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VOL 2: XENARTHRA

2009 EDITION

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1a
Introduction to Paraguayan Xenarthra

The Xenarthra contain some of the most charismatic and instantly recognisable of all Paraguayan mammals - the Armadillos (Dasypodidae), the Anteaters (Myrmecophagidae) and the Sloths (Bradypodidae). Though many of the species included in this volume are amongst the easiest of Paraguayan mammals to observe, surprisingly little is known about their habits and there are numerous popular misconceptions about their behaviour. Only one species of armadillo can roll itself into a ball for example (the Southern Three-banded Armadillo *Tolypeutes matacus*), sloths do not spend all their time upside-down in trees (they are actually excellent swimmers!) and anteaters are not defenceless, half-blind, halfwits (they possess a pair of scythe-like foreclaws that can rip attackers to pieces!).

Paraguay is particularly blessed with its armadillo fauna, its total of 11 species being greater than that of any other South American country. Amongst them are the humongous Giant Armadillo *Priodontes maximus,* a lumbering hulk of an animal that feeds almost entirely on ants and termites, the adaptable Six-banded Armadillo *Euphractus sexcinctus* which breaks from the family tradition by hunting small mammals and crunching carrion, and the remarkable Chaco Fairy Armadillo *Calyptophractus retusus,* a tiny fossorial species with a mole-like existence and hardened rear-end, a butt-plug if you will, that stops predators following him down his tunnels.

Two of the four known anteater species are present in Paraguay. Remarkable for having lost their teeth completely (other Xenarthrans have peg-like "pseudo-teeth" that lack enamel and grow throughout life), the rostrum has adapted into a tubular "vacuum cleaner" for ants and termites, the insects being lapped up by a remarkably sticky and elongate extensile tongue. Anteaters use the massive foreclaws to smash open the cement-hard nests of their prey, but are not immune to the bites of the defending insects, limiting their feeding time at any one colony to the amount of pain they can endure before deciding that enough is enough. This fascinating ecological restraint is a form of natural sustainable harvesting which ensures that colonies remain to be plundered another day. Furthermore these fascinating animals do not secrete stomach acids - they use the formic acid contained in their ant prey to literally dissolve them in their own juices.

The sloths are a mainly Amazonian group, but enigmatic but unconfirmed reports suggest that one species may reach the northern Paraguayan Chaco. Though difficult to observe these fascinating animals live life at their own pace, moving slowly through the trees and munching on leaves - just about the only food they are quick enough to catch! So slow are they in fact that symbiotic algae grow on their pelage, this remarkable relationship between beast and blob providing the sloth with perfect camouflage in their green canopy domain.

The aim of this volume is to summarise the current knowledge of the biology and ecology of the Paraguayan species of Xenarthra and present it in an accessible and readable form that I hope will be of interest to amateurs and of utility to professionals who work with this fascinating and ancient group of mammals.

1b
Taxonomy of the Xenarthra, Cope 1889

The higher level taxonomy of the Xenarthra has undergone considerable changes over recent years with wider use of new molecular and genetic techniques for determining relationships radically re-shaping our traditional understanding of the group. The taxonomy used in this volume follows Gardner (2007) for the most part, but incorporates the results of Möller-Krull et al (2007) for the subfamilial relationships of the Dasypodidae.

As currently recognised the Xenarthra forms a Magnorder, containing two orders, the Pilosa (anteaters and sloths) and the Cingulata (armadillos). The Pilosa are further split into two sub-orders - Vermilingua (literally "worm-tongues" in Latin!) for the anteaters (Myrmecophagidae and Cyclopedidae) and Folivora (literally "leaf-eaters" in Latin!) for the sloths (Bradypodidae and Megalonychidae). The Xenarthra in their current form are entirely Neotropical in distribution, though at least one armadillo species has spread to the Nearctic region. (Gardner 2007).

Traditionally this arrangement was somewhat different with Xenarthra being treated as a suborder of the order Edentata (literally "no teeth") an expanded group which included the Old World Pangolins (now Order Pholidota) on account of their apparent similarity in lifestyle, lack of teeth and scaly appearance - characters they superficially shared with one or all of the New World Xenarthrans. However these similarities do not reflect taxonomic relationships and can be attributed to convergent evolution. Furthermore the Pholidota lack skeletal structures unique to the Xenarthrans such as ischial articulations on the vertebral column and intervertebral articulations on the arches of the posterior trunk surface (Gardner 2007). See below for a comparison of the classifications:

TRADITIONAL SEQUENCE

ORDER EDENTATA

SUBORDER XENARTHRA
Family Dasypodidae: Armadillos (21sp)
Family Myrmecophagidae: Anteaters (4sp)
Family Bradypodidae: Three-toed Sloths (3sp)
Family Megalonychidae: Two-toed Sloths (2sp)

SUBORDER PHOLIDOTA
Family Manidae: Pangolins (8sp)

MODERN SEQUENCE

MAGNORDER XENARTHRA

ORDER PILOSA
SUBORDER VERMILINGUA
Family Myrmecophagidae: True Anteaters (3sp)
Family Cyclopedidae: Silky Anteater (1sp)
SUBORDER FOLIVORA
Family Bradypodidae: Three-toed Sloths (3sp)
Family Megalonychidae: Two-toed Sloths (2sp)

ORDER CINGULATA
Family Dasypodidae: Armadillos (21sp)

Pangolins (Order Pholidota) are no longer considered to be related to the Xenarthrans, in fact their closest relatives are the Carnivora!

2
Family
Dasypodidae: Armadillos

General characteristics: Eleven species recorded in Paraguay. The back is rounded and armoured with a carapace covered with horny scales and with bony dermal scutes forming movable bands across the midsection. Both the forepart and the hind part of the carapace are immovable. The underside of the animal is hairy and lacks armour. Armadillos run with rapid movements of their short, strong legs. They have five toes on the hind foot and three to five toes on the forefoot, each marked with strong claws. Forelimb structure is specialised for digging, exceptionally so in some species. Hind limb structure is associated with weight bearing and measurement indices are correlated with body size. Most species are excellent diggers, constructing species-specific caves with a rounded roof in which they sleep and raise their young. Armadillos are generally solitary, approachable and tame, with poor vision but an excellent sense of smell. The Guaraní common name is most often used for the species in Paraguay, the Spanish names being understood but rarely used in everyday speech. The Guaraní word for armadillo, "tatu" is also used in vulgar speech in reference to female genitalia! The family is ancient, dating from the late Paleocene of South America.

Dental characteristics: The long mandibles are lined with a varying number of semicircular "molariform" teeth which grow continuously through life. These teeth lack enamel. Dental formula is variable and canines and incisors are lacking.

Skeletal characteristics: More fossorial species showing a greater length of the olecronon process of the ulna and more robust humerus.

Taxonomy: According to Möller-Krull et al (2007) the Dasypodidae are split into four subfamilies - Dasypodinae, Chlamyphorinae, Tolypeutinae and Euphractinae. The Tolpuetinae can be split into two tribes, Tolypeutini (containing the genus *Tolypeutes*) and Priodontini containing the genera (*Priodontes* and *Cabassous*).

3
Key to the Armadillos of Paraguay

1a Carapace complete on head and dorsum, with movable bands on latter. Total length >25cm.....**2**
1b Carapace incomplete, reduced to small dorsal plates on head and along spine. Heavily furred. Total length tiny <16cm.....*Calyptophractus retusus* (p34)

2a Forefeet with one or more greatly enlarged, scythe-like foreclaws.....**3**
2b Forefeet lacking greatly enlarged, scythe-like foreclaws.....**6**

3a Enormous, total length >140cm, body length >70cm.....*Priodontes maximus* (p76)
3b Total length <80cm, body length <50cm.....**4**

4a Three movable bands across dorsal surface. Curls into ball for defence - does not dig. Tail short, stumpy and covered in bony tubercles.....*Tolypeutes matacus* (p84)
4b >10 movable bands across dorsal surface. Digs rapidly to escape persecution. Tail long, thin and "naked" - lacking well-developed plates.....*Cabassous* **5**

5a Ears long and funnel-shaped extending well above the head. Distributed in eastern Paraguay.....*Cabassous tatouay* (p68)
5b Ears short and rounded do not extend above the head. Fleshy expansion on anterior margin of ear. Distributed in the Chaco.....*Cabassous chacoensis* (p64)
NB: *Cabassous unicinctus* has not yet been recorded in Paraguay but could theoretically occur in the extreme north of the Oriental region. It is similar to *C.tatouay* but is distinguished by the shorter ears which do not extend well above the head but are longer than those of *C.chacoensis* (and lack the characteristic fleshy expansions of that species). In measurements it is intermediate between the two documented species (see **SSP** section of *C.tatouay* account). Typically in *C.tatouay* the ear length is >40mm and head and body length (excluding tail) >36cm, and in *C.unicinctus* ear length is <30mm and head and body length<35cm.

6a Stiff dorsal hairs present on carapace. Ears well-separated at base. Snout short and blunt.....**9**
6b Carapace steeply rounded and lacking dorsal hairs. Ears joined at base. Snout long and tubular…….....*Dasypus* **7**

7a Total length >60cm. Tail equal to or greater than head and body length. 8 or 9 movable bands with distinct pale edges. Mean of 60 scutes along 4th movable band.....*Dasypus novemcinctus* (p45)
7b Total length <50cm. Tail equal to or shorter than head and body length. 6 or 7 movable bands lacking pale edges.....**8**

8a Overall colouration pale yellowish. Tail 65-70% of head and body length. Ears 25-30% head length. Total length c46cm. Mean of 54 scutes along 4th movable band.....*Dasypus hybridus* (p39)
8b Overall colouration dark blackish. Tail 80-100% of head and body length. Ears 40-50% head length. Total length c40cm. Mean of 48 scutes along 4th movable band.....*Dasypus septemcinctus* (p57)

9a Total length <40cm. Ears long, projecting well above head and extending to the second row of scapular scutes when laid back. Carapace somewhat rounded. Lacks holes in pelvic shield.....*Chaetophractus vellerosus* (p11)
9b Total length >40cm. Ears short and rounded. Carapace flattened dorsally. Holes in pelvic shield……...……...**10**

10a Scutes typically dark reddish brown, guard hairs dark. 7 or 8 movable bands (never 6) between scapular and pelvic shields, at least 2 movable neck bands. Scutes of head shield small and disorganised.....*Chaetophractus villosus* (p17)
10b Scutes typically pale yellow-brown, guard hairs pale. 6 to 8 movable bands between scapular and pelvic shields and one movable neck band. Scutes of head shield large and well-organised.....*Euphractus sexcinctus* (p24)

4
Subfamily Euphractinae, Winge 1823

General characteristics: Three species in Paraguay in two genera. These are small to medium-sized armadillos with a broad head, short snout and short ears. Conspicuous body hair on the carapace, sides and venter. The cephalic shield is broad and forms a ledge over the orbit. Scutes along the ventral margin of the carapace are rounded anteriorly and pointed posteriorly. The forefoot possesses four toes, claws on digits II and III being longest.
Cranial characteristics: Auditory bullae and external auditory meatus are ossified.
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Chaetophractus Fitzinger 1871. Three species, two present in Paraguay.
Euphractus Wagler 1830. Monotypic genus.

5
Genus *Chaetophractus*, Fitzinger 1871

There are three species in this genus, two present in Paraguay. Synonyms adapted from Gardner (2007).

Synonyms:

Loricatus Desmarest 1804:28. In part.
Dasypus Illiger 1870:70. In part. Not *Dasypus* Linnaeus (1758).
Tatus Olfers 1816:220. In part. Incorrect spelling of *Tatu* Blumenbach (1779).
Tatusia Lesson 1827:309. In part.
Euphractus Burmeister 1861:427. In part. Not *Euphractus* Wagler (1830).
Chaetophractus Fitzinger 1871:268. Type species *Dasypus villosus* (=*Loricatus villosus* Desmarest 1804) by designation.
Dasyphractus Fitzinger 1871:264. Type species *Dasyphractus brevirostris* by monotypy.
Choetophractus Trouessart 1898:1146. Incorrect spelling.

General characteristics: Two species of small to medium-sized armadillos. Head is armed with a dermal shield that reaches to the nose. The medium-length ears are well-separated with rounded ends. The dorsal scutes are arranged in a linear fashion and covered in sparse, stiff hairs, with six to eight flexible bands across the centre. The legs and underparts are densely haired. Armadillos in this genus are omnivorous, with some suggestion of seasonal diet changes. The genus is known from the Pliocene of South America.

Cranial characteristics: Marked post-orbital constriction. Broad zygomatic arch. Brain case expanded and flattened dorsolaterally. Palatine terminates in a V-shape.

Dental characteristics: Dental formula 9/10 = 36

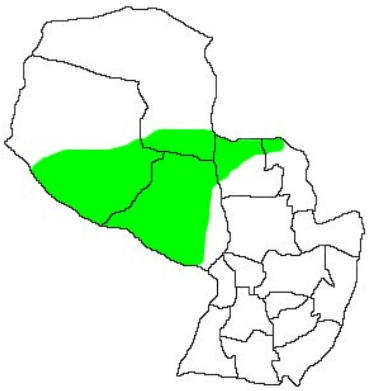
Paraguayan Species:

Chaetophractus vellerosus - Lesser Hairy Armadillo
Chaetophractus villosus - Greater Hairy Armadillo

6
Lesser Hairy Armadillo
Chaetophractus vellerosus

Cryptophractus brevirostris Fitzinger 1860:385. Nomen nudum.
Dasypus vellerosus Gray 1865:376. Type locality "Santa Cruz de la Sierra", Santa Cruz, Bolivia.
Dasyphractus brevirostris Fitzinger 1871:264. Type locality "Chili" Chile.
[*Dasypus* (*Choetophractus*)] *vellerosus* Trouessart 1898:1146. Name combination.
Dasypus boliviensis Grandidier & Neveu-Lemaire 1908:5. Type locality "Environs d´Uyuni (Bolivie), à 3660 mètres d´altitude", Potosi, Bolivia. Preoccupied by *Tatusia boliviensis* Gray 1873 (=*Dasypus novemcinctus* Linnaeus 1758).
Dasypus villerosus Grandidier & Neveu-Lemaire 1908:6. Incorrect spelling.
Chaetophractus vellerosus vellerosus Yepes 1928:500. First use of current name.
E[uphractus]. vellerosus Krumbiegel 1940:56. Name combination.
Euphractus villosus desertorum Krumbiegel 1940:61. Type locality "San Carlo", Chaco, Argentina.

***Chaetophractus vellerosus* (Gray 1865)**



TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Order Cingulata; Family Dasypodidae; Subfamily Euphractinae (Myers et al 2006, Möller-Krull et al 2007). Three species are recognised in this genus, two are present in Paraguay. *Chaetophractus* is taken from the Greek meaning "hairy shell", the specific name *vellerosus* is from the Latin and also means "hairy". The genus *Chaetophractus* was defined by Fitzinger in 1871. There are two recognised subspecies, that present in Paraguay being *C.v.vellerosus*. Formerly placed in the Chaetophractinae, Möller-Krull et al (2007) provided DNA evidence that demonstrated their position within the Euphractinae. Synonyms adapted from Gardner (2007).
ENG: Lesser Hairy Armadillo, Small Hairy Armadillo (Redford & Eisenberg 1992), Small Screaming Armadillo (Redford & Eisenberg 1992), Screaming Hairy Armadillo (Neris et al 2002).
ESP: Pichi peludo (Neris et al 2002), Quirquincho chico (Redford & Eisenberg 1992, Díaz & Barquez 2002), Piche Llorón (Redford & Eisenberg 1992), Tatú Llorón (Cuéllar & Noss 2003).
GUA: Tatu poju´i (Neris et al 2002), Taturavuku (Cuéllar & Noss 2003), Tatundovivi (Cuéllar & Noss 2003), Tatukirisi (Cuéllar & Noss 2003). "Poju" refers to the needle-like claws of the forefeet, the addition of "i" meaning small. In other words "little Tatu poju", or small version of Six-banded Armadillo *Euphractus sexcinctus*, the species commonly known as Tatu poju in Paraguay.

DES: A medium-small armadillo with conspicuously long, tan-coloured hairs and a notably rounded carapace. Possesses 7 or 8 movable bands between the scapular and pelvic shields and at least 2 neck bands. There are no holes in the posterior part of the pelvic shield. The head shield is large, notably downcurved in profile on the forehead and reaches almost to the base of the snout - it has a width to length ratio of 0.9 to 0.95 (Myers and Wetzel 1979). It is composed of small disorganised scutes and has a straight posterior border. The head shield is curved over the eye and the scutes are smooth. Head and carapace greyish with pinkish or yellowish edging to scutes, most obvious on the movable bands of the neck and mid-region. Ears are long, projecting well above the head and are greyish in colour, scaled on the outer surface with a pinkish tinge to the basal part of the inner ear. Pushed backwards the ears extend beyond the second row of scapular scutes. Sides of head and ventral skin pale flesh with long tufts of hair on cheeks, legs and throat, the hairs of the underparts are longest, tinged greyish on the flanks and paler in the mid-ventral area. Nose pinkish. Legs short but robust with flattened claws on all toes. There are four claws on the forefeet, the second of which is the longest. **CR:** No information. **CR: DF:** Armadillos lack true teeth, but possess a series of "molariform" teeth that do not follow the standard mammal dental formula. 9/9 = 36. First molariform located in the premaxillary as in *Euphractus*. **CN:** 2n=60.
TRA: No information.
MMT: A medium-small armadillo with a rounded carapace. **TL:** male 37.6cm (32.8-40cm), female 36.8cm (26.5-41.9cm); **HB:** unsexed (21-25.3cm); **TA:** male 11.4cm (8.4-13.1cm), female 11.2cm (7.7-13.8cm), unsexed (10-12.8cm); **FT:** male 4.9cm (4-5.3cm), female 4.8cm (3.1-5.6cm), unsexed (4.4-5.1cm); **EA:** male 2.8cm (2.2-3.1cm), female 2.7cm (2.2-3.1 cm), unsexed (2.5-3.3cm); **WT:** male 860g (543-1,329g), female 814g (257-1.126g); May be up to 10% heavier during winter due to a 1-2cm thick layer of subcutaenous fat. (Parera 2002, Eisenberg & Redford 1999, Ceresoli et al 2003, Neris et al 2002, Redford & Eisenberg 1992).
SSP: Unlikely to be confused in Paraguay, this is much the smallest of the Hairy Armadillos. It can be further distinguished by its proportionately longer ears than other "Peludos" and the fact that it lacks holes in the pelvic shield. Note the smooth scutes of the cephalic shield and the pale-coloured hair on the body.
DIS: Distributed in arid areas from western Bolivia through the Paraguayan Chaco to central Argentina and west-central Chile. The nominate subspecies *C.v.vellerosus* occupies the northern part of the range, with *C.v.pannosus* (O.Thomas 1902) replacing it in central Argentina south to Provincia Mendoza. Typically it occurs in areas with low rainfall of between 200 and 600mm per year, though the species is also present in Provincia Buenos Aires where the rainfall is c1000mm. In Paraguay it is most numerous in the Central Chaco, being less frequently encountered or absent from the more northerly areas of the Chaco and less common in the Humid Chaco. The species is also present in cerrado areas of the northern Orient in Departamentos Concepción and Amambay.
HAB: Typical of dry, xeric areas with a loose and often sandy soil. They are absent from areas with rocky soil which impedes burrow construction. In the Chaco they are found in matorral and chaco scrub, as well as agricultural areas and even human settlements. In the northern Orient they are found in dry campo sucio cerrado and grassland. Abba et al (2007) found that the species burrows were found mainly in primary native woodland with calcaneous soils in the Buenos Aires area of Argentina, but that they tended to forage in adjacent, more open habitats.
ALI: The majority of the daily activity is attributed to foraging and there has been some seasonal variation in diet noted by researchers. Greegor (1980a) working in the Monte Desert of NW Argentina stated that insects dominate the diet in the summer (46% by volume) and plant matter predominates in winter (50.7% by volume) when insect matter drops to 25.7%. A significant vertebrate content in the diet was also detected, typically lizards, birds, anurans and mice such as *Elygomodontia* and *Phyllotis* (27.7% by volume in summer, 13.9% by volume in winter). Scorpions were found in 31% of stomachs analysed in summer and 47% of winter stomach, and though spiders were equally common they appeared to be absent from the diet. Stomach analysis in the Bolivian Chaco revealed vegetable material to predominate in the diet (56%) typically fruits of Algarrobo *Prosopis chilensis,* Mistol *Ziziphus mistol,* Yvyra hû *Sideroxylon obtusifolium* supplemented with beetles, ants and termites (40%) (Cuéllar & Noss 2003). In Buenos Aires Province, Argentina a 14 month study found

that 63.6% of stomach contents consisted of animal material, with just 18% plant material. Insects predominated in the diet during spring and winter, but plant material predominated during autumn. (Soibelzon et al 2007). Soibelzon et al (2007) noted that they were not able to confirm whether vertebrates in stomachs were captured alive or consumed as carrion, but hypothesised that amphibians and reptiles present in stomachs were likely captured underground, when rendered immobile by thermal factors and that the armadillos most likely made use of prey items that were most abundant and easy to capture during any given season. A considerable amount of sand is often ingested when foraging and has accounted for up to 50% of the content of some examined stomachs (Greegor 1980a). Over the course of 5 nights an individual in Catamarca was recorded to probe for food 222 times and dug 19 burrows, frequently retracing the paths of previous evenings and revisiting the same burrows (Greegor 1980b). This species is able to pass long periods without drinking (Eisenberg & Redford 1999) and derives the majority of its water from its food thanks to an extremely efficient renal system. Captive specimens maintained on a dehydrated meat diet were able to remain in water balance where *Nine-banded Armadillos* were not. (Greegor 1975).

REP: In the Bolivian Chaco the presence of lactating females suggest that the species breeds from November to January (Cuéllar & Noss 2003).

BEH: *General Behaviour* Though occasionally active by day this species is principally nocturnal with peaks of activity from 8pm to 3am (Cuéllar & Noss 2003). Burrows typically have numerous entrances, often located at the base of shrubs or under some kind of vegetation cover, and the entrance ranges from 80-150mm in diameter. Mean burrow slope is 28º (Greegor 1974). Individual animals have several burrows within the home range and burrow systems may be several metres long. They do not necessarily use the same burrow on consecutive nights and generally enter and leave any given by burrow by different holes (Greegor 1980b). When present the animal usually seals the entrance with plant material. No nest is built in the burrow. Minimum home range for one individual has been estimated at 3.4ha. (Redford & Eisenberg 1992), however there appears to be a difference in home range according to habitat-type, being around 4ha in humid areas but considerably larger in more arid environments (Edentate Specialist Group 2004). On one night an individual in Catamarca, Argentina was recorded to move between 650 and 1400m whilst foraging (Greegor 1980b). *Defensive Behaviour* Typically runs from danger, being capable of high-speeds and adopting a zig-zagging path to confuse the pursuer. Heads rapidly for its burrow. Captured individuals have been documented to emit a high-pitched scream.

VOC: Frequently emits loud screams of protest when handled, though in the authors experience with several animals in the Paraguayan Chaco, none have produced vocalisations when handled.

HUM: According to a long term study of the diet of the Isoso indigenous in group in the Bolivian Chaco this was the least frequently hunted armadillo species (Cuéllar & Noss 2003). Soibelzon (2007) concluded that their tendency to prey on potential pest species such as larvae of Scarabaeidae, Noctuidae and Curculionidae means that their presence in agricultural areas may even be beneficial to farmers.

CON: The Lesser Hairy Armadillo is considered Low Risk, least concern by the IUCN (see www.iucnredlist.org/search/details.php/4369/all for the latest assessment of the species). The species is not listed by CITES. Though only confirmed to be present in Paraguay in 1979 (Myers and Wetzel 1979), this is one of the more commonly-encountered armadillo species in the Central Chaco area. This species is able to withstand considerable alteration of habitat by humans and is not unduly affected (and may even have benefited from) ranching and farming practices in the areas around the Mennonite colonies. The species is frequently seen on roads in the Mennonite colonies.

Online Account: www.faunaparaguay.com/chavelhb.html.

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Lesser Hairy Armadillo *Chaetophractus vellerosus.* Adult. Laguna Capitán, Cuenca del Upper Yacaré Sur, Departamento Presidente Hayes, July 2006. Photo Paul Smith.

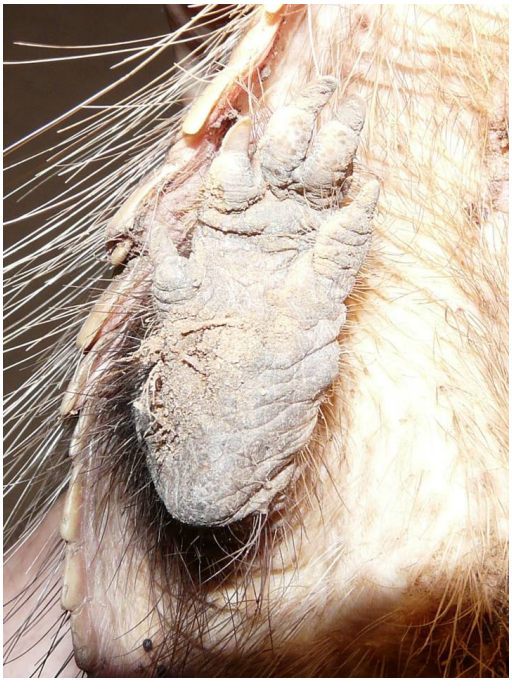
Lesser Hairy Armadillo *Chaetophractus vellerosus.* Adult dorsal. Laguna Capitán, Cuenca del Upper Yacaré Sur, Departamento Presidente Hayes. July 2006. Photo Paul Smith.

Lesser Hairy Armadillo *Chaetophractus vellerosus.* Adult lateral. Laguna Capitán, Cuenca del Upper Yacaré Sur, Departamento Presidente Hayes. September 2005. Photo Paul Smith.

Lesser Hairy Armadillo *Chaetophractus vellerosus.* Frontal. Laguna Capitán, Cuenca del Upper Yacaré Sur, Departamento Presidente Hayes. September 2007. Photo Paul Smith.

Lesser Hairy Armadillo *Chaetophractus vellerosus.* Adult cephalic shield. Laguna Capitán, Cuenca del Upper Yacaré Sur, Departamento Presidente Hayes, October 2008. Photo Paul Smith.

Lesser Hairy Armadillo *Chaetophractus vellerosus.* Adult Fore Foot. Laguna Capitán, Cuenca del Upper Yacaré Sur, Departamento Presidente Hayes. October 2008. Photo Paul Smith.



Lesser Hairy Armadillo *Chaetophractus vellerosus.* Adult Hind Foot. Laguna Capitán, Cuenca del Upper Yacaré Sur, Departamento Presidente Hayes. October 2008. Photo Paul Smith.

Lesser Hairy Armadillo *Chaetophractus vellerosus.* Cave. Laguna Capitán, Cuenca del Upper Yacaré Sur, Departamento Presidente Hayes. October 2008. Photo Paul Smith.

7
Greater Hairy Armadillo
Chaetophractus villosus

Dasypus octocinctus Molina 1782:305. Type locality "Nel Cujo" Chile (=Provincia Mendoza, Argentina). Preoccupied by *Dasypus octocinctus* Schreber 1774 (=*Dasypus novemcinctus* Linnaeus 1758).
lor[*icatus*]. *villosus* Desmarest 1804:28. Based on de Azara (1801). Type locality "Les Pampas", Buenos Aires, Argentina.
[*Dasypus*] *villosus* G.Fischer 1814:125. Name combination.
T[*atus*]. *villosus* Olfers 1818:220. Name combination.
Tatusia villosa Lesson 1827:312. Name combination.
Dasypus (*Tatusia*) *villosus* Rapp 1852:10. Name combination.
Dasypus [*Euphractus*] *villosus* Burmeister 1861:427. Name combination.
Euphractus villosus Gray 1865:376. Name combination.
Chaetophractus villosus Fitzinger 1871:268. First use of current name.
[*Dasypus* (*Choetophractus*)] *villosus* Trouessart 1898:1146. Name combination.
D[asypus]. pilosus Larrañaga 1923:343. Type locality "Campis Bonaerensibus". Preoccupied by *Dasypus pilosus* (Fitzinger 1856).
Euphractus (*Chaetophractus*) *villosus* Moeller 1968:514. Name combination.

Chaetophractus villosus
(Desmarest 1804)

TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Order Cingulata; Family Dasypodidae; Subfamily Euphractinae (Myers et al 2006, Möller-Krull et al 2007). Three species are recognised in this genus, two are present in Paraguay. *Chaetophractus* is taken from the Greek meaning "hairy shell", the specific name *villosus* is from the Latin and also means "hairy". The genus *Chaetophractus* was defined by Fitzinger in 1871. The genus *Chaetophractus* was defined by Fitzinger in 1871. The species in monotypic. The species description is based upon de Azara´s (1801) "Le Tatou Velu" Formerly placed in the Chaetophractinae, Möller-Krull et al (2007) provided DNA evidence that demonstrated their position within the Euphractinae. Synonyms adapted from Gardner (2007).

ENG: Greater Hairy Armadillo, Larger Hairy Armadillo (Eisenberg & Redford 1999), Large Hairy Armadillo (Neris et al 2002), Big Hairy Armadillo (Gardner 2007).
ESP: Pichi peludo (Neris et al 2002), Quirquincho grande (Eisenberg & Redford 1999), Tatu pecho amarillo (Cuéllar & Noss 2003), Tatú peludo (Parera 2002).

GUA: Tatu poju´i (Neris et al 2002). "Poju" refers to the needle-like claws of the forefeet, the addition of "i" meaning small. In other words "little Tatu poju", or small version of *Euphractus sexcinctus*, the species commonly known as Tatu poju in Paraguay.
DES: A medium-large armadillo with conspicuous blackish dorsal hairs and a somewhat flattened carapace. Possesses 7 or 8 movable bands between the scapular and pelvic shields and at least 2 neck bands. Small individuals possess 2 to 4 small openings in the posterior part of the pelvic shield which are glandular openings and produce an odorous secretion. The head shield is large, notably downcurved in profile on the forehead and reaches almost to the point of the snout. It is composed of small disorganised scutes and has a distinct posterior border. There is no spur behind the eye. Head and carapace dark reddish-brown, somewhat paler and more tan coloured on the borders. Ears are medium-sized and dark brown in colour. Sides of head and ventral skin dark brown with long tufts of hair on cheeks, legs and throat, the hairs of the underparts being slightly paler than those of the dorsal surface. Legs short but robust with flattened claws on all toes **CR:** See figure. **DF:** Armadillos lack true teeth, but possess a series of "molariform" teeth that do not follow the standard mammal dental formula. 9/10 = 38. First molariform located in the premaxillary as in *Euphractus*. **CN:** 2n=60. FN=88 or 90. Males have not been karyotyped (Gardner 2007).

Chaetophractus villosus.
Photo courtesy of
www.skullsunlimited.com

TRA: No information.
MMT: A medium-sized armadillo with a flattened carapace. **TL:** 43.67cm (38.6-55cm); **HB:** 29.11cm (26.1-34.4cm); *Head* 10cm; *Head Width* 11cm; **TA:** 11.2-15.6cm; *Tail Diameter at Base* 8cm; **FT:** 6.17cm (5-7cm); **EA:** 2.4cm (2.2-3.1cm); *Mouth* 7x4cm; **WT:** 2.37kg (1-3.89kg) They are capable of depositing large amounts of fat and captive individuals may be much heavier than wild individuals; **WN:** 127.29g (108-155g); *Claws of Forefeet:* 1.5-2.5cm. (Parera 2002, Eisenberg & Redford 1999, Neris et al 2002, Redford & Eisenberg 1992, Ceresoli et al 2003, Olocco-Diz & Duggan 2004, Olocco-Diz et al 2006).

SSP: This species is easily confused with the larger *Euphractus sexcinctus* with which it overlaps throughout its Paraguayan range - though note that this species is absent from much of the Orient. In general *Euphractus* is more yellowish in colour with pale guard hairs on the carapace, this species somewhat more reddish-tan with dark brownish hairs. *Chaetophractus villosus* is hairier overall (though the dark hairs against the dark shell are not always conspicuous) with more obvious tufts of hair on the cheek, throat and legs. Though the number of movable bands is variable in both species, this species never has less than 7 whilst *Euphractus* may occasionally have 6. Examining the head plate *Euphractus* can be seen to have a "spur" behind the eye and often a line of small scales beneath the eye which are both absent in this species. Note also the rounded forehead in profile of the *Chaetophractus* when compared to the flattened forehead of *Euphractus*. Furthermore the large, well-organised scales on the head shield of *Euphractus* are in contrast to the smaller, disorganised scales of *Chaetophractus* which also usually shows a well-defined posterior border to the head shield. At least two neck bands are present between the head shield and the scapular plate in this species, only one is present in *Euphractus*. The other member of the genus *Chaetophractus vellerosus* is considerably smaller with longer ears.
DIS: Widely distributed in the Southern Cone of South America from Brazil and extreme western Brazil to Argentina and eastern Chile south to Magallanes, though its distribution in that country is somewhat disjunct. In Argentina it is the commonest and most widespread armadillo, being found throughout Patagonia north to Provincias Buenos Aires and Cordóba, and extending further north through the central zone of the country to Provincias Santiago del Estero and Chaco. It has been introduced into Tierra del Fuego, Argentina. In Paraguay it is present throughout the Chaco, though considerably less common in the humid Chaco. According to Neris et al (2002) they occur in eastern Paraguay in areas of cerrado in the drier areas of the northern Orient in Departamentos Concepción and Amambay. However this was rejected by the Edentate Specialist Group (2004) who insist that the

species is absent from eastern and southern Paraguay and confined to the Dry Chaco. Confusion with the superficially similar *Euphractus sexcinctus* may be responsible for the Oriental records. This is the commonest large armadillo in the Paraguayan Chaco.

HAB: Confined to xerophytic areas of the Chaco where it occurs in matorral, edges of Chaco woodland, ranchland and agricultural areas. Burrows are generally located in bushy areas though they tend to forage in more open habitats, including along roads - they are often seen by the side of the Ruta Trans-Chaco in Departamento Boquerón. Frequently found close to human habitation.

ALI: A generalist omnivore, their ability to survive on a low water diet is one of the reasons for their success in arid environments where other armadillos are less abundant (Greegor 1975). Analysis of stomach contents reported in Cuéllar & Noss (2003) revealed that the species feeds primarily on fruits (60% of diet) in the Bolivian Chaco, especially Guayacán *Caesalpinia paraguariensis,* Algarrobo *Prosopis chilensis,* Mistol *Ziziphus mistol,* Yvyra hû *Sideroxylon obtusifolium* and the cacti *Quiabentia pflanzil,* with the addition of insect material such as beetles, termites and ants. Neris et al (2002) describe it as principally a scavenging species feeding largely on carrion and roadkill. Parera (2002) notes that the diet may change through the year with invertebrates predominating in winter and vegetable matter in summer. In areas of human habitation they may raid rubbish bins in search of food or chicken coups for eggs. They may even construct temporary burrows under or even into carcasses to exploit maggots. Rarely they may drive the rostrum into soft soil and turn the body in a circular motion to form a conical hole in order to obtain insects. (Nowak 1991). In captivity they have adapted to commercial dog and cat foods supplemented with fruit, vegetables, eggs and large amounts of live insects, but as they show a tendency towards obesity should not be fed for at least one day each week. (Ratajszczak & Trzesowska 1997). A pair of captive juveniles were able to take bananas by day 48 and dog food by day 56. During their first month their mean milk consumption was 15.22% of their body weight per day and they increased in weight by 11.52g daily. During the second month their milk consumption fell to 8.48% of body weight and they gained 18.54g per day. In the final fortnight prior to weaning consumption was 4.05% of body weight and they gained 13.56g per day. (Olocco-Diz & Duggan 2004).

REP: In the Bolivian Chaco they appear to reproduce from November to May with the majority of lactating females being found in December and April (Cuéllar & Noss 2003). Breeding occurs in September in Provincia Santa Fé, Argentina. If conditions allow a second litter may be attempted in a single season. Prior to mating males follow females sniffing the genital area before mounting (Ratajszczak & Trzesowska 1997). Captive males were seen to attempt mountings throughout the year with the birthing season from February to December (Redford & Eisenberg 1992). Pregnant females are easily recognised due to a visible flattening of the carapace so that the sides barely cover the flanks, the "armour" returning to its natural position after birth (Ratajszczak & Trzesowska 1997). Litters usually consist of 2 or more rarely 3 offspring born after a gestation of 60 to 75 days. At Pozán Zoo, Poland all births took place at night with females perparing a shallow depression in the substrate using the forelegs and nose. Births were rapid with two offspring typically being born within a 10 minute period and following birth the female immediately proceeding to add more material to the "nest" so that the juveniles were concealed, eventaully entering and accompanying the offspring as soon as building is complete (Ratajszczak & Trzesowska 1997). Twins often consist of one male and one female (Nowak 1991). New-borns have soft leathery skin which gradually hardens with age, the pinnae are not yet formed and the mouth is closed except for the terminal portion. The nails are soft but they are able to crawl in search of milk. (Olocco-Diz & Duggan 2004). Lactation lasts 50-60 days with females often feeding young whilst lying on the back, and the eyes open after 16-30 days. Juveniles begin to move outside the nest at 30 days and take solid food from 35 days onwards Ratajszczak & Trzesowska (1997). Sexual maturity is reached at 9 months. (Redford & Eisenberg 1992). Ratajszczak & Trzesowska (1997) noted that interbirth intervals of captive individuals were often short, as little as 72 to 74 days in some females, and that such short periods followed successful rearings not unsuccessful breeding attempts. There was no need to remove males from the enclosure during breeding, but females were sensitive to nest disturbance by humans which frequently resulted in nest failure. During failed breedings the young were consumed by the mother leaving no trace of their existence.

BEH: *General Behaviour* Active by day and by night. Neris et al (2002) states that the species is more diurnal in winter and nocturnal in summer. Individuals of this species were observed to be active by day from at least July to early October in the area around PN Tte Enciso, Departamento Boquerón during 2006 and 2007 (P. Smith pers. obs.). Cuéllar & Noss (2003) describe the species as diurnal in the Bolivian Chaco and note that it is active during the hottest hours of the day with peaks of activity from 10am to 4pm. Armadillos at Pozán Zoo, Poland became quickly tame and enjoyed petting and scratching (Ratajszczak & Trzesowska 1997). *Sociability* Usually seen alone or in pairs in the wild (P.Smith pers.obs.). Ratajszczak & Trzesowska (1997) noted that as many as eight individuals were kept together at Pozán Zoo, Poland without any aggression being shown even when two females simultaneously raised young in the same enclosure. *Refuges* Burrow architecture in the Argentinean Pampas was described in detail by Abba et al (2005). They found burrows typically to consist of a steeply declining entrance tunnel that levels out to a horizontal gallery. The single entrance was approximately circular (19-20cm wide x 15-20cm high) and faced away from the prevailing wind direction. In soft terrain they descend to a mean depth of 30cm, but may be as deep as 1m if an obstacle is in the way. Fifty-seven percent of the burrows examined were found to be branched. Two burrow types were identified: longer, deeper burrows (complex) were built in harder soil and shorter, shallower burrows (simple) in soft soil. Simple burrows had a mean length of 70cm and mean depth of 50cm and were found only in soil with a high organic content. These were likely associated with feeding (60% of those examined ended in a tunnel excavated by Scarabaeid larvae (Coleoptera)) or temporary refuges from potential predators. These burrows are frequently clustered to some degree. Complex burrows were located in hard, calcareous soil with little moisture and reached 485cm in length and 100cm in depth. Seven of the 34 complex burrows found had chambers near the mouth or at the end, and mean chamber dimensions were 20 x 30 x 50cm. These likely represent permanent, home burrows and were always located in areas that were not subject to flooding. Burrows may be shared by a mated pair but lack nesting material. *Defensive Behaviour* When pursued this species runs rapidly towards its burrow, frequently adopting a zig-zagging course and heading through dense, and often thorny vegetation in an attempt to shake its pursuer (P. Smith pers. obs.). Nowak (1991) states that they may give a snarling noise when pursued and that if overtaken they draw the legs under the body so that the carapace is in contact with the ground. Upon entering a burrow they may spread the feet and arch the body so that the claws and edges of the movable bands anchor the animal in place, making it impossible to remove them by force. If surprised at great distance from their home burrow they may immediately try to dig (Parera 2002). Vigilant individuals can rise up onto the hind legs using the tail for support (Parera 2002). *Enemies* In Argentina the principal predator is *Puma* and the species is also undoubtedly taken by *Jaguar* in the Paraguayan Chaco. Foxes probably take young animals. *Longevity* Captive individuals have survived for 20 years (Nowak 1991).

VOC: Females disturbed at the nest emerge and growl (Redford & Eisenberg 1992). Captured animals can produce a quiet grunting sound by contracting the abdomen (Parera 2002). Suckling young make a noise similar to a cats murmur (*sic*) (Ratajszczak & Trzesowska 1997).

HUM: The species is consumed by indigenous populations in the Chaco, though it is not the favoured armadillo species for the table. Campesinos tend to avoid eating the species because of its scavenging habits (Neris et al 2002). In Argentina the species is hunted in winter when fat deposits make them heavier. Due to its poor eyesight it is prone to be a victim of roadkill and may also be hunted by domestic dogs. In agricultural areas they may be considered a pest for their habit of burrowing into soft soil. (Chiarello et al 2006, Parera 2002)

CON: The Greater Hairy Armadillo is considered Low Risk, least concern by the IUCN (see www.iucnredlist.org/search/details.php/4369/all for the latest assessment of the species). The species is not listed by CITES. The species was first confirmed to occur in Paraguay as late as 1979 (Myers and Wetzel 1979), reflecting the previous inaccessibility of its habitat rather than the rarity of the species. Due to the wide distribution, isolated nature of its chosen habitat in Paraguay and apparent abundance it appears to be under no imminent threat. The species is present in several protected areas. It is able to adapt readily to habitats altered by humans and may even benefit from the association due to its ability to scavenge on refuse. (Chiarello et al 2006).

Online Account: www.faunaparaguay.com/chavilhb.html.

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Greater Hairy Armadillo *Chaetophractus villosus*. Adult lateral. PN Teniente Enciso, Departamento Boquerón, July 2006. Photograph courtesy of Sylvia Centrón.

Greater Hairy Armadillo *Chaetophractus villosus*. Adult dorsal. PN Teniente Enciso, Departamento Boquerón, July 2006. Photograph courtesy of Sylvia Centrón.

8
Genus *Euphractus*, Wagler 1830

This is a monotypic genus. Synonyms adapted from Gardner (2007).

Synonyms:

Dasypus Linnaeus 1758:50. In part.
Loricatus Desmarest 1804:28. In part.
Tatus Olfers 1818:220. In part. Incorrect spelling.
Euphractus Wagler 1830:36. Type species *Dasypus sexcinctus* Linnaeus (1758) by designation.
Encoubertus McMurtie 1831:163. In part. Proposed as a subgenus of *Dasypus* Linnaeus (1758).
Pseudotroctes Gloger 1841:113. Type species *Dasypus setosus* Wied-Neuwied (1826) by monotypy.
Scleropleura Milne-Edwards 1871:178. Type species *Scleropleura bruneti* Milne-Edwards (1871) by monotypy.
Scelopleura Trouessart 1898:1141. Incorrect spelling.

General characteristics: One large species. The carapace is flattened and with a fine layer of stiff pale hairs protruding from between the dorsal bands. The head is triangular in shape and the ears are short. Forefeet with five digits, the third being the longest. Two to four openings for scent glands present in the mid-dorsum of the pelvic shield. An active burrower, digging for food and to escape enemies. Omnivorous, in addition to insects taking fruit, small vertebrates and even carrion. The genus is known from the mid-Pleistocene of South America.

Dental characteristics: Dental formula 9/10 = 36

Paraguayan Species:

Euphractus sexcinctus - Six-banded Armadillo

9
Six-banded Armadillo
Euphractus sexcinctus

Dasypus sexcinctus Linnaeus 1758:51. Type locality "America Meridionali" restricted to Pará, Brazil by O.Thomas (1907).
lor[*icatus*]. *flavimanus* Desmarest 1804:28. Type locality "Paraguay", based on de Azara (1801) and Buffon (1763).
Dasypus flavipes G.Fischer 1814:122. Type locality "Paráguay".
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Das[*ypus*]. *gilvipes* Lichtenstein 1818:215. Renaming of *Dasypus gilvipes* Illiger (1815).
T[*atus*]. *gilvipes* Olfers 1818:220. Type locality "Paraguay, Brasilien, Guiana"
Dasypus pilosus Olfers 1818:220. Nomen nudum.
Dasypus encoubert Desmarest 1822:370. Type locality "Le Paraguay".
Tatus sexcinctus Schinz 1824:pl.113. Name combination.
D[*asypus*]. *setosus* Wied-Neuwied 1826:520. Type locality "in den Grossen Campos Geraes und den Angrän zenden Gegenden des Sertong" restricted to Bahía, Brazil by Ávila-Pires (1965)..
Euphractus musetlinus Fitzinger 1871:259. In part. Type locality "Sud-und-Mittel-Amerika".
Scleropleura bruneti Milne-Edwards 1872:1. Type locality "San Antonio … Ceará", Brazil based on deformed specimen.
[*Dasypus* (*Dasypus*)] *sexcinctus* Trouessart 1898:1145. Name combination.
[*Scleropleura*] *Bruneti* Trouessart 1898:1141. Name combination.
[*Dasypus*] *poyú* Larrañaga 1923:243. Type locality implied as Uruguay. Based on *Dasypus sexcinctus* Gmelin (1788) (=*Dasypus sexcinctus* Linnaeus 1758) and de Azara (1802).

***Euphractus sexcinctus* (Linnaeus 1758)**

TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Order Cingulata; Family Dasypodidae; Subfamily Euphractinae (Myers et al 2006, Möller-Krull et al 2007). The genus *Euphractus* was defined by Wagler in 1830 and contains a single species. The genus name *Euphractus* was taken from the Greek meaning "true or good shell" and the species name *sexcinctus* means "six bands". Five subspecies were tentatively recognised by Gardner (2007), two of which are present in Paraguay - *Euphractus sexcinctus flavimanus* (Desmarest 1804) in the east and *E.s.boliviae* in the Chaco (O.Thomas 1907). Desmarest´s description of the subspecies *E.s.flavimanus* was based on de Azara´s (1801) "Le Tatou Poyou" and "L´´Encoubert" of Buffon (1763). Synonyms adapted from Gardner (2007):

ENG: Six-banded Armadillo (Gardner 2007), Yellow Armadillo (Parera 2002).
ESP: Armadillo de seis bandas (Neris et al 2002), Armadillo amarillo (Emmons 1999), Peludo (Emmons 1999), Gualacate (Parera 2002).

GUA: Tatu poju **M** (Villalba & Yanosky 2000), Poju **AP** (Villalba & Yanosky 2000), Krypurá **Ac** (Villalba & Yanosky 2000), Kry´y pura **Ac** (Esquivel 2001), Tatú poyú (Parera 2002), Tatú-podyu (Emmons 1999). "Poju" and its variations which feature in the Guaraní names refers to the needle-like claws of the forefeet.

DES: Predominately yellowish to reddish-brown in armour colour (usually yellowish), darker and somewhat blackish-brown on skin. The head plate is triangular with a straight posterior margin, coming to a blunt point just before the nose and is distinctly flattened on the upper part. It is relatively narrow, the width about 70-80% of its length. It extends as a spur behind the eye and there may be traces of scales in a semi-circle below the eye. Scales of the head plate are large and arranged in a well-defined pattern. Ears are medium-lenght, extending backwards to the second or third line of the scapular plate. They are well-separated by a distance greater than the ear-length across the top of the head. The carapace consists of two fixed plates, the scapular and pelvic plates, with 6 to 8 movable bands separating them. There is a single "nuchal" band between the head and scapular the plate. A sparse covering of long, stiff yellowish-tan hairs sprout from the skin between the bands. The tail is cylindrical and well-armoured with 2 to 4 bands of scales at the base. Two to four holes in the plates above the tail base are glandular openings responsible for the animals distinctive odour - this character is found only in *Euphractus* and *Chaetophractus*. The forefoot possesses five toes with robust claws, the third of which is the longest. Females have two pectoral nipples. Body temperature is 34ºC.

Euphractus sexcinctus. Photo courtesy of www.skullsunlimited.com

Euphractus sexcinctus. Photo courtesy of www.skullsunlimited.com

CR: Broad and relatively long rostrum. Interorbital with a marked postorbital constriction. Brain case with obvious lateral markings, somewhat squarish and flattened. Zygomatic arch slender and elongate. Jugal never twice as high as the overlying anterior edge of the squamosal. Tympanic bulla present. External auditory meatus is ossified. *Condylonasal Length:* 114.5mm (109-125.5mm); *Zygomatic Width:* 68.6mm (61.7-75.4mm). (Diaz & Barquez 2002, Redford & Wetzel 1985). **DF:** Armadillos lack true teeth, but possess a series of "molariform" teeth that do not follow the standard mammal dental formula. They are particularly robust in this species. 9-10/10 = 38-40. First molariform located in the premaxillary as in *Chaetophractus*. There are nine pairs of maxillary teeth and 10 pairs of mandibular teeth in adults. **CN:** 2n=58. FN=102. (Gardner 2007).

TRA: The slightly rocking gait of this species leads to a distinctive print pattern in which the steps are almost perfectly aligned but the feet are slightly inward pointing towards the medial line. The tail is carried clear of the floor and does not usually leave an impression in the substrate. Despite the size of the animal the prints are surprisingly small, leaving somewhat rounded impressions, especially towards the tips of the digits. The hindfoot appears to have just three short digits and is similar in basic form to the forefoot, though slightly larger and with more rounded pads. **FP:** 2 x 1.7cm **HP:** 3 x 2.2cm. **PA:** 5cm. (Villalba & Yanosky 2000). Faeces typically with an irregular surface, measure 15 (+/-1.5mm) x 20mm (+/-1.3mm) and contain c62% soil and some plant material (18%). They are of fragile consistency and have a strong odour, presumably due to formic acid and decaying plant material. Weight 2.3g (+/-0.8mm). Typically found near areas of excavation and along trails (Anacleto 2007).

MMT: The largest of the "hairy armadillos" in Paraguay. **TL:** 61.64cm (40.1-95cm); **HB:** 39.57cm (34.1-49.5cm); **TA:** 22.02cm (11.9-30cm); **FT:** 8.35cm (7.5-9.2cm); **EA:** 3.52cm (2.4-4.7cm); **WT:** 4.32kg (2-6.5kg). Like other "hairy armadillos" they store fat and a captive female individual reached 11kg in weight. **WN:** 95-115g. (Parera 2002, Nowak 2001, Emmons 1999, Ceresoli et al 2003, Redford & Eisenberg 1992, Diaz & Barquez 2002, Redford & Wetzel 1985).

SSP: This is a large armadillo, second only in size to *Priodontes maximus*. Its covering of hair on the dorsum means that it is most likely to be confused with *Chaetophractus villosus*, *C.vellerosus* being considerably smaller. Note however that that species is generally darker and more reddish and hairier overall, especially ventrally, with conspicuous tufts of hair on the cheeks, legs and throat. Perversely the dark brown hairs of the dorsum of *C.villosus* may be harder to see against the dark carapace than the paler, yellowish-tan hairs of *Euphractus*. The number of bands is variable in this species and whilst *C.villosus* may possess 7 or 8 bands, it never has 6. Another useful character is the flattened head of this species, *C.villosus* shows a more rounded forehead and crown in profile. Behind the eye the head plate descends as a "spur" in *Euphractus* which may also show traces of a plate below the eye, both these features are absent in *C.villosus* which has a smooth and even edge to the plate behind the eye. Examination of the scales on the head plate shows a regular pattern of large scales in this species, that of *C.villosus* is a somewhat less-organised meleé of smaller scales, generally with a well-marked posterior "border". Beyond this border *C.villosus* shows at least two distinct dorsal bands prior to the scapular plate, only one is present in *Euphractus*. Note also that *Chateophractus* armadillos in Paraguay are confined to the Chaco and the cerrado belt of the northern Orient, whilst this species is less conservative in its habitat choice.

DIS: Widely distributed in eastern and central South America east of the Andes and south of Amazonia. It occurs from Pará, Brazil south through the caatinga and cerrado belt to Bolivia, Paraguay, Uruguay and northern Argentina (Misiones, Corrientes, Formosa, Chaco, Salta, Jujuy, Tucumán, northern Santa Fé and Santiago del Estero). There is an isolated population north of Amazonia in extreme southern Surinam and adjacent Brazil. In Paraguay the species occurs widely in both eastern Paraguay (*E.s.flavimanus*) and the Chaco (*E.s.boliviae*) and is absent only from extensively forested areas and urban zones. *E.s.flavimanus* is distributed through eastern Paraguay, Mato Grosso in Brazil, northeastern Argentina and Uruguay. *E.s.boliviae* occupies the Gran Chaco of Bolivia, western Paraguay and northern Argentina. The remaining subspecies are *E.s.setosus* in southeastern Brazil, *E.s.tucumanus* in the Argentinean Provincias of Tucumán and Catamarca, and *E.s.sexcinctus* occupying the northern part of the range and southern Surinam. The latter intergrades with *flavimanus* in Mato Grosso and *setosus* in southern Brazil. *E.s.boliviae* intergrades with *tucumanus* in the southernmost part of its range.

HAB: Typical of open grassy and scrubby habitats, generally in dry areas, but also occurs in gallery forest in the Pantanal area and seasonally-flooded palm savanna in the Humid Chaco. In the Dry Chaco they are less common in densely-forested areas, preferring forest edge and scrub. In the cerrado belt they are found in campo limpio, campo sucio and sensu-strictu cerrado but are less frequent in cerradón - though Bonato et al (2008) reported that in the cerrado of Brazil they could find no clear preference between the patchwork of cerrado habitats and the species was equally common in grassland and forest. Habitat choice is apparently unaffected by fire, a study in the cerrado of Mato Grosso, Brazil finding that they utilised burnt areas as frequently as they do unburnt areas when foraging (Prada & Marinho-Filho 2004) - burning is of course a natural occurrence in the cerrado biome. Apparently less common at humid forest edge and probably absent from humid forest interior, but the expansion of the agricultural frontier is probably allowing them to colonise new areas. (Parera 2002, Nowak 2001, Emmons 1999, Neris et al 2002, Redford & Eisenberg 1992).

ALI: Omnivorous and able to exploit a wide variety of foodstuffs from fruits and plant matter to meat and even carrion. Eyesight is poor and smell is the primary method used for locating food. Six-banded Armadillos take large insects and exploit seasonally plentiful resources such as palm nuts and bromeliad fruits - at certain times of year plant material can compose a significant part of the diet. In Mato Grosso, Brazil, a study found the diet to consist of 90% plant matter, notably palm fruits (*Acrocomia* sp), pineapple (*Ananas* sp.) and figs (*Ficus* sp.), with the remaining 10% made up of beetles, crickets, ants, spiders, larvae, pupae and one amphibian. A study of stomachs of road kill individuals in São Paulo, Brazil found plant matter to make up just 33% of the diet, whereas insects (principally Formicidae and Scarabaeidae) made up more than 50% of the samples. Vertebrate remains included a Sigmodontid rodent, armadillo plates (likely from scavenging), pig skin, a snake and a small bird (Dalponte & Tavares-Filho 2004). One female roadkill individual from Goiás, Brazil had four *Calomys* sp. mice in its stomach, two of which were young (Bezerra et al 2001), while in the cerrado of Brazil

Bonato (2002) found *Oxymycterus* sp., *Clymomys* sp., remains of a tanager (Thraupidae) and snakes amongst vertebrate remains. Bezerra et al (2001) suggested that predation on rodents during the dry season in the cerrado may be related to the scarcity of plant matter available at this time of year. Captive individuals have been seen to kill large rats, but their hunting technique was ineffectual and they were incapable of making a quick, clean kill (Redford & Eisenberg 1992). The flesh is removed by standing on the carcass and ripping off pieces with the mouth (Redford & Wetzel 1985). Captive individuals have also been observed attacking a Grey Brocker Deer fawn *Mazama gouazoubira* and a Rhea *Rhea americana* and attempting to drag them into their burrow (Dalponte & Tavares-Filho 2004). Though generally solitary, numbers may gather at large carcasses to feed on carrion and maggots (Nowak 1991). In common with other members of the subfamily Euphractinae they are able to store fat and this may be of assistance during seasonal food shortages (Redford & Wetzel 1985).

REP: Neris et al (2002) note the breeding season as "spring and summer" but that captive individuals have also engaged in breeding activities during autumn. Pregnant females have been found in central Brazil during September and October, and in Uruguay during January. Bonato et al (2008) considered breeding to be year round in the Brazilian cerrado whilst Cuéllar (in press) states that in the Bolivian Chaco there is a short concentrated breeding season at the end of the dry season with maximum fecundity in the first months of the wet season. Desbiez (2006) detailled chasing behaviour involving up to 8 individuals in a straight line and noted that local people in the Brazilian Pantanal consider this to be a form of mate competition, with several males chasing a female ready to breed. Such chases were seen to last over an hour and covering an area of no more than one hectare, the animals moving in an dout of denser vegetation. A female taken in Mato Grosso, Brazil was pregnant with two well-developed young in July. The gestation period is 60 to 64 days. Captive females have been seen to construct nests shortly before giving birth and typical litters contain one to three young and may include both sexes (Redford & Wetzel 1985). Meritt (1976 in Nowak 1991) states that twins frequently consist of one male and one female offspring. Newborns are poorly-developed and have a soft carapace. Females disturbed with their young may try to move or hide them and/or respond aggressively towards the intruder. Young displaced from the nest are returned by the mother. The eyes open after 22 to 25 days and by the end of the first month they have quadrupled in weight and are able to take solid food. Sexual maturity is reached at 9 months in captivity. (Redford & Eisenberg 1992, Parera 2002, Redford & Wetzel 1985).

BEH: *General Behaviour* Solitary and diurnal or nocturnal, tending to be nocturnal in areas where human population pressure is higher. Bonato et al (2008) reported that the species is nocturnal in the Brazilian cerrado, despite the lack of human predation in the area and suggested that this was because the species maintains body temperatures at a low temperature range. They are active, alert foragers and constantly on the move, maintaining a steady trot with a distinctly rocking motion, stopping occasionally to investigate potential sources of food. No difference in activity levels between seasons was noted by Bonato et al (2008) but there is some evidence to suggest that activity patterns are closely tied to rainfall and ambient temperature, perhaps because of their effect on food sources (Brooks 1995, Parera 2002). Adept diggers, they scratch the earth with the forefeet and uses the hindfeet to kick it clear of the burrow entrance (Nowak 1991). Caves typically have a single semi-circular entrance with the U-shaped roof corresponding to the convex dorsum of the animal being almost as high as they are wide - approximate dimensions being 20-22cm wide by 19-20cm high (Emmons 1999, Parera 2002). Carter & Encarnaçao (1983) found the mean dimensions of the burrow to be 21cm wide x 19 cm high at the entrance, narrowing to 20cm x 16cm 10cm inside the burrow, and the mean burrow angle to be 32.4º. Many burrows may be dug in a relatively small area and unlike many other armadillos burrows are frequently re-used, one male using a single burrow for 18 consecutive days (Carter & Encarnaçao 1983). In general burrows are only 1 or 2m deep, but open into a chamber that is wide enough for the animal to turn around (Nowak 1991). They are frequently constructed between tree roots (Parera 2002) and are dug in a direction so that the prevailing wind blows away from the entrance (Carter & Encarnaçao 1983). Minimum home range in Brazil was found to average 93.3ha (Nowak 1991, Parera 2002). Captive animals mark their cages with secretions from their pelvic scent gland and it would seems likely that burrows were marked by the same means

in the wild state. (Emmons 1999, Redford & Eisenberg 2002). This species has a characteristic odour which is released from holes in the plates above the base of the tail (Nowak 1991). Defecation always takes place away from the burrow. A captive individual lived for 18 years and 10 months (Jones 1982). *Aggressive Behaviour* Female aggression is generally associated with lactation. Chases involving several individuals may have an aggressive function (Desbiez 2006). *Defensive Behaviour* Unlike other armadillos this species is reported to bite when handled (Emmons 1999, Redford & Eisenberg 2002) but despite handling numerous wild individuals of this species I have yet to encounter an individual which has attempted to bite when captured. Its main defence is to run for its burrow and if captured en route it will attempt to burrow rapidly into the ground even when held by the tail. Burrowing animals show remarkable strength and stubbornness and an animal which has begun to burrow can rarely be dislodged from its work unless it is in extremely soft soil. The animal will stop burrowing when pulling pressure is applied, digging in its feet and holding firm, but will immediately continue to burrow as soon as the pressure desists (P.Smith pers. obs.). *Enemies* Six-banded Armadillos figure in the diet of big cats such as *Jaguar* and *Puma*, but are probably also at risk from *smaller cats* and *foxes*. Juveniles may be taken by *Lesser Grison* which are small enough to enter burrows. *Parasites* Fujita et al (1995) reported the following nematodes from two specimens in Paraguay: *Ascaris dasypodina, Aspidodera fasciata, A.esperanzae* (described as a new specis in the same paper), *A.scoleciformis, Cruzia tentaculata, Mazzia mazzia, Moeniggia complexus, Spirura guianensis, Trichohelix tuberculata* and an unidentified species of Heterakinae. The two specimens were infected with 1504 specimens of six species and 97 specimens of four species respectively.

VOC: Generally quiet apart from the usual grunting noises produced by foraging armadillos. Juveniles are able to produce soft clicks and squeaks. (Redford & Wetzel 1985).

HUM: This species is frequently hunted for food by indigenous groups and rural populations on account of its large size and abundance (Cartés 2007, Emmons 1999). However it is not the preferred armadillo species for the table, in some areas having a reputation for being "unclean" on account of its habit of consuming carrion and it is even said to spread leprosy in some areas (Neris et al 2002). The meat is said to have a strong flavour (Redford 1994). Though it likely suffers from burning of grasslands to create pasture, the species may actually have benefited from agricultural activities opening up potential new areas for colonisation. However conflict arises when the crops are tubers such as manioc (mandioca) or sweet potato (batata), favoured foods for the armadillo, resulting in its persecution as a pest species. The presence of a large number of burrows in a small area creates a potential pitfall for horses and their riders (Nowak 1991). The fat of the animal may be used to cure respiratory illnesses and contusions. (Neris et al 2002). In Argentina the tail may be used by indigenous groups to strike with flint to make sparks, as well as to carry fire-making tools (Redford & Wetzel 1985). In the Brazilian caatinga snuff is inhaled through the hollowed-out tail (Redford & Wetzel 1985).

CON: The Six-banded Armadillo is considered Lowest Risk, least concern by the IUCN (see www.iucnredlist.org/search/details.php/8306/all for the latest assessment of the species). The Centro de Datos de Conservación in Paraguay consider the species to be persecuted by humans in Paraguay and give it the code **N3**. The species is not listed by CITES. This is generally one of the most commonly-encountered armadillo species in drier areas of the country and, despite hunting pressure in some areas, the population does not appear to be in decline. It occurs in a number of protected areas and its future seems secure. Biomass in the Brazilian Pantanal was estimated at18.8kg/km^2 about two-thirds of the overall armadillo biomass in the area (Redford & Wetzel 1985). In Mato Grosso, Brazil, the density was estimated in varying types of habitat with the following results 0.48/km^2 in cerrado, 2/km^2 in gallery forest, 0.59/km^2 in secondary forest and 2.9/km^2 in deciduous forest (Parera 2002). In the Brazilian cerrado the density was calculated at 0.14 individuals/ha (Bonato 2002, Bonato et al 2008) whereas in the Bolivian Chaco it was as low as 0.012 individuals/ha (Cuéllar in press). In São Paulo State this species made up 37% of all roadkills during a highway survey. However it does not appear to be unduly affected by burning within its habitat, Prada & Marinho-Filho (2004) considering direct mortality caused by fire to be negligible in the cerrado of Brazil.

Online Account: www.faunaparaguay.com/eupsexhb.html.

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Six-banded Armadillo *Euphractus sexcinctus.*
Adult lateral. Location unknown. Photo courtesy of Alberto Esquivel

Six-banded Armadillo *Euphractus sexcinctus.*
Adult dorsal. Laguna Blanca, Departamento San Pedro. September 2006. Photo Paul Smith.

Six-banded Armadillo *Euphractus sexcinctus.*
Adult roadkill. Laguna Capitán, Cuenca del Upper Yacaré Sur, Departamento Presidente Hayes. September 2006. Photo Paul Smith.

Six-banded Armadillo *Euphractus sexcinctus.*
Footprints. Laguna Blanca, Departamento San Pedro. September 2006. Photo Paul Smith.

10
Subfamily Chlamyphorinae, Bonaparte 1850

General characteristics: One genus and one species present in Paraguay. This tribe contains the most fossorial of all armadillos. The ears are small and eyes tiny. Head shield is reduced to a thin flexible plate which is separated from the rounded rump plate. The sides of the body and ventral region is covered with long, thick whitish hair. Forefoot possesses five digits with disproportionately large claws - the species is adapted for "fast digging" in soft soils as opposed to "power digging" in hard substrates.

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11
Genus *Calyptophractus*, Fitzinger 1871

This is a monotypic genus. Synonyms adapted from Gardner (2007).

Synonyms:

Chlamyphorus Burmeister 1863:167. Not *Chlamyphorus* Harlan (1825).

Burmeisteria Gray 1865:381. Type species *Burmeisteria retusa* (=*Chlamyphorus retusus* Burmeister 1863) by monotypy. Preoccupied by *Burmeisteria* Salter (1865).

Calyptophractus Fitzinger 1871:388. Type species *Chlamyphorus retusus* Burmeister (1863) by monotypy.

General characteristics: A single, distinctive species of small armadillo. Head shield is broad and carapace is thin and flexible, attached along the sides of the body. The tail is extremely short, flattened dorsoventrally and with a pointed tip. The rump plate is rounded, abruptly flattened and acts as a "plug" when burrowing. The genus is known from the Pleistocene of South America.

Cranial characteristics: External auditory meatus is long, extending forwards above the zygomatic arch to the posterior border of the orbit.

Paraguayan Species:

Calyptophractus retusus - Chaco Fairy Armadillo

12
Chaco Fairy Armadillo
Calyptophractus retusus

Chlamyphorus retusus Burmeister 1863:167. Type locality "Santa Cruz de la Sierra" Santa Cruz, Bolivia.
Burmeisteria retusa Gray 1865:381. Name combination.
Calyptophractus retusus Fitzinger 1871:389. First use of current name.
Burmeisteria retusa clorindae Yepes 1939:38. Type locality "Tapia en la gobernaciòn de Formosa" Argentina.

Calyptophractus retusus
(Burmeister 1863)

TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Order Cingulata; Family Dasypodidae; Subfamily Chlamyphorinae (Myers et al 2006, Möller-Krull et al 2007). Gardner (2007) included the Chlamyphorinae as a tribe Chlamphorini of the subfamily Euphractinae. The genus *Calyptophractus* was defined by Fitzinger (1871) and contains a single species. *Calyptophractus* is derived from the Greek meaning "concealed bands". This species has been previously placed in the monotypic genus *Burmeisteria,* Gray 1865 but this name is unavailable as it is preoccupied by a trilobite (Salter (1865). Alternatively it has been placed in the genus *Chlamyphorus,* Burmeister (1863), jointly with the other member of the subfamily, the Pink Fairy Armadillo *C.truncatus.* Morphologically *Calyptophractus* is quite different to *Chalmyphorus* not least for the fact that the carapace is firmly attached to the body in *Calyptophractus* whilst it is almost separated from the body in *Chlamyphorus.* The Edentate Specialist Group (2004) advocates the use of *Calyptophractus* over *Burmeisteria* as the generic name for this species following Wetzel (1985) and this was also followed by Gardner (2007). The species is monotypic. Synonyms adapted from Gardner (2007).

ENG: Chaco Fairy Armadillo (Redford & Eisenberg 1992), Greater Fairy Armadillo (Redford & Eisenberg 1992), Burmeister´s Fairy Armadillo (Cimardi 1996), Burmeister´s Armadillo (IUCN 2008), Greater Pichi Ciego (IUCN 2008).

ESP: Pichiciego grande (Redford & Eisenberg 1992, Cuéllar & Noss 2003), Culo tapado (Cuéllar & Noss 2003), Tatú ciego, Tatú de abrigo. The Spanish name "Culo tapado" means in vulgar terms "Butt plug", a reference to the flattened, hardened rump region which is used to block tunnels as a defence mechanism.

GUA: Tatu jeikuarajoya (Cuéllar & Noss 2003). Roughly translated the Guaraní name means "short-anus armadillo".

DES: Bizarre, subterranean mole-like armadillo with greatly reduced eye and ear. The carapace is pinkish with an undulating lateral edge, and attached firmly to the skin of the dorsum. It has approximately 23 rows of squarish scutes. The rump is armoured with an ovoid "plug" that naked, pinkish and scattered with roundish scales. Tail short, pinkish, lightly armoured and lacking a spatulate tip, located at the lower edge of the anal carapace. The head shield widens posteriorly and has a rounded posterior edge, it does not extend below the level of the eye. Heavily-furred both ventrally and laterally, the pelage being whitish with a golden tinge towards the midline. The sides of the head are also furred. Forelimbs are pinkish, largely naked with large, irregular vestiges of scutes. Forefeet armed with three greatly enlarged claws (digits 1-3), and one smaller claw, adapted for digging. The three larger claws are rotated so that they are visible laterally. Hindfoot with five toes, similarly arranged but with reduced claws when compared to the forefeet. **CN:** 2n=64.
TRA: No information.
MMT: Much the smallest of the Paraguayan armadillos. Measurements for Bolivian individuals, two males and two females **HB:** Male 13.5-14.5cm, Female 12.5-13.2cm; **TA:** Male 3.5-3.6cm, Female 3.3-3.5cm; **FT:** Male 3cm, Female 2.8-3cm; **EA:** Male 0.5-0.6cm, Female 0.5cm; **WT:** Male 71-86.9g, Female 63-5-84.2g (Cuéllar 2004). An unsexed specimen from Paraguay had the following measurements **TL:** 15.85cm; **HB:** 11.6cm; **TA:** 4.25cm; **FT:** 3.9cm; **EA:** 4.5cm. (Redford & Eisenberg 1992).
SSP: This distinctive species is unmistakeable in its range and unlikely to be confused. Perhaps the most likely error would be to erroneously consider it a juvenile armadillo of another species based on its small size. However structurally this species is quite distinct with small eyes and ears, a very short tail and the distinctive pattern of the carapace on the rump. Furthermore it is heavily furred, unlike any juvenile armadillo.
DIS: Essentially confined to the Chaco region of Bolivia, western Paraguay and northern Argentina. Distribution is closely linked to soft, sandy soil areas, so it is locally distributed despite the apparently wide geographic range. Its fossorial habits means that it is likely under-recorded and it may potentially reach sandy areas of the Paraguayan and Brazilian Pantanal, though the species has yet to be recorded in those areas (Edentate Specialist Group 2004). In Paraguay
HAB: Endemic to the Chaco biome where it is apparently locally distributed and confined to areas with soft, sandy soil. The surface habitat seems less important to the species and it even occurs in areas close to human habitation if the soil conditions are adequate. Much of the habitat in the Paraguayan Chaco is unsuitable for this species, consisting of compacted clay soils beyond the burrowing capabilities of this small species.
ALI: Likely insectivorous feeding on subterranean invertebrates and their larvae. A captive individual kept in a fish tank filled with soil at Brookfield Zoo was fed on cooked rice (Edentate Specialist Group 2004). Another thrived in captivity in Bolivia in a yard where it was able to burrow, but died shortly after translocation to the US National Zoo of respiratory infection where it had been fed on mealworms, raw eggs and meat.
REP: No information. It is assumed that they give birth to a single young (Cuéllar & Noss 2003).
BEH: *General Behaviour* Almost nothing is known of the behaviour of this species other than the fact that it is fossorial and rarely observed. Essentially they fill a similar ecological niche to that occupied by the Old World moles of the family Talpidae. They are primarily nocturnal, with activity beginning after dark and are apparently solitary. An adult in Bolivia was found at 22.00h scuttling and sniffing along the ground and making occasional shallow excavations in search of food (Cuéllar 2004). A study of limb morphology suggested that the members of the subfamily Chlamyphorinae were adapted for speed rather than power, essentially making them "sand swimmers" and explaining their absence from areas with hard soils (Vizcaíno & Milne 2002). *Defensive Behaviour* Little known. An individual in Bolivia responded to the approach of observers by burying itself half way into the soil (Cuéllar 2004). The flattened rump acts as a plug to block tunnels, affording the animal protection as it burrows. *Enemies* When above ground these relatively defenceless armadillos are vulnerable to predators. Individuals are probably killed by domestic dogs and cats, and would be easy prey for other carnivorous mammals as well as owls.
VOC: Cries like those of a human infant have been noted in this species (Nowak 1991).

HUM: Not hunted by humans for food on account of its small size and subterranean habits. In many parts of its range it is however considered an animal of ill omen, foretelling the imminent death of a family member and must be killed on sight to prevent such a fate (Cuéllar 2001).

CON: Globally considered Lowest Risk, near threatened by the IUCN (see www.iucnredlist.org/search/details.php/4703/all for the latest assessment of the species). The Centro de Datos de Conservación in Paraguay consider the species to be endangered in Paraguay and give it the code **N2**. This is a Chaco endemic species and though widespread in Bolivia and Paraguay it is locally distributed and occurs only in areas with loose sandy soils. It may also occur in sandy soil areas of the Pantanal in Paraguay and Brazil, though to date it has not been recorded there. Considered an animal of ill-omen, it is killed by humans when encountered and such pressure on a rare species is likely to have telling effects on the population. Though it thrives in secondary habitats it would seem that the population is in decline, though no data is available to support the assumption. Conversion of appropriate habitat to pasture may affect the species but fortunately in Paraguay much of the range of the species is at least nominally protected in the various national parks of the Chaco region. However it should be noted that these parks are protected more by their isolation than by an effective conservation plan. (Edentate Specialist Group 2004).

Online Account: www.faunaparaguay.com/calrethb.html.

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Chaco Fairy Armadillo
Calyptophractus retusus.
Adult. PN Teniente Enciso, Departamento Boquerón. Photo courtesy of Secretaria del Medio Ambiente (SEAM).

13
Subfamily Dasypodinae, Gray 1821.
Genus *Dasypus* Linnaeus 1758.

The subfamily Dasypodinae contains a single genus. There are seven species in this genus, three present in Paraguay. Synonyms adapted from Gardner (2007).

Synonyms:

Dasypus Linnaeus 1758:50. Type species *Dasypus novemcinctus* Linnaeus (1758) by tautonomy.
Tatus Fermin 1769:110. Name unavailable.
Tatu Frisch 1775:Table. Name unavailable.
Tatu Blumenbach 1779:94. Type species *Tatu novemcinctus* (=*Dasypus novemcinctus* Linnaeus 1758) by monotypy.
Cataphractus Storr 1780:40. Proposed for all armadillos known at the time.
Loricatus Desmarest 1804:28. In part. Type species *Loricatus niger* Desmarest (1804) (=*Dasypus novemcinctus* Linnaeus 1758).
Tatus Olfers 1818:220. In part. Incorrect spelling.
Tatusia Lesson 1827:309. In part. Type species *Dasypus peba* Desmarest (1822) (=*Dasypus novemcinctus* Linnaeus 1758).
Cachicamus McMurtie 1831:163. Type species *Dasypus novemcinctus* Linnaeus (1758).
Cachicama P.Gervais in I.Geoffroy St.-Hilaire 1835:53. Invalid emendation.
Zonoplites Gloger 1841:114. Name proposed for armadillos with four toes on forefeet and two middle toes longer than outer toes.
Praopus Burmeister 1854:295. Type species *Dasypus longicaudis* Wied-Neuwied (1826) by monotypy.
Cryptophractus Fitzinger 1856:123. Type species *Cryptophractus pilosus* Fitzinger (1856) by monotypy.
Hyperoambon W.Peters 1864:180. Type species *Dasypus pentadactylus* W.Peters (1864). Valid as a subgenus.
Muletia Gray 1874:244. Type species *Dasypus septemcinctus* Gray (1874) (=*Loricatus hybridus* Desmarest 1804, not *Dasypus septemcinctus* Linnaeus 1758) by monotypy.
Tatua W.Robinson & Lyon 1901:161. Incorrect spelling.
Mulletia Yepes 1928:506. Incorrect spelling.
Mulieta Talmage & Buchanan 1954:80. Incorrect spelling.

General characteristics: Small to large armadillos that are easily recognized by their long, naked, tubular ears, set close together on the head, long snout (55% or more of head length) and long, pointed tail (<50% of head and body length). The carapace is smooth, high and rounded, the denticles placed in irregular circles. The proximal two-thirds of the tail is ringed, each ring formed by two or more rows of scutes. There are four toes on the forefeet (digits 2 and 3 the longest) and five on the hindfeet (digit 3 the longest). Diet consists mainly of insects, but somewhat omnivorous, also taking small vertebrates and fruit. The earlies fossils date from the Pliocene of South America.

Cranial characteristics: Palate extends way beyond the last molar. Brain case is high and rounded, becoming thinner towards rear. Tympanic ring represents an otherwise unossified bulla.

Dental characteristics: Dental formula 7-9/7-9 = 28-36

Paraguayan Species:

Dasypus hybridus - Southern Long-nosed Armadillo
Dasypus novemcinctus - Nine-banded Armadillo
Dasypus septemcinctus - Seven-banded Armadillo

14
Southern Long-nosed Armadillo
Dasypus hybridus

lor[icatus] hybridus Desmarest 1804:28. No type locality given. Based on de Azara (1801). Restricted to San Ignacion, Misiones, Paraguay by Cabrera (1958).
[*Dasypus*] *hybridus* G.Fischer 1814:126. Name combination.
[*Dasypus*] *auritus* Illiger 1815:108. Nomen nudum.
T[*atus*] *auritus* Olfers 1818:221. Type locality "Paraguay". Based on de Azara (1801).
Tatusia hybridus Lesson 1827:311. Name combination.
T[*atusia*] *hybrida* Turner 1853:213. Corrected gender.
Praopus hybridus Burmeister 1861:428. Name combination.
Tatu hybridus Lahille 1899:203. Name combination.
[*Tatusia* (*Muletia*)] *hybrida* Trouessart 1898:1140. Name combination.
[*Tatusia* (*Muletia*)] *hybridus* Trouessart 1905:814. Name combination.
Muletia hybrida A.Miranda-Ribeiro 1914:46. Name combination.
D[*asypus*] *Brevi-cauda* Larrañaga 1923:344. Type locality not given but Uruguay implied. Based on de Azara (1802).
Dasypus hibridus Azevedo, El Achkar, Martins & Ximénez 1982:95. Incorrect spelling.

***Dasypus hybridus* (Desmarest 1804)**

TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Order Cingulata; Family Dasypodidae; Subfamily Dasypodinae (Myers et al 2006, Möller-Krull et al 2007). Seven species are recognised in this genus, three are present in Paraguay. *Dasypus* is derived from a Greek translation of the Aztec name "Azotochtli" which roughly means "tortoise-rabbit"; *hybridus* means "hybrid", presumably in reference to the supposedly "hybrid-appearance" of the species between either a tortoise and a rabbit, or else a tortoise and a mule (from Spanish common name "mulita"). The synonymy with *Dasypus septemcinctus* below refers to a period when the two species were regularly confused in the literature. This species is monotypic. Desmarest´s original description was based on "Le Tatou Mulet" of de Azara (1801). Synonyms adapted from Gardner (2007).

ENG: Southern Long-nosed Armadillo (Superina & Aguiar 2006, Garnder 2007), Southern Lesser Long-nosed Armadillo (Redford & Eisenberg 1992).

ESP: Mulita orejuda (Redford & Eisenberg 1992), Mulita (González 2001), Mulita pampeana (Chebez 2001), Mulita chica (Chebez 2001). The Spanish name "Mulita" or "little mule" stems from the long, donkey-like ears present in members of this genus. Despite the name "orejuda" (meaning big ears) this species has proportionately the shortest ears of the Paraguayan *Dasypus*. "Mulita chica" (little Mulita) is in direct comparison to the Nine-banded Armadillo, the only *Dasypus* sympatric with it over much of its Argentinean range. "Mulita pampeana" reflects its preference for grassland-type habitats such as those of the Argentinean pampas.
GUA: Tatu mburica **MPA** (Hamlett 1939). The Guaraní name Tatu mburica is the most frequently utilised in Paraguay for this species, the Spanish names rarely being heard in everyday speech. However it is rare for this species to be encountered and identified specifically, so it is just as likely to be confused with ,*novemcinctus Dasypus*the Tatu hu. "Tatu mburica" means "Donkey armadillo" in reference to the long ears of the species.
DES: "Long-nosed" Armadillos have a broad, depressed body, an obtusely-pointed rostrum, long, pointed ears and short legs. The carapace consists of two immobile plates, the scapular and pelvic shields separated by 6 or 7 movable bands connected to each other by a fold of hairless skin. The carapace is mostly dull brownish-grey to brownish-yellow, distinctly paler than other Paraguayan *Dasypus* and with a very light covering of hair. Frequently there is a paler yellowish lateral line that is more visible in some individuals than others. The scales of the anterior edge of the movable bands are darker than the rest of the dorsum. Scutes on the movable bands are triangular in shape, but those on the main plates are rounded. The number of scutes present on the fourth movable band varies from 50 to 62, with a mean of 54 (Diaz & Barquez 2002, Hamlett 1939). The head is thin and triangular with a sloping forehead and long, mobile ears with rounded tips that are not separated by armour at the base. The tail is short compared to other *Dasypus* (60-70% body length), broad at the base and narrowing towards the tip. There are four toes on the forefeet (characteristic of the Subfamily Dasypodinae), the middle two much the longest, and five on the hindfeet. The underside is naked and pink-grey. Females possess four mammae. **CR:** Steeply descending frontal bone. **DF:** Armadillos lack true teeth. "Long-nosed" armadillos have single-rooted, peg-like teeth that lack enamel. Dental formula 6/8=28. **CN:** 2n=64. FN=76. (Gardner 2007).

Dasypus hybridus. Photo courtesy of www.skullsunlimited.com

Dasypus hybridus. Photo courtesy of www.skullsunlimited.com

TRA: *Dasypus* prints can be distinguished from those of other armadillos by their long, pointed toes with four toes on the forefoot and five on the hindfoot. However they generally leave the impression of only the two central toes on the forefeet (though sometimes the outer toe is also visible) and three central toes on the hindfeet. Given a full print, the hindfoot has a pointed heel with three long, somewhat pointed central toes and two, much shorter, outer toes set well back towards the heel. The forefoot has the inner toe much reduced and it rarely leaves an impression.
MMT: The "intermediate" "long-nosed armadillo" in Paraguay. **TL:** 45.95cm (39.7-49.8cm); **TA:** 16.84cm (13.2-19.1cm); **FT:** 6.73cm (5.5-7.3cm); **EA:** 2.51cm (2.3-2.8cm); **WT:** 1.5kg (1.09-2.04kg). (Redford & Eisenberg 1992, González 2001). Hamlett (1939) gives the following mean measurements of preserved specimens for this species ***Head*** 7.5cm; ***Body:*** 24cm; **TA:** 15.7cm; **EA:** 2.33cm (2-3.5cm).
SSP: This species is intermediate in size between the other two "long-nosed armadillos" in Paraguay and is characterised by its shorter ears (25-30% of head length) and tail (67-70% of body length) which give it a distinctive appearance. Furthermore it is paler in colouration than both the other species, being distinctly

brownish-yellow overall. It can be immediately separated from the much larger and more widespread *Dasypus novemcinctus* by the number of bands - 6 or 7 as opposed to eight or nine (usually 8) in that species (Hamlett 1939). Note also that the tail length of *D. novemcinctus* is equal to or greater than the body length and that the ears are much longer (40-50% of head length). *Dasypus novemcinctus* has 7 to 9 teeth in the upper jaw, typically 8, compared to 6 in this species. Using the fourth movable band as a standard, Hamlett (1939) noted that this species has a mean of 54 scutes whereas *D. novemcinctus* has a mean of 60 scutes. Furthermore this species prefers open country habitats, whereas *D. novemcinctus* is more often associated with forested areas. The other open-country *Dasypus* is the smaller and darker *D.septemcinctus*, but it is unclear exactly how much their ranges overlap in Paraguay or even if they do at all. It would seem that *D.septemcinctus* is perhaps more likely to be encountered in the north of the country and this species in the south. *D.septemcinctus* shares the number of movable bands and number of teeth in the upper jaw with this species, but is clearly longer-eared (40-50% head length) and longer tailed (80-100% body length). *D.septemcinctus* has a mean of 48.4 scutes along the fourth movable band (Hamlett 1939).

DIS: The most southerly of the *Dasypus* armadillos, with an extensive range from Argentina through Uruguay in the east to Brazil, probably as far north as Matto Grosso do Sul. However the species is apparently absent or un-recorded in many areas of the vast range and the maps given by Redford & Eisenberg (1992) incorrectly exaggerate the extent of the species distribution in Brazil and Argentina. In Argentina it is found east only as far as eastern Provincia Cordoba in Argentina and south to Provincia Buenos Aires, with records for the Andean foothills being the result of mis-identification. Though it has been cited as present in Provincia Misiones, Argentina there is apparently no confirmation of the species occurrence there (Chebez 2001) and there are only two records with an imprecise locality from Jujuy both collected in the 1930s (Diaz & Barquez 2002). In Paraguay its precise range is uncertain because of confusion over the species identity. Neris et al (2001) mapped both this species and that of the Seven-banded together, reflecting the lack of clarity in the range of the two species. However it would seem that Southern Long-nosed is more likely to be found in the south of the country, north perhaps as far as southern Departamento Candideyú. It has not been found in the Mbaracayú Biosphere Reserve, though Seven-banded does occur there and there are no records of either species in the south-west of Paraguay from Asunción south to Departamento Ñeembucú and much of Departamento Misiones. A species of undisturbed grasslands that does not tolerate human alteration of habitat, its distribution may have been naturally limited in Paraguay by the expanse of the Atlantic Forest and further reduced by human activity.

HAB: This species is typical of native, undisturbed grasslands and is unable to tolerate human interference, rapidly disappearing from agricultural areas (Edentate Specialist Group 2004).

ALI: Constantly on the move, this species feeds in much the same way as the Nine-banded Armadillo. moving rapidly and snuffling constantly when digging shallow foraging holes. In Uruguay they have been recorded as digging into ant and termite nests. One stomach contained mostly ants and termites as well as Orthoptera, Lepidoptera, other invertebrates and the remains of a small rodent, though it is unclear if that individual was hunted or scavenged. (Redford & Eisenberg 1992). Captive individuals were maintained on a daily diet of 100g high protein (26%) commercial puppy food soaked in water a day before presentation, 50mg powdered milk, water and 30g mince meat. This was supplemented with vitamins and minerals and an egg was added twice a week.(Ferrari et al 1997).

REP: Ferrari et al (1997) published the first data on captive breeding of the species. They noted that the breeding cycle begins in March in Buenos Aires with the first copulations, with births in October and November. The male was not removed from the enclosure as it posed no threat to the offpring. Embryo counts range from 7 to 12, with 8 the most common number (Redford & Eisenberg 1992).

BEH: *General Behaviour* Solitary and active during the day and at night, though often more nocturnal in summer to avoid the heat of the day (González 2001). Captive inidividuals in Buenos Aires, Argentina were observed to be most active at midday during winter and in the afternoon during summer, remaining inactive during the hottest temperatures (Ferrari et al 1997). The main function of burrows is to provide refuge from predators and to provide shelter for resting (González et al 2001). Burrows are located only in open areas in grasslands and not in forested habitats. Typically they are around 1-2m long with a single entrance less than 25cm in diameter and dry grass may be accumulated

at the entrance (González 2001). In Uruguay burrows were most frequently located in open areas with sandy soils on flat or sloping ground (89.3%), in ravines (5.1%) or amongst rocks (5.6%). (González et al 2001). Of the 20 excavated burrows studied the mean dimensions where length 118.8cm (+/-105.69cm), width 15.3cm (+/-5.15cm) and depth 43.3cm (+/-10.22cm). These burrows were approximately cylindrical with a conical end, consisting of a single tunnel without branches and in 6 cases terminating in a chamber 25.6cm (+/-6.19cm) wide x 35.2cm deep (+/-8.49cm). Burrows were randomly situated but the entrance avoided facing south, the direction of prevailing winds in the study area. The considerable difference in burrow lengths may be related to differences in usage . Burrows providing refuge from predators would be needed year round, and these would be likely to be more numerous, shorter burrows which are rapidly constructed and fulfil the function of providing safe haven. The qualities of resting burrows will likely vary through the year given the difference in summer and winter temperatures in Uruguay. During the cold winters longer and deeper burrows which maintain a higer temperature than the outside air help the animal thermoregulate. (González et al 2001). *Defensive Behaviour* When pursued they run rapidly and erratically towards their burrow.

VOC: Snuffling noises are given when foraging.

HUM: Hunted throughout its range as a source of food. It is hunted in Uruguay and has been used in the fabrication of crafts since Prehispanic times, though only during the 20th Centruy did the pressure on the species begin to tell (Fallabrino & Castañeira 2006). No specific information is available for Paraguay where the species is extremely poorly known, but it is undoubtedly hunted for food and it is doubtful whether hunters would consciously distinguish this species from other *Dasypus*.

CON: The Southern Long-nosed Armadillo is considered Lowest Risk, near threatened by the IUCN, (see www.iucnredlist.org/search/details.php/6288/all for the latest assessment of the species). The Centro de Datos de Conservación in Paraguay do not list the species and nor is it listed by CITES. This species is more susceptible to human interference than other *Dasypus* and has disappeared over large areas of its range in Argentina as a result of the expanse of agriculture. It has undergone a notable decline and range contraction over the last thirty years as a result of hunting and habitat destruction and few of the areas with viable populations of the species are under official protection. The situation in Paraguay is unclear and its precise distribution is unknown as a result of confusion with other *Dasypus*. However, conversion of natrual grasslands to agriculture in Paraguay has been equally rapid and the species has undoubtedly undergone a similarly silent decline in the country.

Online Account: www.faunaparaguay.com/dashybhb.html.

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15
Nine-banded Armadillo
Dasypus novemcinctus

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***Dasypus novemcinctus* Linnaeus 1758**

TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Order Cingulata; Family Dasypodidae; Subfamily Dasypodinae (Myers et al 2006, Möller-Krull et al 2007). Seven species are recognised in this genus, three are present in Paraguay. *Dasypus* is derived from a Greek translation of the Aztec name "Azotochtli" which roughly means "tortoise-rabbit"; *novemcinctus* means "nine bands", in reference to the movable bands across the back. There are seven subspecies, the nominate subspecies *D.n.novemcinctus* Linnaeus 1758 is present in Paraguay (Gardner 2007). Examination of cranial characteristics is necessary to assign specimens to subspecies. Desmarest´s (1804) description was based on de Azara´s (1801) "Le Tatou Noir" and Buffon´s (1776) "Le Tatueté et Cachicame" Larrañaga´s (1923) description was based on de Azara´s (1802) "Negro". Synonyms adapted from McBee & Baker (1982) and Gardner (2007).

ENG: Nine-banded Armadillo (Gardner 2007), Common Long-nosed Armadillo (Redford & Eisenberg 1992).

ESP: Mulita grande (Redford & Eisenberg 1992, Diaz & Barquez 2002, Parera 2002), Armadillo mulita grande (Neris et al 2002), Tatu negro (Parera 2002). The Spanish name "Mulita" or "little mule" stems from the long, donkey-like ears present in members of this genus.

GUA: Tatu hu **MPA** (Neris et al 2002, Villalba & Yanosky 2000), Tatú-hu (Redford & Eisenberg 1992) Tatú-hú (Parera 2002), Tatu **MPA** (Villalba & Yanosky 2000), Chachú **Ac** (Villalba & Yanosky 2000). The Guaraní name is the most frequently utilised in Paraguay for this species, the Spanish names rarely being heard in everyday speech. Tatu hu means "black armadillo" in reference to the dark colouration of the carapace.

DES: "Long-nosed" Armadillos have a broad, depressed body, an obtusely-pointed rostrum, long, pointed ears (40-50% head length) and short legs. The carapace consists of two immobile plates, the scapular and pelvic shields each with 18-20 rows of ossified scutes and separated by 8 or 9 movable bands connected to each other by a fold of hairless skin. The vast majority of Paraguayan individuals possess 8 movable bands, despite the common name, and the average number of movable bands across the entire range is 8.3. The carapace is mostly blackish, hairless and with the scales of the

anterior edge of the movable bands diagnostically pale yellowish-white in colour. Paler scales are also present on the lower halves of the scapular and pelvic plates, generally with broad blackish margins. Scutes on the movable bands are triangular in shape, but those on the main plates are rounded. The number of scutes present on the fourth movable band varies from 54 to 65, typically 60 (Díaz & Barquez 2002). The head is thin and triangular with a sloping forehead and long, mobile ears with rounded tips that are not separated by armour at the base. Head plate is generally pale and pinkish-yellow, often slightly darker and blacker on the crown. Scutes of the head plate are heavy and closely attached to the skull. The tail is long (equal to or greater than body length) with 12 to 15 rings of bicoloured scutes giving it a banded appearance along the basal 60% and narrowing towards the tip where it terminates in irregular scutes. There are four toes on the forefeet (characteristic of the Subfamily Dasypodinae), the middle two much the longest, and five on the hindfeet. The underside is naked and pinkish with only a light covering of coarse greyish hair sprouting from regularly-spaced papillae. Sexes are barely distinguishable, though males may be slightly hairier along the lateral part of the venter. Females have four nipples, two pectoral and two inguinal. Males lack a scrotum and the testes descend no further than the pelvis. Males have an average body temperature of 33.4ºC and females 31.3ºC, males also have a consistently faster heart rate. **CR:** Occipitonasal length 90mm (Diaz & Barquez 2002). Steeply descending frontal bone and an almost horizontal rostrum with a triangular tip in lateral profile. **DF:** Armadillos lack true teeth. "Long-nosed" armadillos have single-rooted, peg-like teeth that lack enamel. 7-9/7-9 = 28-36 - most often 8/8=32. **CN:** 2n=64, FN=80. Autosomes separable into five groups: two large pairs of metacentrics, four large pairs of acrocentrics, six pairs of medium metacentrics, fourteen pairs of medium acrocentrics and five pairs of small acrocentrics. The X chromosome is a large metacentric with a medial centromere. The Y chromosome is a small acrocentric.

TRA: *Dasypus* prints can be distinguished from those of other armadillos by their long, pointed toes with four toes on the forefoot and five on the hindfoot. However they generally leave the impression of only the two central toes on the forefeet (though sometimes the outer toe is also visible) and three central toes on the hindfeet. Given a full print, the hindfoot has a pointed heel with three long, somewhat pointed central toes and two, much shorter, outer toes set well back towards the heel. The forefoot has the inner toe much reduced and it rarely leaves an impression. **FP:** 4.8 x 3.5cm **HP:** 6 x 4.8cm. **PA:** 25cm. (Villalba & Yanosky 2000). Faeces resemble those of *Tamandua tetradactyla* being composed largely of ant and termite remains, but they are generally more elongated and also contain soil and elements of vegetable matter. Typically no more than 2 or 3 pellets are dropped in one place. Faeces are usually deposited along runways in forested areas, making them difficult to locate (Taber 1945, Anacleto 2007).

MMT: The largest of the "long-nosed armadillos" in Paraguay. Males slightly larger than females. **TL:** 64.57 (60-100cm - generally in the range 60-85cm) Adult size is not reached until the animal is 3 to 4 years old (Redford & Eisenberg 1992); **HB:** 41.03cm (32.4-57.3cm); *Height at Shoulder* 155-230mm; **TA:** 30.18cm (21.1-45cm); **FT:** 87.5cm (5.9-11.4cm); **EA:** 4.32cm (3.3-5.9cm); **WT:** 3.91kg (2-9.83kg - generally between 3-6.5kg) Carapace accounts for c16% of body weight; **WN:** 85g. (Parera 2002, Nowak 1991, Emmons 1999, Ceresoli et al 2003, Redford & Eisenberg 1992, Diaz & Barquez 2002, McBee & Baker 1982). Hind foot and ear lengths can be used to determine fetal age (Rojas-Suárez & Maffei 2003).

50 days **HF** 7mm; **EA** 2mm; **WT** 2g.
70 days **HF** 13mm; **EA** 9mm; **WT** 16g.
90 days **HF** 20mm; **EA** 14mm; **WT** 36g.
120 days **HF** 27mm; **EA** 20mm; **WT** 64g.

SSP: This is much the largest of the "long-nosed armadillos" in Paraguay and can be immediately identified by the number of bands - generally eight or nine (usually 8) in this species and never more than seven in other Paraguayan *Dasypus* (Hamlett 1939). It can be further distinguished by the blackish colouration with yellowish-white triangular scales on the posterior edge of the movable bands. Of all the *Dasypus* this species has proportionately the longest ears (40-50% of head length) and tail (equal to or greater than body length). *Dasypus hybridus* is generally much paler in colouration, somewhat yellowish with proportionately shorter ears and 6 or 7 movable bands. The ears are shorter, typically

25-30% of head length, as is the tail (67-70% body length). It has a preference for open grassy areas and the two species are not usually found together. Using the fourth movable band as a standard, Hamlett (1939) noted that this species has a mean of 60 scutes whereas *D.hybridus* has a mean of 54 scutes. *Dasypus septemcinctus* is dark and blackish, lacking the pale edges to the movable bands which also number 6 or 7. It has similar length ears (40-50% head length) but a proportionately shorter tail (80-100% body length) than the Nine-banded. It has a mean of 48.4 scutes along the fourth movable band (Hamlett 1939). Both *D.septemcinctus* and *D.hybridus* have just 6 upper teeth in each jaw. Footprints are approximately 50% larger than those of *D.septemcinctus*.

DIS: This is the most widely distributed of all the armadillos, occurring from the USA south to Argentina, and is actually in the process of expanding its range to the north. It was recorded in Texas for the first time in 1880 and now extends east to Florida and north to central Oklahoma though cold its slowing its northward advance (MacDonald 1985). It is found throughout Central America and even some Caribbean Islands. West of the Andes it occurs south to northern Peru, but east of the Andes it reaches Uruguay and Argentina as far south as Provincia Entre Rios in the east of the country, though only to the Yungas in the west. In Paraguay it occurs throughout the country in all departments, though it is considerably more sparsely distributed in arid areas. Parera (2002) states that its presence in the Dry Chaco of Argentina requires confirmation, but Neris et al (2002) report multiple records of the species in the Dry Chaco of Paraguay - though they note that the species is more common in humid areas. The northern and southerly limits of the range are probably defined by cold, lack of insects and drought (Redford & Eisenberg 1992) whilst MacDonald (1985) also notes that competition with other armadillo species may also limit its southerly expansion. The subspecies found in Paraguay is *D.n.novemcinctus*, which is distributed through most of South America, east of the Andes from Colombia and Venezuela south to Argentina. The remaining subspecies are: *D.n.mexicanus* from the USA south to southern Mexico; *D.n.davisi* from the Balsas Basin to the mountains of Morelos in Mexico; *D.n.hoplites* from Trinidad and Tobago, Grenada, Barro Colorado Island and Costa Rica; *D.n.aequatorialis* west of the Andes in Ecuador and probably also Peru and Colombia; *D.n.fenestratus* from Oaxaca through Central America to Panama and possibly also across northern South America; *D.n.mexianae* is endemic to the delta of the Rio Amazonas, Pará, Brazil.

HAB: This adaptable species is able to colonise a variety of habitats from humid Atlantic forest, through grasslands and agricultural areas, to the palm savanna of the Humid Chaco and drier chaco forest and cerradón. It is more common in warm, humid areas and seems to prefer some forest cover, being the most frequently encountered armadillo species in undisturbed humid forest habitats (ECOSARA Biodiversity Database). It reaches its greatest abundance in the Humid Chaco but is generally absent from open, grassy areas where other species of *Dasypus* are present.

ALI: Considered a generalist insectivore that exploits the food materials most easily available in any given habitat. Feeds largely on ants and termites which are plentiful in its Paraguayan range. Anacleto (2007) studied the diet via faecal samples during the dry season in the cerrado of Mato Grosso, Brazil and found Coleoptera to be the biggest single item in the diet by weight (71.3%) followed by ants (16.5%) and termites (12.2%) of the genera (in order of prominence as biomass) *Nasutitermes, Velocitermes, Rhynchotermes, Cornitermes* and *Anhangatermes*. The nests of the two most prominent termite species in this study were those that are the most easily opened, suggesting that the species excavates when foraging for termites. In the USA it also supplements the diet with carrion, fruit and small vertebrates, but these are less prominent in the diet of South American specimens. Parera (2002) also lists amphibians, reptiles, birds eggs and juvenile micro-mammals in the diet of Argentinean individuals and to a lesser extent fruit, roots and seeds. An analysis of stomach contents estimated the 93.3% of foods taken were animal in nature (McBee & Baker 1982). They begin to forage immediately on leaving the burrow after nightfall and studies suggest that there is a move from more forested to more open habitats as the night progresses (McBee & Baker 1982). Foraging animals are noisy and follow random paths, snorting constantly and investigating every potential source of food. Eyesight is poor and food is located by smell, with most food items taken from the soil surface or by using the claws to dig shallow, triangular feeding holes just below the surface. (Redford & Eisenberg 1992). Frequently they will rise up onto the hindlegs, using the tail for balance, and sniff the air. The nose is

often pressed into the hole to maintain the scent trail and they may hold their breath for up to 6 minutes to avoid dust inhalation (MacDonald 1985). Nine-banded Armadillos re-use traditional feeding trails and foraging individuals are so preoccupied with the job in-hand that they may even collide with an immobile observer (Emmons 1999). Capable swimmers they may enter water to feed, using the forefeet to search for aquatic invertebrates in the substrate (Parera 2002). Adults have been seen using the forefeet to smash bird´s eggs and to hold down rabbit carcasses whilst ripping off pieces of flesh with the mouth (McBee & Baker 1982). Armadillos must drink water frequently and do so by lapping in the manner of a dog, leaving a film of their thick saliva over the water surface. Taber (1945) fed captive individuals on bone and fishmeal mixed with sour milk and mash. They also learned how to eat dead chicken, using the foreclaws to scratch meat from the bones and tugging with the mouth to loosen it. When the carcasses became infested with maggots the maggots were preferred to the chicken. Chicken eggs were eaten only when broken first. Watermelon and cantelopue were taken only when broken and only when other food was unavailable. Cereals were ignored, even when soaked in fish oil, but bread soaked in fish oil was accepted. Beets, potatoes, onions and turnips were never consumed despite being offered for over a month.

REP: Females are receptive once a year, but males produce sperm all year-round and the main breeding season is from August to November (Neris et al 2002). Parera (2002) states that in fact the females ovulate twice a year and that mating occurs in the summer-autumn season. In Izogog, Departamento Cordillera, Bolivia births were found to be highly seasonal and concentrated from October to December with just a single litter per year (Rojas-Suárez & Maffei 2003). Pairs form for a single breeding season, at which time they may share a burrow. Males are sometimes polygynous, but females always take a single mate. Because of the position of the genitalia mating occurs with the female on her back. (Mc Bee & Baker 1982). In common with the other "long-nosed armadillos" this species produces multiple, same sex offspring from a single egg - essentially clones of each other. Rojas-Suárez & Maffei (2003) found a greater proportion of males to females in 44 litters in Bolivia (males 26:14 females), and the proportion was sustained in their sampling of the adult population. Four young are almost always produced in this species, limited by the number of nipples available on the mother, though Parera (2002) notes that exceptionally litters of 2 to 8 have been recorded. In 300 examined litters there were only four cases of triplets, four cases of quintuplets and one set of twins (McBee & Baker 1982). Because of the polyembryonic breeding strategy there is almost always an even number of offspring. The gestation period is 8 to 9 months, a remarkably long pregnancy explainable by a 3 to 4 month embryonic diapause (delayed implantation). At 5 to 7 days the ovum forms a blastocyst and passes into the uterus where development ceases, becoming implanted several months later. Neris et al (2002) quotes the gestation period at 120 days, presumably not including the diapause. Newborns have soft, leathery skin which takes several weeks to harden and the eyes are open from the first day. They are able to walk within a few hours and join their mother on foraging expeditions after a couple of weeks (McBee & Baker 1982). Wild individuals are weaned in three months but the family may remain together for nine months. Females reach sexual maturity and ovulate for the first time at two years, males by the end of their first year. In captivity females have been known to bear young 13 to 24 months after capture and isolation from males. (Redford & Eisenberg 1992).

BEH: *Activity* Solitary and largely nocturnal, though occasionally active at dusk and during the day (P.Smith pers.obs.). Activity levels are likely determined by ambiental factors, particularly temperature and they may become more diurnal during the reproductive season (Parera 2002). Peaks of activity usually occur around 21-22-00h. They are not well-adapted to cold conditions and are able to lower the body temperature by only around 2.5ºC, resulting in periods of inactivity during cold spells. Rain does not affect activity unless accompanied by cold weather (Taber 1945). The lifespan is 12 to 15 years. *Nesting* Typically this species spends the day in self-dug burrows 0.5-6m long (mean 1.25m) which are usually located in forested areas close to a water source. Any one animal may have a mean of 4.5 to 8.5 burrows depending on locality (Taber 1945). Burrows are dug by wedging the nose and forefeet into the soil to loosen it, then scratching with the forefeet to position it below the abdomen. Using the forefeet and tail for balance, the hindfeet are brought forward in front of the pile of dirt, the back is arched and then suddenly thrusted straight so that the loose soil is propelled behind the animal

(McBee & Baker 1982). Burrows generally have multiple entrances 17-20cm in diameter and contain a grass nesting chamber c34cm in diameter which is used for reproduction, sleeping and refuge during colder periods. Average vertical depth to the nest chamber is 50cm, but an extreme of 151cm has been recorded. Few studies have investigated burrow orientation in this species, but what little data exists appears to suggest a random orientation, unlike those of savanna species which typically have the entrance to the burrow sheltered from the prevailing winds. It has been hypothesised that their preference for forested environments provides the necessary protection from prevailing winds, liberating them from constraints affecting burrow orientation (Platt et al 2004). Plant material is carried between the chin and forelegs, the animal zig-zagging backwards, at which time the tail may serve a tactile function. On arrival at the burrow the armadillo enters backwards, raking the plant material into the hole with the nose and feet. (McBee & Baker 1982). In Arkansas Taulman (1994) observed somewhat different nest-building behaviour. He noted that collecting material involved 3 to 5 scrapes lasting about 3 to 5 seconds and amassed a bundle of leaf litter c20cm in diameter. The armadillo made several collecting trips, each in different directions, and return trips followed the same direct path as the outward journey, with the animal hopping backwards to its burrow. Between collecting bouts (approximately once a minute) the animal paused to sniff the air before continuing with its task. The animal only turned to face the burrow upon arrival, when it used the forefeet and snout to push material into the hole. The material from the last trip (the fifth) was simply dumped at the burrow entrance, the hole apparently beingcompletely full with material, and the armadillo then walked away. Taber (1945) noted that nests of this species have no structure and rather are piles of leaves into which the animal buries itself. As a result occupied burrows often appear to have the entrance plugged with plant material, a fact that may serve a purpose for camouflage as well as providing insulation to prevent over-heating or heat loss. (Taulman 1994). Several individuals may use the same burrow, but these are likely members of the same family, though usually all of the same sex. Burrows are frequently used by other species. In areas that are subject to periodic flooding (eg Humid Chaco) nests are frequently built above ground to avoid drowning and resemble miniature haystacks (Nowak 1991). *Range size and territorial behaviour* Home ranges of males often overlap considerably without antagonism and may encompass the ranges of several females. The size of the range varies depending on the carrying capacity of the habitat, with figures of 3.4ha suggested for prime habitat and 15ha for suboptimal habitats having been suggested (Redford & Eisenberg 1992, Nowak 1991), with male ranges up to 50% larger than those of females (MacDonald 1985). This species possesses glands on the ears, eye-lids, anus and soles of the feet which play an advertising role warning of the presence of the individual in the area. Upon meeting they frequently sniff the anal regions and to further mark territories they defecate and urinate on prominent posts and along feeding trails (MacDonald 1985). The yellowish glandular secretions may also be used to deter predators, producing a nauseating effect if inhaled in quantity. Animals have been seen to feed in close proximity to each other without signs of aggression, though sick or injured animals have been reported to victims of mutilation or even cannibalism by conspecifics (Mc Bee & Baker 1982). *Swimming and Bathing* Nine-banded Armadillos are capable of swimming short distances by gasping to inflate the stomach and intestine with air for buoyancy - upon first entering the water they are almost completely submerged, but ride higher on the water surface the longer they swim (McBee & Baker 1982). Swimming armadillos fold the ears back against the head, kick all four legs in doggy fashion and periodically raise the nose to breathe before lowering it again (Taber 1945). Though by no means a common occurrence, the ability to hold the breath and accrue a considerable oxygen debt means they can also cross streams and small rivers by walking along the river bed (MacDonald 1985) - in fact they may even feed in the water (Parera 2002). Taulman (1994) described an individual seen bathing in a large puddle 15-28cm deep. The animal dipped its snout into the water and raised the head quickly so that water dripped backwards over the carapace, before systematically shaking in a front to back sequence lasting 1 to 2s. The animal then rolled onto its back and writhed briefly as if rubbing mud onto its dorsal surface. Each rolling sequence lasted approximately 4 seconds and it was repeated three times before the animal trotted away. *Aggressive Behaviour* Aggression is commonly observed during the breeding season. Male aggression likely assures exclusivity of mates, female aggression may be a result of competition for limited resources or to stimulate dispersal of the previous year´s young

(McDonough 1994). Adults have been observed chasing juveniles at high speed for a period of up to 35 minutes, presumably to displace them (Breece & Dusi 1985). Fights are rare but generally take the form of one individual leaning back on the hind feet and clawing with the forefeet or clawing at the sides of another individual with the hind feet whilst rolling and flipping (McDonough 1994). *Defensive Behaviour* Surprised animals frequently explode into a run, crashing through the undergrowth towards their nest burrow. One animal at Itabó Itaipú Reserve, Departamento Alto Paraná was observed to run and collide with a tree when disturbed, stopping momentarily before continuing on (K.Atkinson pers.comm.). Animals frightened at close range may perform remarkable vertical jumps with arched back prior to fleeing or when pursued (Emmons 1999) and if overtaken may attempt to curl up to protect as much of the body as possible (Nowak 1991). When pursued into a burrow they may arch the back, digging the scales of the carapace into the tunnel roof and make it impossible to pull them out (McBee & Baker 1982). *Enemies* In Belize this species constitutes up to 50% of the diet of the Jaguar and remains have also been found in the nests of Harpy Eagles *Harpyia harpyja*. Juveniles are likely taken by Lesser Grison, foxes, small cats and Black Tegu *Tupinambis merianae. Parasites* Relatively few parasites have been documented for this species despite its extensive range. All ticks reported on armadillos are in the genus *Amblyomma,* with the species *A.concolor* and *A.pseudoconcolor* documented on this species. Fleas are rarely found but the following species have been reported: *Echidnophaga gallinacea, Juxtapulex echidnophagoides, Polygenis roberti, P.occidentalis* and *Tunga travassosi.* It is also known as a carrier of the protozoan *Trypanosoma cruzi* which is responsible for Chaga´s Disease, probably becoming infected by eating insect carriers. It is also susceptible to infection by *Schistosoma haematobium* but develops no symptoms and the eggs and parasites do not reach the urogenital system. Helminths (*Ascarops sp., Aspidodera fasciata, Brachylaemus virginianus, Hamanniella sp., Mazzia mazzia, Oncicola canis, Oochoristica sp., Physocephalus sp., Travassosia carinii*). Strongyloidea (*Dasypostrongylus filamentosus, Delicata ransomi, D.uncinata, D.cameroni, Maciela macieli, M.flagellata, Moennigia moennigi, Pintonema intrusa, P.pulchra, P.pseudopulchra, P.pintoi, Pulchrostrongylus complexus*). Fujita et al (1995) reported the following nematodes from two specimens in Paraguay: *Ancylostoma* sp., *Aspidodera esperanzae* (described as a new species in the same paper), *Moeniggia complexus, M.pintoi* and an unidentified species of Heterakinae. The two specimens were infected with 69 specimens of four species and 3 specimens of one species respectively.

VOC: Though it does not generally vocalise, the Nine-banded Armadillo is one of the noisiest forest inhabitants given its snorting foraging style and clumsy form of ambulation with complete disregard for the noise created by snapping branches, dry leaves and moving undergrowth. A medium-sized animal charging through the undergrowth of humid forest at high speed at night is likely to be this species (Emmons 1999).

HUM: This species is one of the principal prey items of the Aché in Mbaracayú Biosphere Reserve who prize it for its white meat (Esquivel 2001). In the period 1980 to 1996 a total of 1500 individuals of this species were taken by the Aché in the reserve, representing 5,750kg of meat or 35.2% of the biomass that they consumed (Cartés 2007). The species has become more prominent in the diet of the Aché since 1994, when it represented 43.1% of the wild game in their diet compared to just 13.5% in 1980, a change likely related to deforestation and the reduction in numbers of larger prey species such as *White-lipped Peccary* which declined from 22% to 2% of the diet over the same period (Cartés 2007). In other areas Nine-banded Armadillos is one of the preferred wild game food items over much of its range with the meat being considered a substitute for chicken (Neris et al 2002) and the species is customarily cooked in its "shell" (McBee & Baker 1982). A campesino community in Departamento Caazapá took 66 individuals of this species over a four year period, making it the third most frequently hunted species and representing 21% of all animals taken, though this corresponded to only 5% of the total biomass (Cartés 2007). Fat is used as a remedy for the treatment of coughs, bronchitis, asthma, rheumatism, open wounds, appendicitis and concussion (Cartés 2007, Neris et al 2002), making it the second most utilised mammal species for medicinal purposes in Paraguay after the *Capybara*. The carapace may be used to fashion wallets as a cheap substitute for leather and the species is often taken as a pet (Neris et al 2002). With the reduction in populations of other myrmecophagous species, Nine-banded Armadillos probably play an important role in population control of ants and termites.

Though easily tamed they do not adapt well to captivity (Nowak 1991). They have been falsely accused of attacking domestic poultry in some areas of their range (McBee & Baker 1982). Recently the species has been used in laboratory studies of in birth defects, multiple births, organ transplants and investigations of diseases such as leprosy, trichinosis and typhus (Nowak 1991). There are no documented cases of leprosy being passed from an armadillo to a human (McBee & Baker 1982).

CON: The Nine-banded Armadillo is considered Lowest Risk, least concern by the IUCN, (see www.iucnredlist.org/search/details.php/6290/all for the latest assessment of the species). The Centro de Datos de Conservación in Paraguay consider the species to be secure in Paraguay but with the potential to become threatened in the future and give it the code **N4**. The species is not listed by CITES. The species is able to coexist with humans in rural areas because of its largely nocturnal habits and large litter size, but has declined over much of its range in eastern Paraguay as a result of destruction of optimal habitat. It remains most numerous in the Humid Chaco were large unpopulated areas of relatively undisturbed habitat allow the species to proliferate. The species is extremely susceptible to leprosy both under captive conditions and in the wild (Nowak 1991). Population density has been estimated at 0.36/km² in the cerrado of Brazil (suboptimal) to 50/km² in the coastal prairies of Texas and may be even higher in tropical forest areas (MacDonald 1985).

Online Account: www.faunaparaguay.com/dasnovhb.html.

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Nine-banded Armadillo *Dasypus novemcinctus.*
Adult. Itabó Itaipú Reserve, Departamento Alto Paraná, November 2008.
Photo Paul Smith.

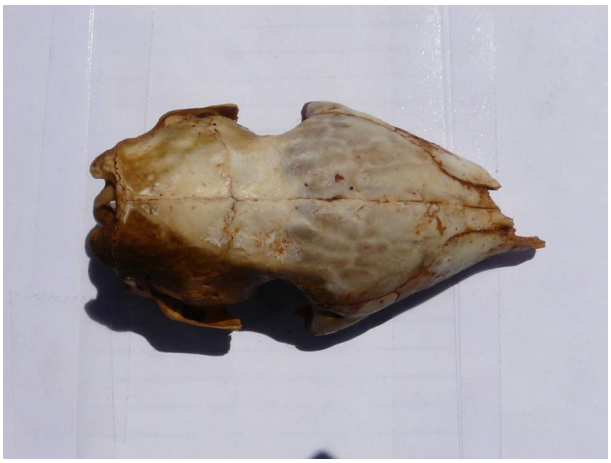
Nine-banded Armadillo *Dasypus novemcinctus.*
Adult frontal. Estancia Nueva Gambach, PN San Rafael, Departamento Itapúa, undated.
Photo courtesy of Pro Cosara and ECOSARA Biodiversity Database.

Nine-banded Armadillo *Dasypus novemcinctus.*
Adult rear. Estancia Nueva Gambach, PN San Rafael, Departamento Itapúa, undated.
Photo courtesy of Pro Cosara and ECOSARA Biodiversity Database.

Nine-banded Armadillo *Dasypus novemcinctus.*
Adult lateral. Estancia Nueva Gambach, PN San Rafael, Departamento Itapúa, undated.
Photo courtesy of Pro Cosara and ECOSARA Biodiversity Database.

Nine-banded Armadillo *Dasypus novemcinctus.*
Adult head. Estancia Nueva Gambach, PN San Rafael, Departamento Itapúa, undated.
Photo courtesy of Pro Cosara and ECOSARA Biodiversity Database.

Nine-banded Armadillo *Dasypus novemcinctus.*
Skull lateral. CZPCN, PN San Rafael, Departamento Itapúa. Photo Paul Smith and ECOSARA Biodiversity Database.



Nine-banded Armadillo *Dasypus novemcinctus.*
Skull dorsal. CZPCN, PN San Rafael, Departamento Itapúa. Photo Paul Smith and ECOSARA Biodiversity Database.

Nine-banded Armadillo *Dasypus novemcinctus.*
Skull ventral. CZPCN, PN San Rafael, Departamento Itapúa. Photo Paul Smith and ECOSARA Biodiversity Database.

16
Seven-banded Armadillo
Dasypus septemcinctus

[*Dasypus*] *septemcinctus* Linnaeus 1758:51. Type locality "in Indiis" corrected to "Brasilia" by Erxleben (1777) and restricted to Pernambuco, Brazil by Cabrera (1958).
Tatusia (*Muletia*) *propalatum* Rhoads 1894:111. Type locality "Bahía" Brazil.
Tatusia megalolepis Cope 1889:134. Type locality "Chapada" Matto Grosso, Brazil.
[*Tatusia* (*Tatusia*)] *megalolepis* Trouessart 1898:1140. Name combination.
[*Tatusia* (*Muletia*)] *propalatum* Trouessart 1898:1140. Name combination.
Tatu septemcincta O.Thomas 1900:548. Name combination.
Tatu megalolepis O.Thomas 1904:243. Name combination.
[*Tatus* (*Tatus*)] *megalolepis* Trouessart 1905:814. Name combination.
[*Tatus* (*Muletia*)] *propalatum* Trouessart 1905:814. Name combination.
Dasypus megalolepe Yepes 1928:468. Name combination and incorrect spelling.
Dasypus propalatus Yepes 1928:468. Name combination.
Dasypus [(*Dasypus*)] *septemcinctus* Wetzel & Mondolfi 1979. Name combination.

***Dasypus septemcinctus* (Linnaeus 1758)**
Image Gallery

TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Order Cingulata; Family Dasypodidae; Subfamily Dasypodinae (Myers et al 2006, Möller-Krull et al 2007). Seven species are recognised in this genus, three are present in Paraguay. *Dasypus* is derived from a Greek translation of the Aztec name "Azotochtli" which roughly means "tortoise-rabbit"; *septemcinctus* means "seven bands", in reference to the movable bands across the back. Prior to Hamlett´s (1939) clarification of the species identity, this species had been constantly confused with *Dasypus hyvridus* and *Dasypus novemcinctus* in the published literature. Synonyms adapted from Hamlett (1939) and Gardner (2007).
ENG: Seven-banded Armadillo (Cimari 1996), Seven-banded Long-nosed Armadillo (Cimari 1996), Brazilian Lesser Long-nosed Armadillo (Redford & Eisenberg 1992), Lesser Long-nosed Armadillo (Esquivel 2001), Yellow Armadillo (Gardner 2007).
ESP: Mulita común (Redford & Eisenberg 1992). The Spanish name "Mulita" or "little mule" stems from the long, donkey-like ears present in members of this genus. Despite the name this is not the commonest of the "Mulitas" in Paraguay and is not particularly common anywhere in its range.

GUA: Tatu´i **MPA** (Villalba & Yanosky 2000), Chachu **Ac** (Villalba & Yanosky 2000), Tatu kuju **Ac** (Esquivel 2001). The Guaraní name Tatu´i is the most frequently utilised in Paraguay for this species, the Spanish names rarely being heard in everyday speech. Tatu´i means "little armadillo" in reference to the smaller size of this species when compared to *Dasypus novemcinctus*, commonly referred to as Tatu hu.

DES: "Long-nosed" Armadillos have a broad, depressed body, an obtusely-pointed rostrum, long, pointed ears and short legs. The carapace consists of two immobile plates, the scapular and pelvic shields separated by 6 or 7 movable bands connected to each other by a fold of hairless skin. The carapace is mostly blackish, hairless and with the scales of the anterior edge of the movable bands not notably different in colour from the rest of the dorsum. Lateral scutes have dark blackish-pink centres only slightly discernible from the rest of the carapace, but never as obviously pale as in Nine-banded. Scutes on the movable bands are triangular in shape, but those on the main plates are rounded. The number of scutes present on the fourth movable band varies from 44 to 52, with a mean of 48.4 (Hamlett 1939). The head is thin and triangular with a sloping forehead and long, mobile ears with rounded tips that are not separated by armour at the base. Head plate is dark and blackish, the scutes of the head plate are heavy and closely attached to the skull. The tail is intermediate length (80-100% body length), broad at the base and narrowing towards the tip. There are four toes on the forefeet (characteristic of the Subfamily Dasypodinae), the middle two much the longest, and five on the hindfeet. The underside is naked and blackish-pink with only a light covering of coarse greyish hair sprouting from regularly-spaced papillae. **CR:** Steeply descending frontal bone and an almost horizontal rostrum with a triangular tip in lateral profile. **DF:** Armadillos lack true teeth. "Long-nosed" armadillos have single-rooted, peg-like teeth that lack enamel. Dental formula 6/8=28.

TRA: *Dasypus* prints can be distinguished from those of other armadillos by their long, pointed toes with four toes on the forefoot and five on the hindfoot. However they generally leave the impression of only the two central toes on the forefeet (though sometimes the outer toe is also visible) and three central toes on the hindfeet. Given a full print, the hindfoot has a pointed heel with three long, somewhat pointed central toes and two, much shorter, outer toes set well back towards the heel. The forefoot has the inner toe much reduced and it rarely leaves an impression. **FP:** 3 x 1.8cm **HP:** 4.5 x 3.4cm. **PA:** 18cm. (Villalba & Yanosky 2000).

MMT: The smallest of the "long-nosed armadillos" in Paraguay. **TL:** 40.08cm (36.5-47.5cm); **HB:** 26.05cm (24-30.5cm); **TA:** 14.75cm (12.5-17cm); **FT:** 6cm (4.5-7.2cm); **EA:** 3.09cm (3-3.8cm); **WT:** 1.63kg (1.45-1.8kg). (Emmons 1999, Redford & Eisenberg 1992) Hamlett (1939) gives the following measurements of preserved specimens for this species *Head* 6.5cm (5.2-7.3cm); *Body:* 17.8cm (14.7-20.3cm); **TA:** 15.3cm (14.6-20cm); **EA:** 2.67cm (2-3.5cm).

SSP: This is the smallest of the "long-nosed armadillos" in Paraguay and can be immediately separated from the much larger and more widespread *Dasypus novemcinctus* by the number of bands - 6 or 7 as opposed to eight or nine (usually 8) in that species (Hamlett 1939). Though of similar proportions *D.novemcinctus* is typically 50% larger in all measurements. Note also that the tail length of *D.novemcinctus* is equal to or greater than the body length, and that this species is often noticeably proportionately shorter-tailed, the tail being 80-100% body length. It can be further distinguished by the blackish colouration extending to the movable bands, which lack yellowish-white triangular scales on the posterior edge. This species has similarly-proportioned long ears (40-50% of head length) but given the difference in size between the animals the measurements are considerably smaller in this species. Proportionately this species is larger headed with a broader snout (Hamlett 1939). *D.novemcinctus* has 7 to 9 teeth in the upper jaw, typically 8, compared to 6 in this species. Using the fourth movable band as a standard, Hamlett (1939) noted that this species has a mean of 48.4 scutes (range 44-52) whereas *D.novemcinctus* has a mean of 60 scutes. *Dasypus hybridus* is generally much paler in colouration, somewhat yellowish with proportionately shorter ears (25-30% of head length) and noticeably shorter tail (67-70% body length). It is intermediate in size between this species and *D.novemcinctus* and shares the 6 or 7 movable bands across the dorsum and the 6 teeth in the upper jaw. It has a mean of 54 scutes along the fourth movable band (Hamlett 1939). Prints of *D.novemcinctus* are approximately 50% larger than those of this species.

DIS: Wide-ranging from the eastern Amazon of Brazil south to northern Rio Grande do Sul, and west through eastern Bolivia and to northern Argentina. In Paraguay the species is possibly widespread but its exact range is unclear as a result of confusion with other species of *Dasypus*. In eastern Paraguay it occurs in the cerrado belt of Departamentos Concepción and Amambay, south at least to Departamento Canindeyú and, given its presence in north-eastern Provincia Corrientes in Argentina it may well be present in suitable habitat in pretty much all of the southern Departments. However it has not been confirmed to occur in Misiones Province in northern Argentina, though it is supected to occur in open habitats in the south of that Province (Chebez 2001) and the previous extent of the Atlantic Forest may have acted as barrier to the distribution of this species both in Paraguay and northern Argentina. In the Chaco it is absent from the driest areas but apparently present in southern Departamento Boquerón and in the Mato Grosense region of Departamento Alto Paraguay.

HAB: Little information is available on habitat preference in this species, though it apparently prefers dry as opposed to humid areas. Reportedly occurs mainly in open habitats, grasslands and pastures, including cerrado and chaco. In southeastern Brazil it has also been found in gallery forest and shrubland and is apparently able to withstand moderate levels of human disturbance (Edentate Specialist Group 2004). In São Paulo, Brazil Bonato (2002) found the species in low numbers in campo sucio cerrado.

ALI: Almost nothing is known of the specific feeding behaviour of this species but it is likely to be similar to that of the Nine-banded Armadillo. Bonato (2002) found only ants and termites in the diet in the Brazilian cerrado. In captivity it will take yoghurt and eggs (Olmos 1995).

REP: Females give birth to 7 to 9 genetically identical offspring (Esquivel 2001).

BEH: *General Behaviour* Little known. Solitary and said to be largely nocturnal, though occasionally active at dusk and during the day. However Bonato (2002) found them active only between 6am and 2pm in the Brazilian cerrado. They frequently expand burrows dug by other species. Captive juveniles construct nests at low temperatures. (Redford & Eisenberg 1992)

VOC: Captive animals emit quiet grunts not usually audible in the wild (Villalba & Yanosky 2000).

HUM: Opportunistically hunted for food. During a study of the Xavante indigenous groups inhabiting the cerrado of Central-West Brazil this species was hunted 14 times during 33 months, but was not considered a major part of the diet of the group (Leeuwenberg 1997).

CON: The Seven-banded Armadillo is considered Lowest Risk, least concern by the IUCN (see www.iucnredlist.org/search/details.php/6293/all for the latest assessment of the species). The Centro de Datos de Conservación in Paraguay do not list the species and nor is it listed by CITES. This species is extremely little known throughout its range, despite its wide distribution. It is nowhere common in Paraguay but possibly under-recorded because of its superficial similarity to the Nine-banded Armadillo. It is apparently able to withstand a moderate degree of human disturbance and precise data on the threats it faces are lacking. It would seem that, as for other armadillos, habitat destruction, fire and hunting are the major threats to the species, though because of its small size it is unlikely to be specifically sought by hunters and rather more likely the victim of opportunistic killing.

Online Account: www.faunaparaguay.com/dassephb.html.

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Seven-banded Armadillo *Dasypus septemcinctus*. Mbaracayú Biosphere Reserve, Departamento Canindeyú. Photographer unknown.

17
Subfamily Tolypeutinae, Gray 1865

General characteristics: Three genera and four species present in Paraguay. This subfamily contains the most specialised fossorial armadillos and the most powerful diggers, though notably the genus *Tolypeutes* is non-fossorial.
Taxonomy: The subfamily is split into two tribes, the Priodontini (*Cabassous* and *Priodontes*) and the Tolypeutini (*Tolypeutes*).

Tribe Priodontini Gray, 1873

General characteristics: Two genera and three species in Paraguay. Small to extremely large armadillos with a blunt, rounded snout, thick fleshy ears and relatively large eyes. The carapace is domed and separated from the cephalic plate by three rows of nuchal scutes. Scapular and pelvic shields are separate by 11 to 14 movable bands. Body hair is sparse. Five toes on the forefoot with digit III armed with a scythe-shaped claw.
Cranial characteristics: Frontal bones have a dome-like swelling. Only the tympanic ring of each bulla is ossified.

CONTENTS

Cabassous McMurtrie 1831 Four species, two present in Paraguay.
Priodontes F.Cuvier 1825. Monotypic genus.

Tribe Tolypeutini Gray, 1865

Consists of a single genus of which one species is present in Paraguay. Characteristics are discussed under the generic and species accounts.

CONTENTS

Tolypeutes Illiger 1811. Two species, one present in Paraguay.

18
Genus *Cabassous*, McMurtrie 1831

Four species in this genus, two present in Paraguay. A third species *Cabassous unicinctus* may perhaps reach extreme north-eastern Paraguay but has yet to be documented for the country. Synonyms adapted from Gardner (2007):

Synonyms:

Dasypus Linnaeus 1758:50. In part.
Tatus Olfers 1818:220. In part. Incorrect spelling of *Tatu* Blumenbach (1779).
Xenurus Wagler 1830:36. Type species *Dasypus gymnurus* Wied-Neuwied (1826) (=*Xenurus squamicaudis* Lund 1845) by monotypy. Preoccupied.
Tatusia Lesson 1827:309. In part.
Cabassous McMurtrie 1831:164. Type species *Dasypus unicincttus* Linnaeus (1758) by monotypy. Proposed as a subgenus of *Dasypus* Linnaeus (1758).
Arizostus Gloger 1841:114. Type species *Dasypus gymnurus* (=*Tatus gymnurus* Olfers 1818) by monotypy.
Tatoua Gray 1865:378. Type species *Dasypus unicincttus* Linnaeus (1758) by monotypy. Proposed as a subgenus of *Dasypus* Linnaeus (1758).
Ziphila Gray 1873:22. Type species *Ziphilus lugubris* Gray (1873) by monotypy.
Lysiurus Ameghino 1891:254. Proposed as replacement name for *Xenurus* Wagler (1830).
Cabassus Trouessart 1905:820. Incorrect spelling.
Cabassus Neveu-Lemaire & Grandidier 1911:103. Incorrect spelling.

General characteristics: Two species of medium-sized armadillo characterized by the fairly long, thin tail lacking well-developed plates (hence "naked-tailed"). The snout is very short and broad with a blunt end and the nostrils are guarded by a fine line of bristles. Ears funnel-shaped and capable of folding flat, closing the external auditory meatus. All feet possess five toes. Digits three, four and five of the foreefeet are broad and scythe-shaped and the claw on the first digit is long and slender. Hindfoot with blunt claws, the third being the longest. Carapace ovoid, dome-shaped and quite flexible with 11 to 14 movable bands. Dorsal plates are in transverse rows across the length of the body. These are nocturnal, solitary animals that give birth to a single young. The diet consists largely of ants and termites, these armadillos burrow frequently and often forage underground. The genus is known from the mid-Pleistocene of Brazil.

Cranial characteristics: Frontal bone with dome-like expansion. Rostrum short and tympanic ring present. Elongated infraorbital canal. Distance from lacrimal foramen and anterior opening of infraorbital foramen one-quarter to one-third rostral length. Mandible slender with articular process higher than coronoid process.

Dental characteristics: Dental formula 7-10/8-9 =30-38. Teeth peg-shaped and vary from circular to oviod in form on either axis.

Skeletal characteristics: 7 cervical vertebrae, 12 (or 12-13) thoracic, 3 (or 3-4) lumbar, 10 (or 9-11) sacral and 18 (or 15-20) caudal.

Paraguayan Species:

Cabassous chacoensis - Chaco Naked-tailed Armadillo

Cabassous tatouay - Greater Naked-tailed Armadillo

19
Chaco Naked-tailed Armadillo
Cabassous chacoensis

Xenurus gymnurus Lahille 1899:204 Not *Tatus gymnurus* Olfers (1818).
Cabassous loricatus Yepes 1935:441 In part. Not *Cabassous loricatus* (JA Wagner 1855)
Cabassous loricatus Cabrera 1959:219. In part. Not *Cabassous loricatus* (JA Wagner 1855)
Cabassous loricatus Moeller 1968:420. In part. Not *Cabassous loricatus* (JA Wagner 1855)
Cabassous chacoensis Wetzel 1980:335 Type locality "5-7km W of Est. Juan de Zalazar, Departamento Presidente Hayes, Paraguay"

***Cabassous chacoensis* Wetzel 1980**

TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Order Cingulata; Family Dasypodidae; Subfamily Tolypeutinae Tribe Priodontini (Myers et al 2006). The genus *Cabassous* was defined by McMurtie in 1831 and contains four species, two of which are present in Paraguay. The genus was reviewed by Wetzel (1980). This species is monotypic (González 2001). The species name *chacoensis* refers to the Gran Chaco the eco-region to which this species is confined. Formerly placed in the Euphractinae, Möller-Krull et al (2007) provided DNA evidence that demonstrated their position within the Tolypeutinae. Synonyms adapted from Gardner (2007).
ENG: Chaco Naked-tailed Armadillo, Chacoan Naked-tailed Armadillo (Redford & Eisenberg 1992, Canevari & Vaccaro 2007, Gardner 2007).
ESP: Cabasú chico (Canevari & Vaccaro 2007), Tatu de rabo molle (González 2001, Canevari & Vaccaro 2007).
GUA: Tatu ai menore (sic) (Redford & Eisenberg 1992).
DES: *Cabassous* armadillos have a short, broad snout and small eyes. The cephalic shield has an average of 38.7 scutes (range 34-42). Dorsal plates are arranged in transverse rows along the body and there are 12 movable bands. The third movable band has a mean of 28.3 scutes (range 27-30) and the fourth a mean of 26.7 scutes (range 25-29). There are very few, isolated scales on the cheek. Scutes of the movable bands are poorly differentiated from the rest of the dorsal scutes and are of a similar size and shape. The scapular and pelvic shields extend almost to the base of the limbs. First and second complete rows of scutes on the scapular shield wider than they are long. The first complete band of the scapular shield has a mean of 17.3 scutes (range 16-19) and the last a mean of 25.3 scutes (range 23-27). The first complete band of the pelvic shield has a mean of 25 scutes (range 24-26) and the last a mean of 6 scutes (range 5-7). Colour ranges from brown to dark brown, somewhat yellower laterally. There are no hairs present on the dorsal surface, though the lateral hairs may be fairly long. Ventrally

greyish almost naked and only sparsely haired. The tail is fairly long and slender and lacks scales. This species is best identified by its short ears, well-separated from each other but not extending beyond the first complete band of the scapular shield when laid backwards. The pinna has a characteristically fleshy anterior edge. Both feet have five pale claws, those of the forefeet being particularly long, especially the central (third) one which is greatly elongated and sickle-shaped. (Wetzel 1980). **DF:** Teeth are peg-like. Dental formula 8/8=32. There are no teeth present in the premaxillary bone. Mandibular (lower) toothrow distinctly curved. Uniquely in this genus the anterior and posterior teeth are wider than they are long (they are constricted anteroposteriorly). *Upper Tooth Row Length* 25.2mm (+/-0.5); *Lower Tooth Row Length* 23.7mm (+/-0.7). *Dimensions of Maxillary (Upper) Teeth* (*Length x Width): 4th*=2.6 (+/-0.2) x 3.4 (+/-0.12), *5th*=2.7 (+/-0.16) x 3.6 (+/-0.2), *6th*=2.5 (+/-0.28) x 3.6 (+/-0.38), *7th*=2.4 (+/-0.28) x 3.2 (+/-0.16); *Dimensions of Mandibular (Lower) Teeth* (*Length x Width): 5th*=2.6 (+/-0.38) x 3.2 (+/-0.15), *6th*=2.6 (+/-0.16) x 3.3 (+/-0.26), *7th*=2.4 (+/-0.19) x 3 (+/-0.33). (Wetzel 1980). **CR:** Rostrum short but skull proportionately broader than that of *C.tatouay*. Mandible narrow and distinctly curved on the dorso-ventral and medio-alteral axes. Condyloid process of mandible only slightly higher than coronoid process. Tympanic rings present rather than bullae. *Ratio of palatal length to maxillary tooth row* 1.62. *Ratio of rostral length to postrostral length* 0.8. *Condylonasal length* 69.8mm (+/-1.3); *Rostral length* 30.7mm (+/-0.8); *Palatal length* 41mm (+/-1.2); *Postrostral length* 38.9mm (+/-0.9); *Palatal width* 10.3mm (+/-0-9); *Anterior rostral width* 11.1mm (+/-0.9); *Interlacrimal width* 29.1mm (+/-1); *Interorbital width* 21.1mm (+/-0.9); *Zygomatic width* 40.1mm (+/-2.4); *Mastoidal width* 33.3mm (+/-1.6); *Cranial height* 29.9mm (+/-1.6). (Wetzel 1980).

TRA: This species walks supported by the claws of the forefeet while the entire sole of the hindfoot comes into contact with the substrate.

MMT: The smaller of the "naked-tailed armadillos" in Paraguay and indeed the smallest member of the genus. The following measurements were given by Wetzel (1980) taken from two specimens: **HB:** 30.3cm (30-30.6cm); **TA:** 9.3cm (9-9.6cm); **FT:** 6.1cm; **EA:** 1.45cm (1.4-1.5cm).

SSP: *Cabassous* armadillos are essentially smaller versions of *Priodontes maximus*, but size alone immediately rules out confusion with that species - no other armadillo even approaches *Priodontes* in size. They can be further identified by the lack of armoured plates on the tail (the tail is "naked") and the greatly enlarged claw on the forefeet. Highly-fossorial in behaviour these armadillos dig to escape danger - they do not try to run away. As a result of these distinctive features in Paraguay this species is only likely to be confused with the congeneric *Cabassous tatouay*. That is a larger species (approximately 50% larger than this species) and crucially has much longer ears that lack a fleshy expansion on the anterior margins. The long funnel-shaped ears of *C.tatouay* extend well above the top of the head (reaching beyond the first complete row of scapular scutes when laid backwards) and are quite different in length and form to the extremely short ears of this species. The two appear to be allopatric with this species confined to the Chaco and *C.tatouay* only recorded in eastern Paraguay. Note that this species has consistently smaller scale counts and cranial measurements than *C.tatouay* for all standard measurements used in the description. Cranially the curved mandible and anteroposteriorly constricted maxillary teeth are diagnostic of this species.

DIS: A restricted range species and Chaco endemic confined to western Paraguay and a small area of adjacent northern Argentina (Provincias Santiago del Estero and Formosa, and possibly also Tucumán). The species may occur in southwestern Bolivia and Matto Grosso do Sul, but its presence has not been confirmed in either of these countries. A specimen MACN4388 from Buenos Aires Zoo with supposed provenance "Brasil, Matto Grosso" was listed by Yepes (1935) as *Cabassous loricatus* but is actually this species and is the only evidence of its occurrence in that country. However Gardner (2007) suspected that the record was in error. Three Paraguayan specimens were examined by Wetzel (1980) MZ1600 with no locality data other than "Paraguay Chaco", USNM 531004 from Filadelfia, Departamento Boquerón and the type specimen CONN 16892 from 5-7km W of Estancia Juan de Zalazar, Departamento Presidente Hayes. The range of the species in Paraguay may be greater than is currently known, this being a secretive, largely subterranean species that is naturally rare and infrequently encountered owing to the isolated and inhospitable nature of its habitat.

HAB: Confined to xeric habitats of the Dry Chaco. The type specimen was taken in an area of thorn forest and mixed grasses. Given the subterranean nature of this species behaviour it may be assumed that soft soils are required for burrowing and coupled with the specilaised diet it is likely locally distributed.
ALI: No specific information is available on feeding behaviour of this species but it may be supposed to be myrmecophagous as are other members of the genus, using the long claws of the forefeet to break intoant nests and termite mounds.
REP: A single young is born (Canevari & Vaccaro 2007).
BEH: *General Behaviour* Almost nothing is known of the behaviour of this species other than the fact that it is highly fossorial and rarely observed. They are probably primarily nocturnal.
VOC: Handled males may give a pig-like grunting noise, but females are generally silent (Canevari & Vaccaro 2007).
HUM: This rarely recorded species probably passes undetected over most of its range, an area with a low human population.
CON: The Chaco Naked-tailed Armadillo is considered Near Threatened by the IUCN (see www.iucnredlist.org/details/3413 for the latest assessment of the species. The species is not listed by CITES. The population may have declined by as much as 25% over the last 10 years as a result of increased human activity in the species range. It is absent from cultivated areas and grazed areas, and the elimination of ant and termite populations in areas of anthropomorphic activity also directly affects the species. The species is easily captured and likely hunted opportunistically by human populations, though its small size and subterranean behaviour means that it is not a species that is deliberately sought. The species undoubtedly suffers predation from domestic dogs.
Online Account: www.faunaparaguay.com/cabchahb.html.
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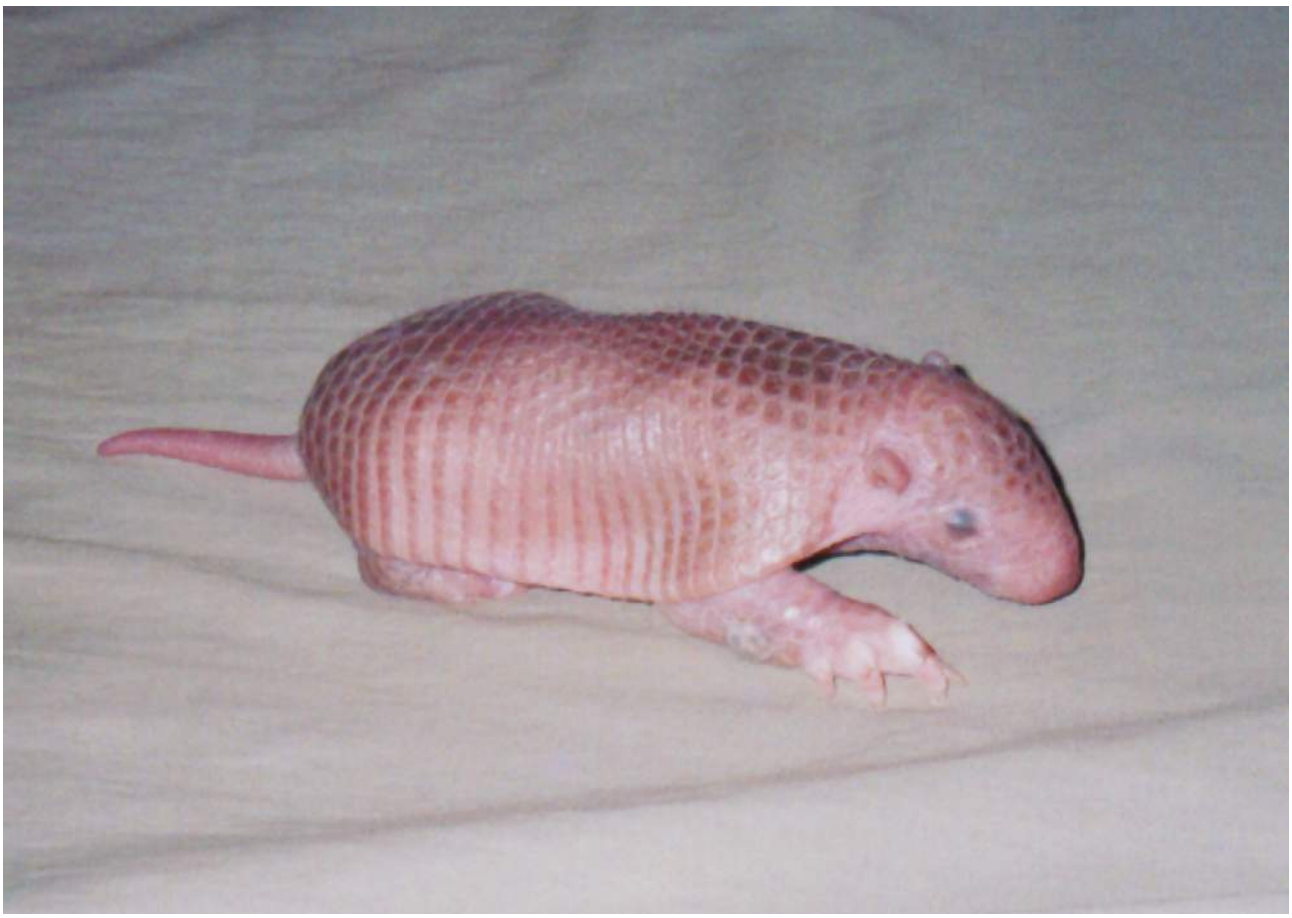
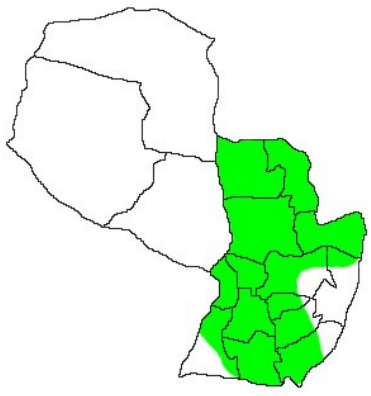


Chaco Naked-tailed Armadillo *Cabassous chacoensis*. Juvenile. Above lateral, below dorsal. Fortín Toledo, Departamento Boquerón, August 2004. Photo courtesy of Hugo del Castillo.

20
Greater Naked-tailed Armadillo
Cabassous tatouay

Loricatus tatouay Desmarest 1804:28. No type locality given, but restricted to Paraguay by Cabrera (1958) who considered the description to be based on de Azara (1801).
[*Dasypus*] *dasycercus* G.Fischer 1814:124. Type locality "Paraquaia".
[*Dasypus*] *gynmurus* Illiger 1815:108. Nomen nudum.
T[*atus*] *gymnurus* Olfers 1818:220. Type locality Paraguay. Based on de Azara (1801).
Tatusia tatouay Lesson 1827:311. Name combination.
Dasypus gymnurus Rengger 1830:290. Name combination.
Xenurus nudicaudis Lund 1839:231. Nomen nudum.
Dasypus 12-cinctus Burmeister 1854:282. Variant spelling of *Dasypus duodecimcinctus* Schreber (1774), wrongly applied.
Xenurus tatouay P.Gervais 1855:254. Name combination.
Xenurus unicinctus Gray 1865:254. In part. Not *Dasypus unicinctus* Linnaeus (1758).
Xenurus gymnurus Fitzinger 1871:242. Name combination.
Tatoua unicinctus Miller 1899:2. Not *Dasypus unicinctus* Linnaeus.
Xenurus duodecimcinctus Winge 1915:32. Not *Dasypus duodecimcinctus* Schreber (1774).
D[*asypus*] *nudi-cauda* Larrañaga 1923:343. Type locality "Provincia Paracuarensi". Based on de Azara (1802).
Cabassous tatouay Cabrera 1958:219. First use of current name.
Cabassous gymnurus Ximénez, Langguth & Praderi 1972:14. Name combination.
Cabassous duodecimcinctus Paula-Couto 1973:267. Name combination.

***Cabassous tatouay* (Desmarest 1804)**



TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Order Cingulata; Family Dasypodidae; Subfamily Tolypeutinae, Tribe Priodontini (Myers et al 2006). The genus *Cabassous* was defined by McMurtrie (1831) and contains four species, two of which are present in Paraguay. The genus was reviewed by Wetzel (1980). This species is monotypic (González 2001). The species name *tatouay* is an adaptation of the widely-used Tupi/ Guaraní name Tatu ai. Desmarest (1804) described the species based on de Azara´s (1801) "Tatou Tatouay". Larrañaga´s (1923) description was based on de Azara´s (1802) "Tatuaí". Cabrera (1958) lists more synonyms, though these are based on misidentifications of other authors who considered *C.tatouay* a junior synonym of *C.uninctus* (Gardner 2007). Formerly placed in the Euphractinae, Möller-Krull et al (2007) provided DNA evidence that demonstrated their position within the

Tolypeutinae. Synonyms adapted from Wetzel (1980) and Gardner (2007).
ENG: Greater Naked-tailed Armadillo (Redford & Eisenberg 1992), Spiny Armadillo (Cimardi 1996).
ESP: Tatu de rabo molle (González 2001), Armadillo de Cola Pelada Grande, Armadillo grande (Esquivel 2001).
GUA: Tatu ai (Emmons 1999, Esquivel 2001).
DES: Essentially similar to miniature versions of *Giant Armadillo*. *Cabassous* armadillos have a short, broad snout and small eyes. The cephalic shield has an average of 48.3 scutes +/-3.7. Dorsal plates are arranged in transverse rows along the body and there are 12-14 movable bands (mean 12.8 +/-0.6) - more than in any other Paraguayan armadillo. The third movable band has a mean of 31 scutes +/-1.7 and the fourth a mean of 30.8 scutes +/-1.6. There are two "nuchal" bands between the head and scapular plates and only isolated scales on the cheek. Scutes of the movable bands are poorly differentiated from the rest of the dorsal scutes and are of a similar size and shape. The scapular and pelvic shields extend almost to the base of the limbs. The first complete band of the scapular shield has a mean of 21.8 scutes +/-5.5 and the last a mean of 29 scutes +/-1.5. The first complete band of the pelvic shield has a mean of 29.1 scutes +/-1.4 and the last a mean of 8 scutes +/-1.3. Colour ranges from reddish-brown to blackish, but they are frequently stained by soils and they may be yellower laterally. There are no hairs present on the dorsal surface, though the lateral hairs may be fairly long. Ventrally greyish almost naked and only sparsely haired. The tail is fairly long and slender, armoured with thin, widely-spaced plates. This species is best identified by its long, funnel-shaped ears, well-separated from each other and extending well above the top of the head. Ears are scaled on the posterior side. Both feet have five pale claws, those of the forefeet being particularly long, especially the central (third) one which is greatly elongated and sickle-shaped. (Wetzel 1980). Core body temperature ranges from 32-34ºC (Zajic & Myers 2006). **DF:** Teeth are peg-like. Dental formula 9/8=34. There are no teeth present in the premaxillary bone. Maxillary teeth transversely compressed. *Upper Tooth Row Length* 38.3mm (+/-2.1); *Lower Tooth Row Length* 35mm (+/-1.9). *Dimensions of Maxillary (Upper) Teeth* (*Length x Width): 4th*=3.6 (+/-0.25) x 2.8 (+/-0.26), *5th*=3.7 (+/-0.2) x 3.1 (+/-0.21), *6th*=3.6 (+/-0.14) x 3.3 (+/-0.2), *7th*=3.5 (+/-0.28) x 3.2 (+/-0.24); *Dimensions of Mandibular (Lower) Teeth* (*Length x Width): 5th*=3.8 (+/-0.29) x 3.2 (+/-0.21), *6th*=3.7 (+/-0.17) x 3.2 (+/-0.25), *7th*=3.3 (+/-0.2) x 2.8 (+/-0.32). (Wetzel 1980). **CR:** Mandible narrow and straight with condyloid process of slightly greater height than coronoid process. Tympanic rings present rather than bullae. Palate more elongate than other members of the genus with medial posterior margin extending posteriorly beyond a line between the anterior margins of the zygomatic rami of the squamosals. *Ratio of Palatal length to Upper tooth row* 1.81 +/-0.09. *Ratio of Rostral Length to Postrostral Length* 0.94 (+/-0.05). *Condylonasal Length* 109.9mm (+/-4.5); *Rostral Length* 53mm (+/-2.8); *Palatal Length* 68.2mm (+/-3.2); *Postrostral Length* 56.4mm (+/-2.4); *Palatal Width* 17.1mm (+/-1); *Anterior Rostral Width* 17mm (+/-1.6); *Interlacrimal Width* 44.4mm (+/-2.6); *Interorbital Width* 33.8mm (+/-1.2); *Zygomatic Width* 56.3mm (+/-2.8); *Mastoidal Width* 49.7mm (+/-3.2); *Cranial Height* 42.4mm (+/-2.2). (Wetzel 1980). **CF:** 2n=50, FN=71. Autosomal complement consists of 4 large metacentrics, 6 smaller metacentrics and submetacentrics and 14 teleocentrics. X is a small submetacentric and Y minute and likely acrocentric. (Gardner 2007).
TRA: This species walks supported by the claws of the forefeet while the entire sole of the hindfoot comes into contact with the substrate. The most obvious characteristic of the track of this species is the sickle-shaped central claw on the forefeet which is greatly elongated and curves inwards. Typically only the three longest claws leave impressions on both feet, the two central toes of the forefeet being notably longer and more curved than the others. The impression of the hindfoot usually shows the three narrow, tapering central toes which are not curved and have normal-sized claws. In soft soil the entire foot leaves an impression, the hindfoot being elongated with the innermost and outermost toes greatly reduced and set well-back from the longer central toes. Faeces are pelleted and composed of insect remains and soil (Zajic & Myers 2006).
MMT: The larger of the "naked-tailed armadillos" in Paraguay and indeed the largest member of the genus. **TL:** 63.68cm (56-80cm); **HB:** 45.78cm (36-49cm); **TA:** 17.9cm (15-20cm) González (2001) gives the tail measurements as 24-32cm, considerably longer than other published sources; **FT:** 8.22cm (8-8.6cm); **EA:** 4.17cm (4-4.4cm); **WT:** 5.35kg (3.4-6.4kg). The weight range of 7-12kg given

in González (2001) seems at odds with all other published sources. (Wetzel 1980, Redford & Eisenberg 1992, González 2001).

SSP: *Cabassous* armadillos are essentially smaller versions of *Priodontes maximus*, but size alone immediately rules out confusion with that species - no other armadillo even approaches *Priodontes* in size. They can be further identified by the lack of armoured plates on the tail (the tail is "naked") and the greatly enlarged claw on the forefeet. Highly-fossorial in behaviour these armadillos dig to escape danger - they do not try to run away. As a result of these distinctive features in Paraguay this species is only likely to be confused with the congeneric *Cabassous chacoensis*. That is a smaller species (approximately 50% smaller than this species) and crucially has much shorter ears with an unusual fleshy expansion on the anterior margins. The long funnel-shaped ears of this species extend well above the top of the head and back beyond the first complete scapular band when folded backwards - quite different in length and form to the extremely short ears of *C.chacoensis*. The two appear to be allopatric with this species confined to eastern Paraguay and *C.chacoensis* only recorded in the Chaco. Note that this species has consistently greater scale counts and cranial measurements than *C.chacoensis* for all standard measurements used in the description. The Southern Naked-tailed Armadillo *Cabassous unicinctus squamicaudis* has been hypothetically reported for Paraguay in the past, though no evidence of the species occurrence in the country has been forthcoming. It is intermediate in size between the two documented species, but closer to *C.tatouay* in general proportions. Externally the two species are best separated on measurements and scale counts (particulary of the cephalic shield) and a comparison table is presented below taken from Wetzel (1980):

Number of movable bands: *C.tatouay* 12.8 (+/-0.6) *C.unicinctus squamicaudis* 12 (+/-0.4).

Number of head scutes: *C.tatouay* 48.3 (+/-3.7) *C.unicinctus squamicaudis* 54 (+/-5.5).

Number of scutes on 3rd movable band: *C.tatouay* 31 (+/-1.7) *C.unicinctus squamicaudis* 28 (+/-1.3).

Number of scutes on 4th movable band: *C.tatouay* 30.8 (+/-1.6) *C.unicinctus squamicaudis* 27.4 (+/-1.3).

Number of scutes on 1st scapular band: *C.tatouay* 21.8 (+/-5.5) *C.unicinctus squamicaudis* 20.1 (+/-1.9).

Number of scutes on last scapular band: *C.tatouay* 29 (+/-1.5) *C.unicinctus squamicaudis* 26.3 (+/-1.7).

Number of scutes on 1st pelvic band: *C.tatouay* 29.1 (+/-1.4) *C.unicinctus squamicaudis* 24.4 (+/-1.6).

Number of scutes on last pelvic band: *C.tatouay* 8 (+/-1.3) *C.unicinctus squamicaudis* 6.6 (+/-1).

Head and Body Length (excluding tail) : *C.tatouay* >36cm *C.unicinctus squamicaudis* <35cm.

Ear Length: *C.tatouay* >40mm *C.unicinctus squamicaudis* <30mm.

Ratio of Palatal length to Upper tooth row: *C.tatouay* 1.81 (+/-0.09) *C.unicinctus squamicaudis* 1.62 (+/-0.05).

Ratio of Rostral Length to Postrostral Length: *C.tatouay* 0.94 (+/-0.05) *C.unicinctus squamicaudis* 0.86 (+/-0.06).

DIS: Occurs from south-central Brazil (Pará, northern Goiás and southern Bahía) south to Uruguay. It is apparently widespread in eastern Paraguay with records from all Departments. It appears to be absent from most of Ñeembucú Department where the habitat and climate are reminiscent of the Humid Chaco. In Argentina it is found in Corrientes and Misiones Provinces, and perhaps as far as south as Entre Rios Province in that country. In Uruguay it has been recorded in Lavalleja and Cerro Largo Departments, with unconfirmed reports from Rivera and Treinta y Tres. Its fossorial habits means that it is likely under-recorded.

HAB: Occurs in open, grassy habitats generally with loose, sandy soils that are ideal for digging, but its primary habitat appears to be forest. Esquivel (2001) notes that the species is found in Atlantic forest areas at the Mbaracayú Forest in Paraguay as well as in the extensive cerrado area. Their is little data available for the presence of the species in Atlantic Forest in Paraguay. In Uruguay it is found in grasslands with bushes and patches of forest (González 2001).

ALI: They feed largely on ants and termites which are extracted from their nests, either by burrowing into mounds from the surface, or by approaching from below via the tunnels. The long, extensile tongue is used to lick up prey and the sickle-shaped mid-claw of the forefeet is used to cut through small roots as the animal digs (Nowak 1991). In the process other invertebrates may be incidentally

ingested, as well as soil. They possess a keen sense of smell which is used in the location of food (Zajic & Myers 2006).

REP: A single young is born (González 2001).

BEH: *General Behaviour* Almost nothing is known of the behaviour of this species other than the fact that it is highly fossorial and rarely observed. They are primarily nocturnal, with activity beginning after dark and are apparently solitary. At Serra da Canastra NP in Brazil Carter & Encarnaçao (1983) found the mean dimensions of the burrow to be 21cm wide x 15 cm high at the entrance, narrowing slightly to 21cm x 14cm 10cm inside the burrow, finding no significant difference in burrow width from those of *Euphractus sexcinctus* but a significant difference in burrow height. The mean burrow angle was calculated to be 47.7º. Burrows are dug so that the prevailing wind blows away from the entrance. Holes have a single entrance and are used only once. On rare occasions they may spend more than 24 hours in a single burrow but burrows are never re-used. Carter & Encarnaçao (1983) only found burrows to be dug into active termite mounds. *Defensive Behaviour* Being essentially slow-moving animals their main form of defence is to dig rapidly into soft soil, and they are capable of completely burying themselves within a few seconds. However some may attempt to escape by running, and some individuals have been recorded to immerse themselves in water during pursuit (Grzimek 2003). The dorsal plate extends well down the side of the animal but would provide little defence against large predators.

VOC: Handled males may give a pig-like grunting noise, but females are generally silent.

HUM: This species was recorded amongst the prey items of the indigenous Aché in Mbaracayú Biosphere Reserve, though only 24 individuals were taken in the period 1980 to 1996, representing just 130kg of meat or 0.8% of the biomass that they consumed, suggesting that it is not one of their principal targets, or perhaps, given the ease with which it may be captured, reflecting the scarcity with which the species is encountered (Cartés 2007).

CON: The Greater Naked-tailed Armadillo is considered Lowest Risk, least concern by the IUCN, (see www.iucnredlist.org/search/details.php/3414/all for the latest assessment of the species). The Centro de Datos de Conservación in Paraguay consider the species to be persecuted by humans in Paraguay and give it the code **N3**. The species is not listed by CITES. Though widespread, the fossorial behaviour of this species means that it is rarely detected. It is able to tolerate some degree of habitat disturbance, but the transformation of large tracts of eastern Paraguay into agricultural land is not conducive to the continued presence of this species and it is presumably in decline in many areas in Departamentos Alto Paraná and Itapúa or else has suffered from regional extinctions. Of course the fossorial habits of this species are damaging to agriculture and it may be persecuted for that reason. Clearing of habitat by fire is also likely to take its toll, the species being ill-equipped to escape. It is hunted opportunistically for food along with other armadillo species, but hunting pressure is unlikely to be the major cause of population decline. It is present in several protected areas in Paraguay.

Online Account: www.faunaparaguay.com/cabchahb.html.

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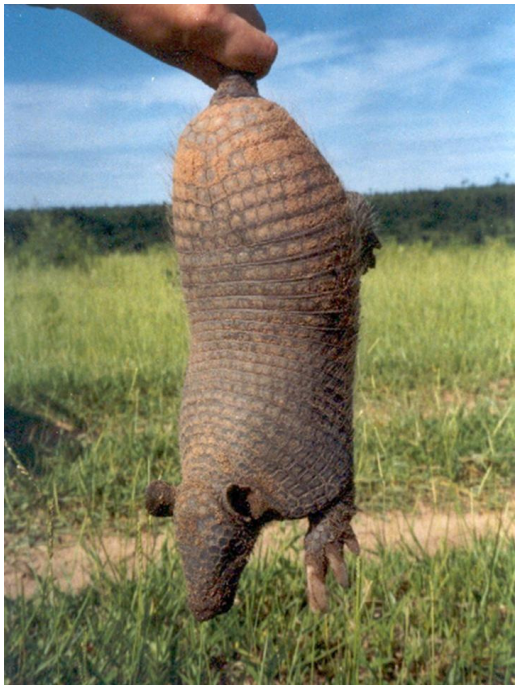
Greater Naked-tailed Armadillo *Cabssous tatouay.* Adult lateral. Estancia Ypety, Departamento Caaguazú, undated.
Photo courtesy of José Luis Cartes.

Greater Naked-tailed Armadillo *Cabssous tatouay.* Adult frontal. Estancia Ypety, Departamento Caaguazú, undated.
Photo courtesy of José Luis Cartes.



Greater Naked-tailed Armadillo *Cabssous tatouay.* Adult dorsal. Estancia Pa´i Kuára, Departamento Amambay, January 2006. Photograph courtesy of Hugo del Castillo.

Greater Naked-tailed Armadillo *Cabssous tatouay.* Adult lateral. Estancia Pa´i Kuára, Departamento Amambay, January 2006. Photograph courtesy of Hugo del Castillo.

Greater Naked-tailed Armadillo *Cabssous tatouay.* Adult burrowing sequence, frame 1. Estancia Pa´i Kuára, Departamento Amambay, January 2006. Photograph courtesy of Hugo del Castillo.

Greater Naked-tailed Armadillo *Cabssous tatouay.* Adult burrowing sequence, frame 2. Estancia Pa´i Kuára, Departamento Amambay, January 2006. Photograph courtesy of Hugo del Castillo.

Greater Naked-tailed Armadillo *Cabssous tatouay.* Adult burrowing sequence, frame 3. Estancia Pa´i Kuára, Departamento Amambay, January 2006. Photograph courtesy of Hugo del Castillo.

Greater Naked-tailed Armadillo *Cabssous tatouay.* Adult burrowing sequence, frame 4. Estancia Pa´i Kuára, Departamento Amambay, January 2006. Photograph courtesy of Hugo del Castillo.

22
Genus *Priodontes*, F.Cuvier 1825

This is a monotypic genus. Synonyms adapted from Gardner (2007).

Synonyms:

Dasypus Kerr 1792:112. In part. Not Linnaeus (1758).
Loricatus Desmarest 1804:28. In part.
Tatus Olfers 1818:220. In part. Incorrect spelling of *Tatu* Blumenbach (1779).
Priodontes F.Cuvier 1825:527. Type species *Dasypus gigas* G.Cuvier (1817) by monotypy.
Cheloniscus Wagler 1830:35. Type species *Dasypus gigas* G.Cuvier (1817) by monotypy.
Priodon McMurtrie 1831:164. Type species *Dasypus gigas* G.Cuvier (1817) by monotypy. Proposed as a subgenus of *Dasypus* Linnaeus (1758). Preoccupied by *Priodon* Quay & Gaimard (1824).
Polygomphius Gloger 1841:114. Type species *Dasypus gigas* G.Cuvier (1817) by monotypy.
Prionodon Gray 1843:xxvii. Nomen nudum.
Priodonta Gray 1843:xxvii. Incorrect spelling.
Prionodontes Schinz 1845:312. Incorrect spelling.
Prionodos Gray 1865:374. Introduced as a replacement for *Priodontes* F.Cuvier (1825).

General characteristics: A single species of huge size, much the largest member of its family. The snout is rounded and blunt-ended. Ears and eyes are large. Carapace is divided into bands of which the central 11 to 13 are flexible. The tail is covered with tightly-packed plates that are not arranged in rows. Feeds almost exclusively on ants and termites, destroying their nests with the long, sharply hooked claws of the forefeet (third digit being especially long). This species digs habitually, creating diagnostic large burrows which are occupied for a single night. Such burrows are often dug into termite mounds and a large number may be clumped into a single small area.

Dental characteristics: Highly variable with as many as 20 in a single tooth row, many of which are lost as the animal ages.

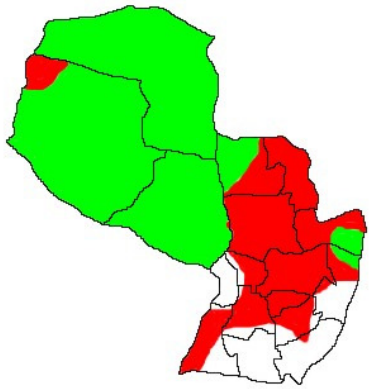
Paraguayan Species:

Priodontes maximus - Giant Armadillo

23
Giant Armadillo
Priodontes maximus

Dasypus maximus Kerr 1792:112. Type locality "Cayenne", French Guiana.
Dasypus giganteus É. Geoffroy St-Hilaire 1803:207. Type locality "Le Paraguay" referenced to de Azara (1801). Restricted to Pirayú, Departamento Paraguarí by Cabrera (1958).
Dasypus gigas G.Cuvier 1817:221. Based on Buffon (1763).
D[*asypus*]. *gigans* Schmid 1818:164. No type locality.
T[*atus*] *grandis* Olfers 1818:219. Type locality "Paraguay".
Priodontes giganteus Lesson 1827:309. Name combination.
D[*asypus*]. (*P*[*riodontes*].) *Gigas* Voigt 1831:261. Name combination.
Priodonta gigas Gray 1843:120. Name combination.
Priodon gigas Owen 1845:21. Name combination.
Prionodontes gigas Schinz 1845:316. Name combination.
Prionodos gigas Gray 1865:374. Name combination.
Prionodon gigas Gray 1869:380. Name combination.
Cheloniscus gigas Fitzinger 1871:227. Name combination.
Priodontes maximus O.Thomas 1880:402. First use of current name.
Priodon maximus JA Allen 1895:187. Name combination.
D[*asypus*]. *maximus* Larrañaga 1923:343. Type locality "Nemoribus septentrionalibus paraquarensibus". Based on de Azara (1802).

***Priodontes maximus* (Kerr 1792)**



TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Order Cingulata; ;*Dasypodidae Family* Subfamily Tolypeutinae, Tribe Priodontini (Myers et al 2006, Möller-Krull et al 2007). The genus *Priodontes* was described by F. Cuvier (1825). Formerly placed in its own subfamily Priodontinae, Möller-Krull et al (2007) provided DNA evidence that demonstrated their position within the Tolypeutinae. E.Geoffroy St-Hilaire´s (1803) description was based on specimen "Nº CCCCXIV" with reference to de Azara´s (1801) "Le Grand Tatou". G.Cuvier´s (1817) description was based on an illustration of "Le Kabassou" in Buffon (1763), who wrote that it was the largest tatou and came from Cayenne, the type locality. Larrañaga´s (1923) description was based on de Azara´s "Maximo". Synonyms adapted from Gardner (2007).
ENG: Giant Armadillo (Gardner 2007).

ESP: Tatú gigante (Emmons 1999), Armadillo gigante (Esquivel 2001).
GUA: Tatu carreta (Neris et al 2002, Villalba & Yanosky 2000), Kry´y pura vachu **Ac** (Esquivel 2001), Krypuravachú **Ac** (Villalba & Yanosky 2000), Tatu guazu **MA** (Emmons 1999, Villalba & Yanosky 2000), Nambirope **A** (Villalba & Yanosky 2000), Jautare **P** (Villalba & Yanosky 2000), Tatú-wasu (Chebez 1996), Tatu-carrera (Redford & Eisenberg 1992 - transcription error??). Tatú carreta is the most commonly-used named for the species in Paraguay and is used in preference to the Spanish names.

Priodontes maximus Photo courtesy of www.skullsunlimited.com

DES: A huge armadillo, most easily recognised by its size and flat carapace which does not cover the sides of the body. Carapace flattened and largely hairless, with rectangular scales aligned in rows. Colouration dark greyish centrally with pale, buffy border - though pattern sometimes obscured by earth from excavations. There are 11 to 13 movable dorsal bands on the carapace, making it extremely flexible and 3 to 4 movable neck bands. The head is relatively small., pale-coloured and with well-separated ears split by armoured scales. The head shield is oval-shaped and not expanded between the eyes. Muzzle rounded and somewhat conical, blunt at the end with a small mouth opening. Tail long, covered with small, pale, pentagonal scales and narrowing towards the tip. Underside naked, lacking either armour or hair, and with a pinkish-brown colouration. Feet are large, especially the hind feet and the X toes of the forefeet each bear a large, scimitar-shaped claw, the third being particularly long (up to 20.3cm). Females have two teats. Individuals can be distinguished by scale patterm, particularly the dividing line between the dark and light scales on the carapace and hind legs and the number of light scales per row from the lower edge of the carapace up to the dividing line (Noss et al 2004). **CR:** See figure. **DF:** Armadillos lack true teeth, but possess a series of "molariform" teeth that do not follow the standard mammal dental formula. Dentition in this species is abundant but poorly differentiated and teeth are shed with age. As a result the number of teeth reported is highly variable. An individual captured in Argentina for example had 65 teeth. 20-25/20-25 = 80-100. **CN:** 2n=50.
TRA: Distinctive foreprint like a broken scythe-shape with a broad, long "comma" situated towards the outer part of the print separated from an oval-shaped impression on the inner part of the print. Hind print with four well-formed, round-tipped toes, the outer two toes somewhat smaller than the inner two, and the innermost slightly separated from the rest. With the exception of the long third toe, the print is notably wider than it is long. A large oval pad leaves an impression below toe 3. The heavy tail leaves a zig-zag shaped scratch mark between the prints, formed by the rolling gait of the animal. **FP:** 5.5 x 3.4cm **HP:** 4.9 x 3.8cm. (Villalba & Yanosky 2000). Faeces typically have a flat surface and measure 14.7 (+/-1.7mm) x 22.7mm (+/-3mm). They are of firm consistency and have a weak acrid odour, containing up to 85% soil and almost no plant material (0.1%). Remains of ants and termites prominent. Weight 2.3g (+/-0.8mm). Typically found near areas of excavation and at burrow entrances (Anacleto 2007).
MMT: Much the largest armadillo in Paraguay, more than twice the size and five times the weight of the next largest species *Euphractus sexcinctus*. **TL:** (147-160cm); **HB:** 89.5cm (75-100cm); **TA:** 52.82cm (48-60cm); **FT:** 19.1cm (18-20cm); **EA:** 5.38cm (4.5-6cm); **WT:** 26.8kg (18.7-45kg) Captive individuals may reach 80kg in weight; **WN:** 113g. (Parera 2002, Nowak 2001, Ceresoli et al 2003, Emmons 1999, Redford & Eisenberg 1992).
SSP: Identifiable by size alone, adults are unmistakable on account of their great bulk. Juveniles potentially confusable with Naked-tailed Armadillos of the genus *Cabassous,* which share the greatly developed claws on the forefeet, but even adults of that genus are notably smaller than juvenile Giant Armadillos. Note also that the carapace of the Giant Armadillo seems to rest on the back, whereas that of other armadillos covers the sides and flanks. Furthermore Naked-tailed Armadillos have, as the name suggests, greatly-reduced scaling on the tail.
DIS: Widely distributed at low density in South America east of the Andes. Occurs from southeast Venezuela south through the Amazon Basin of Colombia, Ecuador, Brazil, Peru and Bolivia through Paraguay to northern Argentina. It is absent from eastern Brazil and there are no records from

Uruguay or Chile. Historically probably occurred to about 31ºS in Argentina (corresponding to Provincia Córdoba and Santa Fé) but today it is confined to Formosa, Chaco, Salta and northern Santiago del Estero (Parera 2002). Records from Misiones and Corrientes are considered doubtful as the name "Tatu carreta" is also applied to *Cabassous tatouay* there (Chebez 1996) and there are no specimens from either province. In Paraguay it has disappeared over much of its former range and is extinct over vast swathes of the Orient. Small and possibly unsustainable populations remain in the larger Itaipú Reserves in Departamento Alto Paraná, in the Mbaracayú Forest Reserve in Departamento Candindeyú (though there are no recent records) and in more remote areas of Departamento Concepción. There are no records from Departamento Misiones or Central (though the species probably occurred historically at least in the latter) and only a single record in Itapúa and the species is now extinct there as in much of the rest of eastern Paraguay. It remains widespread in the Chaco but local extinctions occur where human populations are established and it has apparently disappeared from the Nueva Asunción and PN Tte Enciso area, northern Departamento Boquerón (Neris et al 2002).

HAB: Found mainly in undisturbed forest, scrub and grassland, it rapidly disappears from inhabited areas. In the Central Chaco it most often encountered in areas xerophytic and semi-xerophytic areas vegetated with Lapacho (*Tabebuia* sp) and Palo Santo (*Bulnesia sarmientoi*) trees, but also occurs in deciduous forest in the Pantanal area and more open, seasonally-flooded palm savanna in the Humid Chaco. During a camera-trapping survey it was not recorded in the dry Chaco alluvial plains of Santa Cruz Bolivia, though it was present where there is forest cover, however the authors noted that animals occurring at very low density could easily escape attention (Noss et al 2004). In eastern Paraguay it formerly occurred at the edge of humid forest and cerrado savanna, but has disappeared from the vast majority of its former range and is in decline wherever it remains. Merritt (2006) note the preferred habitat of the species in the Paraguayan Chaco to be riparian areas or areas with loose, sandy-loam soil. The presence of substantial food reserves appears to be vital for the existence of the species and affinity for areas near water has also been noted (Nowak 1991). Habitat choice is apparently unaffected by fire, a study in the cerrado of Mato Grosso, Brazil finding that they utilised burnt areas as frequently as they do unburnt areas when foraging (Prada & Marinho-Filho 2004). Burning is of course a natural occurrence in the cerrado biome and does not directly affect the species main prey items.

ALI: Almost entirely myrmecophagous, feeding for the most part on ants (especially *Atta* sp) and *termites* with the addition of other subterranean invertebrates found in their colonies. Anacleto (2007) studied the diet of the species in the cerrado of Mato Grosso, Brazil and found only Hymenoptera and Isoptera in the faeces. Ants made up 27.5% of the biomass of the faeces, with the termite *Cornitermes* accounting for 60.6%. Other termite species including *Velocitermes, Nasutitermes* and *Coptotermes* made up just 0.9% of the biomass. The nest of *Cornitermes* is the most resistant to opening, requiring considerable force to break it open, but termites with more resistant nests have weaker chemical defences. Giant Armadillo foraging strategy is very similar to that of anteaters in that it uses the massive claws of the forefeet to break open nests and then feeds on the occupants. However one major difference is that the armadillo frequently destroys the colony at a single feeding necessitating a roaming rather than a territorial existence. Neris et al (2002) state that animals in the Paraguayan Chaco feed mainly on the larvae and honey of ground nesting bees. Carrion and vertebrates such as snakes have also been reported in the diet of the species, but these would seem to be unusual occurrences (Parera 2002). Captive individuals have been maintained on meat and meat-based formulas (Merritt 2006).

REP: Litter size is one or two (usually one), born after a gestation period of four months in a burrow dug by the mother (Redford & Eisenberg 1992, Neris et al 2002). Young have tough, leathery skin and are weaned at 4 to 6 months. Sexual maturity is reached at 10 to 12 months (Neris et al 2002, Parera 2002, Nowak 1991).

BEH: *General Behaviour* Solitary, nocturnal or crepuscular and highly fossorial and so rarely observed. Noss et al (2004) found the species to be most active between 10pm and 6am in Santa Cruz, Bolivia. Individuals pass the daylight hours in large burrows (40-45cm wide x 30-31cm high) dug with their powerful front claws and often built into sandbanks, or occasionally active or dead termite mounds.

Carter & Encarnaçao (1983) found the mean dimensions of burrows to be 45cm wide x 32cm high at ground level, increasing to 47x34cm 10cm inside the burrow, much larger than any other armadillo species and instantly recognisable by size alone. Typically the upper part of the burrow entrance is pointed rather than rounded (Emmons 1999), the mean burrow slope is 34.4º and they are dug in a direction so that the prevailing wind blows away from the entrance (Carter & Encarnaçao 1983). When digging the adult may pose on its hind legs and tail and throw the whole wait of its body behind violent strikes with the forelegs, the massive claws able to inflict considerable damage onto even hard-baked soil and termite nests. After the initial "attack" the loosened soil is scraped using the forefeet towards the hind feet where it is then kicked behind the body. (Emmons 1999). Burrows are often clumped and inhabited for at least 24 hours, though frequently a single burrow may be occupied for several nights (Redford & Eisenberg 1992) and one female occupied the same hole for 17 consecutive days (Carter & Encarnaçao 1983). In Brazil 68% of burrows were located in open grassy habitats, 28% in areas prone to flooding and just 3% in forested habitats and almost half of these were in active termite mounds (Nowak 1991). The open country burrows were located an average of 192m from forest edge. Adults leave their burrow only to feed and to look for a mate. They are surprisingly capable swimmers. Though the species is not territorial, the minimum home range has been estimated at an average of 452.5ha and individuals may cover 3km in a single night (mean 2,765m) (Parera 2002, Carter 1985). According to camera trap data home ranges of males overlap considerably (Noss et al 2004) and the maximum distance moved by a single individual was given as 7.5km. Published life spans of the species are between 12 to 15 years. This species walks on the soles of the hindfeet and only the tips of the claws of the forefeet are in contact with the ground (Vizcaíno & Milne 2002). *Defensive Behaviour* The species has a well-developed sense of smell but poor eyesight, and on the approach of a potential threat they rise up onto the hind legs, supported by the tail and begin to sniff from side to side. This position is similar to the defensive position adopted by anteaters and enables them to strike out with their sharply-hooked claws if suddenly attacked. For the most part their usual response to danger is to flee or to begin to dig rapidly into the substrate, digging in with the claws so that they cannot be dislodged. *Enemies* Besides man Giant Armadillos probably count on very few natural enemies. Their low density and large size means that they would not form a substantial part of the diet of any predator. However there are records of the species being attacked by Jaguar in Venezuela and Puma might also be expected to occasionally prey on the species.

VOC: No information.

HUM: Attractive to hunters on account of its large size and eyecatchingly large and often clumped burrows which are frequently re-used, allowing the occupant to be "staked out". The meat is considered "invigorating", whilst the fat is used for the treatment of asthma and bronchitis (Neris et al 2002). The rarity and large size of the species means that trophy hunting is as big a threat as hunting for the table (Villalba & Yanosky 2000). The species has almost disappeared from eastern Paraguay and occurs at naturally low densities in the Chaco which means that it is not likely to be hunted in large numbers, however individuals unlucky enough to stray close to populated areas put themselves at great risk. Locals state that it possesses an acute sense of hearing that enable it to detect the presence of predators from a considerable distance (Neris et al 2002). The species is frequently accused of digging up vegetables, but it is likely that this is a side-effect of digging for insects (Nowak 1991).

CON: The Giant Armadillo is considered Vulnerable by the IUCN (see www.iucnredlist.org/search/details.php/18144/all for the latest assessment of the species). The Centro de Datos de Conservación in Paraguay consider the species to be in imminent danger of extinction in Paraguay and give it the code **N1**. The species is listed on CITES Appendix 1 (see www.unep-wcmc.org/isdb/CITES/Taxonomy/tax-common-result.cfm?source=animals&displaylanguage=eng&Common=21278&Country=&tabname=all for the justification). The species occurs at naturally low density on account of its nomadic feeding behaviour, but does not tolerate the close presence of humans. Estimates of its decline vary widely and population figures for large areas of intact habitat do not exist. Over its entire range it is estimated to have declined by 30% over the last 20 to 30 years by the IUCN, whereas a decline of 50% in the last decade has also been noted. It has a low fecundity rate and populations rapidly fall victim to hunters. Adults require large home ranges with adequate food supplies and so local extinction has occurred

average of 452.5ha in Argentina (Parera 2002, Carter 1985), whilst crude estimates of 5-8 individuals per 100km² were made for the species in Santa Cruz, Bolivia from camera trap data. Assuming that all specimens remained in the area in which they were photographed they estimated a maximum of 14 individuals per 100km² for the Tucavaca region of Santa Cruz, Bolivia, though they noted that the majority of animals were photographed only once during the 28 month study (Noss et al 2004). The population remains healthy and relatively well-protected in the Chaco as a result of the isolation of the habitat, but it is at risk from conversion of natural habitat into ranchland and desertification in areas of extensive deforestation. Burning can have a severe impact on the species, with 2 individuals being found burnt to death in a 2000ha area following a fire in Emas National Park. Intensive pesticide use in agricultural areas actively eliminates their food source. Historically it has been considered a zoological "rarity" and was much sought after for zoological gardens and private collections. Vulnerability to fire would seem to be correlated to the intensity of the blaze (in turn related to the combustability of the vegetation), and regular burning may in fact be less damaging to the species than infrequent but more severe fires. Burning does not apparently affect the species choice of habitat, it being equally as frequent in burned areas as unburnt areas in the cerrado of Brazil (Prada & Marinho-Filho 2004). Any conservation strategy should be accompanied an educational element in which local people are taught to admire and respect the species and myths about its supposed great value on the black market are dispelled (Porini 2001). A captive breeding programme is currently underway in Argentina with the aim to reintroduce the species and augment wild populations.

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Giant Armadillo *Priodontes maximus*. Adult roadkill. Estancia Morocha, Alto Paraguay, July 2002. Photo courtesy of Hugo del Castillo.

Giant Armadillo *Priodontes maximus*. Adult rear. Bahía Negra, Departamento Alto Paraguay, August 2004. Photo courtesy of Arne Lesterhuis.

23
Genus *Tolypeutes*, Illiger 1811

Two species, one present in Paraguay. Synonyms adapted from Gardner (2007)

Synonyms:

Tolypeutes Illiger 1811:111. Type species *Dasypus tricinctus* Linnaeus (1758) by designation (Yespes 1928).
Matacus Rafinesque 1815:57. Nomen nudum.
Tolypeutis Olfers 1818:221. Incorrect spelling.
Tatusia Lesson 1827:309. In part.
Apara McMurtrie1831:163. Type species *Dasypus tricinctus* Linnaeus (1758) by monotypy. Proposed as a subgenus of *Dasypus* Linnaeus (1758) .
Sphaerocormus Fitzinger 1871:376. Type species *Tolypeutes conurus* I. Geoffroy St.Hilaire (1847) by monotypy.
Cheloniscus Gray 1873:23. Type species *Cheloniscus tricinctus* Gray (1873) (=*Dasypus tricinctus* Linnaeus (1758) by monotypy. Preoccupied.
Tolypentes Matschie 1894:62. Incorrect spelling.
Tolypoïdes Grandidier & Neveu-Lemaire 1905:370. Type species *Tolypoïdes bicinctus* Grandidier & Neveu-Lemaire (1905) by monotypy.
Tolypuetes Talmage & Buchanan 1954:73. Incorrect spelling.

General characteristics: A single species of small armadillo possessing a uniquely short, stumpy tail covered in tubercles. The ears are fairly large and rounded and the carapace is high, rounded and almost without hairs. Pectoral and pelvic shields are convex and extremely hard separated by 2-4 (usually 3) movable bands. Head shield is is elongated, flattened and with rounded lateral and posterior margins. Body hair is conspicuous below the carapace. In the Paraguayan species there are 4 toes on the forefeet and five toes on the hindfeet with digits II to IV unified and bearing hoof-like claws. Feeds almost exclusively on ants, termites and soft-bodied invertebrates. When threatened it takes flight rather than burrowing as do other armadillos, characteristically rolling into a ball when captured. The earliest record of the genus is from the Pliocene of South America.

Paraguayan Species:

Tolypeutes matacus - Southern Three-banded Armadillo

24
Southern Three-banded Armadillo
Tolypeutes matacus

Dasypus octodecimcinctus GI Molina 1782:305. Type locality "Nel Cujo" Chile, identified as Provincia Mendoza, Argentina by Tamayo (1968). Name preoccuppied by *Dasypus octodecimcinctus* Erxleben (1777) =*Cabassous unicinctus* (Linnaeus 1758).
Lor[*icatus*], *matacus* Desmarest 1804:28. No locality mentioned. Based on de Azara (1801). Sanborn (1930) restricted the type locality to Tucumán, Argentina.
[*Dasypus*] *brachyurus* G.Fischer 1814:130. Type localities "Tecumanis et Circa Buenos-Ayres".
Tolypeutes globules Illiger 1815:108. Nomen nudum.
T[*olypeutis*] *octodecimcinctus* Olfers 1818:221. Name combination.
Dasypus apar Desmarest 1822:367. Type localities "Le Tecuman et les campagnes découverts dans les environs de Buenos-Ayres, à partir du 36º. degré et gagnant vers le sud".
Tatusia apar Lesson 1827:310. Name combination.
Tolypeutes conurus I. Geoffroy St.Hilaire 1847:137. Type localities "Tecuman et des pampas de Buenos-Ayres (Argentina), et de la province de Santa Cruz de la Sierra (Bolivia).
Dasypus [(*Tolypeutes*)] *conurus* Burmeister 1861:436. Name combination.
Dasypus aparoides P.Gervais 1869:132. Nomen nudum.
Tolypeutes muriei Garrod 1878:223. Type locality unknown. Sanborn (1930) restricted the type locality to Bahía Blanca, Buenos Aires, Argentina.
Tolypoides bicinctus Grandidier & Neveu-Lemaire 1905:370. Type locality "l´Amérique du Sud" restricted to "environs de Tarija" Bolivia by Grandidier & Neveu-Lemaire (1908).
Tolypeutes matacus Osgood 1919:33. First use of current name.
D[*asypus*]. *globulosus* Larrañaga 1923:343. Type locality "Australem plagam bonaerensem" Based on de Azara (1802).
Tolypeutes matacos Yepes 1928:478. Incorrect spelling.
Tolypeutes tricinctus matacus Sanborn 1930:66. Name combination.
Tolypeutes tricinctus muriei Sanborn 1930:66. Name combination.

Tolypeutes matacus (Desmarest 1804)

TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Order Cingulata; Family Dasypodidae; Subfamily Tolypeutinae (Myers et al 2006). The genus *Tolypeutes* was defined by Iliger in 1811. There are two known species according to the latest revision (Gardner 2007) only one of which is present in Paraguay. Desmarest´s (1804) description was based on de Azara´s (1801) "Le Tatou Mataco". Larrañaga´s (1923) description was based on de Azara´s (1802) "Mataco". The species is monotypic (Gardner 2007). Synonyms adapted from (Gardner 2007).

ENG: Southern Three-banded Armadillo (Gardner 2007), Three-banded Armadillo (Neris et al 2002, Parera 2002), La Plata Three-banded Armadillo (Merritt 1976), Southern Domed Armadillo (Gardner 2007).

ESP: Tatu bolito (Villalba & Yanosky 2000), Quirquincho bola (Redford & Eisenberg 1992, Neris et al 2002), Tatú bola (Parera 2002), Mataco (Parera 2002).

GUA: Tatu bolita (Neris et al 2002), Tatu ai **MPA** (Villalba & Yanosky 2000), Chachu kuyú **Ac** (Villalba & Yanosky 2000), Tatu apepú (Parera 2002). "Bolita" and its variations which feature in the Guaraní and Spanish names refer to the species defensive behaviour of curling up into a ball.

DES: Heavily-armoured with the carapace extending almost to the feet, the Southern Three-banded Armadillo is generally sandy-yellow coloured in Paraguay (blackish individuals being found in some other parts of their range). Typically the aspect of the body is hinge-like, with the back steeply rounded and the two halves of the carapace forming an open V-shape at their lower edge. The triangular head plate is remarkably thick and robust and the main carapace consists of two huge plates (scapular and pelvic) separated by 2 to 4 movable bands (generally three). The individual scales are notable for their hexagonal rosette form. The sides of the body are not attached to the carapace, allowing a certain amount of flexibility of movement within the "shell". Long, thick, pale sandy-coloured bristles sprout along the lower edge of the carapace. The ears are large and somewhat flattened with a roughened edge. The iris is brown. The underbelly is quite heavily furred with dark brownish hair. Bare skin on the sides of the face is similarly dark brown, but the tip of the snout and nose are pinkish. The inflexible tail is covered in scutes, short and thick, triangular in form, and blunt-ended, fitting perfectly alongside the head when the animal rolls into its defensive ball. The legs are short and strong, armoured but with a covering of thick brownish hair. The forefeet bears four toes with greatly elongated claws particularly on the middle toes. The hindfeet also bear five toes, the second, third and fourth almost unified, flattened and hoof-like, the first and fifth with "normal" claws. **CR:** Occipitonasal length 60mm. Relatively long and tubular rostrum. (Diaz & Barquez 2002). **DF:** Armadillos lack true teeth, but possess a series of "molariform" teeth that do not follow the standard mammal dental formula. 9/9 = 36. All molariforms are located in the maxillar, differentiating *Tolypeutes* from *Chaetophractus* and *Euphractus*. **CN:** 2n=38 This species lacks truly acrocentric autosomes and the diploid number is lower than any other armadillo (Nowak 1991).

Tolypeutes matacus. Photo courtesy of www.skullsunlimited.com

Tolypeutes matacus. Photo courtesy of www.skullsunlimited.com

TRA: Given the dry areas in which this species lives footprints are usually only encountered in areas of loose soil or after rains. The print of the forefeet is distinctive, leaving marks of three triangular forward-facing toes, the middle one approximately twice the length of the outer two. The unusual structure of the hind print leaves a peculiar "compound" print in soft soil which may appear to be

made by two feet. For the most part the armadillo walks on the front part of the foot, with the posterior part, complete with its own pads, leaving its impression only in softer soil. **FP:** 3.7 x 2.7cm **HP:** 3.4 x 2.7cm. **PA:** 22cm. (Villalba & Yanosky 2000).

MMT: A small armadillo with a steeply-rounded, hinge-like carapace. **TL:** (25-30cm); **HB:** 25.7cm (21.5-27.3cm); **TA:** 6.37cm (5.5-8cm); **FT:** 4.23cm (2.5-4.7cm); **EA:** 2.28cm (1.9-4.1cm); **WT:** 1.1kg (0.8-1.5kg). (Parera 2002, Nowak 2001, Ceresoli et al 2003, Redford & Eisenberg 1992, Diaz & Barquez 2002). The following additional measurements were taken from two individuals at PN Tte Enciso, Departamento Boquerón during July 2006 - *Head Length:* - 7.4-7.7cm; **TA:** 5.7-6.3cm; **EA:** 2.62cm; *Carapace Width:* 11.5-11.6cm; *Longest Claw on Forefoot:* 2.65cm (P. Smith unpubl.).

SSP: The most instantly recognisable of the small armadillos due to its hard, inflexible carapace and presence of just three movable bands. Furthermore, contra the stereotypical image that many people have of armadillos rolling into a ball to protect itself, the genus *Tolypeutes* are the only armadillos that do so, making this behaviour diagnostic of the species in Paraguay.

DIS: Occurs from southeastern Bolivia, through the southwestern and western cerrado belt of Brazil, the Paraguayan Chaco to northern and central Argentina in the Provinces of Formosa, Chaco, northern Santa Fé, Santiago del Estero, eastern Salta and Jujuy, Tucúman, Rioja, Catamarca, Córdoba, San Juán, La Pampa, San Luís, extreme northeastern Mendoza and southern Buenos Aires. References to the species presence in Chile probably stem from GI Molina (1782) when Provincia Mendoza ormed part of Chile (Gardner 2007). The species is declining rapidly in the southern parts of its Argentinian range. In Paraguay it is most abundant in the Dry Chaco departments of Boquerón and Alto Paraguay, less common in Presidente Hayes and there are marginal records from extreme western Departamentos Concepción and San Pedro (Neris et al 2002).

HAB: This species is confined to the Chaco where it is most abundant in xerophytic areas, typically thorny Chaco forest and scrub. In the area around the Mennonite colonies of the Central Chaco it may be found in agricultural land and around rural dwellings provided patches of scrubby forest are maintained nearby. In the Humid Chaco it occurs in palm savanna and gallery forest (Brooks 1995). It chooses to take refuge in forested areas but often forages in more open habitats. At PN Tte Enciso, Departamento Boquerón, the species frequently forages in the area close to the accommodation despite the presence of artificial lights. Parera (2002) states that it does not occur in areas with greater than 700mm annual rainfall.

ALI: Three-banded Armadillos are opportunistic insectivores that feed mainly on the surface of the ground, only occasionally digging shallow holes into ant and termite nests. They do not perform extensive digging projects in order to obtain food stuffs, given that in the dry areas in which they live the soil is often so hard as to have the consistency of concrete and requires considerable force even to break the surface with a spade. Considered to be largely myrmecophagous, feeding on ants and termites, but other soft-bodied invertebrates are also taken and they regularly scratch at tree trunks in search of arthropods (Redford & Eisenberg 1992, Parera 2002). In the Brazilian cerrado three stomachs were found to contain the non-colonial termite *Syntermes molestus,* spiders and ants of the genus *Camponotus*. During a study in northeastern Santiago del Estero, Argentina, 66 stomachs were analysed by Bolkovic et al (1995) which showed the diet of wild individuals to consist of 70% invertebrate material, 20% fruits and 10% unidentified material, and that the presence of different items in the diet was seasonal. All invertebrates found lived at ground level or below and invertebrate larvae were the most common item in the diet, especially Coleoptera larvae. Termites were shown to be an important item in the diet from July to November but less prominent at other times of year. The following ant species were recorded Ponerinae; Pseudomyrmicinae (*Pseudomyrmex*); Dorylinae (*Crematogaster, Neivamyrmex*, and *Novamyrmex*); Myrmycinae (*Acromyrmex, Pheidole, Elasmopheidole, Solenopsis* and *Wasmannia*); Dolechoderinae (*Dorymyrmex*); Formicinae (*Camponotus* and *Brachymyrmex*). Lepidopteran larvae and pupae were most prominent during July and August. Of the fleshy fruits present *Zyzyphus mistol* (Rhamnaceae) was the most prominent, being a fruit that stays on the ground for several weeks after falling. Other fruits reflected seasonal abundance, but fruits of *Castela coccinea* (Simaroubaceae) were avoided and the presence of phenols, alkaloids and triterphenoids probably acts to deter the armadillos which seek their food by smell. A considerable quantity of soil was found to be

ingested, making of up to 40% volume by weight in some stomachs and an extraordinary 92% volume by weight in one stomach. Items were found intact in the stomach, suggesting that they do not chew their food and local reports suggested that the animals deliberately ingest soil, possibly to assist with digestion. Intact seeds in the stomach suggest that the species may play an important role in seed dispersal of certain plants. Parera (2002) reports that in the Argentinian Chaco the mostly insectivorous diet is also supplemented with fruit. Captive individuals took fruit, leaves, boiled rice, bread soaked in milk or tea, ants and their eggs and larvae, and mealworms (Nowak 1991). Additional items fed to captive individuals include boiled egg, grated carrot, honey, lean horsemeat and cod-liver oil (Bolkovic et al 1995).

REP: Several males pursue single females in oestrus hoping for the opportunity to mate. Most births happen from October to January, meaning that mating takes place from July to October (Redford & Eisenberg 1992). Neris et al (2002) state that the Paraguayan breeding season is from May to October or November, somewhat earlier than the dates stated by Redford & Eisenberg, but Merritt (1976) concurred with them, quoting November to January as the Paraguayan breeding season. Parera (2002) records breeding in Argentina from September to February. A single young is born after a gestation period of 120 days - though Neris et al (2002) indicate that twins occasionally occur. Reproductive rate is slow, with an average of 1.5 young per female per annum (Abba et al 2007). Newborns are miniature versions of adults, with claws fully-developed and hardened. The carapace is flexible and has a leathery texture, but the markings of the individual scutes are apparent from the beginning. From birth newborns are able to walk and roll into a ball. Young first open their eyes and ear pinnae at 22 days and are weaned in 10 weeks (72 days). Sexual maturity is reached at 3 to 5 years.

BEH: *General Behaviour* Solitary for much of the year, small groups gather only during the breeding season when several males pursue single females in oestrus (Neris et al 2002). Though sometimes active during the day, animals observed at PN Tte Enciso, Departamento Boquerón during July 2006 were only encountered at night and major activity peaks are likely affected by temperature and rainfall (P. Smith pers. obs., Redford & Eisenberg 1992). Specimens were also found to be active during the first hour of daylight at PN Defensores del Chaco, Departamento Boquerón during September 2006. Neris et al (2002) states that the species becomes more diurnal during the breeding season. In Mato Grosso, Brazil most encounters with the species were between midday and 18.00h. Despite well-developed claws on the forefeet, this species does not dig its own burrows, preferring to re-use burrows made by other armadillos and burrowing mammals. This species walks on the soles of the hindfeet and only the tips of the claws of the forefeet are in contact with the ground (Vizcaíno & Milne 2002). *Defensive Behaviour* The first reaction of this armadillo when faced with a potential predator is to run, the legs moving rapidly like a clockwork toy and the path chosen irregular and zig-zagging to avoid vegetation. The eyesight is poor and frequently the animal will almost collide with static objects, pulling up suddenly before changing direction and accelerating again. Unlike many other armadillos they do not dig to escape danger and do not immediately head for their hole and can usually be captured fairly easily by hand after a short pursuit provided their path does not take them into dense thorny scrub. Upon capture the armadillo rolls into a ball, the triangular head plate fitting tightly into the extensive scapular plate posteriorly and anteriorly jig-saw-like with the triangular tail so that the soft underbelly of the animal protected by the continuous covering of armour. Frequently the shell remains slightly open and if an attempt is made to touch the underbelly the shell snaps shut with remarkable force (Nowak 1991). Villalba & Yanosky (2002) state that the force of closing is capable of damaging a human finger and likely acts as a substantial deterrent against predators. If left unmolested the animal begins to unroll slowly, suddenly bursting into a run (Sanborn 1930). Handled animals typically half unroll the shell and begin to defecate. (P. Smith pers. obs.). The longevity of this species is 12 to 15 years. *Enemies* The carapace of this species is especially rigid and it is common to find hollowed-out, dried carapaces in the Dry Chaco, often with the head still attached (P. Smith pers. obs.). The original cause of mortality is not always clear, but the "cleaning" of the remains is probably due to vultures and Southern Crested-Caracaras *Caracara plancus*. It provides an effective defence against foxes and small cats, and it is possibly even enough to dissuade large felines. Interestingly remains of this species have been found in the pellets of Burrowing Owls *Athene cunicularia* in Santiago

del Estero, Argentina. Members of this species often have a heavy parasite load and individuals in PN Tte Enciso, Departamento Boquerón frequently carried ticks (Acari) on their underbelly (P.Smith pers. obs.).

VOC: A captured individual at PN Tte Enciso, Departamento Boquerón made quiet grunting noises similar to a domestic guinea-pig (P.Smith pers. obs.)

HUM: This armadillo is confiding and easily captured by hand, making it a popular pet for indigenous groups and the "preferred armadillo for the table" in the Chaco (Hugo del Castillo pers. comm.). It is said to have the best flavour amongst the armadillos, but it is uncertain how much of this is due to its palatability and how much is due to wishful thinking with it being the most abundant and easily captured species in the area. In Santiago del Estero, Argentina, it was found to constitute 55% of the wild fauna in the diet of local people. *Tolypeutes* are the only armadillos that roll into a ball to protect themselves, but this atypical behaviour has become associated with a "stereotypical armadillo" in the minds of many people across the globe.

CON: The Southern Three-banded Armadillo is considered Low Risk, near threatened by the IUCN (see www.iucnredlist.org/search/details.php/21974/all to see the latest assessment of the species). The Centro de Datos de Conservación in Paraguay consider the species to be persecuted by humans in Paraguay and give it the code **N3**. The species is not listed by CITES. The major threats to this species appear to be hunting for food, capture as a pet and burning. The species has poor eyesight and a somewhat haphazard way of escaping danger and burning of forest or grassland undoubtedly claims many victims. Exportation of the species occurs across its range and there is a high mortality rate during this process with upwards of 80% of the specimens sent to Europe dying en route. Currently the Dry Chaco does not pose any real conservation concern, its isolation, low population and extreme climactic conditions are not attractive for agriculture, but the low price of land in the area means that cattle ranchers are beginning to purchase properties in the area. Persistent rumours of undiscovered oil and gas reserves in the Chaco may also make the area vulnerable to prospecting in future. The species is able to tolerate moderate conversion to agriculture but too much habitat perturbation is likely to have a negative effect on populations, furthermore the slow reproductive rate of this species hinders the ability of populations to recover quickly. The species is present and common in several protected areas in the Chaco and its survival in Paraguay seems secure for the moment. However in Brazil the species is in widespread decline and populations are estimated to have decreased by 30% over the last decade. Population densities in Mato Grosso, Brazil were estimated at 0.96/km² in cerrado, 0.59/km² in secondary forest and 0.42/km² in deciduous forest. Wetzel (1982) however estimated a population density of 7/km². An estimate of 1.9/km² has been quoted for Chaco habitat. A self-sustaining captive population is present in the USA, notably at the Lincoln Park Zoo in Chicago (Abba et al 2007), but captive individuals often suffer from pathologies and stereotyped behaviours (Parera 2002).

Online Account: www.faunaparaguay.com/tolmathb.html.

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Southern Three-banded Armadillo
Tolypeutes matacus. Adult lateral. PN Teniente Enciso, Departamento Boquerón, July 2006. Photo Paul Smith.

Southern Three-banded Armadillo
Tolypeutes matacus. Adult head detail. PN Teniente Enciso, Departamento Boquerón, October 2007. Photo courtesy of Marcelo Bombaci.

Southern Three-banded Armadillo
Tolypeutes matacus. Adult defence. PN Teniente Enciso, Departamento Boquerón, July 2006. Photo Paul Smith.

Southern Three-banded Armadillo
Tolypeutes matacus. Adult cephalic shield. PN Teniente Enciso, Departamento Boquerón, October 2008. Photo Paul Smith.

Southern Three-banded Armadillo
Tolypeutes matacus. Adult tail. PN Teniente Enciso, Departamento Boquerón, October 2008.
Photo Paul Smith.

Southern Three-banded Armadillo
Tolypeutes matacus. Dung. PN Teniente Enciso, Departamento Boquerón, July 2006.
Photo Paul Smith.

25
Family
Myrmecophagidae: Anteaters

General characteristics: Two distinctive species with elongated snout, small eyes and small rounded ears. The mouth is much reduced and located at the tip of the snout. Both species are equipped with a long sticky tongue adapted for hunting ants and termites, their principal food. Both species have four digits on the front foot (though greatly reduced in *Tamandua*), armed with large, viciously hooked claws (particularly the third) designed to break down the nests of their prey. As a result of this they walk on their "wrists" which are marked with a special thickened pad. Their food, though ubiquitous, is of low nutritional value and the anteaters have a correspondingly low metabolic rate. Both species give birth to a single young and exhibit advanced parental care. The small mouth and clawed feet are unsuitable for transporting young, so they ride on the back of the parent until they are old enough to fend for themselves. Fossils are known from the early Miocene of South America.
Cranial characteristics: Broad interorbital region. Incomplete zygomatic arch. Greatly elongated snout. Posterior margin of the palate formed by the pterygoids.
Dental characteristics: Teeth are lacking in this family.
Skeletal characteristics: Ribs have a double articulation with the sternal element.

Key to Adults of Paraguayan Species of Anteaters

1a Large size, total length >180cm. Predominant colouration blackish-grey. Tail long and bushy. Exclusively terrestrial.....*Myrmecophaga tridactyla* (p.94)

1b Small size, total length <105cm. Predominant colouration creamy-yellow with variable dark patch across shoulder and forelegs. Tail long and narrow, not bushy. Semi-arboreal…….*Tamandua tetradactyla* (p102)

26
Genus *Myrmecophaga*, Linnaeus 1758

This is a monotypic genus. Synonyms adapted from Gardner (2007)

Synonyms:

Myrmecophaga Linnaeus 1758:35. Type species *Myrmecophaga tridactyla* Linnaeus (1758).
Nyrmecophaga Bechstein 1801:1346. Incorrect spelling.
Myrmecopha G.Fischer 1803:333. Incorrect spelling.
Myrmecophagus Gray 1825:343. Unjustified emendation.
Falcifer Rehn 1900:576. Type species *Myrmecophaga jubata* Linnaeus (1766) by monotypy.

General characteristics: Immediately idenfitiable by its huge size and long, hairy, non-prehensile tail. Body hair long, shorter on the head. Pectoral mammae are present. Digit I of forefeet possesses a short and sharp, but inconspicuous claw. Exclusively terrestrial.Fossils known from the early Pleistocene of South America.

Cranial characteristics: Rostrum much longer than brain case.

Skeletal characteristics: Clavicles rudimentary.

Taxonomy: Rehn proposed *Falcifer* as a replacement generic name as he was under the mistaken belief that the type species of *Myrmecophaga* was *M.tetradactyla* (=*Tamandua tetrdactyla*).

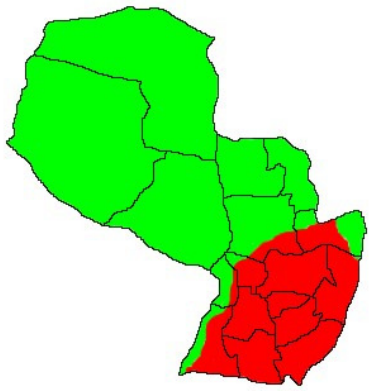
Paraguayan Species:

Myrmecophaga tridactyla - Giant Anteater

27
Giant Anteater
Myrmecophaga tridactyla

[*Myrmecophaga*] *tridactyla* Linnaeus 1758:35. Type locality "America Meridionali", restricted to Pernambuco, Brazil by O.Thomas (1911).
[*Myrmecophaga*] *jubata* Linnaeus 1766:52. Type locality "Brasilia".
M[*yrmecophaga*]. *iubata* Wied-Neuwied 1826:537. Incorrect spelling.
Tamandua tridactyla Matschie 1894:63. Name combination.
Falcifer jubata Rehn 1900:576. Name combination.
Myrmecophaga centralis Lyon 1906:570. Type locality "Pacuare" Limón, Costa Rica.
Myrmecophaga trydactyla Utrera & Ramo 1989:65. Incorrect spelling.

Myrmecophaga tridactyla
Linnaeus 1758



TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Magnorder Xenarthra; Order Pilosa; Suborder Vermilingua; Family Myrmecophagidae; (Myers et al 2006, Möller-Krull et al 2007, Gardner 2007). The genus *Myrmecophaga* was defined by Linnaeus in 1758. The genus name *Myrmecophaga* is from the Greek for "anteater". The species name *tridactyla* means "three fingers", distinguishing it from the "four-fingered" *Tamandua*, the only other living species. Gardner (2007) tentatively recognised three subspecies, *M.tridactyla tridactyla* being present in Paraguay. Synonyms adapted from Gardner (2007).
ENG: Giant Anteater (Gardner 2007), Great Anteater (Lyon 1906).
ESP: Oso hormiguero (Neris et al 2002, Parera 2002), Tamanduá bandera (Carol Fernández pers. comm.), Oso bandera (Neris et al 2002).
GUA: Jurumi **MA** (Neris et al 2002, Villalba & Yanosky 2000), Yurumí (Parera 2002), Tamandua guasu **A** (Villalba & Yanosky 2000), Kuarevachú **Ac** (Villalba & Yanosky 2000), Jautare **P** (Villalba & Yanosky 2000).
DES: With a long tubular head and tiny, circular toothless mouth, the Giant Anteater is like a living "vacuum-cleaner". The extensile tongue is some 60cm long and cylindrical, and secretes a sticky substance that traps their prey. The head is merely an extension of the snout and bears small, relatively ineffectual brown eyes and tiny ovaloid ears that do not emerge above the level of the head. The legs are robust and powerful, the front feet bearing five toes including three viciously-hooked claws, so well-developed that the animal must walk on its knuckles. The other two toes are greatly reduced. The

Myrmecophaga tridactyla
Photo courtesy of
www.skullsunlimited.com

hindfoot also bears five, more reasonably-sized claws, enabling the animal to correctly use the sole. There is a slight hump at the base of the neck and a line of stiff hairs along the midline form a bristly mane. The pelage is long and stiff, mainly greyish peppered with white and with a broad black band stretching from the throat forming a triangular point at the shoulder and bordered thinly with white along its length. The forelegs are mostly white with large black patches just above the forefeet. The hind legs are mostly black. A voluminous bushy grey tail greatly exaggerates the size of the appendage. **CR** - Occipitonasal length 210mm. Elongated rostrum with nasal bones of similar length to the frontal bones. (Díaz & Barquez 2002). **DF:** I0/0 C0/0 P 0/0 M 0/0 = 0. **CN:** 2n=60.

TRA: Forefoot completely different to hindfoot, showing traces of two large claw marks on outer part of print. Hindfoot somewhat rounded and only slightly oblong, with five, relatively short, even-sized toes. Does not leave trace of tail. **FP:** 10.8 x 9cm **HP:** 8.6 x 6cm. **PA:** 11cm.

MMT: TL: 182-217cm; **HB:** 126.5cm (100-140cm); **TA:** 73.4cm (60-90cm) plus hairs of c30cm in length; **FT:** 16.5cm (15-18cm); **EA:** 4.7cm (3.5-6cm); **WT:** 31.4kg (18-52kg); **WN:** 1.5kg (1.1-1.6kg). (Parera 2002, Neris et al 2002, Nowak 2001, Emmons 1999, Redford & Eisenberg 1992).

SSP: Unmistakable on account of its size and colouration. Only *Tamandua tetradactyla* has the same basic shape, but it is creamy-yellow in colouration not black, considerably smaller, lacks the bushy tail and is semi-arboreal in behaviour. Footprint of *Tamandua* has a trace of a single hooked claw and rounded pad on forefoot and hindfoot more elongate (almost twice its width) with longer toes. Tamandua drags the tail along the ground leaving an imprint in soft substrate.

DIS: Widely distributed from Belize and southern Central America (where it is disappearing), through much of South America (except the Andes) and south to Santiago del Estero in Argentina - though historically it ranged as far south as 31ºS. It is extinct in Uruguay. In Paraguay it occurs throughout the country but has disappeared from large areas of eastern Paraguay as a result of hunting pressure. (Neris et al 2002, Parera 2002). Three subspecies were tentatively recognised by Gardner (2007). *M.t.centralis* Lyon, 1906 is found in central America south to northwestern Colombia and northern Ecuador. It is absent from western Colombia. *M.t.artata* Osgood, 1912 is found in northeastern Colombia and northwestern Venezuela north and west of the Mérida Andes. The nominate subspecies *M.t.tridactyla* (Linnaeus 1758) occurs in the rest of the South American range east of the Andes fromVenezuela and the Guianas south to northern Argentina.

HAB: Giant Anteaters can survive wherever there are sufficient ant or termite populations to sustain them, but though they do occur in Chaco forest and in humid forest, it appears to be suboptimal habitat and they are less common there than in open habitats. Large areas of suitable grassland and cerrado habitat are present in eastern Paraguay, but they have disappeared from the majority of these areas due to hunting pressure. They are most abundant in the seasonally-flooded palm savanna of the Humid Chaco. Habitat choice is apparently unaffected by fire, a study in the cerrado of Mato Grosso, Brazil finding that they utilised burnt areas as frequently as they do unburnt areas when foraging (Prada & Marinho-Filho 2004). Burning is of course a natural occurrence in the cerrado biome and does not directly affect the species main prey items.

ALI: Giant Anteaters are strictly myrmecophagous and epitomise the concept of sustainable harvest, moving around their territory and visiting ant nests and termite mounds without ever completely destroying the colony or exhausting the resource. Their vision is poor but they overcome that by establishing a routine that helps familiarise them with their territory and by possessing a strong sense of smell which is used in food location. In Argentina termites such as *Nasutitermes* and *Cornitermes* and ants such as *Camponotus, Iridomyrmex* and *Solenopsis* are preferred with the percentages of each species varying throughout the year (Parera 2002). In the Pantanal of Brazil they consumed only two species of termites (*Nasutitermes coxipoensis* and *Armitermes* sp.) and only during the month of June. The same study recorded five ant genera in the diet *Solenopsis* (46%), *Camponotus* (12%), *Labidus* (2%), *Odontomachus* (2%) and *Ectatomma* (2%). (Medri et al 2003). They may consume as many as 30,000 individual ants, larvae and cocoons in a single day (Nowak 1991). Ant and termite nests are broken

using the hooked claws of the forefeet and the extensile tongue is inserted (reaching some 40cm beyond the mouth but only 10-15mm wide at its widest point), the insects becoming stuck to the mucous-like covering of the tongue or fastening onto it with their jaws. The animal is able to withstand only a short period of feeding before the defensive response of the ants becomes more organised, and it then retreats, ensuring that the colony is not totally destroyed and remains to be exploited at a later date. Braga de Miranda et al (2003) reported on an individual that had apparently raided and eaten a honey bee nest *Apis mellifera* located inside a termite mound 1.5m high but this is apparently an extremely rare occurrence. The salivary glands of Giant Anteaters appear to be active only when feeding. In captivity the species is raised on a mixture of milk, eggs, mealworms and ground beef, and captive individuals have also taken eaten fruit (Nowak 1991). Giant Anteaters drink frequently and when the water table drops below the surface they may even dig to access water sources, in the process habilitating them for other mammal species (Emmons et al 2004).

REP: Pair comes together only for a brief courtship period between May and July and a single young is born after a gestation of 183-190 days (6 months) - though births after as little as 142 days have been reported (Nowak 1991). Newborns have the eyes closed but they open after 6 days. Young are weaned at four to six weeks but are carried on her back "piggy-back" style for up to a year, ensuring that the black-and-white shoulder band is aligned with that of its mother to help break up its body shape (Parera 2002). Occasionally juveniles may be left in a "nest" while the mother feeds. Juveniles remain with the mother until she becomes pregnant again. Giant Anteaters reach sexual maturity at 2.5 to 4 years. (Neris et al 2002).

BEH: *General Behaviour* For the most part solitary and diurnal in behaviour, Giant Anteaters revert to being nocturnal only in areas where they are persecuted or human activity is high. Most activity takes places during the early hours or the morning, but activity takes place throughout the day on cool cloudy days and during rain when temperatures are lower. They are territorial and the home range is generally quoted as 9 to 25km^2 (Neris et al 2002) though in Argentina 3 to 90km^2 has been suggested (Parera 2002). In Brazil territory sizes of 3.67km^2 for females and 2.74km^2 were recorded (Shaw, Machado-Neto & Carter 1987) - though the difference is not statistically significant. Territories frequently overlap, but individuals keep their distance from each other. Shaw, Machado-Neto & Carter (1987) recorded an overlap in territorial range of 29% in females but just 4% in males, reflecting their more aggressive character towards conspecifics. Giant Anteaters are surprisingly capable swimmers and can cross wide rivers but do not climb trees (Nowak 1991). Emmons et al (2004) documented the bathing behaviour of Giant Anteaters, noting that they did so during the night but were unable to reach a conclusion as to why the animals bathe given that they do not fit the profile of typical bathing mammals. They did however add that captive animals apparently enjoy being hosed down and even aggressively compete for spaces under the spray. In general they walk slowly with a lolloping gait, but are capable of running at high speeds if disturbed (Emmons 1999). Though clearly capable of digging they do not construct burrows to sleep, preferring to curl up in a secluded area with the head between the forelegs and the huge tail curled over the body. A captive individual lived for 25 years and 10 months (Jones 1982), but a life expectancy of around 16 years is considered normal for captive individuals (Redford & Eisenberg 1992). *Aggressive Interaction* Males are more aggressive than females and the majority of agonistic interactions occur between males. Such interactions range from slow circling to chases and even fighting which can result in serious injury. During one such encounter observed by Rocha & Mourão (2006) in the Brazilian Pantanal one individual apparently detected another by smell and began to walk towards it giving a long, drawn-out *harrr* noise. The two animals circled each other with tail raised before the aggressor began to strike at the other´s face with his foreclaws. After a few seconds the attacked animal fled and was chased over a distance of 100m by the aggressor who maintained the tail raised. A captive group of three males and two females lived apparently in harmony at Sao Leopoldo Zoo in Brazil, but such group living has never been recorded in the wild (Widholzer & Voss 1978). *Defensive Behaviour* Though almost blind and comparatively slow moving, it would be a mistake to think that the Giant Anteater is defenceless. For the most part they are tame and approachable creatures and bear no threat to man, but the vicious hooked claws of the forefeet are as efficient at ripping open the skin of attackers as they are at ripping open termite mounds. Typically the animal will react violently only when cornered, rearing back on his

hind legs and hooking with the forelegs in the direction of the intruder. Human fatalities in the wild state are almost unheard of, but a zoo keeper was killed by a captive Giant Anteater at the Florencio Vela Zoological Park in Berzategui, Argentina on 10 April 2007 after suffering massive injuries to the torso and legs. The previous keeper had resigned because of the animal´s aggressive temperament. (En Linea Directa News Report April 2007).

VOC: Adults are usually silent but on occasion produce quiet grunts, especially when perturbed. A long, drawn-out *harrrr* sound was given by an individual approaching another prior to an aggressive encounter in which the other animal was seriously injured (Rocha & Mourão 2006). Juveniles give sharp whistles to keep contact with their mother. (Emmons 1999)

HUM: Because of its large size, predictable behaviour patterns and cumbersome movements this species is an attractive target for hunters and it figures in the diet of various indigenous groups (Cartés 2007). However the religious beliefs of the Chamacoco Indians of Departamento Alto Paraguay prevent them from consuming the meat of this species (Neris et al 2002). Various parts of the body have supposed medicinal properties. Burning of the pelage creates a smoke that when inhaled cures bronchitis, whilst the ash generated from burning tail hair heals wounds and doubles as a contraceptive. Bones are considered an alternative medicine for rheumatism and fat is used as an ointment to prevent over-exertion of muscles during pregnancy. (Neris et al 2002).

CON: The Giant Anteater is considered Lowest Risk, near threatened by the IUCN (see www.iucnredlist.org/search/details.php/14224/all for the latest assessment of the species). It is listed on CITES Appendix II (see http://www.cites.org/eng/resources/species.html to see the species account in the CITES Species Database). In eastern Paraguay it has disappeared from large areas of suitable habitat and does not tolerate well the presence of humans. Being slow and short-sighted it is an easy victim for hunters and local extinctions have occurred in most departments and it appears to be decreasing in most areas of the Orient where it still occurs. It remains common in the Chaco (particularly the Humid Chaco and Pantanal) where population pressure is low and vast amounts of pristine habitat remain. However they are frequent victims of roadkill on the Ruta Trans-Chaco, with a total of 12 roadkill adults counted along the length of the Ruta on 12 October 2007, easily the most numerous victim amongst the large mammal species (Paul Smith pers. obs.). In a study in Brazil a total of 54 individuals were killed on a single stretch of road between the cerrado and Pantanal over the course of a year, reflecting the vulnerability of this species to vehicles (Parera 2002). Though uncontrolled fires do not affect the availability of food for the species, it does destroy available refuges limiting their attractiveness. Burning of campos to generate regrowth for cattle ("limpieza") is a common practice throughout the year, though historically ranchers observed a "burning season" which had a reduced effect on populations of this species. The intoxicating effects of smoke on this slow-moving animal and its highly-flammable pelage also increase its vulnerability to fires and individuals have been known to burn to death (Redford & Eisenberg 1992) but vulnerability to fire would seem to be correlated to the intensity of the blaze (in turn related to the combustability of the vegetation), and regular burning may in fact be less damaging to the species than infrequent but more severe fires. Burning does not apparently affect the species choice of habitat, it being equally as frequent in burned areas as unburnt areas in the cerrado of Brazil (Prada & Marinho-Filho 2004).

Online Account: www.faunaparaguay.com/myrtrihb.html.

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Giant Anteater *Myrmecophaga tridactyla.*
Adult lateral. Atinguy, undated.
Photo courtesy of Hugo del Castillo.

Giant Anteater *Myrmecophaga tridactyla.*
Adult head detail. PN Tinfunque, Departamento Presidente Hayes, undated.
Photo courtesy of Alberto Esquivel.

Giant Anteater *Myrmecophaga tridactyla.*
Adult roadkill. PN Teniente Enciso, Departamento Boquerón, July 2006.
Photo Paul Smith.

Giant Anteater *Myrmecophaga tridactyla.*
Adult fore foot. PN Teniente Enciso, Departamento Boquerón, July 2006.
Photo Paul Smith.

Giant Anteater *Myrmecophaga tridactyla.*
Adult hind foot. PN Teniente Enciso, Departamento Boquerón, July 2006.
Photo Paul Smith.

Giant Anteater *Myrmecophaga tridactyla.*
Footprint. PN Teniente Enciso, Departamento Boquerón, July 2006.
Photo Paul Smith.

28
Genus *Tamandua*, Gray 1825

There are two species in this genus, one of which occurs in Paraguay. Synonyms adapted from Gardner (2007)

Synonyms:

Myrmecophaga Linnaeus 1758:35. In part
Tamandua Gray 1825:343. No type mentioned, *Myrmecophaga tamandua* G.Cuvier (1798) inferred.
Tamanduas F.Cuvier 1829:501. French vernacular. Unavailable.
Uroleptes Wagler 1830:36. Type species *Myrmecophaga tetradactyla* Linnaeus (1758) by monotypy.
Dryoryx Gloger 1841:112. No type species mentioned.
Uropeltes Alston 1880:191. Incorrect spelling.

General characteristics: A single species of semi-arboreal anteater with a prehensile-tipped tail, naked on the ventral portion. Body hair short and smooth. Fossils known from the Pleistocene of South America.

Cranial characteristics: Rostrum approximately half the greatest length of the skull.

Paraguayan Species:

Tamandua tetradactyla - Southern Tamandua

29
Southern Tamandua
Tamandua tetradactyla

Myrmecophaga tetradactyla Linnaeus 1758:35. Type locality "America meridionali". Restricted to Pernambuco, Brazil by O.Thomas (1911).
Myrmecophaga myosura Pallas 1766:64. Type locality Brazil.
Myrmecophaga nigra É Geoffroy St.-Hilaire 1803:217. Type locality "La Guyane?" (=French Guiana according to Cabrera 1958).
Myrmecophaga bivittata Desmarest 1817:107. Type locality "Brésil".
Uroleptes tetradactyla Wagler 1830:36. Name combination.
[*Myrmecophaga*] *crispa* Rüppell 1842:179. Type locality "Guiana"
Tamandua tetradactyla Gray 1843:91. Name combination.
M[*yrmecophaga*]. *longicaudata* JA Wagner 1844:211. Type locality "in dem Nördlichen Theil Sudamericas". Restricted to "al interior de Surinam" by Cabrera (1958).
Uroleptes bivittatus Fitzinger 1860:395. Name combination.
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Myrmecophaga bivittata straminea Cope 1889:132. Type localities "São João (Rio Grande do Sul) or at Chapada (Matto Grosso)" Wetzel (1975) restricted the type locality to Chapada, Matto Grosso, Brazil.
Tamandua tridactyla Matschie 1894:62. Name combination. Not *Myrmecophaga tridactyla* Linnaeus (1758).
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Tamandua tetradactyla chapadensis JA Allen 1904:392. Type locality "Chapada, Matto Grosso, Brazil".
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[*Tamandua tetradactyla*] *bivittata* Osgood 1910:24. Name combination.
T[*amandua*]. *straminea* Osgood 1910:24. Name combination.
Tamandua longicauda Vesey-FitzGerald 1936:164. Incorrect spelling.
Tamandua longicauda Rode 1937:346. Incorrect spelling.
Tamandua tetradactyla kriegi Krumbiegel 1940:171. Type locality "Zanja Moroti" Concepción, Paraguay.
T[*amandua*]. *kriegi* Lönnberg 1942:42. Name combination.
T[*amandua*]. *quichua* Lönnberg 1942:43. Name combination.
Tamandua longicaudata mexianae Cabrera 1958:203. Nomen nudum.

Tamandua tetradactyla (Linnaeus 1758)

TAX: Class Mammalia; Subclass Theria; Infraclass Eutheria; Magnorder Xenarthra; Order Pilosa; Suborder Vermilingua; Family Myrmecophagidae; (Myers et al 2006, Möller-Krull et al 2007, Gardner 2007). Genus *Tamandua* was split from Linnaeus *Myrmecophaga* by Gray (1825). The species name *tetradactyla* is from the Greek meaning "four fingers", a distinguishing feature of the species when compared to the other living species. The variability in pelage colour in this species has led to a great number of invalid species and subspecific description based largely on the distribution of black on the body. Turner´s (1853) name *Tamandua longicaudata,* referred to the wholly yellowish variant lacking a black vest, whilst *Myrmecophaga nigra* (E. Geoffroy St.-Hilaire 1803) and *T*[*amandua*]. *quichua* (Lönnberg 1942) referred to wholly black variants. Gardner (2007) recognised four subspecies, that present in Paraguay being *T.t.straminea* (Cope 1889). Synonyms adapted from Gardner (2007).

ENG: Southern Tamandua (Gardner 2007), Tamandua, Tree Anteater, Collared Anteater (Parera 2002), Lesser Anteater (Nowak 1991).
ESP: Tamandúa (Villalba & Yanosky 2000), Tamandúa de collar, Hormiguero de collar, Brazo fuerte, Oso melero (Parera 2002), Oso hormiga (Emmons 1999), Oso colmenero (Emmons 1999).
GUA: Kaguare **MA** (Villalba & Yanosky 2000), Tamandua miri **A** (Villalba & Yanosky 2000), Tamandua **P** (Villalba & Yanosky 2000), Kuareminí **Ac** (Villalba & Yanosky 2000), Kaaguaré (Parera 2002).
DES: The robust head is of medium-length, somewhat conical with a steeply sloping forehead, tubular snout and tiny, circular mouth - equivalent in diameter to a pencil (Nowak 1991). The extensile tongue is some 40cm long and cylindrical, lubricated by sticky secretions from enormous submaxillary glands located on both sides of the neck. Part of the stomach is modified into a muscular gizzard to accommodate for the lack of teeth. The eye is small and the ears are rounded and of moderate size. The legs are short but muscular with four well-developed, viciously-hooked claws on the forefeet - the third being particularly long, causing the animal to walk on its wrists. The claws are proportionately shorter than those of *Myrmecophaga tridactyla*. The hindfoot has five somewhat elongated toes, which are an adaptation for gripping tree branches. The long, prehensile tail is moderately-furred at the base and naked towards the tip which has a gripping function. The tip of the tail is irregularly blotched with pinkish-yellow and brownish-black. The soft, short pelage is two-tone with the head, upper back, legs and furred part of the tail a creamy-yellow colour, though the tonality varies substantially and some individuals are almost orange-yellow in colour. A black "sleeveless jacket"forms a distinct V-shape on the dorsum of the animal and reaches to the rump, though the size is often variable. It acts to break up the outline of the animal when it is climbing in trees. The tip of the snout and area in front of the eyes is usually darker than the rest of the head, tinged grey-black. **CR** - Occipitonasal length 120mm. Slightly elongated rostrum with nasal bones shorter than the frontal bones. Palatte with posterior extension. (Díaz & Barquez 2002).**DF:** I0/0 C0/0 P 0/0 M 0/0 = 0. **CN:** 2n=54.
TRA: The forefoot leaves a distinctive print with a rounded sole and single, viciously-hooked claw on the anterior edge, with the point facing inwards. The hindfoot is elongated, almost twice as long as it is wide, and with five long toes. The tail is dragged when walking on the ground and in soft substrates leaves a distinct impression between the prints of the left and right side. **FP:** 7 x 5.2cm **HP:** 8.7 x 4.7cm **PA:** 21cm. Tamandua is excrement is distinctive, consisting of piles of discrete spheres composed almost entirely of termite remains. The presence of Tamanduas in an area is revealed by arboreal termite nests showing considerable damage left by the claws of the species. This species has a characteristically strong smell. (Villalba & Yanosky 2000).

MMT: The smaller of the two anteater species in Paraguay. **TL:** male 95.9cm (93-98.8cm), female 94.5cm (84-105cm), unsexed 100.2cm (90.5-130cm); **HB:** 61.5cm (52.2-88cm); ***Head*** male 13.75cm (13-5-14cm), female 13.77cm (12-16cm); **TA:** male 41.5cm, female 41.8cm (37.2-48.2cm), unsexed 43.5cm (37-59cm); **FT:** male 9.05cm (8.6-9.5cm), female 8.47cm (7.5-9cm), unsexed 9.1cm (5.7-10.5cm), **EA:** male 4.7cm (4-5-4.9cm), female 4.5 (4.2-5cm), unsexed 4.7cm (4-6cm); **WT:** male 4.88kg (4.02-5.74kg), female 3.61kg (2.54-4.63kg), unsexed 5.66kg (3.6-8.5kg). (Parera 2002, Neris et al 2002, Nowak 2001, Emmons 1999, Redford & Eisenberg 1992, Rodrigues & Marinho-Filho 2003).
SSP: Unmistakable on account of its size and colouration. Only *Myrmecophaga tridactyla* has the same basic shape, but it is blackish in colouration, much larger and longer-headed, has a voluminous bushy tail and is strictly terrestrial in behaviour. The footprint of *Myrmecophaga* shows traces of several large, hooked claws on the forefoot (the species walks on its knuckles) and a more rounded hindfoot with much shorter toes. The *Myrmecophaga* never leaves an impression of its tail, it being held well clear of he ground.
DIS: Distributed east of the Andes from Venezuela, through Amazonas and south through Bolivia and Paraguay to extreme northern Argentina and northern Uruguay. In Paraguay it is found throughout the country though there has been considerable local extinction in eastern Paraguay as a result of human activities. It appears to be most common in the Humid Chaco, Pantanal and cerrado belt of north-eastern Paraguay. (Neris et al 2002, Parera 2002). There are four subspecies. *T.t.nigra* (É.Geoffroy St-Hilaire 1803) occurs from eastern Colombia through Venezuela, Trinidad and the Guianas to the northern Amazon Basin and east-central Brazil; *T.t.quichua* O.Thomas 1927, is in the upper Amazon Basin of eastern Ecuador, Peru and Brazil; *T.t.tetradactyla* (Linnaeus 1758) is in the Atlantic lowlands and eastern highlands of Brazil from Rio Grande do Norte to Rio Grande do Sul; *T.t.straminea* (Cope 1889)ranges from the southern Amazon Basin of Brazil, through to the southern and western limits of the species range in Bolivia, Argentina, Paraguay and northern Uruguay.
HAB: As with the *Giant Anteater* this species is adaptable and occurs in a variety of habitats, though the presence of some tree cover is usually necessary. It can be found in both dry and humid forest, occurring in the dry Chaco forest, the humid Atlantic forest, the palm savannas of the Low Chaco and the semi-humid forest of the Pantanal. It is also present in the cerrado belt being most common in cerradón and campo sucio cerrado. In most areas it appears to be most common in dense vegetation and along waterways where its favoured prey species tend to congregate. (Emmons 1999).
ALI: Tamanduas feed almost exclusively on social insects, raiding their nests and exposing their contents by ripping them open with their hooked foreclaws. Being semi-arboreal, Tamanduas are equally able to exploit arboreal termitaria, wasp, bees and ants nests as well as ground colonies, taking the larvae, adults and eggs as well as honey, beeswax and other substances that the nest may contain - hence the Spanish name Oso melero (Honey Bear). Studies suggest that worker and reproductive castes are preferred to soldiers. Prey items become adhered to the sticky substance secreted onto the tongue by the extensive submaxillary glands and are licked up by the animal. Tamandua have poor eyesight and hearing but a well-developed sense of smell that helps them locate food sources (Parera 2002). Wild individuals typically consume a diet containing between 30-65% protein and 10-50% fat (Redford & Dorea 1984)
REP: There is surprisingly little data available for wild populations. Females give birth to a single young after a gestation period of 4 to 5 months, though twins are very occasionally reported (Jimeno 2003). Published gestation periods range from 130 to 190 days (Merritt 1975) with a mean of around 160 days (Redford & Eisenberg 1992). A captive female consumed the placenta of its new-born young (Jimeno 2003). Juveniles are carried on their mother´s back for several months and even up to a year during which the offspring learns certain aspects of survival - including location of food sources (Parera 2002) and may even adopt her dietary preferences (Redford & Eisenberg 1992). Juveniles may occasionally be left in a "nest" (Redford & Eisenberg 1992). A captive juvenile increased in weight by an average 13.5g per day in weight during its first 6 months of life and 6.86g during the second 6 months, a mean of 10.12g per day over the first year, representing an increase in weight of 3665g in the first 12 months (Jimeno 2003).

BEH: *General Behaviour* Solitary and nocturnal or diurnal in behaviour (more nocturnal where persecuted), activity periods last an average of 8 hours (Parera 2002). Though they are able climbers, using their prehensile tail as a fifth limb, they are just as comfortable on the ground, where they walk slowly but purposefully. However unlike *Myrmecophaga tridactyla* it seems they are not capable of galloping. Tamanduas take refuge in tree-holes, well-vegetated branches or in ground nests - using old burrows of other mammals which may be enlarged. Animals in the cerrado of Brazil were found to almost exclusively take refuge on the ground (presumably as a result of the scarcity of tree cavities), typically in armadillo burrows and often at the base of termite mounds (35.4% of cases). On one occasion an animal was found sleeping exposed on bare ground next to a termite mound and on another an adult spent three days in a burrow apparently without leaving in the interim. Individuals taking refuge in armadillo burrows are often clearly visible to predators. (Rodrigues & Marinho-Filho 2003). In humid forest areas they are frequently accompanied by clouds of flies and regularly rub the eyes with their front legs. The average territory size is around 350-400ha (Parera 2002). A captive individual lived for 9 years and 6 months (Jones 1982). *Defensive Behaviour* When threatened Tamanduas rear up on their hind legs with the forelegs held out before them. If in a tree they balance by gripping the branch with the tail and hind legs. If on land they lean the back against a tree-trunk or rock for extra support. They make swift "hooking" motions with the forelegs, the hooked claws that they bear acting as potentially lethal weapons. *Enemies* Tamanduas have been included as prey items in the diet of Ocelot and Jaguar and juveniles are likely taken by *foxes* and small cats (Redford & Eisenberg 1992).

VOC: Noisy feeders, grunting sounds when consuming prey can be used to locate the species. Also look out for debris falling from the trees, at night its a tell-tale sign that a Tamandua is breaking open an arboreal termite mound. The same sound during the day can be attributed either to a diurnal Tamandua or to Brown Capuchins (Parera 2002, Emmons 1999).

HUM: Slow-moving and easily hunted, the Tamandua is figuring more and more on the menu for hunters and indigenous groups (Cartés 2007, Neris et al 2002).

CON: The Southern Tamandua is considered Lowest Risk, least concern by the IUCN (see www.iucnredlist.org/search/details.php/21350/all for the latest assessment of the species). The species was removed from CITES Appendix II in June 1992. The species is widespread in Paraguay but local extinction has occurred in large areas of eastern Paraguay on account of human influences. It remains common in the Humid Chaco but is less so in the Dry Chaco.

Online Account: www.faunaparaguay.com/tamtethb.html.

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Southern Tamandua *Tamandua tetradactyla.*
Adult. Estancia Cachiveo,
Departamento Presidente Hayes, July 2007.
Photo courtesy of Karen Penayo Álvarez.

Southern Tamandua *Tamandua tetradactyla.*
Adult threat posture. Estancia Cachiveo,
Departamento Presidente Hayes, July 2007.
Photo courtesy of Karen Penayo Álvarez.

Southern Tamandua *Tamandua tetradactyla.*
Adult dorsal. Departamento Concepción,
December 2007.
Photo courtesy of Hugo del Castillo.

Southern Tamandua *Tamandua tetradactyla.*
Adult. Departamento Concepción,
December 2007.
Photo courtesy of Hugo del Castillo.

Southern Tamandua *Tamandua tetradactyla.*
Adult roadkill. Ruta Trans-Chaco km200,
Departamento Presidente Hayes, March 2004.
Photo Paul Smith.

Southern Tamandua *Tamandua tetradactyla.*
Adult roadkill head detail.
Ruta Trans-Chaco km200,
Departamento Presidente Hayes, March 2004.
Photo Paul Smith.

30
Family
Bradypodidae: Sloths

General characteristics: A single Paraguayan species with a rounded head, flattened snout, inconspicuous ears and forward-facing eyes. Facial vibrissae are sparse and the rostrum is covered with short hair, bordered with longer hair on the sides of the face and neck. The dense pelage is double-layered - the outer layer longer and thick, and the under layer short and fine - an arrangement that encourages the growth of algal symbionts that appear to assist in camouflage. Sloths are cryptic and slow-moving, easily overlooked where they occur. Sloths are highly adapted for a hanging arboreal existence, the front limbs being 1.5x larger than the rear limbs and the three digits on each foot unified and armed with long, curved claws. Each foot also possesses a long, calloused palmar and plantar pad. Tail is short, rounded, mobile and tapers distally with a fixed outward curve. Fossil record is lacking.

Cranial characteristics: Broad interorbital region lacking postorbital processes. Incomplete zygomatic arch with long dorsal and ventral processes. Rostrum reduced and prenasal is lacking. Foramina in the anterior nasopharynx, typical of most species in this family are absent in the Paraguayan species. Pterygoids elongated and uninflated.

Dental characteristics: They are equipped with simple cylindrical teeth that lack enamel and grow throughout life. Anterior chisel-shaped teeth 1/1 and molariform teeth 4/3 are also present.

Skeletal characteristics: The neck is equipped with 8 or 9 cervical vertebrae (instead of the usual mammalian 7) giving increased flexibility. Ball and socket joint between astralagus and fibula. Coracoid and acromial processes of the scapula united. Xenarthrous thoracic and lumbar vertebrae.

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Genus
Bradypus Linnaeus, 1758

There are three species in this genus. Synonyms adapted from Gardner (2007)

Synonyms:

Bradypus Linnaeus 1758:34. Type species *Bradypus tridactylus* Linnaeus (1758).
Ignavus Blumenbach 1779:70. Type species *Ignavus tridactylus* Blumenbach (1779) (=*Bradypus tridactylus* Linnaeus 1758) by monotypy.
Pradypus Ledru 1810:257. Incorrect spelling.
Choloepus Desmarest 1816:327. In part. Not *Chloepus* Illiger (1811).
Acheus F.Cuvier 1825:194. Type species *Bradypus tridactylus* Linnaeus (1758) by monotypy.
Achaeus Erman 1835:22. Incorrect spelling. Not *Achaeus* Leach (1817) crustacea.
Achaeus Gray 1843:xxviii. Incorrect spelling. Not *Achaeus* Leach (1817) crustacea.
Arctopithecus Gray 1843:xxviii. Nomen nudum.
Arctopithecus Gray 1850:65. No type species selected. Preoccupied by *Arcopithecus* Virey (1819) primates.
Scaeopus W.Peters 1864:678. Type species *Bradypus torquatus* Illiger (1811) by monotypy.
Hemibradypus R.Anthony 1906:292. No type species selected. Type species *Hemibradypus mareyi* R.Anthony (1907) by designation
Eubradypus Lönnberg 1942:5. Type species *Bradypus tridactylus* Linnaeus (1758). Proposed as a subgenus of *Bradypus* Linnaeus (1758).
Neobradypus Lönnberg 1942:10. No type species selected. Name unavailable. Proposed as a subgenus of *Bradypus* Linnaeus (1758).

General characteristics: This is the only genus in this family and characteristics are given in the family account.

Paraguayan Species:

There are unconfirmed anecdotal reports of sloths in the Paraguayan Chaco which have been tentatively attributed to the widespread *Bradypus variegatus,* Brown-throated Three-toed Sloth. Redford & Eisenberg (1992) mapped the species for the Cerro León area (Departamento Boquerón), presumably on the basis of such reports, but Gardner (2007) notes that the species "has not been recorded from Paraguay", although he mentions a published report by Bertoni (1939) which lacked further data. His mapping of the species in the extreme east of the Paraguayan Orient (approximately Departamentos Amambay, Canindeyú and Alto Paraná) is the result of joining the range extremes of known specimens and shading the intervening area, it is not based on physical evidence of the species presence. In fact no sloths were found following the flooding caused by the Itaipú Dam, and data from rescue missions after flooding elsewhere in South America have tended to find sloths more abundant than had previously been realised. The species would therefore seem to be absent from the Atlantic Forest of Paraguay. The CDC lists the species for Paraguay but no specimens have apparently been collected and it is uncertain what the basis of the listing is (Hugo del Castillo pers. comm.). A report of an individual crossing a road near Madrejón, PN Defensores del Chaco, Departamento Boquerón by Inginiero Dany Levi requires investigation, though I have been unable to trace him.

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If you would like to contribute to future editions or have any comments, queries or corrections related to this volume, you can email the author at:
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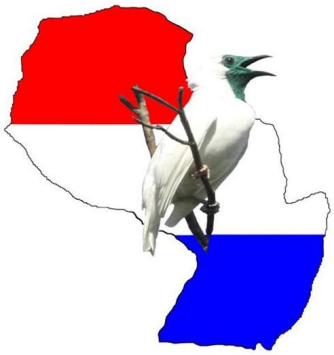

FAUNA Paraguay

FAUNA PARAGUAY HANDBOOK OF THE MAMMALS OF PARAGUAY

VOL 2: XENARTHRA

The **FAUNA Paraguay Online Handbook of Paraguayan Fauna** aims to collate together in one place all that is currently known about the animals inhabiting this richly biodiverse country located at the heart of the South American continent. With the data presented in a readable manner and fully-referenced throughout the text, these handbooks aim to be of use to the profesional whilst simultaneously appealing to the interested amateur. The complete online handbook will provide detailed coverage of all the vertebrate species inhabiting this little known country and will be constantly updated as and when new data is published, ensuring that the information presented is the most up-to-date that is currently available. The aim of the handbooks is to help generate an interest in the biodiversity of Paraguay, a country all to frequently ignored by researchers and eco-travellers, to stimulate an interest in the conservation issues affecting the country, and to highlight the gaps in our knowledge as an aid to future research.

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