo alimentó sólo dos veces al día (08:00 y 18:00 hs), con la papilla exclusivamente. Una hembra de la misma especie (*Rosarito*) era alimentada con la misma fórmula y en los mismos horarios. Al preparar la papilla se tenía especial cuidado en que no quedaran restos de fibras musculares de la carne sin haber sido suficientemente procesadas, ya que se ha sabido de ejemplares en los que las mismas se han enredado en la lengua, llegando en los casos más graves hasta la muerte del mismo (P. Vogt, com. pers.; Pérez Jimeno, obs. pers.). Durante las horas de luz se intercalaban paseos por el área parquizada para que tomara sol y se ejercitara, con períodos de descanso en su jaula.

Cuando se encontró totalmente recuperado se intentó el primer acercamiento a la hembra de la especie. La reacción de ambos fue de rechazo, emitiendo fuertes bufidos; mientras ella lanzaba zarpazos, él se alejaba bufando. Recién en marzo de 1997, se logró la aceptación mutua.

Ganancia de peso

El desarrollo de este bebé fue rápido, habiéndose registrado períodos con ganancias de peso diarias de hasta 28 g/día, con un promedio de 13,5 g/día para los primeros 6 meses de vida, 6,86 g/día para la segunda mitad del año y de 10,12 g/día para el total del primer año. La ganancia total de peso

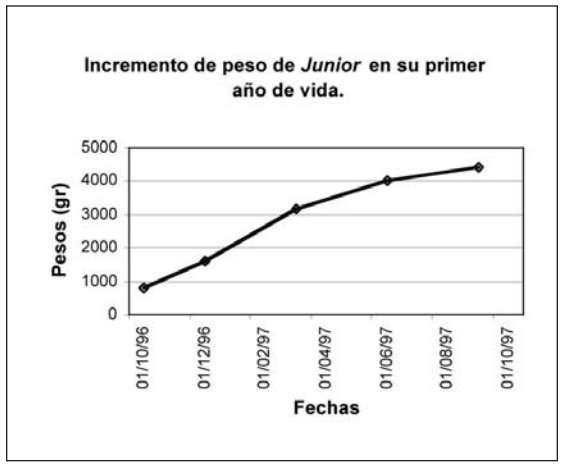

FIGURA 1. Incremento de peso de *Junior* en el primer año de vida.

para su primer año en el zoo fue de 3665 g (ver Figura 1).

En el Lincoln Park Zoo, tuvieron un nacimiento en noviembre de 1987, el que se desarrolló con un ritmo promedio de 22,5 g, crecimiento levemente inferior a los 25 g por día registrados en el Zoológico de Krefeld, Alemania (Sanmarco, 1987).

Manejo Reproductivo

En la naturaleza los tamanduás son animales solitarios, viéndoselos juntos sólo en la época de apareamiento. A pesar de lo dicho muchas instituciones mantienen a más de un ejemplar en el mismo recinto con éxito. Particularmente preferimos basarnos en las observaciones de Meritt (1975) para no correr riesgo de agresiones, realizando períodos cortos de visita del macho a la hembra siempre bajo el estricto control del cuidador, y jamás en los horarios de comida. Estos períodos no duraban más de 30 minutos al comienzo, para llegar después de 2 años a que el macho permaneciera durante todo el día en el recinto de la hembra, para volver a su recinto en la noche. A primera hora de la mañana (08:00 hs) se les suministraba la dieta a cada individuo en su recinto. Luego que hubiesen concluido la ingesta se trasladaba a *Junior* al recinto de *Rosarito*.

El recinto en cuestión tenía las siguientes dimensiones: 8 m de largo, 4,5 m de ancho y 3,2 m de altura, estaba construido en malla de alambre tejido de rombo de 2,5 cm. En su interior se encontraba una construcción de mampostería con cuatro ventanas con vidrio, tres de ellas fijas y una que se podía abrir y servía a su vez como ingreso, las mismas medían 1,6 m de alto por 0,8 m de ancho y estaban colocadas a 0,5 m del suelo. En el interior se encontraba una caja de dormir de madera de 1 m de frente por 0,8 m de ancho y 0,8 m de alto, a la que se le colocaba paja cama. La misma estaba suspendida a 1,6 m del piso, el que era de tierra dónde se habían sembrado algunas plantas de caña india (*Phyllostachys bambusoides*). En un comienzo se habían colocado estufas a resistencia eléctrica de cuarzo empotradas en las paredes, pero dieron muy malos resultados dado que el cuarzo se quemaba habitualmente, por lo que se sustituyeron por un radiador eléctrico de aceite que se sujetó a una pared. En invierno se mantenía la temperatura entre los 15° y 25 °C, con una humedad relativa siempre superior al 60%.

En la parte abierta la cobertura era de césped. Dos de las caras del recinto estaban cubiertas por plantas de ligustrina (*Ligustrum* sp.), para resguardarlos de los vientos más intensos y fríos, y proveerles de mayor intimidad. Tanto la parte cerrada como la abierta contaban con enramadas que se cambiaban periódicamente. La hembra durante las horas de luz casi siempre se encontraba durmiendo en su caja, y en contadas ocasiones en un hueco en el piso que ella misma había construido.

El macho al llegar al recinto de la hembra generalmente hacía una exploración de éste para luego ir a buscar a *Rosarito*, a quien no siempre lograba incentivar para el juego. Cuando *Junior* conseguía hacerla salir de la caja comenzaba una sesión de "juegos", o acicalamiento mutuo con las lenguas, especialmente de las orejas. Los "juegos" consistían en persecuciones, generalmente del macho a la hembra, intentando montarla o darla vuelta en decúbito dorsal para lanzarse sobre ella abrazándola fuertemente con sus cuatro miembros, a lo que ella respondía

de la misma manera. En muchas ocasiones se los vio colgados de las enramadas por sus colas solamente y profiriéndose zarpazos mutuamente. Los períodos de actividad tenían duración altamente variable (de 5 minutos a más de una hora). Luego ambos buscaban lugar donde dormir, al principio separados y luego de un tiempo llegaron a hacerlo juntos en la caja de dormir. A las 18 hs aproximadamente se sacaba al macho y se les daba a ambos la segunda porción de la dieta.

A mediados de marzo de 1999 se notó que *Rosarito* estaba aumentado de peso. Además se pudo observar que tenía una distensión abdominal que podría corresponder a una preñez. A pesar de lo dicho jamás se pudo observar la cópula, aunque sí muchos intentos fallidos. Se comenzó a observarla con mayor detenimiento y se pudo determinar un cambio importante en su conducta. Buscaba pasar mucho tiempo en reposo y para ello había escogido un pozo que ella misma excavara justamente debajo del radiador. Cesaron los juegos con el macho a quien ignoraba o lo alejaba con bufidos y zarpazos si éste insistía en molestarla.

El día 25 de mayo de 1999 a las 15:20 hs, estando *Junior* en el recinto de la hembra los guardianes comprobaron que el calefactor se había desestabilizado a consecuencia del agrandamiento del pozo que había realizado *Rosarito*, quien se encontraba parcialmente aprisionada por éste. De forma inmediata quitaron el artefacto y pudieron comprobar que la hembra tenía una secreción sanguinolenta en la vulva y ésta se encontraba muy dilatada, como así también que se había defecado encima. Los guardianes procedieron a retirar al macho para llevarlo a su recinto. Al regresar al cabo de 5 minutos, *Rosarito* había parido dos cachorros. Por desgracia eran prematuros (ver foto). La hembra ingirió parte de las placentas y acicaló a las crías. Una de ellas gemía y se movía con considerable fuerza, la otra casi no se veía por la posición, ya que estaba por debajo de su madre. *Rosarito* no aparentó disgusto por la presencia de los cuidadores quienes se quedaron a controlar la situación. A las 16:00 hs se vio que las crías ya estaban muertas. Aparentemente una habría nacido muerta o muerto a los pocos minutos de nacida. La hembra siguió el lamido de los fetos, hasta las 17 hs cuando se le ofreció la dieta habitual, la que atacó con apetito. El peso máximo registrado para *Rosarito* fue de 7500 g el día 16 de mayo. Cuatro días después del aborto el pesó fue 6670 g.

FIGURA 2. Pareja de mellizos abortados por Rosarito el 25 de mayo de 1999. La regla se encuentra en centímetros.

Las crías abortadas

A la inspección post-mortem se pudo determinar que se trataba de un macho y una hembra. Estaban totalmente desprovistos de pelos. Al

TABLA 1. Comparación de las medidas y peso de crías de tamanduá.

Medida	Chaco (1)	Krefeld (2)	Rosario (3)	Rosario (3)
Cráneo	62 mm	-	42 mm	44 mm
Cabeza y cuerpo	207 mm	240 mm	204 mm	210 mm
Brazo	43 mm	-	18 mm	18 mm
Pierna	38 mm	-	23 mm	22 mm
Cola	155 mm	170 mm	105 mm	107 mm
Peso	285 g	450 g	100 g	115 g

1) Medidas de un bebé de tamanduá (*T. tetradactyla*) de un día de vida nacido y muerto en el Zoológico de R. S. Peña, Chaco, Argentina en 1998 (G. Pérez Jimeno, obs. pers.)
2) Parámetros de una cría nacida en el Zoológico de Krefeld, Alemania en 1984 (Vogt y Becker, 1987).
3) Medidas de las crías abortadas en el Zoológico de Rosario.

comparar sus medidas y pesos con un ejemplar muerto al día de vida en el Chaco, Argentina y otro nacido en Krefeld, Alemania (ver Tabla 1) y considerando que en este caso se trataba de mellizos, se dedujo que les debería haber faltado un mes de gestación aproximadamente.

Conclusión

Como se ha comprobado a los tamanduás llegados de la naturaleza les cuesta mucho adaptarse a la situación de cautiverio. Esto se debe, fundamentalmente a su alta especialización en cuanto a la dieta natural y a las condiciones de encierro que se les ofrece (Meritt, 1976; Cuaron, 1987). A pesar de ello, es posible adaptarlos con mucha paciencia y dedicación.

Existen tantas dietas como instituciones que han albergado a la especie. Nosotros hemos tenido éxito con una, pero no por eso diremos que es la mejor. En cuanto al manejo reproductivo sucede algo similar. A nosotros nos llevó tres años lograr una preñez, mientras que por ejemplo en el Lincoln Park Zoo tuvieron éxito al quinto año de haber constituido la pareja (Sanmarco, 1987). El único caso de mellizos registrado en la bibliografía para tamanduá es el del Lincoln Park Zoo, en febrero de 1982, dónde una de las crías murió y la otra tuvo que ser criada artificialmente (Sanmarco, 1985). Sin embargo en Curitiba, Brasil, el 18 de octubre de 1993 se encontró a una de las hembras de *T. tetradactyla* con un cachorro y al día siguiente fue hallado otro bebé en estado de autólisis en el recinto, del que no se pudo determinar la causa de muerte (W. de Moraes, *in litt.*).

Comentario

Desgraciadamente *Junior* murió 3 meses después del aborto, por una bronconeumonía fulminante.

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Dieta de Tamanduá-Bandeira *(Myrmecophaga tridactyla)* no Pantanal da Nhecolândia, Brasil

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Abstract
We collected data on the diet of seven giant anteaters from the Pantanal wetland, state of Mato Grosso do Sul, from April to October, 2001. The anteaters foraged on ants during the entire study period, while termites were eaten only in June. We collected 42 samples of ants and eight samples of termites at nests attacked by foraging anteaters. We registered only two species of termites in their diet (*Nasutitermes coxipoensis* and *Armitermes* sp.). Nine species of ants were identified: *Solenopsis interrupta* and *Solenopsis saevissima* (which occurred in 36% of the nests attacked), *Camponotus crassus* (7%), *Solenopsis pusillignis* (5%), *Camponotus renggeri* (5%), *Solenopsis invicta* (5%), *Ectatomma planidens* (2%), *Labidus spininodis* (2%) and *Odontomachus minutus* (2%).

Introdução
O tamanduá-bandeira, *Myrmecophaga tridactyla* Linnaeus, 1758, possui adaptações anatômicas, comportamentais e fisiológicas voltadas à alimentação constituída de formigas e cupins. Apresenta crânio alongado, língua longa e protátil, e glândulas salivares desenvolvidas, cuja secreção auxilia na atividade alimentar. As garras dianteiras são bastante desenvolvidas, sendo usualmente utilizadas na abertura de formigueiros e cupinzeiros, além de poderem servir como defesa (Nowak e Paradiso, 1983; Rossoni *et al.*, 1981).

A espécie ocorre desde o sul de Belize até o norte da Argentina e sul do Brasil (Wetzel, 1985), numa ampla variedade de tipos de hábitat de baixa altitude, principalmente em áreas com altas densidades de formigueiros e cupinzeiros (Eisenberg, 1989).

A extensa ocupação humana nos mais variados tipos de hábitat, implicando em prováveis alterações nas comunidades de térmitas e formigas (Drumond, 1994), atropelamentos de fauna silvestre (Fischer, 1997), a caça predatória (Leeuwenberg, 1997) e incêndios florestais (Silveira *et al.*, 1999) são fatores que contribuem para a diminuição da densidade das populações de tamanduá-bandeira e seu desaparecimento de certas regiões inclusas na sua área de distribuição original. A espécie é classificada como vulnerável pela IUCN (Hilton-Taylor, 2003) e está na Lista das Espécies da Fauna Brasileira Ameaçadas de Extinção (Brasil, IBAMA, 2003).

Apesar desta espécie ter relevância em termos de conservação há poucos estudos feitos sobre sua dieta (Montgomery, 1985; Redford, 1985, 1986; Shaw *et al.*, 1985; Drumond, 1992). Este foi o primeiro estudo sobre a dieta do tamanduá-bandeira no Pantanal, e teve como objetivo principal listar as espécies de formigas e cupins utilizadas como alimento pelo tamanduá-bandeira na área estudada.

Material e Métodos
O Pantanal é uma planície sedimentar de origem relativamente recente, com área de aproximadamente 140.000 km^2, em território brasileiro. Grande parte da área fica alagada durante o transbordamento do Rio Paraguai, ficando livres da inundação apenas as áreas mais elevadas, poucos metros acima do nível médio da água (Adámoli, 1982). O Pantanal pode ser dividido, conforme Hamilton *et al.* (1996), em dez sub-regiões, cada uma apresentando diferentes características hidrológicas e fitofisionômicas (Figura 1).

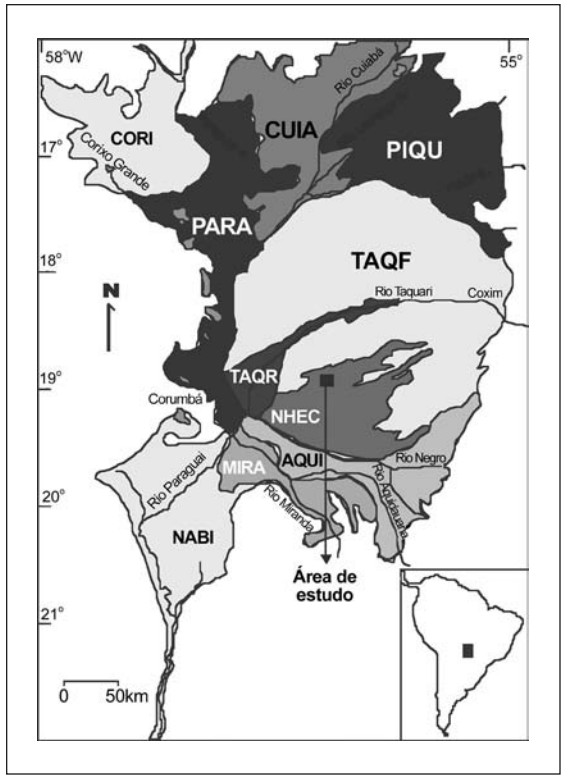

FIGURA 1. Mapa de localização da área de estudo no Pantanal da Nhecolândia (MS) e demais sub-regiões, segundo Hamilton *et al.* (1996): **CORI** = Corixo Grande, **CUIA** = Cuiabá, **PIQU** = Piquiri/São Lourenço, **PARA** = Paraguai, **TAQR** = Rio Taquari, **TAQF** = Leque do Taquari, **AQUI** = Aquidauana e Negro, **MIRA** = Miranda, **NABI** = Nabileque e **NHEC** = Nhecolândia.

Este projeto de pesquisa foi desenvolvido no Pantanal da Nhecolândia, uma região de inundação média, a cerca de 160 km a leste de Corumbá, Mato Grosso do Sul. A área de estudo incluiu partes das Fazendas Nhumirim e Porto Alegre, totalizando 104 km^2, localizados no retângulo entre 19°00'31"S e 56°38'54"W.

A Fazenda Nhumirim (43 km^2) é de propriedade da Empresa Brasileira de Pesquisa Agropecuária (Embrapa) – Pantanal, e sua vegetação é caracterizada por manchas de floresta semidecídua ou "cordilheiras", manchas de cerrado, cerradão e vegetação arbustiva esparsa, além de um grande número de lagoas permanentes ou temporárias e campos sazonalmente inundáveis (Alho *et al.*, 1987). A Fazenda Porto Alegre faz divisa a leste com a Nhumirim e apresenta vegetação semelhante. Em ambos os locais, há poucos cupinzeiros, e estes geralmente são encontrados nos campos de capim "carona" (*Elyonurus muticus*), conhecidos como "caronal", onde quase não há alagamento. Os formigueiros ocorrem dentro e fora dos fragmentos de mata e geralmente estão presentes em grande quantidade em áreas de pastagens próximas das bordas de lagoas.

Nosso estudo ocorreu entre abril e outubro de 2001. Coletamos amostras nos locais de forrageamento de sete tamanduás-bandeira, e equipamos quatro destes com rádio-transmissores na cintura escapular. As informações sobre a área de vida e uso de hábitat do tamanduá-bandeira são disponíveis em Medri (2002) e Mourão e Medri (2002). Neste estudo, a freqüência dos rádio-transmissores variou de 164.064 à 164.163 MHz, e os tamanduás-bandeira aparelhados foram identificados pelos últimos quatro números da respectiva freqüência de seu transmissor.

Quando encontramos tamanduás-bandeira, com ou sem rádio-transmissor, em atividade de forrageamento, registramos a temperatura ambiente e acompanhamos os animais tanto quanto possível. Coletamos e conservamos em álcool 70% os itens alimentares nos locais exatos onde os tamanduás-bandeira haviam forrageado. Posteriormente as amostras de formigas e cupins foram enviadas a especialistas para a identificação das espécies.

Resultados

Observamos atividades de forrageamento de quatro tamanduás-bandeira com rádio-transmissor e de três indivíduos não aparelhados, entre abril e outubro de 2001. Acompanhamos apenas um evento de alimentação para cada indivíduo não aparelhado, entretanto para os tamanduás-bandeira com rádio-transmissor registramos mais de um evento de alimentação, sendo 19 amostras de itens alimentares coletadas para o tamanduá-bandeira 4064, 14 para o 4083, 10 para o 4103 e 4 para o 4143. A maioria das atividades de forrageamento de formigas ocorreu nos campos em bordas de lagoas (39%) e nas

áreas de pastagens (35%), onde havia grande concentração de formigueiros, embora algumas vezes tenha havido forrageamento no campo de caronal (13%), no campo cerrado (9%) e dentro da floresta (4%). Todas as atividades de forrageamento de cupins ocorreram no campo de caronal, onde os cupinzeiros são encontrados em maior quantidade.

As amostras dos itens alimentares dos tamanduás-bandeira foram coletadas em todos os meses, de abril a outubro de 2001, com exceção do mês de julho. Os tamanduás-bandeira se alimentaram de cupins apenas no mês de junho. Coletamos amostras de oito cupinzeiros forrageados por três indivíduos com rádio-transmissor. Em sete casos, a espécie forrageada foi *Nasutitermes coxipoensis* e em apenas um caso *Armitermes* sp. (Tabela 1).

TABELA 1. Espécies de cupins forrageadas por tamanduás-bandeira aparelhados com rádio-transmissor, em oito termiteiros localizados no campo de "caronal" *(Elyonurus muticus)*, Pantanal da Nhecolândia, Mato Grosso do Sul, junho de 2001. Os tamanduás-bandeira foram identificados pelos últimos quatro números da freqüência de seus respectivos rádio-transmissores.

Data (2001)	Hora	Temp.ºC	Indivíduo	Espécie de cupim
19.06	16:08	12,4	4083	*Nasutitermes coxipoensis*
20.06	10:01	22,2	4083	*Armitermes* sp.
20.06	14:56	22,1	4103	*Nasutitermes coxipoensis*
20.06	14:59	22,1	4103	*Nasutitermes coxipoensis*
21.06	11:09	26,2	4103	*Nasutitermes coxipoensis*
22.06	14:56	20,2	4143	*Nasutitermes coxipoensis*
22.06	15:00	20,2	4143	*Nasutitermes coxipoensis*
22.06	15:07	20,2	4143	*Nasutitermes coxipoensis*

Coletamos 42 amostras de formigueiros, provenientes do forrageamento dos quatro tamanduás-bandeira aparelhados e dos três sem aparelho (Tabela 2). Ao todo foram nove espécies de formigas consumidas, distribuídas conforme as seguintes freqüências relativas: *Solenopsis interrupta* (36%), *Solenopsis saevissima* (36%), *Solenopsis pusillignis* (5%), *Camponotus crassus* (7%), *Camponotus renggeri* (5%), *Solenopsis invicta* (5%), *Ectatomma planidens* (2%), *Labidus spininodis* (2%) e *Odontomachus minutus* (2%).

Discussão

Os tamanduás-bandeira observados no Pantanal da Nhecolândia, Mato Grosso do Sul, consumiram proporção muito maior de formigas (81%) que de cupins (19%) e só obtivemos amostras de cupins no mês de junho, enquanto que as de formigas foram coletadas em todos os meses em que investigamos a dieta.

Estudos sobre a dieta de tamanduá-bandeira feitos em cativeiro reportam que a espécie prefere cupins a formigas (Carvalho e Kloss, 1951; Carvalho, 1966). Entretanto, os poucos estudos sobre dieta de tamanduá-bandeira em ambiente natural têm apresentado diferenças quanto à predominância de formigas ou cupins. Tais discrepâncias podem ser devido às diferentes disponibilidades de presas conforme a área (Drumond, 1992; Redford, 1986), incluindo a dificuldade diferenciada do tamanduá-bandeira em encontrar formigas ou cupins durante suas atividades de forrageamento, à sazonalidade (Drumond 1992, Montgomery 1985) e/ou aos diferentes protocolos de estudo.

A disponibilidade de presas pode variar geografica e sazonalmente. Por exemplo, Shaw *et al.* (1985), trabalhando no Parque Nacional da Serra da Canastra (MG), encontraram predominância de formigas (88%) em relação aos térmitas (12%) nos meses de fevereiro e março de 1978. Por outro lado, Drumond (1992), trabalhando de março a outubro de 1990, no mesmo local, registrou 55% de térmitas e 45% de formigas, sendo que os térmitas contribuíram com maior porcentagem nos meses de abril, agosto e outubro e as formigas foram mais representativas nos meses de março, julho e setembro de 1990. Entretanto os dados de Drumond (1992) referentes apenas ao mês de março apontaram maior percentual de formigas (82%) na dieta dos tamanduás-bandeira. Drumond (1992) sugere que devido à curta duração, o estudo de Shaw *et al*. (1985) foi influenciado pela sazonalidade, o que explica em grande parte as diferenças encontradas para ambos os registros. Redford (1985) estudou a dieta do tamanduá-bandeira no Parque Nacional das Emas (GO) e também encontrou maior proporção de térmitas (89%) em relação a

TABELA 2. Espécies de formigas forrageadas por tamanduás-bandeira em 42 formigueiros no Pantanal da Nhecolândia, MS, de abril a outubro de 2001. Os tamanduás-bandeira aparelhados foram identificados pelos últimos quatro números da freqüência de seus respectivos rádio-transmissores.

Data (2001)	Hora	Temp. ºC	Local de encontro do formigueiro	Indivíduo	Espécie de formiga
25.04	14:37	24	Borda de lagoa, sob arbusto guelra-de-dourado[1]	4064	*Solenopsis saevissima*
30.04	19:32	18,4	Borda de lagoa, na base de capim rabo-de-burro[2]	4064	*Odontomachus minutus*
01.05	16:18	29,9	Pasto	4103	*S. saevissima*
08.05	17:34	23,4	Borda de lagoa, na base de capim rabo-de-burro[2]	4064	*Solenopsis interrupta*
09.05	16:42	28,2	Pasto, sob fezes secas de gado	4064	*S. saevissima*
09.05	17:36	23,8	Borda de lagoa, sob arbusto assa-peixe[3]	4103	*S. saevissima*
09.05	17:39	23,8	Borda de lagoa, sob arbusto assa-peixe[3]	4103	*S. saevissima*
18.05	16:48	26,2	Borda de lagoa	NA*	*S. interrupta*
21.05	16:03	33,1	Borda de lagoa	4064	*S. saevissima*
13.06	15:34	33	Pasto, sob fezes secas de gado	4103	*S. saevissima*
13.06	15:38	33	Pasto, na base de capim rabo-de-burro[2]	4103	*Camponotus crassus*
13.06	18:10	24,3	Pasto, sob fezes secas de gado	4064	*S. saevissima*
18.06	14:37	14,6	Borda de lagoa	4083	*S. interrupta*
18.06	14:48	14,6	Borda de lagoa	4083	*S. interrupta*
19.06	15:08	13,4	Campo de "Caronal"[4]	4083	*S. saevissima*
19.06	15:14	13,4	Campo de "Caronal"[4]	4083	*S. interrupta*
19.06	16:12	12,8	Campo de "Caronal"[4]	4083	*S. interrupta*
19.06	16:16	13,1	Campo de "Caronal"[4]	4083	*Solenopsis pusillignis*
19.06	16:32	12,8	Mata, entre a base de uma árvore e gravatá[5]	4083	*S. saevissima*
19.06	16:41	12,4	Pasto	4083	*S. interrupta*
19.06	16:53	12	Pasto	4083	*S. interrupta*
20.06	10:08	22,2	Pasto	4083	*S. interrupta*
20.06	16:06	18	Borda de lagoa	4083	*S. saevissima*
20.06	17:56	10,3	Borda de lagoa	4083	*S. interrupta*
21.06	11:12	26,2	Campo de "Caronal"[4]	4103	*S. saevissima*
21.06	11:18	26,2	Campo de "Caronal"[4], sob fezes secas de gado	4103	*S. interrupta*
21.06	16:23	17	Pasto, sob fezes secas de gado	4064	*S. saevissima*
21.06	16:41	17	Borda de lagoa, na base de capim mimoso	4064	*S. pusillignis*
21.06	16:46	17	Borda de lagoa, na base de capim mimoso	4064	*S. interrupta*
21.06	16:48	17	Borda de lagoa, na base de capim mimoso	4064	*Solenopsis invicta*
21.06	16:49	17	Borda de lagoa, na base de capim mimoso	4064	*S. invicta*
21.06	17:01	17	Borda de lagoa, na base de capim mimoso	4064	*S. interrupta*
14.08	14:56	36,8	Caule de canjiqueira[6]	4064	*Camponotus renggeri*
14.08	16:40	33,3	Capim sobre lagoa seca	NA*	*Labidus spininodis*
15.08	17:01	24	Borda de lagoa	NA*	*S. saevissima*
28.08	16:28	22,4	Campo cerrado	4064	*Ectatomma planidens*
04.09	06:20	22,7	Pasto, sob fezes secas de gado	4064	*S. interrupta*
04.09	06:35	22,7	Pasto, sob fezes secas de gado	4064	*S. saevissima*
21.09	07:42	32,9	Base de acuri[7]	4143	*C. renggeri*
02.10	09:20	22,9	Campo de "Caronal"[4]	4064	*C. crassus*
02.10	09:27	22,9	Campo de "Caronal"[4]	4064	*C. crassus*
03.10	14:32	38	Pasto	4064	*S. interrupta*

***NA** = tamanduás-bandeira não aparelhados.

[1] = *Senna* sp., [2] = *Andropogon* spp., [3] = *Vernonia ferruginea*, [4] = *Elyonurus muticus,* [5] = *Bromelia balansae,* [6] = *Byrsonima* sp., [7] = *Scheelea phalerata.*

formigas (11%). Tanto o estudo de Drumond (1992) quanto o de Redford (1985) foram realizados na época seca, o que poderia explicar a maior proporção de térmitas em ambos.

Os resultados que obtivemos no Pantanal foram semelhantes aos de Montgomery e Lubin (1977) e Montgomery (1985), os quais encontraram mais de 85% de formigas compondo a dieta dos tamanduás-bandeira. O Pantanal da Nhecolândia, com solo altamente arenoso e sujeito a inundações, assemelha-se mais aos Llanos venezuelanos do que à Serra da Canastra, que apresenta escoamento rápido da chuva e está pouco sujeita a inundações. A inundação pode ser um fator que altera a disponibilidade de recursos para os tamanduás-bandeira, e Montgomery (1985) sugere sazonalidade no consumo de cupins por tamanduá-bandeira, com um aumento na proporção da dieta formada por térmitas quando os Llanos estão alagados, apresentando diminuição da disponibilidade de formigas do gênero *Camponotus*. O nosso período de estudo abrangeu predominantemente a estação seca, mas é possível que a proporção de cupins na dieta do tamanduá-bandeira também aumentasse durante a cheia do Pantanal.

A despeito das diferenças observadas nas freqüências relativas de formigas e cupins, houve semelhanças na composição da dieta dos tamanduás-bandeira do Pantanal da Nhecolândia e da Serra da Canastra, com ocorrência de forrageamento dos gêneros de térmitas *Nasutitermes* e *Armitermes* e dos gêneros de formigas *Camponotus*, *Ectatomma* e *Solenopsis* nos dois locais (Drumond, 1992; este estudo).

Alternativas para estudos futuros seriam associar a composição da dieta do tamanduá-bandeira no Pantanal com a disponibilidade de presas em diferentes épocas do ano e as relações desta variação com o tamanho da área de vida e o uso do hábitat.

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Datos Morfométricos de los Armadillos del Complejo Ecológico Municipal de Sáenz Peña, Provincia del Chaco, Argentina

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Introducción

La región del Gran Chaco comprende un millón de kilómetros cuadrados de Argentina, Bolivia, Brasil y Paraguay. Su paisaje incluye un mosaico de praderas, sabanas, montes abiertos, bosques xéricos espinosos y bosques en galería. El Chaco argentino está habitado por una amplia diversidad de edentados: *Priodontes maximus, Chaetophractus vellerosus*, *Chaetophractus villosus*, *Tolypeutes matacus*, *Dasypus novemcinctus*, *Dasypus septemcinctus, Dasypus hybridus, Cabassous chacoensis*, *Euphractus sexcinctus*, *Chlamyphorus retusus, Chlamyphorus truncatus, Myrmecophaga tridactyla* y *Tamandua tetradactyla* (Mares *et al*., 1989; Emmons y Feer, 1990; Redford y Eisenberg, 1992; Zuleta y Bolkovic, 1994; Bertonatti y Corcuera, 2000).

Si bien existen importantes y conspicuas diferencias morfológicas intergenéricas, en algunos casos las diferencias intragenéricas son difíciles de reconocer. Por ejemplo, *Dasypus hybridus, Dasypus novemcinctus* y *Dasypus septemcinctus* poseen una gran similitud en las características morfológicas; si bien *D. septemcinctus*, suele ser más pequeña y con un número menor de bandas móviles (Mares *et al*., 1989). Las cuatro especies del género *Cabassous* también son poco diferenciadas morfológicamente, excepto en el tamaño (Wetzel, 1980).

En algunos casos las similitudes morfológicas sumadas al exceso de nombres comunes, causados por un inadecuado material comparativo, han resultado en problemas taxonómicos, ocasionando la pérdida de unanimidad en la identificación de los tipo-especies de los géneros (Wetzel, 1980). Así, por ejemplo, se ha postulado la existencia de una cuarta especie de *Dasypus*: *D. mazzai* (Vizcaíno, 1994) basada en la posesión de características intermedias entre las otras tres existentes (*D. novemcinctus, D. septemcinctus* y *D. hybridus*). Si bien la evidencia no es concluyente, los autores resaltan la individualidad específica de las mulitas de los bosques del noroeste argentino con respecto a las especies previamente conocidas.

Una detallada caracterización sistemática de los edentados del Gran Chaco es imperativa para desarrollar adecuadas estrategias para su conservación. Si bien dicha caracterización requerirá del estudio de poblaciones silvestres, muchas especies son notoriamente difíciles de investigar en el campo (Fonseca, 2001). Por lo tanto, resultará necesario acompañar dichos trabajos con proyectos de investigación que aprovechen los individuos de edentados en cautiverio. Para ello es fundamental contar con una adecuada representatividad de individuos de diferentes especies en instalaciones apropiadas.

El Complejo Ecológico Municipal de Sáenz Peña (Provincia de Chaco, Argentina) posee una de las representaciones de edentados más diversas y abundantes del mundo, incluyendo los únicos dos ejemplares en cautiverio de *Priodontes maximus.* Es una de las instituciones más activas en la conservación *ex situ* de edentados habiendo logrado regularmente la reproducción de *Myrmecophaga tridactyla*, *Tamandua tetradactyla*, *Euphractus sexcinctus* y *Chaetophractus villosus.* Con el objetivo de continuar expandiendo su programa de investigaciones *ex situ*, se examinaron todos los armadillos de la colección procediendo a su sexado y medición.

Métodos

Se capturó a los individuos manualmente por la tarde, cuando los animales ya estaban en

actividad. No fue posible realizar todas las mediciones en todos los individuos capturados ya que, al no utilizarse anestesia, algunos individuos intentaban escapar. Se obtuvieron las siguientes medidas: longitud total, longitud de la cola, longitud de la pata posterior y longitud de la oreja. La longitud total se midió desde la punta del hocico hasta el extremo distal de la cola; la longitud de la cola, desde la base de inserción en el cuerpo hasta la punta; la longitud de la pata posterior desde el talón hasta el extremo distal de la uña más larga, y la oreja, desde la escotadura hasta el extremo del pabellón (Mares *et al.*, 1989). Los individuos de la especie *T. matacus* se cierran sobre su caparazón al ser capturados. Dado que es virtualmente imposible lograr la extensión de los individuos, las mediciones fueron tomadas con el animal en su típica postura de defensa. Por lo tanto, el largo total para esta especie refleja la circunferencia del individuo cuando se haya en esa posición. Cuando fue posible, los individuos fueron sexados.

Resultados

Se midieron 32 armadillos de las siguientes especies: *Chaetophractus vellerosus* (4 individuos), *Chaetophractus villosus* (6, incluyendo una cría de dos o tres días de vida), *Tolypeutes matacus* (9), *Dasypus novemcinctus* (6), *Cabassous chacoensis* (1), *Euphractus sexcinctus* (4), y *Priodontes maximus* (2) (Tabla 1).

Discusión

La información obtenida es sólo un paso inicial en un programa de conservación *ex situ* de edentados que deberá contemplar, entre otros aspectos, el marcado permanente de los individuos, su caracterización genética y el posterior manejo de la población utilizando la información genética disponible, la aplicación de medicina preventiva a través de controles periódicos de los ejemplares, el estudio de la conducta reproductiva y la preparación de protocolos de cuidados neonatales.

Cualquier programa de conservación *ex situ*, debe tener como objetivo primordial asegurar la continuidad de poblaciones silvestres. Durante el mes de julio de 2002 se realizó un relevamiento preliminar de edentados en la región húmeda del Chaco en la Provincia de Formosa y actualmente se está realizando un relevamiento de cuevas de *P. maximus* en el Chaco seco formoseño. Esperamos que dichos trabajos generen en el curso

TABLA 1. Datos morfométricos de los armadillos del CEMSP (**LT** = largo total, **C** = cola, **PT** = pata trasera, **O** = oreja, **S** = sexo, **M** = macho, **H** = hembra). Las mediciones están expresadas en mm.

Especie	LT	C	PT	O	S
Cabassous chacoensis	733	335	55	40	M
Chaetophractus vellerosus	367	105	50	28	H
Chaetophractus vellerosus	383	100	40	30	M
Chaetophractus vellerosus	390	105	45	30	M
Chaetophractus vellerosus	405	110	45	30	H
Chaetophractus villosus[1]	182	52	-	-	M
Chaetophractus villosus	437	112	50	30	H
Chaetophractus villosus	440	130	60	25	H
Chaetophractus villosus	454	156	-	25	-
Chaetophractus villosus	455	115	60	30	-
Chaetophractus villosus	515	150	70	28	M
Dasypus novemcinctus	-	195	-	-	H
Dasypus novemcinctus	365	80	-	10	-
Dasypus novemcinctus	662	312	50	-	H
Dasypus novemcinctus	685	315	58	45	H
Dasypus novemcinctus	735	335	60	40	H
Dasypus novemcinctus	740	300	62	45	M
Euphractus sexcinctus	-	230	85	40	M
Euphractus sexcinctus	638	180	75	35	H
Euphractus sexcinctus	655	230	80	43	M
Euphractus sexcinctus	690	220	90	42	H
Priodontes maximus	1470	480	190	45	H
Priodontes maximus	1520	500	200	60	M
Tolypeutes matacus	455	60	-	25	M
Tolypeutes matacus	465	65	-	25	M
Tolypeutes matacus	470	63	-	30	M
Tolypeutes matacus	470	70	-	28	M
Tolypeutes matacus	470	70	-	-	-
Tolypeutes matacus	478	68	-	30	M
Tolypeutes matacus	480	70	-	30	M
Tolypeutes matacus	485	70	-	30	H
Tolypeutes matacus	505	75	-	30	M

[1] Cría de no más de tres días de vida.

de los próximos años información necesaria para evaluar el estado poblacional de varias especies de edentados, así como el grado de diversidad existente en la región. De poder lograr nuestros objetivos, en los próximos años habremos dando un paso importante en lo referente al orden Xenarthra y su conservación *in situ* y *ex situ* en el Gran Chaco argentino.

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Fitting Radio Transmitters to Giant Anteaters *(Myrmecophaga tridactyla)*

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Methods to remotely monitor free-ranging animals have become more frequent in studies on wildlife ecology and behavior. The methodology

of attaching a transmitter to an animal varies from collars to a surgically-placed transmitter under the skin of the animal. Regular collars cannot be used with some xenarthran species such as armadillos and anteaters, for lack of space between the head and the carapace in armadillos, or because the neck is thicker than the head, as in the anteaters.

There are few studies reporting the attachment of transmitters in anteater species. Montgomery and Lubin (1977) and Montgomery (1985) radiotracked individuals of the four recognized living species of anteaters, using adhesive tape to attach the transmitters to the tails. However, the transmitters remained on the animals for a short period of time (between 30 and 75 days, depending on the species), required periodic repair, and caused necrosis of the tissue under the transmitter during the rainy season (Montgomery, 1985). An additional disadvantage of this method is related to the possibility that giant anteater females may use the male's tail as an indicator of the male's health; therefore the gap on the tail caused by the adhesive tape could relay a false message of sickness. Sunquist and Montgomery (1973) attached a small transmitter (7 g) to the fur of a silky anteater with clear silicone seal. This method can be used only in short studies, because the transmitter falls off with the hair.

Shaw *et al*. (1987) used harnesses made with cotton web to fix radio transmitters to giant anteaters. They were able to monitor the anteaters for seven months, but three out of twelve marked animals removed their harnesses. Two of them were recaptured and the transmitters were fitted with a braided nylon cord tied to the fur at the animal's flanks. Leather adjustable harnesses (manufactured for use in dogs) also were used to attach transmitters on collared anteaters (Rodrigues *et al*., 2001). Although the harnesses were adapted successfully to collared anteaters, only two out of eight individuals could be monitored for a satisfactory period of time (six and nine months, respectively). The other animals lost their transmitters between one and two months, mainly because their resting behavior in armadillos' burrows, tree hollows and rock rifts created heavy friction, arrest and breakage of the harness fasteners. Mourão and Medri (2002) tested the use of an inexpensive, large-scale assembled GPS radiocollar to monitor free-ranging giant anteaters in the Pantanal over short time intervals.

Here, we describe our experience of fitting radio transmitters on giant anteaters. The studies took place at Emas National Park (18°15'S, 52°53'W), Cerrado region of central Brazil, and at Nhumirim Ranch (18°59'S, 56°39'W), Pantanal region of western Brazil.

At Emas National Park we used harnesses by Telonics Inc., using techniques from captive individuals at the Brasília Zoo. The harnesses were made of nylon and had five pieces: one strap with a circumference of 56 cm around the neck, one strap with a circumference of 86 cm around the thorax, one strap of 31.5 cm linking both straps, where the transmitter was attached, and two straps of 31 cm (one at each side of the animal), to provide better stability of the harnesses (avoiding movements of the harnesses due to the transmitter's weight). The transmitters were positioned above the animal, and the flexible antenna on the back of the transmitter was inclined about 45 degrees (Fig. 1).

Fifteen giant anteaters were captured and equipped with these harnesses. The monitoring period, sex and age of each anteater and

FIGURE 1. Giant anteater equipped with harness at Emas National Park, Brazil.

TABLE 1. Period of monitoring and evaluation of the transmitter attachment methods at Emas National Park and Nhumirim Ranch.

No.	Sex	Capture date	Last location	Recaptures	Equipment evaluation
ENP 1	M	07/25/2001	09/19/2001	-	Signal lost, not evaluated
ENP 2	M	07/27/2001	01/29/2003	01/29/2003	Antenna broken, harness intact
ENP 3	M	07/28/2001	08/15/2002	08/15/2002	Antenna and one lateral strap broken
ENP 4	M	08/28/2001	01/27/2003	01/27/2003	Antenna and harness intact
ENP 5	M	08/28/2001	01/28/2002	-	Signal lost, not evaluated
ENP 6	M	08/29/2001	08/22/2002	-	Signal lost, not evaluated
ENP 7	F	08/29/2001	10/21/2002	08/11/2002	Antenna and harness intact; signal lost in October 2002
ENP 8	F	08/29/2001	05/08/2002	01/22/2002	Antenna and harness intact; signal lost in May 2002
ENP 9	F	08/30/2001	10/25/2001	-	Signal lost, not evaluated
ENP 10	M	08/31/2001	01/29/2003	01/28/2003	Antenna broken, harness intact
ENP 11	M	08/31/2001	08/05/2002	01/23/2002	Antenna broken, harness intact
ENP 12	M	08/31/2001	05/10/2002	08/16/2002	Antenna broken, harness intact
ENP 13	M	09/01/2001	01/22/2002	01/22/2002	Antenna broken, harness intact
ENP 16	F	08/14/2002	01/27/2003	01/27/2003 *	Antenna and one lateral strap broken
ENP 20	F	08/19/2002	01/28/2003	01/28/2003	Antenna and harness intact
Nhu 1	F	03/17/2001	03/19/2001	-	Signal lost, not evaluated
Nhu 2	M	03/29/2001	12/05/2001	09/20/2001, 10/03/2001 and 12/05/2001	Collar intact
Nhu 3	F	03/31/2001	12/14/2001	12/05/2001 and 12/14/2001	Collar intact
Nhu 4	M	04/04/2001	09/04/2001	-	Collar intact
Nhu 5	M	04/23/2001	10/03/2001	10/03/2001	Collar intact
Nhu 6	M	04/25/2001	12/04/2001	12/04/2001	Collar intact
Nhu 7	M	09/20/2001	12/14/2001	-	Collar intact

* Visual contact; not captured.

the evaluation of the harnesses' efficiency are summarized in Table 1. Ten of the captured giant anteaters were recaptured and both the animals and the harnesses were examined for injuries and damages. One of the anteaters not recaptured (ENP 16) was seen after the transmitter failed (in February 2003), and therefore an evaluation of the animal and harness condition could also be made. We could not evaluate the efficiency of four harnesses, because the transmitters failed after two to fifteen months from the first capture, probably due to antenna breakage. After two to twenty months of monitoring, none of the anteaters lost their harness, and they showed no no sign of injury. The lateral straps of two harnesses were broken after six and twelve months, respectively. Some antennas broke, and this component was the most fragile point of the system.

At Nhumirim Ranch, we used standard collars, made of leather, but attached to the anteater's thorax (scapular waist), with the transmitter positioned below the animal (Fig. 2). We captured and equipped seven giant anteaters, and the monitoring period varied from two to 259 days (Table 1). Except for the individual Nhu 1, all anteaters were seen periodically and we were able to evaluate the condition of the collar. One giant anteater had wounds on the back, close to the collar, which could have been caused by irritation from the collar. This individual was seen one week before and did not show signs of any injury. Another giant anteater was found dead two weeks after its last telemetry location, but it was not possible to determine the cause due to the advanced state of decay. There was no evidence of injuries caused by the collar to the anteater that could have lead to its death.

FIGURE 2. Giant anteater equipped with collar at Nhumirim Ranch, Brazil.

Both the harnesses and the collar attached to the thorax were effective methods to fix transmitters on giant anteaters. The damage to the animal was minimal and the anteaters could be monitored for a relatively long time. The harness has the advantage of allowing better signal transmission due to the location of the transmitter on the back of the anteater. The harness also could be adjusted more comfortably to the animal. The collar needs to be adjusted much more firmly to avoid rotation and for positioning the transmitter in the ventral region, and was not accurate for monitoring fast-growing juveniles or pregnant females. The external antennas of the harness were not very effective and the internal antenna (built into the collar) produced better results. Therefore, the combination of harness and internal antennas seems to be the best method to fit radio-transmitters on giant anteaters.

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Observations of Xenarthra in the Brazilian Cerrado and Guyana

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Emas National Park
We placed 45 CamTrakker™ (CamTrak South, Watkinsville, GA, USA) automatic camera phototraps in Emas National Park (18°19'S, 52°45'W) in the Brazilian cerrado from 28 November - 21 December, 2002 to begin a camera-trapping monitoring program. Located in the southwestern region of the State of Goiás, south-central Brazil, the park entrance is a 1½-hour drive south from the town of Mineiros. Emas National Park's 131,000 ha protects a unique landscape consisting largely of savannah, woodland/savannah, and dry forest ecosystems. The cerrado occupies the central Brazil plateau, and the cerrado flora is considered the richest of all tropical savannah regions, with very high levels of endemism.

Of the family Myrmecophagidae, we observed giant anteaters (*Myrmecophaga tridactyla*) on several occasions and the camera phototraps captured several on film, including one carrying a young. On a private ranch just south of the park, in a wooded area along a river, we observed a juvenile tamandua (*Tamandua tetradactyla*) crossing the road and then scaling a nearby tree at our approach. Our camera traps photographed an adult.

In the family Dasypodidae, we observed six-banded armadillos (*Euphractus sexcinctus*) twice while driving along dirt roads in the park. The camera phototraps photographed the giant armadillo (*Priodontes maximus*), tracks of which we often observed on dirt roads within the park. Also photographed by the camera phototraps were a six-banded armadillo (*E. sexcinctus*), naked-tailed armadillo (*Cabassous tatouay*) and nine-banded armadillo (*Dasypus novemcinctus*).

Guyana (J. Sanderson)
As part of the Rapid Assessment Program (RAP) of the Center for Applied Biodiversity Science at Conservation International, a RAP Training Course was held at Mabura Hill Township, West Pibiri Creek, Guyana at the Tropenbos Ecological Station (5°00'40.9"N, 58°36'50.0"W) from 4-18 September, 2001. Located in the interior of central Guyana, West Pibiri Creek was previously an active logging concession operated by Demerara Timbers Limited (DTL) for the selective extraction of valuable hardwoods such as greenheart. The area is described as a riverine floodplain forest (evergreen rain forest) on alluvial soils. This forest is often strongly dominated by Mora (*Mora excelsa*, though with abundance of Crabwood, *Carapa guianensis*), Trysil (*Pentaclethra macroloba*) and Sarebebe (*Macrolobium bifolium*). The population of the Mabura Hill Township is estimated to be about 700, primarily employees of DTL. The research staff of the Tropenbos-Guyana Programme (TGP) living there make up only 3% of the population.

While walking along a former logging road, I observed a tamandua (*Tamandua tetradactyla*) approximately 8 m from the ground walking along branches.

I participated in a RAP study from 21-29 September, 2001 at the beginning of the dry season at Pobuwau Creek (3°16'03.1"N, 58°46'42.7"W) located on the Kwitaro River (a tributary of the Rewa River, which in turn runs into the Rupununi, an affluent of the Essequibo), in Region 9 in southern Guyana and at Cacique Mountain (3°11'29.5"N, 58°48'42.0"W) six miles southwest of Pobuwau Creek. Both sites were approximately 130 m elevation and vegetation was lowland, seasonally inundated, evergreen tropical forest. The river was at high water but dropping rapidly, and fell approximately 1.5 m during our brief visit. I deployed 12 CamTrakker camera phototraps in our study area.

On one occasion a camera phototrap caught a giant armadillo (*Priodontes maximus*) at its burrow. Subsequently, tracks were found near the burrow when the camera was retrieved.

Acknowledgements: We wish to thank the government of Brazil for permission to work in Emas National Park.

Automatic CamTrakker™ phototrap photos by James Sanderson and Leandro Silveira

Giant anteater *(Myrmecophaga tridactyla)* carrying a young, Emas National Park, Brazil.

Giant anteater *(Myrmecophaga tridactyla)*, Emas National Park, Brazil.

Giant anteater *(Myrmecophaga tridactyla)*, Emas National Park, Brazil.

Giant anteater *(Myrmecophaga tridactyla)*, Emas National Park, Brazil.

Giant anteater *(Myrmecophaga tridactyla)*, Emas National Park, Brazil.

Giant anteater *(Myrmecophaga tridactyla)*, Emas National Park, Brazil.

Nine-banded armadillo *(Dasypus novemcinctus),* Emas National Park, Brazil.

Giant armadillo *(Priodontes maximus),* Emas National Park, Brazil.

Six-banded armadillo *(E. sexcinctus),* Emas National Park, Brazil.

Giant armadillo *(Priodontes maximus),* Emas National Park, Brazil.

Six-banded armadillo *(E. sexcinctus),* Emas National Park, Brazil.

Giant armadillo *(Priodontes maximus),* Emas National Park, Brazil.

Tamandua *(Tamandua tetradactyla),* Emas National Park, Brazil.

Naked-tailed armadillo *(Cabassous tatouay),* Emas National Park, Brazil.

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Diurnal Rest Sites of Translocated Lesser Anteaters *(Tamandua tetradactyla)* in the Cerrado of Brazil

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The lesser anteater *Tamandua tetradactyla* (L. 1758) inhabits South America from the eastern side of the Andes to northern Argentina and Uruguay, occupying both open and forested areas. Most of the information on this species' ecology and behavior refers to its diet and foraging behavior (Lubin *et al*., 1977; Montgomery and Lubin, 1977; Lubin and Montgomery, 1981; Montgomery, 1985a, 1985b), and little is known about other aspects of their biology (Montgomery, 1985b; Rodrigues *et al*., 2001).

We studied eight lesser anteaters captured by the Fauna Rescue Operation at the hydroelectric reservoir of Serra da Mesa, Minaçu, Goiás, Brazil (13º49'49"S, 48º19'18"W) (Rodrigues *et al*., 2001), formed by the Rios Bagagem, Tocantinzinho and Maranhão, first-order tributaries of the Rio Tocantins. The vegetation of the region is typical of the Cerrado, a Neotropical savanna (Eiten, 1972). The lake was full in late 1998, flooding an area of 178,000 ha in seven municipalities. The animals were translocated to areas along the border of the reservoir and tracked by radio telemetry. The radios were attached to harnesses, which were firmly fitted to the anteater, in such a way as not to interfere with the animals' movements.

The measurements from some of the captured animals are presented in Table 1. There are few data on lesser anteater measurements, and published information is based on few individuals. The measurements of the Serra da Mesa anteaters are, in general, smaller than those reported by other authors (Wetzel, 1985; Eisenberg and Redford, 1999; Emmons and Feer, 1997), but within recorded variation.

After being released, the animals were located as often as possible, during the day, by following the signal until reaching the animal and the diurnal rest site was noted. Lesser anteaters are cited in the literature as passing their inactive hours in tree cavities or burrows in the ground, made by other animals (Emmons and Feer, 1997; Redford and Eisenberg, 1992). Montgomery (1985b) found that lesser anteaters rest as much in trees as they do on the ground, but also recorded

TABLE 1. Biometric data of lesser anteaters, *Tamandua tetradactyla*, in the Serra da Mesa region, Goiás, Brazil.

Date	Sex and Number	Total length (cm)	Tail (cm)	Ear (cm)	Hind foot (cm)	Head (cm)	Weight (g)
08-19-97	F2	105.0	48.2	5.0	8.9	16.0	4,630
10-24-97	F4	84.0	37.2	4.2	7.5	12.0	2,540
10-24-97	M2	93.0	41.5	4.9	8.6	14.0	4,015
11-20-97	F5	94.5	40.0	4.2	9.0	13.3	3,665
01-28-98	M3	98.8	41.5	4.5	9.5	13.5	5,740

that individuals were captured mainly in palms (*Copernicia tectorum*) and other trees, when they were sleeping. We found a lesser anteater active during the day only once. Every time we found inactive anteaters (n = 19), they were on the ground, generally in armadillo (*Euphractus sexcinctus*) burrows (n = 17), 35.3% of which were in termite mounds, 17.6% in ant nests and the rest (47%) simply on the ground. One shelter was in a cavity in the ground, between rocks, and once an anteater was found sleeping close to a termite mound, unsheltered. In two termite mound shelters, there were signs that the anteater had enlarged the burrow. One anteater was found in the same burrow for three consecutive days, apparently not having left it during this period.

The burrows used by anteaters were 20.4 ± 4.1 cm in height and 18.7 ± 1.9 cm wide (n = 6). On the six occasions we found anteaters sheltered in armadillo burrows on termite mounds, they were partially exposed and easily visible to predators, but when they were sheltered in holes in the ground or in ant nests, they were more difficult to detect. Armadillos make holes at the base of termite nests, to feed and shelter. Feeding holes are superficial, more common and easier to find. Anteaters were protected more against predators in deep holes than in superficial ones, and the high frequency they were found in burrows on termite mounds can be related to the higher availability of feeding holes of armadillos. Due to the lack of large trees and hollow logs in the Cerrado, armadillos can play an important role in the refuge ecology of many vertebrates in this biome, supplying shelters for lesser anteaters and other animals. The over-hunting of armadillos, which seemingly occurs in most of the Cerrado, may have some influence over shelter availability for anteater populations as well as for other vertebrates.

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The Yellow Armadillo, *Euphractus sexcinctus*, in the North/Northeastern Brazilian Coast

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The distribution of the yellow armadillo (*Euphractus sexcinctus*) was recently enlarged to include the state of Maranhão in northern Brazil (Silva-Júnior *et al*., 2001). This species occupies distinct biomes in South America, such as the Caatinga, Cerrado, Pantanal, Chaco, Atlantic Forest and, at least, the open savannas of the Amazon (Silva-Júnior and Nunes, 2001). The yellow armadillo habitat ranges from grasslands to forest borders (Silva-Júnior *et al*., 2001; Olmos, 1995; Redford and Wetzel, 1985; Wetzel, 1985; Brooks, 1985; Emmons and Feer, 1997), but there is no consistent information on the use of tall forest and coastal areas (Silva-Júnior *et al*., 2001). Here we describe records of *E. sexcinctus* in coastal areas of the state of Maranhão.

In April 1994, a female yellow armadillo was captured by fishermen at Cajual Island (02°26'S, 44°03'W), on the western coast of Maranhão, swimming in the sea, about 50 m from the coast. Cajual Island is about 6,000 ha and only 500 m from the coastline. The vegetation is composed mainly of mangroves, but restingas (scrub on coastal sand soils) and mud patches are also present. The yellow armadillo is quite omnivorous, eating insects and plant matter (Redford, 1985) as well as small rodents (Bezerra *et al*., 2001). This broad diet makes possible its occupation of a wide range of habitats, and it is plausible that *E. sexcinctus* feeds on crabs at Cajual Island, an abundant resource there. Although we have no data on habitat use by the armadillos on the island, they probably mostly occupy the restinga habitat, because of the lack of vegetation on the mud patches where the armadillo would be very exposed. Mangroves are the dominant vegetation, and are flooded daily (the tidal range reaches 7 m, the largest in Brazil) and this habitat is not available for burrows and refuge, although it may be used to forage. Its swimming ability makes it possible for the yellow armadillo to colonize islands near the coast, and for dispersal between the various populations. This was the first record of the species at Cajual Island, and it is possible that this individual was even an initial colonizer.

Caju Island is off the eastern coast of Maranhão (02°47'S, 42°05'W) and is one of 80 islands in the Parnaíba Delta, the largest of the Americas. This 100-km^2 island is a private resort. It has a broad range of habitats, with mangroves (35%),

grasslands (20%), salt marshes (10%), sand dunes (12%), savanna (Cerrado) and dry open forest (Cerradão) with cacti from the Caatinga of North-east Brazil (23%) (T. Oliveira, pers. obs.). There, the yellow armadillo is the most frequently seen mammalian species. Although no consistent survey has been carried out to determine its habitat use, to date the large majority of observations have been in restinga and grassland, but they have also been seen in forest near the mangrove. They are highly active during the day: most observations were made during the day, even during the hottest hours. This could be a consequence of the fact that the yellow armadillo has no predators on Caju Island, as the ocelot (*Leopardus pardalis*) has been extirpated, and the largest predators currently found, the crab-eating fox (*Cerdocyon thous*) and raccoon (*Procyon cancrivorus*), pose no threat to the species.

Due to their omnivorous diet, yellow armadillos on Caju Island may also eat the abundant crabs (for example, *Uca* spp. and *Goniopsis cruentata*), besides tubers and occasionally garbage from the lodge. If so, its habitat range, at least for feeding purposes, would also include salt marshes and mangroves. Although no surveys have been conducted on the other nearby islands, it is very likely that yellow armadillos are also present there, as some of them are larger and closer to the coast than Caju Island.

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Reproducción de *Dasypus novemcinctus* en el Izozog, Santa Cruz, Bolivia

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Resumen

Se investigó la biología reproductiva de *Dasypus novemcinctus* en el Izozog, provincia Cordillera, del Departamento de Santa Cruz, mediante análisis de fetos colectados desde el año 1997 hasta 1999 y datos de cacería de l996 hasta 1999, donde los cazadores habían anotado las hembras en estado reproductivo (preñadas o lactando). De las medidas biométricas tomadas a los fetos, se observó que la medida de la pata trasera, la oreja y el peso estuvieron muy relacionados con la edad. Así mismo el análisis de sexos demostró que existe un porcentaje mayor de machos (59,1%) que de hembras (40,9%). Los resultados demostraron que *D. novemcinctus* presenta estacionalidad en partos, concentrados en los meses de octubre,

noviembre y diciembre. Se estima que tiene una sola camada al año. Nacen cuatro crías todos del mismo sexo. Los datos de cacería demostraron infravaloración en la proporción de hembras preñadas lo que produjo una subestimación en la proporción de hembras reproductivas y por consiguiente de la productividad reproductiva anual de la especie (1,04 cría/hembra/año). Los datos de la productividad reproductiva de una especie favorita en la caza de subsistencia son importantes en la elaboración de planes de manejo, porque junto a la densidad se podrá estimar la producción por km^2 de esta especie en el Izozog.

Abstract
The reproductive biology of *Dasypus novemcinctus* was studied in the Izozog, Cordillera Province, Santa Cruz Department, involving an analysis of fetuses and hunting data to estimate fetal age and seasonality of reproduction. The biometric measurements of the fetus which correlated best with age were the hindfoot length, ear length, and weight. There is a higher percentage of males (59.1%) than females (40.9%). Births of *D. novemcinctus* are highly seasonal in the Izozog, concentrated in October, November and December. It was estimated that they have just one litter per year. Four same-sex offspring are born. The self-monitoring data from local hunters underestimated the proportion of pregnant and reproductive females. The data presented here, therefore, underestimate annual reproductive productivity (1.04 offspring/female/year). The reproductive rate of a heavily hunted species, when combined with density data, is critical for the elaboration of management plans, allowing for the estimation of production per km^2, and for the evaluation of the sustainability of the hunting offtake.

Introducción
La disminución de algunas poblaciones de animales silvestres en el Chaco Boliviano viene preocupando a los pobladores izoceños porque dependen de ellos para su subsistencia. Más aún, con el crecimiento poblacional requiere de una mayor cantidad de animales silvestres para su alimentación. El tatu mula (*Dasypus novemcinctus*) es una especie de este grupo que se destaca como uno de los mamíferos más importantes en términos de individuos cazados con fines de subsistencia en el Izozog (Cuéllar, 1999).

Para asegurar su uso sostenible se requiere una estimación de parámetros reproductivos, como la evaluación de la productividad reproductiva que cobra particular importancia al ser una de las características más importantes que afecta la habilidad de una especie para soportar la presión de caza. Esto determina cuan rápido los animales cazados pueden ser remplazados por nuevos individuos en la población y cuan bien la población puede soportar la continua remoción de individuos (Emmons, 1999; Robinson y Redford, 1997).

Este artículo presenta una estimación de la productividad reproductiva de *Dasypus novemcinctus* basados en el estudio de fetos y el análisis de los datos de cacería, siendo de gran importancia para el pueblo izoceño, pues ayudará a identificar las potencialidades y limitaciones de los recursos naturales de la zona y recomendar alternativas tanto para la protección de estos recursos como para su uso sostenible por las poblaciones locales.

Área de Estudio
El Izozog se encuentra en la provincia Cordillera, Departamento de Santa Cruz. Se ubica entre las coordenadas geográficas 19°43'21"S y 62°48'61"O. Biogeográficamente se ubica en la Región Chaqueña, Provincia del Chaco Boreal sector del Izozog. La vegetación dominante se define como bosque chaqueño de llanura con un dosel entre los 3 y 8 metros de altura (Navarro, 1997). La precipitación media anual es de 550 mm, con una estación seca de 6 a 8 meses. Las lluvias se concentran entre los meses de octubre a marzo. La temperatura media anual está entre los 22° C y 26° C (Montes de Oca, 1997).

Métodología
Se evaluaron datos de cacería y se analizaron 176 fetos (44 camadas) de *Dasypus novemcinctus*

colectados por los cazadores como parte del programa de automonitoreo de cacería en el Izozog desde 1997 hasta 1999. El análisis de los fetos incluyó la determinación del sexo por la presencia del pene en los machos y la vulva en las hembras.

Para conocer el grado de desarrollo fetal en términos de días de la edad prenatal de *Dasypus novemcinctus* se utilizó la técnica desarrollada por Smith y Sowls (1975), que involucra observaciones de las características físicas del feto y la toma de medidas biométricas. Las medidas registradas fueron seis: largo total, largo del cuerpo, frente-anca, pata trasera, cola oreja y peso. Smith y Sowls (1975) presentan una tabla de edades fetales para chanchos (*Tayassu tajacu*) con sus respectivas medidas biométricas; a partir de ésta y sabiendo que el desarrollo embrionario del tatú es similar a lo observado en otros mamíferos (Talmage y Buchanan, 1954) se creó una tabla matriz de edades fetales para *D. novemcinctus*. Aplicando la regla de tres con las medidas de los chanchos en diferentes estadíos de desarrollo, las medidas de un feto de chancho a término y las medidas de un feto de tatú mula a término como constantes conocidas y las medidas de tatú mula en diferentes estadíos de desarrollo como variable (Anexo 1).

De las medidas biológicas tomadas a los fetos se eligió las de la pata trasera, oreja y peso para la determinación de la edad fetal, por ser las más fáciles de medir y que permiten obtener un resultado confiable respecto a la edad del feto (Larson y Taber, 1987; Smith y Sowls, 1975). Mediante el método de interpolación se relacionaron estos datos con los de la tabla matriz para obtener la edad del feto. Luego se obtuvo un promedio de los tres datos (edad según medida de la pata, oreja y peso) para obtener los días de gestación de cada muestra, los cuales fueron restados a la fecha de colecta para estimar la fecha de implantación del cigoto y restarle tres a cuatro meses de diapausa embriónica (McBee y Baker, 1982; Talmage y Buchanan, 1954) para lograr un estimado de las fechas de apareamiento.

Con las fechas de capturas obtenidas de las etiquetas que acompañan a los fetos, la información de los días de gestación estimados para cada muestra y sabiendo que el tatú mula tiene un tiempo de gestación de 120 días (Nowak, 1991; Ceballos y Galindo, 1984; Contreras, 1984) se pudo estimar las fechas probables de los nacimientos (Fig. 2).

Los datos reportados por los cazadores informaron sobre la ocurrencia de hembras preñadas y en lactancia a lo largo de todo el año (Fig. 3). Se multiplicó el tamaño de la camada, el número de gestaciones por año y la proporción de hembras reproductivas al año para estimar la productividad reproductiva anual por hembra (crías/hembra/año, Tabla 2) y la productividad reproductiva por individuo de toda la población, multiplicando la productividad reproductiva de la hembra por el porcentaje de hembras reproductivas, crías/individuos/año (Townsend, 1996).

Resultados

Se encontró cuatro fetos por camada, todos del mismo sexo. En las 44 camadas se observó mayor proporción de machos 26:18 (M: H), con un porcentaje de 59,1% machos y 40,9% hembras, pero esta proporción no es significativamente diferente de 1:1 (Prueba binomial p = 0.2280, Ayres *et al.*, 1998). Esta relación se mantiene en los animales adultos cazados en el Izozog (608 M y 449 H) de manera que la proporción de sexos entre fetos y animales adultos mostró ser no significativa (p = 0.8365).

De las seis medidas tomadas a los fetos, dos fueron utilizadas para la determinación de la edad fetal, la pata trasera y la oreja. El largo total, del cuerpo y la medida frente-anca no fueron útiles porque la medición no era muy exacta, pues los fetos siempre están doblados y al estirarlos el margen de error es mayor. La longitud de la cola no fue usada por que varias muestras de los fetos no la tenían completa y en otros casos se rompía al manipularla en el proceso de medición. La pata trasera y la oreja fueron las más fáciles de medir por lo que las medidas resultaron ser más exactas. Estas junto al peso arrojaron resultados más confiables de medidas fetales, lo que permitió relacio-

TABLA 1. Medidas biométricas y peso (mm y g) de las diferentes edades fetales estimadas para *Dasypus novemcinctus*, elegidas como representativas encontradas en este estudio.

Días	Pata trasera (mm)	Oreja (mm)	Peso (g)
120	27	20	64
90	20	14	36
70	13	9	16
50	7	2	2

narlos más directamente con los días de gestación de los fetos, originando una tabla de edades para fetos de *Dasypus novemcinctus* con sus respectivas medidas (Tabla 1).

La presencia de fetos indicó que las hembras están preñadas entre los meses de agosto a diciembre (Fig. 1). No se encontraron fetos entre los meses de enero a julio, considerándose este un periodo de apareamiento, reposo embriónico y posterior implantación del embrión característico de esta especie (Talmage y Buchanan, 1954). Las hembras del tatú mula en el Izozog mostraron estacionalidad en partos, estimándose las fechas de nacimientos para los meses de octubre, noviembre, diciembre y uno solo para enero (Fig. 2), lo cual indica que *D. novemcinctus* tiene una sola camada al año.

Relacionando los datos de cacería registrados por los cazadores sobre hembras preñadas y en lactancia (Fig. 3), con las fechas probables de nacimientos de los fetos (Fig. 2), se observó, una disminución en el número de hembras preñadas a partir de octubre (27 individuos) a 10 en noviembre, cuatro en diciembre y cero en enero y un aumento del número de hembras en lactancia de dos en octubre, una en noviembre, ocho en diciembre y cuatro en enero, luego de iniciar los nacimientos. Quizás el aumento del número de hembras en lactancia no sea muy marcado y no esté de acuerdo al número de nacimientos por que en esta etapa las hembras salen poco o si salen no se alejan mucho de sus cuevas por cuidar a sus crías recién nacidas, esto hace que los cazadores no las encuentren.

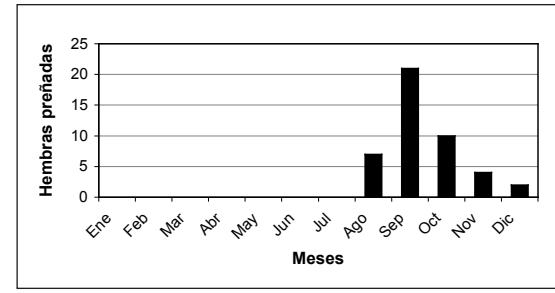

FIGURA 1. Distribución mensual de las hembras preñadas, de *Dasypus novemcinctus* (n = 44) según la colecta de fetos en el Izozog.

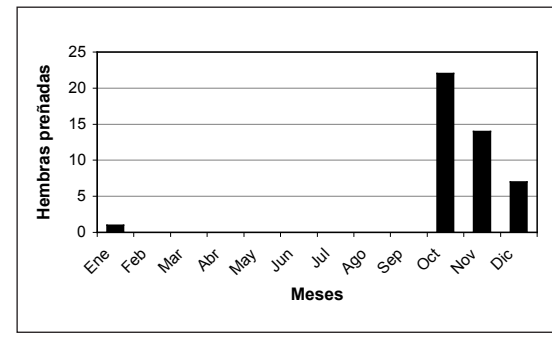

FIGURA 2. Fechas probables de nacimientos estimadas de *Dasypus novemcinctus* en el Izozog (n = 44).

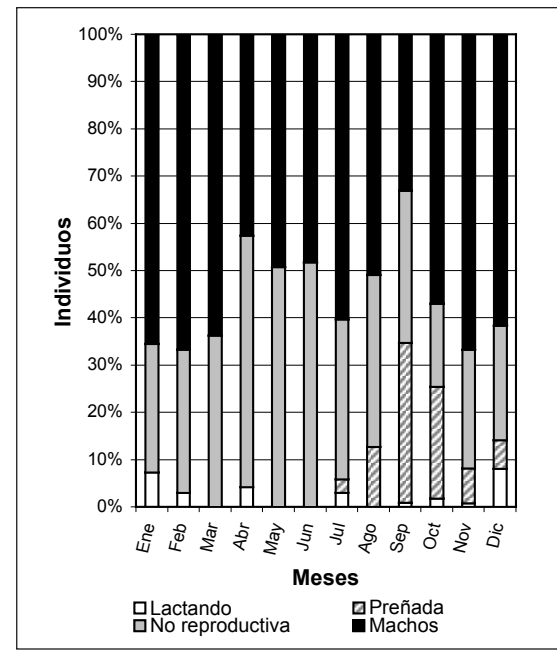

FIGURA 3. Estimación de la distribución mensual de las hembras de *Dasypus novemcinctus* cazadas en el Izozog (n = 449) indicando el estado reproductivo, preñada o lactando (n = 120) y no reproductivo (n = 329). Además incluye el total de machos (n = 608), lo que hace un total de 1057 tatuses cazados en el Izozog. Los porcentajes presentados en esta figura están basados en datos de cacería (reportado por los cazadores).

El 26,7% de las hembras de tatú mula cazadas se encontraban reproductivamente activas en el año (de 449 hembras cazadas había 120 hembras reproductivas). Los meses de septiembre y octubre presentaron los porcentajes reproductivos más altos, con 51% y 59% de hembras en estado de reproducción respectivamente (Fig. 3).

Tomando en cuenta la diapausa embriónica (Talmage y Buchanan, 1954; Hamlet, 1932) el ciclo reproductivo del tatú mula en el Izozog probablemente sigue el siguiente orden: el apareamiento ocurre en verano (febrero-marzo), seguido de la diapausa embriónica en otoño (abril-mayo-junio), posteriormente ocurre la implantación del embrión en invierno (junio-julio-agosto), terminando con los nacimientos en primavera (octubre-noviembre-diciembre) para concluir el ciclo con la posterior lactancia (octubre a febrero). La productividad reproductiva mínima estimada fue de 1,04 crías/hembra/año y 0,42 crías/individuo/año (Tabla 2).

Discusiones

La coincidencia de las tasas del sexo en estado fetal y los adultos cazados sugiere que los cazadores cazan de acuerdo a la disponibilidad y que la proporción de sexos en fetos y adultos se mantiene, sin que los machos sean más vulnerables que las hembras a la cacería, y sin que discriminen el sexo del animal que va a ser cazado. Esto coincide con lo observado por Townsend (1996) en la zona de Ibiato, donde menciona que de un total de 192 fetos de *Dasypus novemcinctus* 60% eran machos y 40% hembras. Esta situación indicaría que quizás en la población de esta especie siempre hay más machos que hembras, sin embargo, en los adultos cazados Townsend (1996), reportó una diferencia leve a favor de los machos, 396 (54%) versus 339 (46%) de hembras.

Se observó que un feto a término (120 días) presenta una medida frente-anca de 125 mm, similares a los resultados que encontró Enders (1966) en Norteamérica, donde indica que un feto terminal tiene como medida frente-anca = 120-130 mm, lo que demuestra que la toma de medidas biométricas como método para la determinación de la edad fetal es confiable. La relación cercana de las medidas pata trasera, oreja y peso con los días de gestación fue también mencionada por Smith y Sowls (1975) en su publicación sobre desarrollo fetal en pecaríes, donde menciona que dichas medidas son las mas fáciles de medir y tienen mayor relación con la edad.

La época de parto estimada para los meses de octubre, noviembre y diciembre al final de la época seca y al inicio de la etapa húmeda es corroborada por Guinart (1998) en la Chiquitanía que presenta un bosque tropical seco. Quizás en esta época los recursos alimenticios son más abundantes y la mayor temperatura le es favorable, ya que esta especie es muy limitada por el frío (Eisenberg y Redford, 1999), además, la vegetación es más densa y le da cobertura y protección.

Tomando en cuenta la diapausa embriónica, las estaciones del año en que se desarrolla el ciclo reproductivo del tatú mula en el Izozog es similar a lo observado en otros estudios de Norteamérica (Enders, 1966; Storrs *et al*., 1989; Talmage y Buchanan, 1954; McBee y Baker, 1982; Nowak, 1991).

El bajo porcentaje anual de hembras reproductivas reportadas por los cazadores se atribuye

TABLA 2. Estimación de la productividad reproductiva de *D. novemcinctus* en el Izozog.

	Hembras cazadas	Hembras reproductivas	Proporción de hembras reproductivas	Productividad reproductiva por hembra	Productividad reproductiva por indivíduo de la población
Anual reproductivo	449	120	0,26	1,04	0,42
Mes máximo reproductivo	49	29	0,59	2,36	0,96

a que esta especie después del apareamiento tiene una diapausa embriónica de tres a cuatro meses donde el embrión no se desarrolla aún (Talmage y Buchanan, 1954; McBee y Baker, 1982). Aunque la hembra ya está fecundada, los cazadores no lo observan a menos que se realice un estudio en el laboratorio de los órganos reproductores. Además, los cazadores subestiman el número de hembras preñadas en los primeros meses después de la implantación, debido a que confunden a los fetos con las vísceras, ya que estos son muy pequeños y sus características no están bien definidas. Por consiguiente reportan a estas hembras como no preñadas, lo que disminuye el porcentaje estimado de hembras reproductivas al año. El elevado porcentaje reproductivo para los meses de septiembre y octubre se debe a que en estos meses la mayoría de los fetos han alcanzado su máximo desarrollo, están a punto de nacer y es muy difícil que los cazadores se confundan en su observación.

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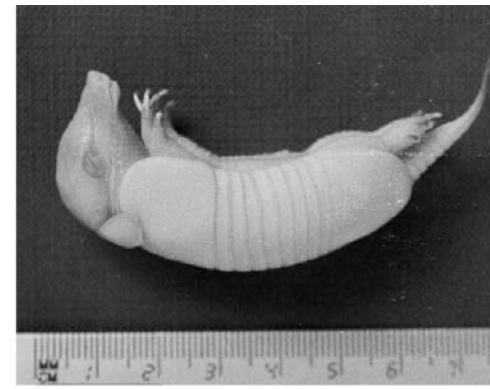
a. Feto de 50 días



b. Feto de 70 días

c. Feto de 90 días

d. Feto de 120 días

Anexo 1. Detalle del desarrollo de las características y medidas de los embriones de *Dasypus novemcinctus.* De acuerdo a su edad se observó las siguientes características físicas a los fetos:

Fetos de 50 días

- De aspecto gelatinoso, con una armadura que no se diferencia mucho del vientre.
- Las orejas pequeñas se encuentran bien separadas una de otra y son redondeadas.
- Las patas presentan dedos que se pueden distinguir.
- Genitales visibles pero muy difícil de diferenciar el sexo.

Fetos de 70 días

- La armadura se empieza a formar y se diferencia del vientre.
- Orejas pequeñas y algo puntiagudas separadas dispuestas hacia la parte inferior del cuello.
- Las fosas nasales y los ojos están cerrados.
- Los dedos de las patas bien distinguibles, observándose presencia de uñas blandas.
- Los genitales se diferencian todavía con dificultad.

Fetos de 90 días

- Las orejas y la cabeza empiezan a presentar una coloración oscura.
- Las orejas más grandes se encuentran juntas y dispuestas verticalmente hacia la espalda.
- Las fosas nasales están abiertas, y los ojos entreabiertos.
- Los genitales se pueden diferenciar fácilmente.
- Las uñas comienzan a endurecer.

Fetos de 120 días

- Presentan pigmentación oscura característica de un feto a término.

- Los párpados pueden ser abiertos y cerrados sin dificultad con la mano.
- Las orejas grandes presentan una coloración más oscura y están dispuestas en la nuca como en individuos adultos, unidas en la base.
- Se encuentran completamente formados y son verdaderas réplicas de los adultos.

NEWS

Biology and Maintenance of Armadillos (Dasypodidae)

A doctoral thesis which reviewed the biology, maintenance and current status of armadillos kept in captivity was defended by Mariella Superina in June 2000 at the Institut Für Zoo-, Heim- und Wildtiere, University of Zürich, Switzerland. Her research advisor was Prof. Dr. Ewald Isenbügel, with codirector Prof. Dr. Rico Thun. Her research was supported in part by a Reisestipendium (a grant for scientific studies in a foreign country) from the Schweizer Akademie für Naturwissenschaften in Zürich, Switzerland in October 1999. It permitted a one-month stay at the Universidad Nacional del Sur in Bahía Blanca, Argentina, which enabled her to participate in field studies and learn the handling of armadillos.

The introduction is based on the literature, conversations with scientists and personal observations. It discusses the evolution, taxonomy and biology of the 21 known species of armadillos, as well as different aspects of their care and maintenance in captivity, and contains information on adequate and appropriate housing, nutrition and their reproduction. Comments on their handling and on suitable blood-sampling techniques, hematological parameters and a compilation of the most common diseases and their therapies should help zoo veterinarians in the husbandry and management of armadillos.

This first section is followed by the results of a survey made in European and North, Central, and South American zoological gardens that keep armadillos. The zoos were asked for information about housing, nutrition, reproduction and ethology as well as the diagnosed pathologies and causes of death of their armadillos. The analysis of this survey demonstrated that there are serious problems in the care and maintenance of armadillos, which affect their reproduction and health and create stereotypic behavior, such as pacing or constant digging. Because of poor data, we were unable to pinpoint the factors responsible for the lack of reproductive success and the onset of stereotypic behavior, although possible reasons for the appearance of this behavior in 50% of the zoos surveyed are discussed. Some recommendations are made for behavioral enrichment, improvement of enclosures, better nutrition and ideas for presentation to the visitor, in order to increase the attractiveness of armadillo exhibits. A comparison of the conditions in which armadillos are usually kept in zoos on different continents with Swiss legislation and the guidelines of the Swiss Society for the Protection of Animals clearly shows that it is unacceptable to keep armadillos in current conditions. The animals are held in exhibits that are too small and have little enrichment, are fed inappropriately and suffer from pathologies related to poor maintenance in captivity. Of the zoos surveyed, only a few have breeding programs, and they are rarely successful. Keeping armadillos in captivity is only justifiable if efforts are made to improve their living conditions and to meet the dietary needs of each species. Field studies and further research on captive armadillos are recommended in order to reach this goal.

Dr. Superina is currently working on the translation of her doctoral thesis into English, which she plans to have completed and published soon.

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Giant Anteater *(Myrmecophaga tridactyla)* Beehive Foraging at Emas National Park, Brazil

The largest species of anteater in the world, *Myrmecophaga tridactyla*, is widely dispersed throughout Central and South America, living in varied habitats, including forests and open grassland. The Emas National Park (ENP), about 133,000 ha and mostly savanna, is one of the most important reserves of the Cerrado, and is located in the southwest of the state of Goiás, bordering the states of Mato Grosso and Mato Grosso do Sul.

In the late afternoon of 1 February, 2003, we were following two giant anteaters to capture one of them to attach a radio-transmitter (the other was already equipped) in a grassland area of the ENP. Following the capture and near the capture site, we observed and photographed marks produced by an anteater's claws, alongside a nearly circular burrow (20 cm diameter) in a termite mound about 1.5 m high. Inside this burrow, were found bees, honey, beehive wall, and the remains of a recently destroyed small *Apis mellifera* colony.

We found a bee in the fur of the captured anteater and a small swarm hovered around it, suggesting that this animal may have attacked the beehive to eat the insects and/or the honey or other items. Anteaters have rarely been recorded attacking bees' nests (Cabrera and Yepes, 1940). Bee products are rich in nutrients and the association of a beehive with the termite mound, commonly foraged by anteaters, could facilitate the encounter, resulting in the consumption of bees and their products. In spite of similar problems associated with ants and termites (low nutritional value of the prey, small prey size and forms of defense relying on the sociality of the prey) (Redford and Dorea, 1984), bees may be a suitable food source for giant anteaters (Redford, 1986).

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Official List of Brazilian Fauna Threatened with Extinction – 2002

A workshop, involving about 200 Brazilian and international specialists, was held from 9-12 December, 2002, in Belo Horizonte, Minas Gerais, to revise the Official List of Brazilian Fauna Threatened with Extinction (*Lista Oficial da Fauna Brasileira Ameaçada de Extinção*). The previous revision was in 1989 (Edict 1.522, 19th December, 1989; Bernardes *et al*., 1990). The workshop was coordinated by the Fundação Biodiversitas, in collaboration with the local NGO Terra Brasilis, Conservation International do Brasil (CI do Brasil), and the Sociedade Brasileira de Zoologia (SBZ), and was held at the specific request of the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA) of the Ministry of the Environment (MMA). Sponsorship was provided by the Programa de Biodiversidade (PROBIO) of the Ministry of the Environment (MMA), Shell do Brasil, Grupo Odebrecht, and Conservation International do Brasil. It was also supported by the US Fish and Wildlife Service and Avina.

Demonstrating the importance given to this workshop as a major evaluation of the status of the nation's fauna by the scientific community, the opening ceremony was attended by the Minister of the Environment of Brazil, José Carlos Carvalho; the Minas Gerais State Secretary for the Environment, Celso Castilho; the President of Biodiversitas, Roberto Messias Franco; the President of IBAMA, Rômulo José Fernandes Barreto Melo; the President of SBZ, Olaf Mielke; the Director President of CI do Brasil, Roberto Brandão Cavalcanti; and the Director of Terra Brasilis, Sônia Rigueira.

The list of threatened species tripled from 218 in the 1989 revision to 630, with two extinct in the wild (still maintained in captivity) and a further 10 extinct. The increase in numbers was due to the inclusion of new groups (fish and many invertebrate groups) which had not been assessed previously (only some insects, including Odonata, and Onycophora and Cnidaria were assessed in 1989), but also to an increase in our knowledge of the status of the country's fauna. Eight edentates were assessed, and four were listed as threatened, of which two are endemic to Brazil (*Bradypus torquatus* and *Tolypeutes tricinctus*). The criteria used to evaluate threatened status were those of the IUCN – World Conservation Union Species Survival Commission (SSC), Version 3.1 (IUCN, 2001), with adaptations to a regional scale as proposed by Gärdenfors *et al*. (2001) and approved by the SSC.

Adriano Chiarello (Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte) was the coordinator for the Mammal Group. Gustavo A. B. da Fonseca (Center for Applied Biodiversity Science at Conservation International and Universidade Federal de Minas Gerais, Belo Horizonte) and Adriano Chiarello were joint coordinators of the Edentate Sub-group. Prior to the workshop, information and the opinions of numerous mammalogists and conservationists were solicited through a site on the internet specifically set up for the purpose by the Fundação Biodiversitas. To give an idea of the extent to which the scientific and conservation community were consulted, we give here some statistics. Fifty-two people replied to the consultation for Brazilian mammals, providing a total of 392 "contributions" in terms of pertinent information on a particular species (Table 1). Dividing them into six groups, it can be seen that the Primates and Carnivora attracted the most attention, with 103 contributions from 15 people for

TABLE 1. The number of people who provided information for the assessment of the threatened status of Brazilian mammals in the pre-workshop consultation, and the number of contributions regarding a particular species.

Sub-group	Informants	Contributions
Primates	15	103
Carnivora	21	93
Chiroptera	6	33
Aquatic mammals	8	42
Small mammals	13	42
Other mammals	22	79

the former, and 93 contributions from 21 people for the latter. Fifteen people provided useful input (37 contributions) regarding the status of the Brazilian edentates.

Threatened Edentates

Following the criteria and categories of IUCN (2001), the assessments for eight species of Brazilian edentates resulted in the listing of four as threatened and four as "Data Deficient" (Table 2). The threatened species were ranked as "Vulnerable". Two of them have a wide geographic distribution, the giant armadillo (*Priodontes maximus*) and the giant anteater (*Myrmecophaga tridactyla*). Although widely distributed, these species seem to be rare everywhere, a fact related to their large body size and specialized diet (social insects). The other two threatened edentates have much smaller ranges: the northern three-banded armadillo, or tatu bola (*Tolypeutes tricinctus*), which is restricted to the Caatinga (a xerophytic desert scrub and deciduous forest) of northeastern Brazil and adjacent parts of the Cerrado; and the maned sloth (*Bradypus torquatus*), which occurs in the Atlantic forest in the states of Bahia, Espírito Santo and Rio de Janeiro.

Ascertaining the conservation status of most Brazilian edentates was a rather difficult task given the overwhelming lack of basic population and ecological data for most species, even for the largest and most conspicuous. This limitation is

TABLE 2. Edentates on the Official List of Brazilian Fauna Threatened with Extinction, their category and the criteria of threat (following IUCN, 2001), and their distributions in terms of countries, states, and biome. Workshop: Revisão da Lista Oficial da Fauna Brasileira Ameaçada de Extinção, December 2002.

Species and subspecies	Common name	Distribution	States	Biome				Criteria (IUCN, 2001)
Vulnerable (VU)				**MA**	**AM**	**CE**	**CA**	
Bradypus torquatus	Maned sloth	Brazil	SE, BA, ES, MG, RJ	x				A2cd
Myrmecophaga tridactyla	Giant ant-eater	South and Central America	AC, AM, BA, DF, GO, MG, MT, PI, RO, RS, SC, AP, MA, MS, PA, PR, RR, SP, TO	x	x	x	x	A2cd
Tolypeutes tricinctus	Three-banded armadillo	Brazil	BA, GO, PI, AL, RN			x	x	A2cd
Priodontes maximus	Giant armadillo	South America	AC, AM, BA, DF, GO, MG, MT, PI, RO, AP, ES, MS, PA, RR, TO	x	x			A2cd
Data Deficient (DD)								
Tolypeutes matacus	Southern three-banded armadillo	Bolivia, Paraguay, Argentina, Brazil	MT			x		Data Deficient
Cabassous tatouay	Greater naked-tailed armadillo	Brazil, Uruguay, Paraguay, Argentina	PI, PA, MT, MS, GO, ES, RJ, PR, SP	x		x		Data Deficient
Cabassous chacoensis	Chacoan naked-tailed armadillo	Brazil, Bolivia, Paraguay, Argentina	MT, MS			x		Data Deficient
Dasypus hybridus	Southern lesser long-nosed armadillo	Brazil, Paraguay, Argentina	RS	x				Data Deficient

States: **AC** = Acre, **AL** = Alagoas, **AM** = Amazonas, **AP** = Amapá, **BA** = Bahia, **DF** = Federal District, **ES** = Espírito Santo, **GO** = Goiás, **MA** = Maranhão, **MG** = Minas Gerais, **MS** = Mato Grosso do Sul, **MT** = Mato Grosso, **PA** = Pará, **PI** = Piauí, **PR** = Paraná, **RJ** = Rio de Janeiro, **RN** = Rio Grande do Norte, **RO** = Rondônia, **RR** = Roraima, **RS** = Rio Grande do Sul, **SC** = Santa Catarina, **SE** = Sergipe, **SP** = São Paulo, **TO** = Tocantins. *Biomes:* **MA** = Mata Atlântica, **AM** = Amazônia, **CE** = Cerrado, **CA** = Caatinga.

most severe for armadillos, which are notoriously difficult to observe and study in the wild. Almost nothing, for example, is known of the naked-tailed species of the genus *Cabassous*. Two species of this genus were listed as data deficient (*C. tatouay* and *C. chacoensis*) as a result. In general terms the most prominent threat to xenarthrans in Brazil is habitat destruction or alteration. This is happening not only in the Atlantic forest, where the giant armadillo and the giant anteater are on the verge of regional extinction, but also in the Cerrado and Caatinga. Enormous tracts of Cerrado in the states of Goiás, Mato Grosso and Tocantins, for example, are being cleared at accelerating speeds to make room for pasture and soy bean plantations. This vast region is the major agricultural frontier in Brazil, attracting farmers from other states, notably from southern Brazil, that take advantage of the relatively low land prices. Other main threats include illegal hunting, widespread in Brazil, and fire, notably in the Cerrado region, which particularly affects the giant anteater.

The following people contributed to the pre-workshop consultation for edentates: José de Sousa e Silva Jr., Tadeu de Oliveira, Teresa Cristina Anacleto, Carlos Eduardo Grelle, Fernando Passos, Vera Lúcia Oliveira, Sérgio Maia Vaz, Laurenz Pinder, Rogério C. Paula, Cristiane Encarnação, Antônio R. Mendes Pontes, Denis Sana, Maria Auxiliadora Drumond, Sônia Talamoni, and Flávio Rodrigues.

Prof. Ângelo B. M. Machado, world expert on Neotropical dragonflies, and Professor of Zoology at the Federal University of Minas Gerais, led the assessment process in 1989 (Bernardes *et al.*, 1990), representing the Sociedade Brasileira de Zoologia (SBZ). He was again the driving force for the 2002 re-assessment of the Official List of Brazilian Fauna Threatened with Extinction. This time, representing the Fundação Biodiversitas, he was general coordinator for the workshop and the assessment, and most competently supported by the staff, who are uniquely experienced in carrying out these sorts of workshops (see, for example, Fonseca *et al.*, 1994; Lins *et al.*, 1997; Machado *et al.*, 1998; Mendonça and Lins, 2000), and deserve special acknowledgment: Gláucia Moreira, Cassio Soares Martins, Cláudia Costa, Lívia Vanucci Lins and Gisela Herrmann. Considerable support was also provided by Mônica Fonseca and Adriano Paglia of Conservation International do Brasil, Belo Horizonte.

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Online Bibliography on Armadillos

Dr. Mariella Superina, Med. Vet. has compiled an extensive bibliography on armadillos, which contains approximately 2700 titles. References cited are grouped by years: to 1900, 1901-1950, 1951-1960, 1961-1970, 1971-1980, 1981-1990, 1991-2000, and undated. Each reference grouping is available to download as a single large PDF file, typically with 20-30 pages of references for each of the later decades. The bibliography may be found online at: <http://www.vetmed.lsu.edu/pbs/armadillo_bibliography.htm> and is updated regularly. Dr. Superina would greatly appreciate any comments, error reports, and notes regarding missing entries, as well as citations for any new publications. For further information contact: Dr. Mariella Superina, University of New Orleans, Department of Biological Sciences, New Orleans, LA 70148-0001, Tel: (504) 280-6737 or e-mail: <mariella@superina.ch> or <mesuperi@uno.edu>.

Kaa-Iya Project, Gran Chaco, Bolivia

The Kaa-Iya Project is a collaboration between the Wildlife Conservation Society (WCS) and the Capitanía del Alto y Bajo Izozog (CABI – the political representation of the Izoceño-Guaraní Indians), with support from the United States Agency for International Development (USAID). In order to conserve biodiversity in the Kaa-Iya National Park (3.4 million ha) and the neighboring Izoceño indigenous territory (1.9 million ha) through community wildlife management, the project began a self-monitoring program with Izoceño hunters in 1996. Several hundred hunters participated from 20 communities. Armadillos are hunted a little less than ungulates, with five species representing 4000 captures (in order of importance): *Dasypus novemcinctus*, *Tolypeutes matacus*, *Chaetophractus villosus*, *Euphractus sexcinctus* and *C. vellerosus*. The first two species alone comprised three-quarters of the captures. Subsistence hunting (armadillos are not hunted for commercial means) in the Izoceño indigenous territory appears to be sustainable except possibly in the case of *T. matacus*. A management measure proposed in community meetings, but not yet implemented, is to restrict hunting of female armadillos during the reproductive season (September-December for all species, the austral springtime with the end of the dry season and beginning of the rainy season).

A sixth sympatric species in the Izozog of Chacoan thorn scrub and grasslands is *Chlamyphorus retusus*, which the Izoceños consider to be an evil omen (see *Edentata* (4): 14-16, 2001). The eastern and northern regions of the Kaa-Iya National Park are also home to *Priodontes maximus* in Chiquitano transitional dry forest, recorded in camera traps along the Bolivia-Brazil gas pipeline. Finally, we have registered *Cabassous unicinctus* in Chiquitano transitional dry forest just north of the Bolivia-Brazil gas pipeline and the Kaa-Iya National Park. This record comprises the southernmost location for the species' known distribution in Bolivia, and a significant range extension.

Two other edentates, *Tamandua tetradactyla* and *Myrmecophaga tridactyla*, are present in both Chacoan and Chiquitano transitional dry forests. Izoceños occasionally consume *M. tridactyla* meat, and the species is a preferred prey item for Ayoreo Indians, whereas *T. tetradactyla* is killed only accidentally and infrequently by dogs.

Hunting records have provided useful information on activity patterns and habitat use for the five species which are important prey items. In

addition, Izoceño hunters have provided specimens from hunted animals with which we have analyzed diet for all five species, as well as reproduction in *Dasypus novemcinctus*. The diversity of animals making and using burrows in the Chaco has impeded accurate censuses from burrow counts, while line transect censuses are not practical for the species or the habitat; but efforts to census armadillos with hunting dogs offer some promise. Spool-and-thread as well as implanted radio-transmitters are proving effective in tracking *T. matacus*. The WCS Field Veterinary Program and the Lincoln Park Zoo are collecting serology and parasitology data on *D. novemcinctus* and *T. matacus*.

For additional information please contact **Erika Cuéllar** or **Andrew Noss**, Proyecto Kaa-Iya, Casilla 6272, Santa Cruz, Bolivia, e-mail: <anoss@infonet.com.bo>.

Online Bibliography on Sloths

"Sloth World" is an online bibliography and database compiled by Virginia L. Naples and Robert K. McAfee. The site is updated regularly and can be searched by Author, Recent Publications (1991-2002), Specific Genus (classification follows Bell and McKenna) including extinct genera, and Museum Collections. "Sloth World" also includes sections entitled, "What is a sloth?" and "Slothologists", which gives the names and addresses of researchers who study extinct and extant sloth anatomy, systematics, evolution, ecology, and behavior. "Sloth World" may be found at: <http://www.sloth-world.org>.

PAX TAG Meeting

The inaugural meeting of the newly approved American Zoological Association Pangolin, Aardvark and Xenarthran Taxonomic Advisory Group (PAX TAG) took place in Tucson, Arizona, as part of the AZA Western Regional Conference, on 26 April, 2002. The conference was co-hosted by the Reid Park Zoo and the Arizona-Sonora Desert Museum, and was held at the DoubleTree Hotel at Reid Park.

The meeting agenda included: Steering Committee elections; completion of a space analysis survey (present / projected 3-year / projected 10-year); report of existing holdings by species (per ISIS); development of a regional collection plan, including establishing criteria for captive priorities, issuing management recommendations for Studbooks, Population Management Plans, and Species Survival Plans, non-target species and accession/de-accession policies; development of a three-year action plan, including fund raising initiatives and *in situ* projects; and review status of AZA mammalian standards updates.

Presentations were given by Don Gillespie, DVM, Nashville Zoo, on giant anteater husbandry; John Gramieri, Lincoln Park Zoo, on a FOIA data analysis of pangolin, aardvark, and xenarthran imports; and Jennifer Pervola, Deputy Chair of the IUCN/SSC Edentate Specialist Group, on activities of the ESG.

Mike Flint is currently arranging to have elections and other infrastructure for PAX TAG in place by the end of March 2004. For more information, he may be contacted at 520-548-2206 or <mrzoo@cox.net>.

PAX Listserve

PAXtalk is a newly established listserve established to promote communication relative to the husbandry and management of pangolins, aardvarks and xenarthrans. John Gramieri of the Lincoln Park Zoo is the moderator of the discussion list, <paxtalk@lists.aza.org>. To sign up for the list and to find out more about the listserver, how it works, how to use it, and which groups you are subscribed to, go to <http:

//xlists.aza.org> (click on MEMBERS). Due to concerns about computer viruses, please refrain from attaching files to the messages you post. The contents of your existing files can usually be posted by choosing EDIT > SELECT ALL > COPY and then PASTE into your messages. PAXtalk is an open listserve, which will serve well to expedite the gathering of valuable information about pangolins, aardvarks and xenarthrans. Anyone can post requests for information and ideas about these unique mammals. You may unsubscribe at any time by e-mailing John Gramieri at: <jgramieri@lpzoo.org>.

Atlas of the Colombian Amazon

Fundación Puerto Rastrojo is pleased to present the CD-ROM "Atlas of the Colombian Amazon". A consultative tool, the Atlas contains information about different aspects of the Colombian Amazon, including the physical environment, public services, colonization processes, economy, indigenous settlements, National Parks and institutional presence (amongst others). The Atlas contains more than 35 interactive maps, as well as a database with 47,000 species localities and a collection of 112 photos illustrating the variety of landscapes, ways of life and activities of the Colombian Amazon. We hope that this multimedia application will be useful for researchers, students, public and private institutions and the general public. The use of the maps, photos, data and texts included in the CD-ROM is free of restriction, as long as reference is made to the source. Fundación Puerto Rastrojo is a Colombian NGO which has spent the last 20 years working in the Colombian Amazon carrying out conservation, research and training programmes.

The Atlas is available in Spanish. For more information please contact Fundación Puerto Rastrojo (FPR), Cra. 10 No. 24-76, Of. 1201, Bogotá, Colombia, Tel: (57 1) 284-9010, 560-7054, Fax: (57 1) 560-7055, e-mail: <rastrojo@uolpremium.net.co>.

European Zoos' Commitment to Conservation of the Atlantic Rainforest – EAZA Rainforest Campaign

The mission of the European Association of Zoos and Aquaria (EAZA), Chairman Miklós Persányi, Director Koen Brouwer, is to promote co-operation for furthering wildlife conservation, particularly through internationally-coordinated breeding programmes of wild animals, through the European Endangered Species Programmes (EEP); to promote education, in particular environmental education; to promote regional collection planning activities; to contribute to relevant meetings and discussions of the supra-international organizations, such as the United Nations, The World Conservation Union – IUCN, the European Union, and the Convention on International Trade in Endangered Plant and Animal Species (CITES); and to advise, as required, the European Union, or other representative committees such as the European Parliament and the European Council.

At their annual conference in Prague in September 2001, the EAZA launched a major, two-year, fund-raising campaign in support of the conservation of the threatened fauna and flora of the endangered Atlantic forest of Brazil, eastern Paraguay and northern Argentina (2001-2002). The Atlantic rain forest was chosen because of its status as a priority area for the World Association of Zoos and Aquaria (WAZA), and focuses particularly on the conservation programs for the four lion tamarin species, *Leontopithecus*. The zoo community worldwide has played a fundamental role in the overall conservation programs for these species in terms of reintroduction, translocation, metapopulation management, scientifically-managed captive-breeding, and their participation in the international lion tamarin committees

and support for conservation efforts in the field (see Mallinson, 1996; Kleiman and Mallinson, 1998; Kleiman and Rylands, 2002). Most zoos keeping one or more of the species also use them as flagships for their conservation efforts. The goals of the campaign are to raise awareness about the conservation needs and conservation programmes in the Atlantic rain forest, and to raise money for the Lion Tamarins of Brazil Fund – established in 1991 by the founder of the Jersey Zoo, Gerald Durrell, as a mechanism specifically targeting the institutions holding lion tamarins in captivity to mobilize financial support for ongoing field conservation and research efforts and to launch critical new initiatives (Mallinson, 1994).

The Campaign Planning Group includes: David Field (Dublin Zoo, Ireland), Bengt Holst (Copenhagen Zoo, Denmark), Kristin Leus (Antwerp Zoo, Belgium), Jeremy J. C. Mallinson (until recently of the Durrell Wildlife Conservation Trust, Jersey) and, as Liaison for the EAZA Executive Office, Corinne Bos (Amsterdam Zoo, The Netherlands). It is hoped that the EAZA Rainforest Campaign will have a long-lasting effect through a better understanding of the existing conservation programmes and a more direct involvement of the European zoo world. The campaign will thus contribute to the fulfillment of the accepted obligation of zoos "to contribute to animal conservation".

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Captive Breeding of Giant Anteaters at the Houston Zoo

Breeding Behavior

In our pair of giant anteaters, the female is the one who initiates breeding. She follows the male very closely and won't let him out of her sight. She then grabs hold of him by standing up on her back legs and placing her front legs on his back, forcing him to the ground. (This is easily done because she is 20 lbs heavier.) Initially, it looks as if she is trying to get up on his back like an baby anteater. Many times the male tries to get away from her, but is unable to, and this may go on for several minutes until he relents. We have observed both animals in a "face-to-face embrace" for up to 30 minutes. This will occur off and on for the entire day. Although they are separated in the evening, we have seen the behavior continue again the next day.

Neonates

Our female has had several offspring here at the Houston Zoo, and initially we tried to let her raise them herself. After she demonstrated repeatedly that she was unable to successfully raise her offspring, we decided to attempt to hand-raise the infants. We have now successfully hand-raised two juveniles.

Prior to parturition, we keep her inside so that if she does deliver during the night, she will be

FIGURE 1. This baby giant anteater was born on August 21st, 2002 and weighed in at 1907 grams.

away from the other animals in the enclosure, including the male. After the infant is born, we continue to keep her inside the barn so that she can bond with the infant. Initially she is gentle and seems very attentive; but at anywhere from 3 to 5 days after birth she becomes very aggressive, with fatal consequences for the infant. Until we can determine the variables that will improve her maternal behavior, we will continue to hand-rear all future offspring.

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Pepita y Rafaelo Fueron Padres

El día 4 de junio del 2002 nació un ejemplar de oso hormiguero mayor (*Myrmecophaga tridactyla*) en el Zoológico de Zürich, Suiza. Este ejemplar es hijo de Rafaelo y Pepita. Lo auspicioso de este nacimiento es que Pepita llegó al zoo hace apenas 9 meses. Rafaelo vive aquí desde abril de 1996. Pero a pesar de haber compartido su recinto durante 5 años con "Yurumí" una hembra de la especie, nunca se había reproducido.

Pepita provenía de la naturaleza y fue entregada por las autoridades de Fauna de la Provincia de Santa Fe, República Argentina a la Fundación Wildermuth, en Colonia Belgrano de la misma provincia siendo un bebé, para su crianza.

FIGURA 1. El día 4 de junio del 2002 nació un ejemplar de oso hormiguero mayor *(Myrmecophaga tridactyla)* en el Zoológico de Zürich, Suiza

El cuidado de la misma estuvo a cargo del Sr. Heinz Oppliger y la Sra. Gabriela Krauer. La llegada al zoo de Zürich se produjo a fines del mes de agosto del 2001 y fue "presentada" a Rafaelo el 14 de noviembre del mismo año, luego del período de cuarentena. De lo que se deduce que quedó preñada de forma inmediata, ya que la gestación dura 190 días.

Guillermo Pérez Jimeno, Agrelo 1835, (2005) Rosario, Argentina. E-mail: <tamandua@arnet.com.ar>.

Giant Anteater Sighting

Paule Gros, a scientist at the St. Louis Zoo who heads the Zoo's conservation project in the Bosawas Biosphere Reserve in northern Nicaragua, has reported a sighting of the endangered giant anteater (*Myrmecophaga tridactyla*) there. The discovery is significant due to decreasing populations in Central America. The Reserve lies just south of the Nicaragua-Honduras border and has been dubbed "Central America's Amazon" because it is part of the largest rain forest north of the Amazon. Working with the Zoo and also the International Center for Tropical Ecology at the University of Missouri at St. Louis, Gros is leading a biological inventory of the region, and training Mayangnan forest guards. Since the project began in January 2000, researchers working in the reserve have also found evidence of the silky anteater (*Cyclopes didactylus*) and the northern tamandua (*Tamandua mexicana*).

Update on Nine-Banded Armadillo Research in the U.S.

We have been studying the nine-banded armadillo (*Dasypus novemcinctus*) population at Tall Timbers Research Station in northern Florida

since 1992. Unfortunately, that study is now at an end for two reasons. First, an extensive hardwood removal program conducted between 1998-2000 has led to significant habitat alterations, which in turn have reduced the armadillo population at our study site by over 50%. Second, Tall Timbers has contracted with the U.S. Department of Agriculture on a study to examine the impact of removing nest predators of bobwhite quail eggs. As armadillos are one of these predators, the few remaining animals in our study area will be removed (i.e., killed) beginning in the spring of 2004. Consequently, we are in the process of considering new directions for our research. At present, we see the following as the most promising avenues for future work:

1) *Population Genetics*: We have collected DNA samples from nine-banded armadillo populations located in areas across the species' range (e.g., Brazil, French Guiana, Mexico, and many parts of the U.S.) in order to describe phylogeographic patterns in the genetic structure of these populations. However, additional samples from other parts of the species' range would make our analyses far more robust.
2) *Chemical Ecology*: For animals whose primary sense seems to be olfaction, surprisingly little work has been done on the chemical signals produced by armadillos. In nine-banded armadillos, secretions from the paired anal glands seem a likely source of odors used in chemical communication. It would be interesting to examine what types of information might be available in these secretions (e.g., identity, state of sexual receptivity, etc.). In particular, as *D. novemcinctus* produces litters of genetically identical quadruplets, it would be exciting to determine whether the composition of odors somehow covaries with genetic relatedness.
3) *Disease Ecology*: Nine-banded armadillos are one of the few animal models for leprosy, yet almost nothing is known about the impact of the disease in wild populations. Our population at Tall Timbers was leprosy-free, so we now have an extensive database on an uninfected population. It might be worthwhile to now find a population where leprosy is prevalent and repeat the work we did at Tall Timbers in order to assess how the disease affects armadillo population structure and behavior.
4) *Comparative Analyses*: One of the main reasons for our study of nine-banded armadillos was to assess the impact of polyembryony on population structure and behavior, particularly with regard to the potential for kin selection. We have found little evidence of any kin selection occurring in *D. novemcinctus*, but that does not preclude its possible importance in other members of the genus. What is required are comparative data from the other species in the genus *Dasypus*. (In fact, as a first step, we need genetic data from these other species confirming that littermates are indeed polyembryonic.) At an even broader level, we still have very limited knowledge of basic life-history characteristics for many armadillo species. For example, even published data on something as basic as litter size are often based on very limited observations or rely on information from captive births, which may not be representative of what occurs in the wild. Such data are critical if we are ever to understand evolutionary patterns within this enigmatic group.

Any comments, suggestions, or ideas regarding the above would be most welcome, as would any proposals for collaborative projects. We can be reached via e-mail at either <jloughry@valdosta.edu> or <cmcdonou@valdosta.edu>.

W. J. Loughry and **Colleen M. McDonough**, Department of Biology, Valdosta State University, Valdosta, GA 31698-0015, USA.

Armadillo Online!

Maintained by Joshua P. Nixon, "Armadillo Online" is an extensive site dedicated to the 20 species of armadillo, including pictures of eight. The site gives brief biological summaries of each armadillo species, including: range, description, habitat, ecology, and biology; a short article sum-

marizing the natural history of the armadillo; a quick fact file which answers commonly asked questions about armadillos; and a short description of the scientific and medical research uses of armadillos. Also listed is a page discussing common problems caused by armadillos, such as yard destruction. The site can be viewed at: <http://www.msu.edu/~nixonjos/armadillo/>. For questions or comments contact Joshua Nixon, e-mail: <nixonjos@msu.edu>.

WildlifeDecisionSupport.com

WildlifeDecisionSupport.com was launched by Dr. Andrew McKenzie, the editor of the *Capture and Care Manual* – which has become the definitive text for wildlife managers, ranchers and veterinarians – and Peter Morrison, a well-known ecotourism manager.

The first edition of the *Capture and Care Manual* is virtually sold out and at this stage there is no definite plan for a second edition; however, the full text of the *Manual* is now online at <http://wildlifedecisionsupport.com>. The site also has a community-based section where members can share their experiences, knowledge, techniques and queries with colleagues and experts globally. A "news and smalls" section keeps the members up-to-date with their industry and the option to market or purchase services or products. The site also distributes the specialized wildlife publications of the Wildlife Group and has recently become the South African distributor for the World Organization for Animal Health. For further information contact: Peter Morrison, Member Communications at <http://wildlifedecisionsupport.com>.

Edentate Conservation Action Fund – Grants Awarded

Financed by Conservation International's Center for Applied Biodiversity Science, the Edentate Conservation Action Fund offers small grants to individuals doing conservation research on edentates. In 2002 the Fund approved the following three research projects:

Hematology, Parasite Load and Health Status of Wild *Zaedyus pichiy* Populations in Mendoza, Argentina – Mariella Superina. The pichi (*Zaedyus pichiy*), an armadillo endemic to Argentina and Chile, has been classified as data deficient by the IUCN (2000). Not much scientific information is available about this species. No hematologic reference values have been published to date, which makes health controls of wild and captive pichis difficult. The proposed work aims at collecting basic data about the health status, hematology and parasitological infestation of wild *Zaedyus pichiy* populations in Mendoza Province, Argentina. Such parameters of healthy, wild animals are crucial for a better sanitary control of wild and captive pichi populations. This project will lay the foundation for further studies about *Zaedyus pichiy,* in which the survival of reintroduced individuals will be studied. The data collected in the proposed work will allow an evaluation of the health status of pichis before reintroducing them into the wild, thus preventing the release of pathogens or parasites that could pose a threat to the extant pichi populations.

A Preliminary Survey of the Edentates of the Dry and Wet Chaco of Argentina – Eduardo Fernandez-Duque. The project will conduct a preliminary survey of edentates in the Gran Chaco region of Formosa Province in Argentina. The objectives are: 1) to identify a population of giant armadillos in the dry portion of Formosa Province amenable for long-term studies, 2) to conduct a quantitative survey of edentates in the wet region of Formosa Province, 3) to support the training of Argentinean students who will become responsible for the development of long-term studies on edentates in the area. Information from the study will be used in the development of a conservation education program to be started in 2002 in collaboration with the Conservation Education Department of the San Diego Zoo and the Provincial Wildlife Department in Formosa. The study will also be

the first step in developing a research program on edentates in the province of Formosa. In the wet region of Formosa, systematic censuses of edentates will be conducted in Estancia Guaycolec, a cattle ranch where Fernandez-Duque has been working since 1996. To find a suitable area to work with giant armadillos will require the exploration of vast areas in collaboration with knowledgeable local guides.

Health Survey and Normal Physiologic Values of the Wild Giant Anteater (*Myrmecophaga tridactyla*) in the Brazilian Highlands – Don Gillespie. The giant anteater (*Myrmecophaga tridactyla*) currently ranges over wide areas of South America, with the Brazilian highlands considered among the prime habitat for the species. Even there, the population is estimated to have declined to 25% of the population present 25-30 years ago. Being somewhat specialized from a dietary viewpoint, pressures from rapid land development and overhunting may soon push this rare species to the threatened species list. It is crucial, therefore, to complete a number of timely surveys, including health assessments to ensure that protected areas in this part of Brazil maintain viable populations of the giant anteater in the future. Wild giant anteaters in the Serra da Canastra National Park in the state of Minas Gerais, Brazil, will be assessed for underlying health problems, and these data will be used to build a comparative profile of normal physiologic values for use in captive management, in field collection, and conservation techniques. Results will be compared to the ISIS database and the current U.S. zoo population.

Lista das Espécies da Fauna Ameaçadas de Extinção no Rio Grande do Sul, Brasil

A iniciativa de elaborar a primeira lista das espécies da fauna ameaçadas de extinção no Rio Grande do Sul surgiu de forma independente em dois grupos de pesquisadores gaúchos. No final de 1999, a associação ambientalista PANGEA, com o apoio da Fundação Biodiversitas, estabeleceu contatos com a Secretaria Estadual do Meio Ambiente (SEMA) e com alguns pesquisadores gaúchos no sentido de dar início ao processo de elaboração de uma lista a ser sancionada por decreto governamental.

Paralelamente, em agosto do mesmo ano, teve início o projeto Livro Vermelho da Fauna Ameaçada de Extinção no Rio Grande do Sul, do Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCT-PUCRS), com a proposta mais ampla de elaborar, além de uma lista, também um livro sobre as espécies ameaçadas no Estado, gerenciando as informações através de uma base de dados permanentemente atualizável.

Para evitar a duplicidade de esforços e elaborar uma lista única, as equipes foram reunidas sob coordenação geral do "Projeto Livro Vermelho", contando com apoio da SEMA através da Fundação Zoobotânica do Rio Grande do Sul. A lista aqui apresentada resulta do trabalho desenvolvido desde então. Ela foi elaborada a partir do esforço conjunto de 43 zoólogos diretamente vinculados ao projeto, representando 18 instituições de pesquisa, e 128 colaboradores.

Com o propósito de formalizar o apoio da Secretaria Estadual do Meio Ambiente ao Projeto Livro Vermelho e encaminhar o processo de homologação da lista pelo Governo do Estado, um convênio entre o MCT-PUCRS e a SEMA foi firmado em agosto de 2001. Posteriormente, em 5 de dezembro do mesmo ano, os resultados de dois anos de trabalho do projeto foram sinteticamente apresentados à sociedade gaúcha em uma audiência pública organizada pela SEMA. Participaram representantes do poder público estadual e federal, organizadores da lista, zoólogos vinculados ao projeto, colaboradores, pesquisadores, técnicos e representantes de organizações não governamentais, além da comunidade.

Ao final, 261 espécies foram classificadas como efetivamente ameaçadas de extinção no Rio

TABELA 1. Número de espécies ameaçadas no Rio Grande do Sul por grupo zoológico e categoria de ameaça. As siglas seguem recomendação da IUCN, utilizando a grafia inglesa para facilitar a consulta por pesquisadores de diferentes nacionalidades.

Grupo	Categorias de Ameaça					
	RE	PE	CR	EN	VU	Total
Esponjas				1	2	3
Moluscos				6	11	17
Crustáceos					7	7
Insetos				7	11	18
Peixes			4	6	18	28
Anfíbios					10	10
Répteis				5	12	17
Aves	2	8	31	42	45	128
Mamíferos		1	8	5	19	33
Total	2	9	43	72	**135**	**261**

RE – Regionalmente extinto; **PE** – Provavelmente extinto; **CR** – Criticamente em perigo; **EN** – Em perigo; **VU** - Vulnerável.

Grande do Sul, enquadrando-se nas categorias de ameaça descritas no texto do decreto (Tabela 1).

Com relação aos edentatas, *Myrmecophaga tridactyla* Linnaeus, 1758 foi classificada como Criticamente em Perigo (CR) e *Tamandua tetradactyla* (Linnaeus, 1758) como Vunerável (VU). A destruição e descaracterização dos hábitats constituem as principais fatores que representam ameaça às populações de edentatas no Estado. Como medidas para conservação desses táxons são sugeridas a proteção e recuperação do hábitat, juntamente com programas de educação ambiental e estudos de auto-ecologia.

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Eduardo Vélez, Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Rua Dr. Salvador França 1427, 90690-000 Porto Alegre, RS, Brasil.

Glayson A. Bencke, Laboratório de Ornitologia, Fundação Zoobotânica do Rio Grande do Sul, Rua Dr. Salvador França 1427, 90690-000 Porto Alegre, RS, Brasil.

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Roberto E. dos Reis, Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, Avenida Ipiranga, 6681, Caixa Postal 1429, 90619-900 Porto Alegre, RS, Brasil.

Reference

Marques, A. A. B., Fontana, C. S., Vélez, E., Bencke, G. A., Schneider, M. and Reis, R. E. 2002. *Lista das Espécies da Fauna Ameaçadas de Extinção no Rio Grande do Sul. Decreto nº 41.672, de 11 de junho de 2002*. FZB/MCT-PUCRS/PANGEA, Porto Alegre. 52pp.

Sophie Danforth Conservation Biology Fund

Roger Williams Park Zoo accepts proposals for the Sophie Danforth Conservation Biology Fund of the Rhode Island Zoological Society. Annual awards of up to $1000 are granted to conservation programs that protect threatened wildlife and habitats worldwide. Field studies and other projects that demonstrate a multi-disciplinary approach to biodiversity and ecosystem conservation, as well as projects that involve in-country collaborators, receive highest funding priority. Environmental education programs, development of techniques that can be used in a natural environment, and captive propagation programs that stress an integrative approach to conservation are also appropriate. Deadline for submissions is May 31. Grant recipients will be notified by September 3. Proposal guidelines and additional information are

available on the Roger Williams Park Zoo website at: <www.rogerwilliams parkzoo.org>, in the Conservation section, or may be acquired by contacting Stacia Martin at <smartin@rwpzoo.org>.

The Lincoln Park Zoo Neotropic Fund

The Lincoln Park Zoo Neotropic and Africa/Asia Funds support field research in conservation biology around the world. The Neotropic fund focuses on projects undertaken in Latin America and the Caribbean. Since 1986, the fund has awarded over 150 grants in 19 countries. The Africa/Asia Fund, launched in 1997, focuses on projects throughout Africa, Asia, and the Pacific. The funds emphasize 1) the support of graduate students and other young researchers, 2) direct impact on wildlife conservation and/or conservation biology, 3) involvement by students and/or local field assistants from Latin America, Africa, or Asia at levels that engender appreciation for wildlife conservation, and 4) links to either the Lincoln Park Zoo animal collection or conservation activities of the zoo staff. Each fund typically supports between five and ten projects annually, including project renewals for a second year. Most awards fall into the range of $3,000-$6,000. Initial support is for up to 12 months from the date of award, and the maximum duration of support is two years. The current deadline for receipt of Neotropic and Africa/Asia proposals is October 1st. For additional information and application procedures go to <www.lpzoo.com/conservation>, e-mail: <conservation@lpzoo.org>, or write to: Lincoln Park Zoo NF/AA Funds, Department of Conservation and Science, Lincoln Park Zoo, 2001 N. Clark St., Chicago, IL 60614.

Version 2.0 of Ramas Red List Software Available

Version 2.0 of the RAMAS® software, used for assessing the conservation status of species for possible inclusion in the IUCN Red List of Threatened Species, is now available. The software incorporates the revised Red List Categories (2000) (see below). To purchase a copy, please contact Isabelle Weber, IUCN/SSC, Rue Mauverney 28, CH-1196 Gland, Switzerland, Fax: +41-22-9990015; e-mail: <isc@iucn.org> or Applied Biomathematics, 100 North Country Road, Setauket, NY 11733, USA, Fax: +1 516-751-3435. Single-user and site-licensed copies of the software are priced at US$295 and US$445 respectively. From: *IUCN Species Survival Commission (SSC) E-Bulletin - May 2001*. Anna Knee, Communications Officer, SSC/IUCN.

The Automated Telemetry Project: Studying Species Interactions in a Tropical Forest

Presently being installed on Barro Colorado Island (BCI), Republic of Panama, the premier field station of the Smithsonian Tropical Research Institute, an automated telemetry system will permit the radio-tracking of tagged animals on a large scale in a tropical forest. The project is being funded by the Celerity Foundation, Gray Island Systems and the Smithsonian Tropical Research Institute and will address many of the most important questions in biology and conservation including: species interactions and the evolution of diversity, competition, predation, seed dispersal, effects of fragmentation and human disturbance. Applying telemetry will also allow for the ability to consistently find a study animal, which opens up future possibilities to research behavior, eco-physiology, disease, etc.

The project will be using an automated telemetry system designed by William Cochran, and described by Larkin *et al*. (1996). The system uses a scanning receiver which measures the relative signal strength from an array of six directional antennas to estimate the direction of a transmitter. The correct placement of towers should provide good coverage of the entire island for large terrestrial animals and medium sized high-flying animals, and respectable coverage for smaller animals.

Initial tests suggest an accuracy of about 5 degrees in direction finding. Wireless communication will link each receiver to the main lab and will allow the transmission of data back to the lab in real time which will be used to triangulate location of the animal. Data will be immediately available online through software provided by Gray Island Systems and will be used both for educational purposes, open to the general public, and also through password protected areas available only to researchers involved in specific projects. Presently, three initial projects are planned to test the system, which will hopefully include a study of ocelots, high flying bats, and large frugivorous bats.

For further information contact: Roland Kays, Ph.D., Curator of Mammals, New York State Museum, CEC 3140, Albany, NY 12230, Tel: 518-486-3205, Fax: 518-486-2034, email: <rkays@mail.nysed.gov>, <http://www.princeton.edu/~wikelski/research/index.htm>.

Reference

Larkin, R. P., Raim, A. and Diehl, R. H. 1996. Performance of a nonrotating direction-finder for automatic radio tracking. *Journal of Field Ornithology* 67: 59-71.

Mammalian Species

Mammalian Species, editor Virginia Hayssen, is published regularly by the American Society of Mammalogists with 25-30 new accounts issued each year. Each account summarizes the current understanding of the biology of a single species, including systematics, distribution, fossil history, genetics, anatomy, physiology, behavior, ecology, and conservation. The American Society of Mammalogists have now put 631 mammalian species accounts online as PDF files, and subscriptions to the series are also available for $30.00 per year. For more information on the series email David Stadler at Allen Press: <dstadler@allenpress.com> or visit the *Mammalian Species* website at <www.science.smith.edu/departments/Biology/VHAYSSEN/msi/msiaccounts.html>.

Ecología Austral

Ecología Austral is the scientific journal of the Argentine Ecological Society. It publishes original scientific articles on any area of the environmental sciences. Articles may be (1) Original research: results of field, experimental or theoretical research, (2) Reviews: papers reviewing the present knowledge of a topic, and (3) Short communications: short papers reporting on a minor work representing an improvement in general knowledge or a methodological development. Articles are peer-reviewed by at least two referees. Manuscripts are accepted in Spanish, English or Portuguese. The Editor-in-Chief is seeking the help of reviewers in any of the three languages of the journal. To this end, a database is being developed (about 120 reviewers already entered), in order to have a wide range of expertise available, and also to avoid requesting reviews from the same expert too frequently. For those interested in volunteering for the peer review process please send a message to: Dr. Jorge Rabinovich, Editor, *Ecología Austral*, e-mail: <ecol_aus@netverk.com.ar>. *From*: NeoCons 1(2), April 2001, Neotropical Conservation Biology Bulletin: <http://www.conservationbiology.org/SCB/Publications/NeoCons/>.

Revised Red List Criteria

The new improved categories and criteria used for listing plants and animals on the IUCN Red List of Threatened Species are now available, after a four-year review which was called for by IUCN members. The review, coordinated by SSC, involving broad consultation with users and organizations from around the world, has produced a clearer, more open, and easy-to-use system for assessing species. With particular attention paid to marine species, harvested species, and population fluctuations, the review has refined the effectiveness of the Red List categories and criteria as indicators of extinction risk.

See <http://www.iucn.org/themes/ssc/redlists/RLcategories2000.html> for more details. From: *IUCN Species Survival Commission (SSC) E-Bulletin - March 2001*. Anna Knee, Communications Officer, SSC/IUCN.

International Foundation for Science

Excerpt from the IFS website: IFS is an NGO providing support to developing country scientists to conduct, in a developing country, relevant and high quality research on the management, use, and conservation of biological resources and their environment. IFS believes that the interests of both science and development are best served by promoting and nurturing the research efforts of young science graduates, who are at the beginning of their research careers. Since 1974, IFS has provided support, mainly in the form of small research grants, to over 3,200 scientists in 99 developing countries.

IFS support is primarily financial and in the form of a research grant in the amount of up to USD 12,000, which may be renewed twice. Each grant is for one research period, normally not less than one year nor more than three years and is intended for the purchase of the basic tools needed to conduct a research project: equipment, expendable supplies, and literature. It cannot be used for education, travel, or the applicant's salary. However, a PhD Fellowship (Carolina MacGillavry Fellowship) is available for applicants from the SADC countries. IFS research areas include: Aquatic Resources, Animal Production, Crop Science, Forestry/Agroforestry, Food Science, and Natural Products. A wide interpretation of these scientific disciplines is encouraged, as long as scientific research is proposed, and not a transfer of already-existing technology. Researchers must also ask themselves how their research will affect, or be affected by, local ecological and socio-economic conditions where the research is likely to be implemented.

The applicant for an IFS Research Grant must satisify the following critera: be a scientist and a citizen of a developing country, have at least a MSc or equivalent degree, be under 40 years of age (30 for Chinese applicants), be working at a university or research institution in a developing country (the institution is expected to provide salaries and basic research facilities), will do research in one of the IFS Research Areas and do the research in a developing country. The selection process is rigorous with considerable competition for the available grants. The applications are judged by an international panel of Scientific Advisers on the basis of the applicant's personal qualifications, the scientific quality and feasibility of the proposal, and the relevance of the planned research results. For more information see: <http://www.ifs.se/> or email:<info@ifs.se>.

9th International Mammalogical Congress

The Congress Committee for MAMMAL2005 (the 9th International Mammalogical Congress; formerly the International Theriological Congress: ITC) has been launched. The Congress Committee will periodically inform about the preparation of MAMMAL2005 through e-mail and the official website (<http://www.imc9.jp/>), which is now fully operational. Though we are now managing e-mail addresses based on members lists of the 7th and 8th ITC and several mammalogical organizations, we would like to renew the list of addresses for MAMMAL2005. If you are you interested in MAMMAL2005, please reply to <MAMMAL2005@hokkaido-ies.go.jp>. If you have a colleague who is interested in MAMMAL2005, please recommend him/her to contact us at <MAMMAL2005@hokkaido-ies. go.jp>: Koichi Kaji and Takashi Saitoh (Secretary General). For more information, please contact: Tomoko Takahashi (Secretary), e-mail: <tomochaz@ kmail.plala.or.jp>.

RECENT PUBLICATIONS

AZA Conference Proceedings

The AZA Annual Conference Proceedings from Saint Louis are now available for purchase. Members can receive a copy for $45. Please log on to AZA's website at <www.aza.org>, and click on "Publications" for more information on how to order a copy. An order form can be downloaded from the website and should be filled out and returned to the AZA Publications Department with a check or money order drawn from a U.S. bank. If you have any questions, please feel free to contact the Publications Department at 301-562-0777, ext. 253 or ext. 247.

CITES: A Conservation Tool – New Edition Available

The IUCN/SSC Wildlife Trade Programme has completed the seventh edition of *CITES: A Conservation Tool*, *A Guide to Amending the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora*. This publication guides the CITES Parties through the Convention's articles and resolutions and covers the process for the submission, presentation, and adoption of proposals to amend the Appendices for the 12th CITES Meeting of the Conference of the Parties (CoP 12, 3-15 November 2002, Chile). The seventh edition has been produced in booklet form and CD for the first time. The guide is available in PDF in English, French and Spanish. This guide forms part of a series of tools prepared by the Wildlife Trade Programme for CITES Scientific Authorities. These include a checklist and resource guide to help CITES Scientific Authorities make Non-Detriment Findings (a requirement for export of certain specimens) which will be published as an SSC Occasional Paper. The Programme is working with the CITES Secretariat to develop other tools and is providing input to technical training workshops. The Analyses of Proposals to Amend the CITES Appendices will be produced in collaboration with the TRAFFIC Network for the 12th COP. For more information see: <http://www.cites.org/eng/cop/12/prop/index.shtml> or <http://www.iucn.org/themes/ssc/programs/cites/cites.htm>.

A Red Data Book for the Mammals of Ecuador

The Red Data Book for Ecuadorean Mammals (*Libro Rojo de Los Mamíferos de Ecuador*) is edited by Diego Tirira, S. It is an attractively produced and informative evaluation, in Spanish, of the threatened mammals of Ecuador. Authors of the treatments of the various mammal groups include: Carlos Boada (SIMBIOE), Santiago Burneo (Museo de Zoologia, Pontificia Universidad Católica del Ecuador), Armando Castellanos (Fundación Zoobreviven, Quito), Cristina Castro, A. (Yaqu-Pacha, Organización para la Conservación de Mamíferos Acuáticos en Sudamérica), Francisco Cuesta (Fundación EcoCiencia, Quito), Stella de la Torre (Quito), Judith Denkinger (Yaqu-Pacha, Organización para la Conservación de Mamíferos Acuáticos en Sudamérica), Godfrey Merlen (Estación Científica Charles Darwin, Galápagos), Sandie Salazar (Estación Científica Charles Darwin, Galápagos), Luis Suárez (Fundación EcoCiencia, Quito), Diego Tirira, S. (SIMBIOE) and Victor Utreras, B. (Wildlife Conservation Society – Ecuador). The list of threatened species was the result of two years' work and the participation of more than thirty people. Following training in threatened species assessment and the use of the 2000 IUCN criteria given by the IUCN/SSC Red List program staff, the list was finalized at a workshop organized by SIMBIOE and the Fundación EcoCiencia in Quito, September 2000.

Each threatened species is nicely illustrated, with information on the distribution, current status, principal threats, and measures already undertaken and measures proposed for their conserva-

tion. The IUCN 2000 criteria are used for the assessments (IUCN, 2001). In the introduction, Diego Tirira, Francisco Cuesta and Luis Suárez explain that Ecuador has the richest biodiversity per unit area of any country in the world. They report 369 mammal species, 12 of which are edentates. The book includes some valuable analyses of the biogeography and status of Ecuadorean mammals in general by Santiago Burneo and Diego Tirira. Nine of the 13 mammal orders in Ecuador have threatened species. Forty-nine mammals are listed as threatened, and four orders account for nearly 78% of them – Rodents 14 of 100 species, Carnivora 11 of 31 species, Cetacea 7 of 33 species and Chiroptera 6 of 132 species. Of the 12 edentate species Tirira recognizes for Ecuador, the following are listed as threatened: Near threatened (NT) – *Cabassous centralis*; Data Deficient (DD) – *Cabassous unicinctus, Choloepus hoffmanni, Cyclopes didactylus, Dasypus kappleri, Myrmecophaga tridactyla*, *Priodontes maximus*.

Two books to accompany this one are *Biología, Sistemática y Conservación de los Mamíferos del Ecuador* (1998) and *Mamíferos del Ecuador* (1999), both also by Diego Tirira. The first is an edited volume, which reviews numerous aspects of Neotropical mammalogy and Ecuadorean mammals in particular. The second is a more formal review of the diversity, distributions and taxonomy of Ecuadorean mammals, including chapters on diversity, Ecuadorean species and their distributions, an identification guide, bibliography and scientific collections. Besides the species mentioned above in the Red Data Book, Tirira (1999) lists for Ecuador – *Bradypus variegatus, Choloepus didactylus, Dasypus novemcinctus, Tamandua mexicana* and *T. tridactyla*.

The Red Data Book is available from: SIMBIOE, Av. Amazonas 2915 e Inglaterra, Edifício Inglaterra, Piso 2, Apartado 17-11-6025, Quito, Ecuador, Tel: (593-2) 431-097 or 452-596, Fax: (593-2) 442-771; e-mail: <mamiferosdelecuador @yahoo.com>.

References

IUCN. 2001. *IUCN Red List Categories and Criteria. Version 3.1*. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

Tirira S., D. (ed.) 1998. *Biología, Sistemática y Conservación de los Mamíferos del Ecuador*. Publicación Especial 1. Museo de Zoología. Centro de Biodiversidad y Ambiente, Pontificia Universidad Católica del Ecuador y Sociedad para la Investigación y Monitoreo de la Biodiversidad Ecuatoriana (SIMBIOE), Quito. 217pp. ISBN 9978-40-434-1.

Tirira S., D. 1999. *Mamíferos del Ecuador*. Publicación Especial 2. Museo de Zoología. Centro de Biodiversidad y Ambiente, Pontificia Universidad Católica del Ecuador y Sociedad para la Investigación y Monitoreo de la Biodiversidad Ecuatoriana (SIMBIOE), Quito. 392pp. ISBN 9978-40-835-5.

Tirira S., D. (ed.) 2001. *Libro Rojo de Los Mamíferos de Ecuador*. Sociedad para la Investigación y Monitoreo de la Biodiversidad Ecuatoriana (SIMBIOE) / Ecociencias / Ministerio del Ambiente / UICN. Serie Libros Rojos del Ecuador, Tomo 1. Publicación Especial sobre los Mamíferos del Ecuador. 236pp. ISBN 9978-41-614-5.

Books

Lessons from Amazonia: The Ecology and Conservation of a Fragmented Forest, edited by Richard O. Bierregaard Jr., Claude Gascon, Thomas E. Lovejoy and Rita Mesquita. 2001, 478pp. Yale University Press, NY. ISBN 0-300-08483-8 (Cloth). Price: $65.00. The foreword is by Edward O. Wilson, and prologue by Eneas Salati. This book presents the results of the longest-running and most comprehensive study of forest fragmentation ever undertaken, the Biological Dynamics of Forest Fragments Project (BDFF), north of Manaus, in central Amazonia, run jointly by the Smithsonian Institution and the National Institute for Amazon Research (INPA). Forest fragmentation is one of the

biggest research fields in tropical conservation biology, and this book provides a remarkable overview of many of the key issues, presenting the experimental research, inventories and long-term monitoring of biotic and abiotic aspects of forest fragments of different sizes since 1979 when the project was begun. It is divided into five parts: 1. Theory and overview (4 chapters); 2. Forest ecology and genetics (4 chapters); 3. Fragmentation effects on plant communities (5 chapters), on invertebrate communities (5 chapters), and on vertebrate communities (4 chapters); 4. Management guidelines (6 chapters), and 5. Synthesis (1 chapter on principles of forest fragmentation and conservation in the Amazon). *Available from*: Yale University Press, in the US (toll-free) – Tel: 1-800-405-1619, Fax: 1-800-406-9145, e-mail: <customer.care@triliteral.org>; in Canada, Mexico, South America, Japan, South Korea, Taiwan, or Australia – Customer Service Dept., Tel: 401-531-2800, Fax: 401-531-2801; in the United Kingdom, Europe, Africa, or Asia – London office, Tel: 44-207-431-4422, Fax: 44-207-431-3755, e-mail: <sales@yaleup. co.uk>. Website: <http://www.yale.edu/yup/books/084838.htm>.

Experimental Design and Data Analysis for Biologists, by Gerry P. Quinn, Monash University and Michael J. Keough, University of Melbourne, 2002, Cambridge University Press. Price: $110.00 (Hardbound), ISBN: 0-521-81128-7. Price: $45.00 (Paperback), ISBN: 0-521-00976-6. Statistical analysis is at the core of most modern biology, and many biological hypotheses, even deceptively simple ones, are matched by complex statistical models. Prior to the development of modern desktop computers, determining whether the data fit these complex models was the province of professional statisticians. Many biologists instead opted for simpler models whose structure had been simplified quite arbitrarily. Now, with immensely powerful statistical software available to most of us, these complex models can be fitted, creating a new set of demands and problems for biologists. We need to know the pitfalls and assumptions of particular statistical models, be able to identify the type of model appropriate for the sampling design and kind of data that we plan to collect, be able to interpret the output of analyses using these models, and be able to design experiments and sampling programs optimally, i.e. with the best possible use of our limited time and resources. The analysis may be done by professional statisticians, rather than statistically trained biologists, especially in large research groups or multidisciplinary teams. In these situations, we need to be able to speak a common language: frame our questions in such a way as to get a sensible answer, be aware of biological considerations that may cause statistical problems – we can not expect a statistician to be aware of the biological idiosyncrasies of our particular study, but if he or she lacks that information, we may get misleading or incorrect advice – and understand the advice or analyses that we receive, and be able to translate that back into biology. This book aims to place biologists in a better position to do these things. It arose from our involvement in designing and analyzing our own data, but also providing advice to students and colleagues, and teaching classes in design and analysis. As part of these activities, we became aware, first of our limitations, prompting us to read more widely in the primary statistical literature, and second, and more importantly, of the complexity of the statistical models underlying much biological research. In particular, we continually encountered experimental designs that were not described comprehensively in many of our favorite texts. This book describes many of the common designs used in biological research, and we present the statistical models underlying those designs, with enough information to highlight their benefits and pitfalls. Our emphasis here is on dealing with biological data – how to design sampling programs that represent the best use of our resources, how to avoid mistakes that make analyzing our data difficult, and how to analyze the data when they are collected. We emphasize the problems associated with real world biological situations. Where to order: Cambridge University Press, 40 West 20th Street, New York, NY, 10011-4211, USA. Tel: (800) 872-7423 Fax: (914) 937-4712, website: <http://www.cambridge.org>.

Diversidad y Conservación de los Mamíferos Neotropicales, edited by Gerardo Ceballos and Javier A. Simonetti, Comisión Nacional para el Conhecimento y Uso de la Biodiversidad (CONABIO) and Universidad Nacional Autónoma de México, México, DF. 2002. 582pp. ISBN 970-9000-18-7. This edited volume provides excellent country-by-country reviews of the mammal faunas of South America, Costa Rica, Cuba, Panama, and Mexico. In Spanish but with English abstracts. The Prologue is by Michael Mares (Oklahoma Museum of Natural History and Department of Zoology, University of Oklahoma). Contents: Mamíferos de Argentina – R. A. Ojeda, C. E. Borghi & V. G. Roig, pp. 23-63; Mamíferos de Bolivia – J. G. Bravo, T. L. Yates & L. M. Zalles, pp.65-113; Mamíferos de Brasil – C. J. R. Alho, M. L. Reis & P. Seixas, pp.115-150; Mamíferos de Chile – J. E. Mella, J. A. Simonetti, A. E. Spotorno & L. C. Contreras, pp.151-183; Mamíferos de Colombia – M. Alberico & V. Rojas-Diaz, pp.185-226; Mamíferos de Costa Rica – D. E. Wilson, R. M. Timm & F. A. Chinchilla – pp.227-253; Mamíferos de Cuba – G. S. Taboada, pp.255-270; Mamíferos de Ecuador – L. Albuja V., pp.271-327; Mamíferos de Guyana – M. D. Engstrom & B. K. Lim, pp.329-375; Mamíferos de México – G. Ceballos, J. Arroyo-Cabrales & R. A. Medellin, pp.377-413; Mamíferos de Panamá – R. Samudio Jr., pp.415-451; Mamíferos de Paraguay – P. Myers, A. Taber & I. G. de Fox, pp.453-502; Mamíferos de Perú – V. Pacheco, pp.503-549; Mamíferos de Uruguay – P. O. Baes, S. Sühring & G. Ceballos, pp.551-565; Mamíferos de Venezuela – G. Ceballos, P. O. Baes, S. Sühring, Y. Domínguez & H. Zarza, pp.567-582. *Available from*: Comisión Nacional para el Conhecimento y Uso de la Biodiversidad (CONABIO), Liga periférico-Insurgentes sur 4903, Col. Parques del Pedregal, Tlalpan, 14510, México, DF, México.

Biology, Medicine, and Surgery of South American Wild Animals, edited by Murray E. Fowler and Zalmir S. Cubas, 2001, 536pp. Iowa State University Press, Ames, Iowa. ISBN 0 8138 2846-5. Price US$89.65. An extraordinary compilation of continent-specific coverage of amphibians, birds, reptiles and all South American mammals arranged by order and genus. Topics include conservation efforts, diseases in free-ranging populations, and management of animals in captivity. Special coverage is given to general health topics such as nutrition, ophthalmology and dentistry. Pages 238 to 255 are dedicated to the Xenarthra, with the following contributions: Biology and Captive Management of Armadillos and Anteaters – Ana Maria Beresca and Kátia Cassaro, pp.238-245; Biology and Captive Management of Sloths – Carlos Esbérard, pp.245-246; Husbandry – Antônio Messias-Costa and Carlos Esbérard, pp.246-247; Medicine and Neonatal Care of Sloths – Antônio Messias-Costa, pp.247-249; General Medicine – Lilian de Stefani Munão Diniz, pp.249-255. An excellent compendium and difficult to believe that any zoo or breeding institution could do without it. Available from: Iowa State University Press, 212 South State Avenue, Ames, IA 50014, USA, Tel: 800 862 6657, 515 292 0155, Fax: 515-292-3348. Website: <www.isupress.com>.

The New Encyclopaedia of Mammals, edited by David W. Macdonald, Assistant Editor Sasha Norris. 2001. Oxford University Press, Oxford. 930pp. ISBN 0 19 850823 9. Price £35.00. Unsurpassed in the breadth and depth of its text and the scope of its illustrations, this book treats every living species of mammal from aardvark to antechinus and from zebra to zorros, and all of the edentates besides. Each entry gives a systematic account of a species' or group's form, diet, distribution, behaviour, natural history, and conservation status. The very latest discoveries of new species are also included, making this the most comprehensive and up-to-date resource available. The text is augmented by numerous illustrations which combine the best of wildlife photography with superb detailed colour artwork. 'Factfile' panels with distribution maps and scale drawings give readers an instant overview of key data. It is the completely revised successor to *The Encyclopaedia of Mammals* published in 1984 (George, Allen and Unwin, London). The book itself claims to be the definitive reference work on mammals for the 21st Century and nobody

could argue with that right now. It is a spectacular book and an extremely valuable, an essential reference for any zoologist. Its price is accessible – it is a great bargain. The advisory editors were Hans Kruuk (Centre for Ecology and Hydrology, Banchory, UK), Richard Connor (University of Massachusetts, Dartmouth, USA), John Harwood (Gatty Marine Laboratory, University of St. Andrew's, UK), Guy Cowlishaw (Institute of Zoology, London, UK), John du Toit (Mammals Research Institute, University of Pretoria, South Africa), Jerry O. Wolff (University of Memphis, Tennessee, USA), Christopher R. Dickman (University of Sydney, Australia), and Gareth Jonnes (University of Bristol, Bristol, UK). The artwork is by Priscilla Barrett, Denys Ovenden, Malcolm McGregor, Michael R. Long and Graham Allen. Edentates (a general introduction) – Christopher R. Dickman, pp.786-787; Anteaters – Virginia Naples, pp.788-791; Sloths – Christopher R. Dickman, pp.792-795; Armadillos – Colleen McDonough & W. Jim Loughry, pp.796-799. *Available from*: Direct Sales Department, Oxford University Press, Saxon Way West, Corby, Northhamptonshire NN18 9ES, UK. By e-mail: <book.orders@oup.co.uk>. Website: <www.oup.co.uk>.

Diversidade Biológica e Cultural da Amazônia, edited by Ima Célia Guimarães Vieira, José Maria Cardoso da Silva, David Conway Oren and Maria Ângela D'Incao. 2001, Museu Paraense Émilio Goeldi, Belém, Pará, Brazil. 421pp. ISBN 85 7098 067 1. Price $25.00 (+ US$5.00 p&p outside of Brazil). In English and Portuguese. The results of a symposium celebrating the 130th anniversary of the Museu Paraense Émilio Goeldi, Belém, 23-27 October 1996 – "The Biological and Cultural Diversity of Amazonia in a World of Transformation". The book covers three basic questions: What is the origin of Amazonian biodiversity?; What is the origin of the region's cultural diversity?; and How to promote the sustainable use of biodiversity in the Amazon? *Contents*: Part I. Origin of Biodiversity in Amazonia. The Amazonian rainforest only some 6-5 million years old – N.-A. Mörner, D. Rosetti & P. M. de Toledo, pp.3-18; Paleoecology of Amazonia – T. Van der Hammen, pp.19-44; Hypotheses to explain the origin of species in Amazonia – J. Haffer, pp.45-118; Avian diversification in Amazonia: evidence for historical complexity and a vicariance model for a basic diversification pattern – J. Bates, pp.119-137; Molecular phylogenetics and the diversification of Amazonian mammals – J. Patton & M. N. F. da Silva, pp.139-164. Part II. Human and Cultural Diversity. Diversidade genética de populações humanas na Amazônia. – D. de F. Lobato da Silva, A. K. C. Ribeiro dos Santos & S. E. Batista dos Santos, pp.167-193; Amazônia socioambiental – sustentabilidade ecológica e diversidade social – D. Lima & J. Pozzobon, pp.195-251; Um aspecto da diversidade cultural do caboclo – R. H. Maués, pp.253-272; Science and the representation of nature in Amazonia: from La Condamine through Da Cunha to Anna Roosevelt – D. Cleary, pp.273-296. Part III. Sustainable Use of Biodiversity in Amazonia. As ciências, o uso de recursos naturais na Amazônia e a noção de desenvolvimento sustentável: por uma interdisciplinaridade ampla – F. de Assis Costa, pp.299-318; Natural vs. social science concepts in applied research on Amazônia: a critical assessment – M. Nitsch, pp.319-346; Domestication of Amazonian fruit crops – past, present, future – C. R. Clement, pp.347-367; Dinâmica evolutiva em roças de caboclos amazônicos – P. S. Martins, pp.369-384; Influence of habitat on the sustainability of mammal harvests in the Peruvian Amazon – R. Bodmer, P. Puertas, R. Aquino & C. Reyes, pp.385-402; Biodiversity: today's and tomorrow's importance – W. Kerr, pp.403-409. Part IV. Tributes. La Penha: gerador e gerenciador de ciência – L. M. F. Bassalo, pp.413-416; Paulo Sodero: mestre por excelência – I. C. G. Vieira, p.417; Jorge Pozzobon, agora no céu com diamantes, M. Meira, pp.419-421. *Available from*: Biblioteca, Museu Paraense Émilio Goeldi, Caixa Postal 399, 66040-170 Belém, Pará, Brazil. Website: <www.museu-goeldi.br>.

Técnicas de Coleta e Preparação de Vertebrados, edited by Paulo Auricchio and Maria da Graça Salomão (eds.), 2002. This 350-page book in Portuguese is the first Brazilian compilation of

techniques used for the preparation of vertebrates to be included in museum collections. Chapters, written by nine authors, include discussion of diaphanization; infiltration of paraffin; preparation of skins; cytogenetic, enzymatic and molecular techniques; museum curacy and legal aspects of field work and animal maintenance in Brazil. The book is well illustrated and is a good reference for researchers, technicians, teachers and students who are interested in taxidermy. To order from Brazil: send a FAX to: + 55 11 4655 2731 with your mailing address and the bank deposit receipt from the Instituto Pau Brasil. Payment should be made by bank deposit to: Instituto Pau Brasil, Banco do Brasil, Branch 1476-1, - Arujá - SP, Current account 5682-0. To order from outside Brazil: please arrange for a wire transfer to be made from your account to Instituto Pau Brasil, Banco do Brasil, Branch 1476-1, Arujá, São Paulo, Current account 5682-0. For further information, contact: Paulo Auricchio, e-mail: <ipbhn@institutopaubrasil.org.br>.

Técnicas de Coleta e Preparação de Vertebrados, de Paulo Auricchio e Maria da Graça Salomão. Publicado pelo Instituto Pau Brasil de História Natural, é o primeiro livro brasileiro que reúne técnicas de coleta e preparação de vertebrados. Os nove autores reuniram os mais recentes procedimentos, sendo ricamente ilustrado para facilitar o entendimento das técnicas. Foi elaborado para servir como referência a uma vasta gama de interessados: pesquisadores, professores de ensino médio e estudantes, abrangendo técnicas de Taxidermia científica e didática desde Peixes à Mamíferos, diafanização, preparação científica e didática de esqueletos, infiltração em parafina, curtimento de peles, técnicas citogenéticas, enzimáticas e moleculares, um capítulo sobre coleções zoológicas e outro sobre procedimentos legais. Este livro pretende preencher a lacuna existente na área técnico científica do Brasil e ser um referencial na preparação e manutenção de material biológico de Vertebrados. 350 páginas; capa mole plastificada. R$ 40,00 (não incluindo transporte). Pedidos: Enviar fax para (011) 46552731, com endereço e comprovante de depósito. Forma de pagamento (Depósito em conta): Instituto Pau Brasil, Banco do Brasil, Agência 1476-1 c/c 5682-0.

Animal, The Definitive Visual Guide to the World's Wildlife, edited by Don E. Wilson and David Burnie, 2001, 624pp., DK Publishing, ISBN: 0-789-47764-5, over 4000 color photos and color illustrations. Price: £30.00. Researched by over 70 zoologists and naturalists this book covers over 2000 mammals, birds, amphibians, reptiles, fish and invertebrates. Principle consultants include: Juliet Clutton-Brock (Mammals) – Dr Francois Vuilleumier (Birds) – Richard Rosenblatt (Fish) – Chris Mattison (Reptiles) – Tim Halliday (Amphibians) – George McGavin (Arthropods) – Richard Barnes (Non-Arthropod Invertebrates). Available from: NHBS Mailorder bookstore, 2-3 Wills Road, Totnes, Devon, TQ9 5XN, UK, web site: <http://www.nhbs.com>. NHBS Stock Code*: #119919W hardback.*

The Trade in Wildlife: Regulation for Conservation, edited by Sara Oldfield. 2002. Earthscan Publications, London. ISBN 1 85383 954 X (hardback), 1 85383 959 0 (paperback). Price: £48.00 (hardback) and £17.95 (paperback). This book provides a critical assessment of how the trade in wildlife is currently regulated and the regulations are enforced. Through analysis of case studies and comparisons with the trade in illegal goods, it shows what the weaknesses are, and where the system is failing. It points the way to what must be done if conservation efforts are to be supported by trade regulations, and not undermined. *Contents*: Preface – Michael Meacher. Part 1. Background. The nature and extent of legal and illegal trade in wildlife; What is the goal of regulating wildlife trade?; Is regulation a good way to achieve this goal?; Regulatory design; Regulation, conservation and incentives; Control and the holy grail. Part 2. Systems Regulation and Enforcement. Compliance and enforcement mechanisms of CITES; The European Community wildlife trade regulations; Evolution, impact and effectiveness of domestic wildlife trade bans in India. Part 3. Case Studies. Regulation and protection: successes and failures in rhinoceros conservation; Elephant poaching and resource

allocation for law enforcement; Crocodiles: legal trade snaps back; Regulation of the timber trade; Bushmeat: traditional regulation of or adaptation to market forces; The impact of the proposal to list the devil's claw on Appendix II of CITES; The need for a better understanding of context when applying CITES regulations: the case of the Indonesian parrot – *Tanimar corella*. Part 4. Lessons from Illegal Trade in Other Goods. Lessons from the control of illegal trade in ozone-depleting substances, fisheries and timber; The controlled trade in drugs; Lessons from the trade in illicit antiquities; Conclusion: looking ahead: international wildlife regulation and enforcement. Contributors: S. Broa, T. Mulliken, D. Roe, N. Sinclair-Brown, B. Moyle, M. Murphree, J. C. Vasquez, D. Morgan, M. Misra, N. Leader-Williams, H. Jachmann, J. Hutton, G. Webb, S. Oldfield, W. Bowen-Jones, C. Lombard, P. du Plessis, P. Jepson, D. Brack, D. Lowe, N. Brodie and R. Cooney.

Other titles from Earthscan Publications include: *Policing International Trade in Endangered Species: The CITES Treaty and Compliance*, by Rosalind Reeve (£19.95 – paperback and £50.00 – hardback), and *Endangered Species, Threatened Convention: The Past, Present and Future of CITES, the Convention on International Trade in Endangered Species of Wild Fauna and Flora*, edited by J. Hutton and B. Dickson (£14.95 – paperback and £35.00 – hardback). Available from: Earthscan, 120 Pentonville Road, London, N1 9BR, UK, Fax: +44 (0)20 7278 1142, e-mail: <earthinfo@easthscan.co.uk>. Website: <http://www.earthscan.co.uk>.

A Biodiversidade nos Grandes Remanescentes Florestais do Estado do Rio de Janeiro e nas Restingas da Mata Atlântica, por Carlos Frederico Duarte da Rocha, Helena de Godoy Bergallo, Maria Alice dos Santos Alves e Monique Van Sluys. 2003. RiMa Editora, Rio de Janeiro. 134pp. ISBN 85-86552-49-6. Parceria: Departamento de Ecologia, Instituto de Biologia, Universidade Estadual do Rio de Janeiro (UERJ), Instituto Biomas e Centro de Conservação da Biodiversidade da Conservation International do Brasil. Apoio Fundação Brasileira para a Conservação da Natureza (FBCN). Roberto Cavalcanti, ex-Presidente da Conservation International do Brasil, escreveu, "Para conservar é preciso saber onde estão as oportunidades e o que tem de ser feito. Este livro apresenta um diagnóstico precioso do patrimônio natural remanescente no Estado do Rio de Janeiro. A obra comprova que o Estado é privilegiado em termos de biodiversidade e que, embora sejam gravíssimas as ameaças à sobrevivência das espécies únicas da região, a situação atual pode ser revertida a fim de melhorar o ambiente natural e garantir a qualidade de vida das pessoas e das espécies com que compartilhamos o planeta. Por meio de linguagem técnica mas acessível, os autores descrevem a geologia, o clima, os solos e a biota dos principais blocos de floresta do Rio de Janeiro, dando destaque às unidades de conservação e à sua biodiversidade. Mostram que os parques e reservas não estão ali por capricho ou acaso; sua função é conservar a biota nativa e permitir que gerações futures possam continuar a coexistir com as espécies que sempre nos fascinaram. Trata-se de obra essencial para todos os envolvidos com conservação, planejamento e educação ambiental." Sumário: Prefácio – L. P. Pinto, pp.ix-x; Apresentação, pp.ix-xiii. Parte I. O estado da Biodiversidade no Estado do Rio de Janeiro. 1. Os grandes blocos de remanescentes florestais no Estado do Rio de Janeiro, pp.3-32; 2. Esforço de conservação nos blocos de grandes remanescentes do Estado do Rio de Janeiro, pp.33-36; 3. Fatores predominantes de pressão de degradação nos grandes blocos de remanescentes florestais, p.37-42; 4. A relevância do estabelecimento de corredores interligando os grandes remanescentes florestais do Estado do Rio de Janeiro, pp.43-46; 5. Estado do conhecimento científico biológico nos grandes blocos de remanescentes florestais do Estado do Rio de Janeiro, pp.47-48; 6. Espécies endêmicas e ameaçadas de vertebrados terrestres no grandes blocos de remanescentes florestais do Estado do Rio de Janeiro, pp.49-67. Parte II. A Biodiversidade nas Restingas dos Corredores da Serra do Mar e Central da Mata Atlântica. 7. Diagnóstico do estado de conservação da biodiversidade das restingas do Corredor da Serra do Mar e do

Corredor Central da Mata Atlântica, pp.71-74; 8. Fatores predominantes de pressão de degradação nas restingas dos corredores e diversidade de vertebrados terrestres, pp.75-80; 9. A fragmentação dos habitats de restinga e a ordenação na extinção das espécies das comunidades de vertebrados terrestres, pp.81-84; 10. Esforço de conservação nas restingas do Corredor da Serra do Mar e do Corredor Central da Mata Atlântica, pp.85-88; 11. Vertebrados terrestres endêmicos e ameaçados, pp.89-100; 12. Indicadores biológicos para monitoramento da biodiversidade, pp.101-108; 13. Ampliação da extensão de áreas protegidas e criação de novas áreas para conservação nos grandes blocos de remanescentes florestais e nas restingas dos Corredores da Serra do Mar e Central da Mata Atlântica, pp.109-112; Recomendações, pp.113-116. *Para maiores informações*: Carlos Frederico Duarte da Rocha, Departamento de Ecologia, Instituto de Biologia Roberto Alcântara Gomes, Universidade Estadual do Rio de Janeiro, Rua São Francisco Xavier 524, Maracanã 20550-013, Rio de Janeiro, RJ, Brasil, e-mail: <cfdrocha@uerj.br>.

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MEETINGS

2004

Student Conference on Conservation Science, 24-26 March, 2004, Department of Zoology, University of Cambridge, UK. Plenary lectures by four leading figures in the field: Prof. Gretchen Daily (Stanford University), Prof. Kathy Homewood (University College, London), Prof. John Reynolds (University of East Anglia) and Dr. Bob Watson (The World Bank and former Chair, IPCC). For more information see the website: <http://www.zoo.cam.ac.uk/sccs>.

International Fund for Animal Welfare – Forum on Wildlife Conservation, 17-20 June 2004, Limerick, Ireland. The International Fund for Animal Welfare (IFAW), in association with the University of Limerick, will be holding an international forum in Limerick, Ireland, from 17-20 June 2004. The theme of the forum is: Wildlife Conservation: In Pursuit of Ecological Sustainability. The objective of the forum is to focus attention on, and to advance the understanding of, issues surrounding the pursuit of ecologically sustainable use and the conservation of wildlife (including fisheries). The programme consists of approximately 24 invited lectures, and a limited number of contributed papers, which will be presented as posters. The programme is divided into five sessions: 1) The Global Context; 2) Modern Examples; 3) Factors at Play; 4) The Way Forward; 5) Theory into Practice.

The programme committee invites submission of abstracts to be considered for inclusion in the programme as contributed poster papers. Abstracts will be received until 1 February 2004. Abstracts should follow the guidelines described in the "Abstract Guidelines" section on the IFAW website. For more information on the Forum, including a list of confirmed speakers, please visit

<http://www.ifaw.org/forum> or contact Sheryl Fink at <sfink@ifaw.org>.

Association for Tropical Biology and Conservation 2004 Annual Meeting, 12-15 July 2004, Miami, Florida, USA. The meeting will be held at the James L. Knight International Center in downtown Miami, with the theme of "Geographic and Conceptual Frontiers of Tropical Biology." The meeting will be co-sponsored by the University of Miami and Florida International University, along with other members of the Center for Excellence in Tropical Biology. The deadline for symposium proposals is 15 October 2003. For more information as it becomes available, visit the ATBC Meetings webpage at <http://www.atbio.org/meetings.html> or contact the two Program Directors: Theodore H. Fleming, Department of Biology, University of Miami, Coral Gables, FL 33124, USA, Tel.: 305-284-6881, Fax: 305-284-3039, email: <tfleming@fig. cox.miami.edu>, or David Lee, Department of Biological Sciences, Florida International University, University Park, Miami, FL 33199, USA, Tel.: 305-348-3111, Fax: 305-348-1986, email: <leed@fiu.edu>.

VI International Conference on Wildlife Management in Amazonia and Latin America, 5-10 September, 2004, Iquitos, Peru. Organized by The National University of the Peruvian Amazon (UNAP), the Durrell Institute of Conservation and Ecology (DICE) and the Wildlife Conservation Society (WCS). The organizers cordially welcome and invite the participation of a wide audience including students, professionals, local communities, NGOs, government representatives and the general public. Special emphasis during this conference will be on lessons learnt in wildlife conservation and management in Amazonia and Latin America. Discussions and presentations will look at the advances made for conservation, and the lessons learnt in the design, development, implementation, methods, and management plans for wildlife in Amazonia and Latin America. If you are interested in receiving further information about the conference; submission of abstracts, workshops, and courses; and information on registration and hotels, please visit the conference website at <http://www.vicongreso.com.pe/>. If you have any questions, contact the conference organisers by e-mail at <congresofauna@amauta.rcp.net.pe>. The Organizing Committee includes Dr Richard Bodmer-DICE, Dr Lorgio Verdi-UNAP, Pablo Puertas-WCS.

2005

19th Annual Meeting of the Society for Conservation Biology, Está previsto para acontecer em julho de 2005, na Universidade de Brasília (UnB). A Diretoria da Society for Conservation Biology (SCB) escolheu Brasília como sede do congresso no dia 2 de julho último durante a 17ª reunião que foi realizada em Duluth, MN, EUA. A organização geral estará a cargo do Prof. Miguel Ângelo Marini do Departamento de Zoologia da UnB. Participarão da comissão organizadora, professores do Departamento de Zoologia da UnB, membros da diretoria da Seção da América Austral e Neotropical (ANA) da SCB, e outros pesquisadores principalmente do Brasil e de outros países Latino-americanos. A data exata da realização do congresso será definida nos próximos meses. Informações detalhadas do congresso só estarão disponíveis na Internet em 2004.

Association of Tropical Biology and Conservation 2005 Annual Meeting, 23-29 July 2005, Uberlândia, Brazil. The venue is the Center Convention Uberlandia. For more information write to the Chair of the Organizing Committee, Kleber del-Claro, Laboratório de Ecologia Comportamental e Interações, Universidade Federal de Uberlândia, Caixa Postal 593, 38400-902 Uberlândia, Minas Gerais, Brazil, or email to <delclaro@ufu.br> or <atbc2005@inbio.ufu.br>.

29th International Ethological Conference, 20-27 August, 2005. Budapest, Hungary. Hosted by the Hungarian Ethological Society at the Eötvös University (ELTE) Convention Centre. For more information, write to IEC2005, Department of Ethology, Eötvös University, 1117 Budapest, Hungary, or join the e-mail newsletter: <IEC2005-subscribe@yahoogroups.com>.

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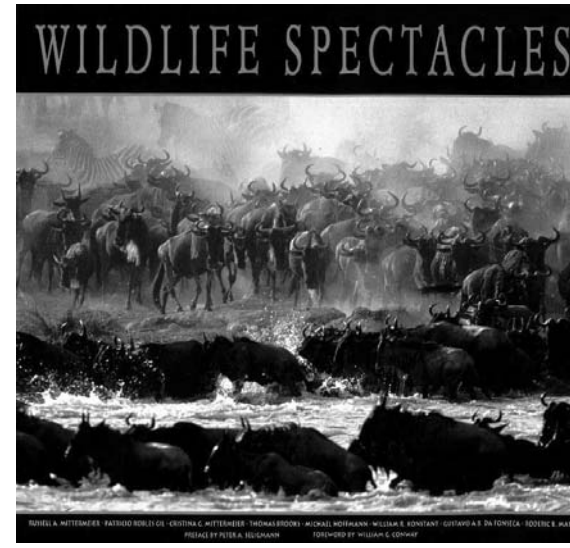

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NOTES TO CONTRIBUTORS

Scope
Edentata, the newsletter of the Edentate Specialist Group, aims to provide a basis for conservation information relating to edentates. We welcome texts on any aspect of edentate conservation, including articles, thesis abstracts, news items, recent events, recent publications, and the like.

Submission
Please send all submissions in English, Portuguese or Spanish to: John Aguiar, Center for Applied Biodiversity Science, Conservation International, 1919 M St. NW, Suite 600, Washington, DC 20036, USA, Tel: (202) 912-1000, Fax: (202) 912-0772, e-mail: <j.aguiar@conservation.org>.

Contributions
Manuscripts may be in English, Portuguese or Spanish, and should be double-spaced and accompanied by the text and any tables and/or figures on diskette for PC compatible text-editors (MS-Word, WordPerfect, Excel, and Access), and/or emailed to <j.aguiar@conservation.org>. Hard copies should be supplied for all figures (illustrations and maps) and tables. The full name and address of each contributing author should be included. Please avoid abbreviations and acronyms without the name in full. Authors whose first language is not English should please have their texts *carefully reviewed* by a native English speaker.

Articles
A broad range of topics is welcomed and encouraged, including but not limited to: Taxonomy, Systematics, Genetics (when relevant to systematics), Biogeography, Ecology, Conservation, and Behavior. Texts should not exceed 20 pages in length (double-spaced and including the references). For longer articles please include an abstract in English and an optional one in Portuguese or Spanish. Please limit the number of tables and figures to six, excepting cases where fundamental to the text.

Figures and Maps
Articles may include small high-quality black-and-white photographs, figures, maps, and tables. Image resolution should be 300 dpi or higher in any of the following electronic file formats: .jpg, .tif, .eps, .pdf, .psd, or .ai. We also accept original artwork, photos, or slides to scan and return to the owner. Please contact Kim Meek at (202) 912-1379 or via e-mail at <k.meek@conservation.org> if you have any questions regarding file formats or images.

News Items
Please send any information on projects, field sites, courses, recent publications, awards, events, etc.

References
Examples of house style may be found throughout this newsletter. Please refer to these examples when citing references:

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