GIANT ANTEATER
Myrmecophaga tridactyla Linnaeus, 1758

FIGURE 1 - (FPMAM1021PH) Adult, Tres Gigantes, Departamento Alto Paraguay, 22 July 2011 (Paul Smith).

TAXONOMY: 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*. Gardner (2007) tentatively recognised three subspecies, *M.tridactyla tridactyla* being present in Paraguay. Synonyms adapted from Gardner (2007):
[*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.

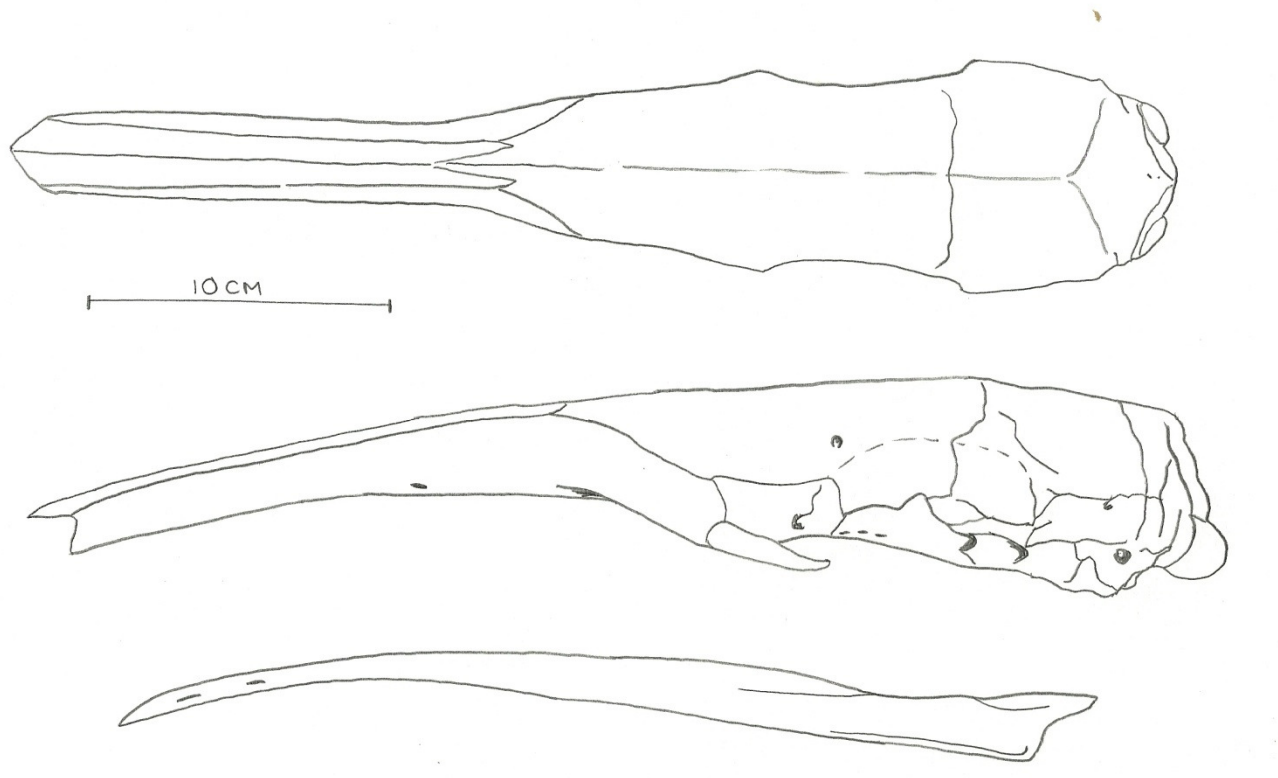
Myrmecophaga centralis Lyon 1906:570. Type locality "Pacuare" Limón, Costa Rica.
Myrmecophaga trydactyla Utrera & Ramo 1989:65. Incorrect spelling.

ENGLISH COMMON NAMES: Giant Anteater (Wilson & Cole 2000, Gardner 2007), Great Anteater (Lyon 1906), Maned Anteater (Macalister 1874), Banded Anteater (Anderson 1997).

SPANISH COMMON NAMES: Oso hormiguero (Neris et al 2002, Parera 2002), Tamanduá bandera (Carol Fernández pers. comm.), Oso bandera (Neris et al 2002), Oso caballo (Wetzel 1985) Hormiguero gigante (Wetzel 1985) Oso palmera (Wetzel 1985), Oso palmero (Superina et al 2010), Oso comilon (Anderson 1997).

GUARANÍ COMMON NAMES: 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).

DESCRIPTION: 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 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.



SKELETAL CHARACTERISTICS: Elongated rostrum much longer than brain case and with nasal bones of similar length to the frontal bones. (Díaz & Barquez 2002). *Occipitonasal length* 210mm. Clavicles rudimentary. Skull illustration based on Chebez (2001).

Jenkins (1970) describes the anatomy of the ribs of this species, noting that skeletal variations are common in Edentates. Sixteen thoracic and 2 lumbar vertebrae (T16-L2) are typically present, but one

specimen had T15-L2 (due to a deficiency in segmentation). Ribs are expanded by well-developed posterior flanges and by moderately-developed anterior flanges. Four or five of the middle thoracic ribs have a secondary expansion at the distal end, arising from the posteromedial aspect of the shaft as a second posterior flange and replacing the more proximal posterior flange. Dorsal and intermediate facets of the xenarthrous vertebrae occur together from the lumbosacral articulation to the T13-T14 joint, at six and five intervertebral joints, respectively. The intermediate is found at two additional joints (T12-T13, T11-T12).

DENTAL CHARACTERISTICS: I0/0 C0/0 P 0/0 M 0/0 = 0.

GENETIC CHARACTERISTICS: 2n=60. Redi et al (2005) gives the genome size as 4.49pg (+/-0.28) or 4391 Mbp. The X chromosome a large metacentric and the Y chromosome a small acrocentric. This species shows two pairs of large metacentrics in Group I, three pairs of large submetacentrics in Group II, eight pairs of medium-sized submetacentrics in Group III, 11 pairs of medium to small metacentrics in Group IV and five pairs of acrocentrics in Group V. (Jacintho Perreira Jr et al 2004).

Garcia et al (2005) identified six microsatellite markers for this species.

TRACKS AND SIGNS: 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.

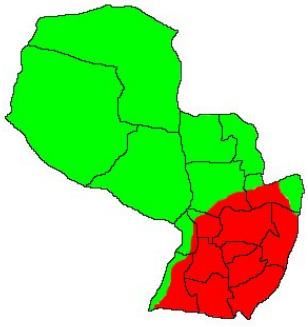
Vynne et al (2009) used scat-detections dogs to record this species with positive results in PN Emas, Goiás, Brazil.

EXTERNAL MEASUREMENTS: 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). Camilo-Alves & Miranda Mourão (2006) recorded the following weights for adults in the Brazilian Pantanal (n=7 males and n=4 females): **WT** males 33-41kg, females 27-39kg.

Jerez & Halloy (2003) give measurements of a newborn individual: **HB:** 33cm; **TL:** 53cm; **WT:** 1.2kg. Growth is exponential during the early weeks of life and by 16 weeks juveniles are almost 100cm in total length and 4.5kg in weight. Beyond this point growth slows and by 52 weeks total length is about 110cm and weight 6.5kg.

SIMILAR SPECIES: 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.

DISTRIBUTION: Widely distributed from Belize ("near Punta Gorda on the coast of the Bay of Honduras" Allen 1910) 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.



Three subspecies were recognised by Gardner (2007). *M.t.centralis* Lyon, 1906 is found in central America (where records are few - Genoways & Timms 2003) south to northwestern Colombia and northern Ecuador. It is absent from western Colombia. Handley (1966) states that in Panama the species is "now confined to the less disturbed portions" of the lowlands of the country. In Costa Rica the species is either exirpated or close to extinction, with the last records in 1979 (Timm & La Val 2000) and it is likely also extinct in Belize and Guatemala (Superina et al 2010). In fact the most recent records of giant anteater in Central America are from northeastern Honduras in 1996 at Reserva de la Biósfera del Rio Plátano (McCain 2001) and Nicaragua in 2005 (Koster 2006). It should be noted that the most northerly record from Belize does not have a specimen to support it and is based on an undocumented personal communication by Salvin (Allen 1910). *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.

In Argentina the species occurs in Provincias Formosa (Departamentos Pilcomayo, Formosa and Bermejo); Chaco (Departamentos Gral Guemes, Alte. Brown, MLJ Fontana, Sgto Cabral, Presidente de la Plaza), northern Santa Fé (Departamentos 9 de Julio, Vera and Gral Obligado), northern and eastern Santiago del Estero (Departamentos Alberdi, Copo, Gral Belgrano, Gral Taboada, Avellaneda and Pellegrini); eastern Salta (Departamentos Anta, Orán and Gral San Martín); northeast Tucumán (Departamentos Burruyacú); northeastern Jujuy (Departamento Ledesma); northern Misiones (Departamentos Iguazú and Gral Belgrano) and north-central Corrientes (Departamento Ituzaingó). Parera (2002) notes that historically the species occurred south to 31ºS in Argentina, but the present day distribution is unlikely to extend beyond 29ºS given the enormous anthropic changes that have taken place in Argentina. (Jimeno & Amaya 2009). It is extinct in Uruguay (Fallabrino & Castiñeira 2006). In Bolivia the species has been recorded in Departamentos Pando, Beni, northern Cochabamba, Santa Cruz and eastern Tarija and probably eastern Chuquisaca (Anderson 1997).

Vaz (2003) lists Brazilian specimens from Roraima, Amazonas, Rondônia, Pará, Amapá, Maranhao, Mato Grosso, Mato Grosso do Sul, Goiás, Minas Gerais, Espírito Santo, Sao Paulo and Rio Grande do Sul, though it is apparently now extinct in the latter (Superina et al 2010).

In Paraguay it occured historically throughout the country but whilst it remains frequent in the Chaco region, it has disappeared from large areas of eastern Paraguay as a result of hunting pressure. (Neris et al 2002, Parera 2002).

Abba & Vizcaíno (2008) list 8 specimens from Paraguay in the Museo Argentino de Ciencia Naturales "Bernadino Rivadavia all lacking precise locality data (MACN25.190 mandible, Zoo Buenos Aires 1925; MACN29.238; MACN29.243; MACN30.242 skin and skull 1929; MACN3.59 skull, Zoo Buenos Aires 1903; MACN23.28 skull 1923; MACN27.26 skin and skull 1927; MACN30.35 skin and skull, Zoo Buenos Aires 1930).

HABITAT: 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.

Mourão & Medri (2007) found an association between activity and habitat type in the Brazilian Pantanal, with most foraging occurring in open habitats and most resting in forested habitats. They associated this with the temperature buffering effect of forest, with temperatures being up to 5ºC warmer than in grasslands on cold days, and up to 8ºC cooler than grasslands on hot days. This behaviour suggested conservation of body heat during cold and avoidance of over-heating, which is in contrast to previous theories that heat retention is not a problem for the species (McNab 1984). It also means that habitat preference may be seasonally affected by temperature. Mourão & Medri (2005b) had earlier noted that the presence of spiny ground bromeliads *Bromelia balansae* Mez in forest patches may also provide protection.

Camilo-Alves & Miranda Mourão (2006) noted that when active anteaters in the Brazilian Pantanal used grassland and svanna at higher frequencies than might be expected given their availability. However at intermediate temperatures (17ºC-27ºC) they were inactive in these habitats. On hot days anteatears preferred more covered habitats for resting, whilst on cold days less covered habitats were used both for activity and for resting. However on cold days (<17ºC) forests were used for shelter, presumably to avoid cold winds. Basking behaviour was also observed in open habitats when temperatures were low.

In Paraguay 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. Santos-Filho & da Silva (2002) found this species in gallery forest and cerrado *sensu strictu* in Mato Grosso, Brazil.

Merritt (2008) reports finding footprint in and around water holes and along edges of seasonal roadside ponds in the Paraguayan Chaco, though the concentration of prints in these areas may be an

artefact of this being a suitable substrate for print persistence, compared to the typically hard, dry soils that dominate in this region.

ALIMENTATION: 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.

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. On average they feed for about 40 seconds at any one mound (Redford 1985).

Jerez & Halloy (2003) documented the relationship between a mother and its offspring during the first year of life. The mother spent about 25.8% (+/-7.6) of her time in exploratory behaviours searching for food during the first eight months of her offsprings life. Her offspring showed no exploration behaviours during the first two months of life, this rising to around 13.8% of its time during the next five months. From the eighth month onwards exploration behavior became much more significant in the daily routine, taking up 60% (+/-18.6) of the mother's time and 61.3% (+/-18.4%) of the juvenile's time.

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). Redford (1986) notes that the proportions of ants to termites in the diet can vary geographically and between individuals, with 100% termites reported in the diet in Amapá, Brazil and 100% ants reported in Ceará, Brazil.

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. 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).

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). Redford (1986) reports that young mice were consumed by captive individuals "with great relish". Leiva & Marques (2010) describe the mixture fed to captive animals at São Paulo Zoo as soybean extract, cat food, boiled egg, ground beef, yoghurt, honey, cooked beets, raw carrot, banana, papaya and apple, offered as a paste in early afternoon. In addition once a week they are offered entire termite nests as an enrichment and dietary supplement. The cat food is an important supplement (replacing the previously used dog food) as it contains the amino acid taurine which is beneficial for vision and avoidance of cardiomyiopathy.

REPRODUCTIVE BIOLOGY: Camilo-Alves & Miranda Mourão (2006) reported a sex ratio of 2 males to 1 female in the Brazilian Pantanal, though this was less than the 3:1 ratio reported for the same area by Medri & Mourão (2005b). A male biased sex ratio has been frequently reported in this species, but Camilo-Alves & Miranda Mourão (2006) warned that this may be an artefact of sampling by day if, as they suspected, males are more diurnally active than females. Anderson (1997) reports on a female with one embryo in Bolvia during January

The 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 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).

Leiva & Marques (2010) reported that of 32 births in captvity in São Paulo Zoo 59.4% were from January to May, and no births were recorded in June, November or December. Age of first breeding of two females were 21 months and 54 months respectively, and ages of first successful copulation of three males were 24, 66 and 138 months respectively. The older age at first breeding of some of these animals compared with figures cited for wild individuals is likely an artefact of captivity, with unsuitable partners offered and associated mating problems. Survival of offspring in captivity is low, with just 17 of these 32 animals born reaching one month of life, and 12 reaching one year. The longest surviving individual reached 21 years. A total of 36.4% of the 32 captive births died within the first 24 hours. The most significant causes of death were attributed to being stillborn, respiratory problems, cardiorespiratory collapse and trauma.

Patzl et al (1998) measured oestrogen and progestagen metabolites in faeces of pregnant females to characterise the oestrous cycle and pregnancy. The follicular phase of the cycle lasted 1-2 weeks, followed by a luteal phase of 2-3 weeks. Average length of the oestrous cycle was 51.4 days (+/-5.6). In the second half of gestation progestagen concentrations began to increase above those in the luteal phase and by a week before parturition was 20 times higher. Concentrations of excreted oestrogens increased above that of the follicular phase two-thirds of the way through the pregnancy, and were 2.5 times higher a week before parturition. Onset of ovarian cyclicity resumed 4 to 11 weeks after parturition. The oestrogen surge during oestrus can be used for identifying the best time for breeding of captive animals. Profiling of progestagens can be used to monitor the normality of ovarian cyclicity.

Jerez & Halloy (2003) documented the relationship between a mother and its offspring during the first year of life. Their observations suggest that the mother-offspring bond begins to change around the eighth month with full independence of the offspring by the ninth or tenth month.

As a result of the elongated snout, juveniles suckle with the tongue, an effect also seen when juveniles are fed with teats. The juvenile begins to take some solid food by the third month, and by the ninth month solid food predominates and they are fully weaned by the tenth month. Approximately 18.5% of the juvenile's time is spent nursing in the first month, declining to 7.2% by the second, 2.4% by the eighth and 0.5% by the ninth. Consumption of solid food takes up 0.8% of the juvenile's time in the third month, rising to 3.4% by the ninth month, 4.5% by the eleventh and 5.2% by the twelfth. Values by the eleventh month are similar to those recorded for adults throughout the year 4.6% (+/-2.2).

Grooming is carried out during times of rest, with the mother licking the offspring with the tongue, particularly on the snout. Grooming bouts could last for up to an hour, but were most common during the first three months and gradually diminished towards the ninth month and stopped altogether by the tenth.

Play behavior is first seen at the end of the first month and takes up around 2-3% of the time from the third until the ninth month. The mother also participated in some play behavior initiated by the offspring until the eighth month. Three types of play behaviour were observed: Jumping in the air and landing on the extended limbs, lying on the back and playing with an object (stone, piece of wood or earth) on its ventrum and social play with the mother in which cases the mother lies on her side and offers her foreclaw to the offspring, who takes it in its own claws and stomps with the hind feet.

During the first six weeks of life the offspring is never more than 1m from its mother, and from the seventh to the tenth week the offspring spent only 40 minutes at a distance of between 1 to 5m from its mother. Until the fourth month the maximum distance had increased to about 20m, with about 50 minutes per week spent at this distance, increasing to more than three hours by nine months of age.

Collevatti et al (2007) reported high levels of inbreeding at PN Emas, Brazil, noting that animals with overlapping range were highly-related. They noted that the amount of inbreeding may have been an indirect result of catastrophic fires in the reserve in 1994, which left a population of just 43 animals, though they may just as likely be a result of the biology of the species. The incursion of agriculture in the area around the park may also have negatively affected gene flow in and out of the park.

GENERAL BEHAVIOUR: For the most part solitary (Merritt 2008).

Activity Levels 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. The species is commonly observed on and around the Ruta Trans-Chaco during the winter months, but much less so during the rest of the year. The reasons for this require investigation. (P.Smith pers.obs.).

Mourão & Medri (2002) describe an inexpensive large-scale assembled GPS radiocollar that can be used to monitor this species over short time intervals. Using this device Mourão & Medri (2007) found that most Giant Anteaters were active during the second half of the night in the Brazilian Pantanal, with over half becoming inactive by 7.30am. During the daylight hours activity was affected by time of day and minimum daily temperature. Most animals were inactive on warm days with temperature >20ºC, and activity began around 6pm, with almost all animals active by 10pm. However animals became active earlier as daily temperature decreased. This suggests that periods of activity may be affected by ambient temperature and perhaps vary seasonally. Habitat also influenced behaviour with most activity taking place in open areas and most resting in forested areas.

Camilo-Alves & Miranda Mourão (2006) observed one period of activity per 24 hour period in all but of the 11 animals they radiotracked. Mean activity duration was 7 hours 45 minutes (+/- 2hr 22min). On hot days (28–30ºC), anteaters were active until sunrise. When daily average ambient temperature was about 25ºC, anteaters were active between sunset and late night, but not at dawn. As daily average ambient temperature decreased, anteaters tended to begin and finish activity earlier and reduce total activity. On cold days (15ºC) they became essentially diurnal.

Jerez & Halloy (2003) calculated that during the first 8 months of life of a newborn animal almost two-thirds of the mother and offspring's time was spent resting in the refuge (mother 67.2% +/-7.6%, offspring 64.9% +/-7.5%), this reducing to approximately half their time in the ninth and tenth month, to just 9.7% and 10.5% of their time in the eleventh month.

Locomotion 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).

Young et al (2003) documented climbing behaviour, with observations of individuals climbing termite mounds and trees. Climbing was apparently associated with foraging. One individual climbed a 2m high termite mound and when disturbed climbed down, hind legs first. The process was difficult for the animal and the mound was heavily scarred with claw marks following the departure of the animal. A second animal feeding on departing queens on top of a termite mound disembarked from the mound head first. A further observation of an animal "hanging vertically from a tree" with the head upwards and feet just on the ground was considered indicative of climbing behaviour, especially given that the tree contained an arboreal termite mound that it may have been trying to access. One zoo animal continually climbed a 20m high tree to escape its enclosure, but was unable to descend from the tree. It climbed using an arm over arm motion. A captive juvenile separated from its mother was able to scale a 1.4m wall with 50cm of meshing on top to return to the company of its parent.

Jerez & Halloy (2003) documented the relationship between a mother and its offspring during the first year of life. The mother carries the juvenile on her back when they are not together in the nest, the juvenile lying with the snout resting longitudinally along the back so as to be partially obscured by her fur. Initially the mother carries the juvenile every time they leave the nest, but between the third and eighth month the juvenile increasingly begins to walk for itself, spending approximately 20% of the time doing so. By the 9th month the juvenile is carried on the mother's back around 4.5% of the time and in the coming months begins to walk independently all the time.

Home Range 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. Medri & Mourão (2005b) estimated home range size of males in the Brazilian Pantanal to be 5.7km^2 (+/-1.7, n=4) and one female to have a home range size of 11.9km^2, but recognised that these figures likely underestimated the true ranges. Radiotelemetry data in the same

study gave larger home range estimates of 9.2-19.5km^2. Working in PN Emas, Goiás State, Brazil Collevatti et al (2007) calculated home range sizes of 9.83km^2 (+/-6.29), again with no difference between sexes.

Desbiez & Medri (2010) estimated density in the Central Pantanal of Brazil at 0.15/km^2 with density highest in forested areas (0.41/km^2) and lowest in floodplain areas (0.12/km^2). Biomass was estimated at 1.70kg/km^2. Miranda et al (2006) estimated densities in PN Emas, Goiás, Brazil to be 0.40/km^2 (+/-0.07) using terrestrial transects and 0.20/km^2 (+/-0.1) using aerial transects. They considered terrestrial transects to be a more reliable way of estimating population density in this species because *Myrmecophaga´*s main sense is olfaction and they would not necessarily react to a passing plane. As they are solitary animals with cryptic patternation an animal that does not move is less likely to be seen from the air.

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. Medri & Mourão (2005b) found considerable territory overlap of between 0 and 55% for male anteaters in the Brazilian Pantanal, and one male anteater had 91.3% of its territory overlapped by three other animals.

Marking Braga et al (2010) documented marking behaviour in this species. Marking or scratching is associated with claw sharpening, foraging, territorial and mating behaviours. In Paraná state, Brazil they noted that scratched trees were on average higher (5m +/-2.06 vs 3m +/- 2.19) and with a higher first branch height than non-scratched trees (133cm +/-65.70 vs 30cm +/- 59.56). Vertical scratches (n=36) were more common than horizontal ones (n=2). Vertical scratches were a mean of 7.05cm (+/-5.53) long and horizontal scratches 2cm (+/-1.17) long. Of the scratched trees (n=91) 54.9% were in wet grassland, 40.6% in dry grassland and 4.4% in rocky outcrops. Of the total trees in each habitat type, 56.7% in dry grassland were scratched and 34% in wet grassland were scratched.

Braga et al (2010) concluded that the preference for taller trees and conspicuous nature of the scratching may be for communication between conspecifics in areas of territorial overlap, and associated it with high levels of population stress. Trees were often remarked following fire damage. The species also scent marks by urinating in open areas with no trees.

Refuges Though clearly capable of digging they do not construct burrows to sleep, preferring to curl up in a secluded area. The typical sleeping position reported in the literature involves the animal curling up with the head between the forelegs and the tail draped over the body, the tail at once helping to camouflage the animal and to conserve body heat. Medri & Mourão (2005) reported variations in this sleeping position in Mato Grosso do Sul, Brazil where animals typically slept in clumps of dense bushes. They slept in a small hollow that they scratched with their claws and in 107 observations the tail was draped over the body. However on one particularly cool but sunny morning (temperature c17ºC) an animals was seen with the body and tail stretched out in a position that it was hypothesised was designed to maximise the heat of the sun´s rays to raise body temperature.

Aggressive Interaction Males are more aggressive than females and the majority of agonistic interactions occur between males, though observations of intraspecific aggressive encounters are extremmely rare. 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 which maintained the tail raised.

Kreutz et al (2009) documented another incidence of intraspecific aggression in Roraima, Brazil in December 2005. During observation one individual was seen to suddenly charge into undergrowth without raising the snout and sniffing as is typical behaviour prior to fleeing. It was then observed shortly afterwards chasing another anteater, the two pursuing each other at full pace for a distance of 1.7km. The animals were then observed to wrestle on the ground, each trying to pin the opponent's limbs whilst striking at the thorax, abdomen or legs in well-aimed attacks. During pauses the animals circled each other, sometimes posturing with head and claw raised in apparent threat. The dominant individual remained on

all-fours with bristled tail raised, prancing on its forelegs and occasionally wagging the tail. The other animal remained sat on its haunches with tail flattened to the ground, screaming and roaring. Five such interruptions took place, the aggressor returning each time to attack the less dominant animal, before finally retreating and leaving its opponent bleeding severely and breathing heavily. The entire encounter lasted 20 minutes.

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).

Mortality Xenarthrans do not show eyeshine at night and as a result are frequent victims of roadkill. On the Ruta Trans-Chaco, a total of 12 roadkill adults were counted along the length of the Ruta on 12 October 2007, making it easily the most numerous victim amongst the large mammal species (Paul Smith pers. obs.). Merritt (2008) describes it as an infrequent roadkill victim on the Ruta Trans-Chaco in Paraguay, but this is presumably in comparison with other, smaller mammals rather than similarly-sized animals. He does however note that three adult roadkill were seen during June 2005 between km200 and 250. 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).

Interestingly Merritt (2008) notes that carcasses of this species are avoided by Cathartid vultures which abound in the Paraguayan Chaco, with local folklore stating that this is because the skin is too tough for vultures to pierce. Given the physical damage typically caused to roadkill victims by vehicles it would seem unlikely that this is correct, and Merritt (2008) notes that even carcasses in a late state of putrefaction are still avoided.

Merritt (2008) lists Puma *Puma concolor* and Jaguar *Panthera onca* as predators of this species in the Paraguayan Chaco. Taber et al (1997) found remains of this species in 2 of 106 scats of Jaguar and 3 of 95 scats of Puma in the Paraguayan Chaco. Lacerda et al (2009) note that the species avoids edge areas in Brasilia National Park where the occurrence of domestic dogs is greater.

Longevity 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).

Parasites The following *Amblyomma* ticks (Ixodidae) have been recorded from this species *Amblyomma auricularium, A.cajennense, A.calcaratum, A.coelebes, A.dubitatum, A.maculatum, A.naponense, A.nodosum, A.parvum, A.pseudoconcolor, A.scalpturatum* and *A.triste. A.calrcaratum* is closely associated with Myrmecophagidae Nava et al (2007) and *A.nodosum* is specific to anteaters in the adult phase (Martins et al 2004). Guglielmone et al (2003) note specimen records of *Amblyomma auricularium*, though this species is more often associated with armadillos of the genus *Dasypus*.

Nava et al (2007) note the presence of the Ixodid tick *Amblyomma calcaratum* in Paraguay, though the collectors did not note the host species. Botelho et al (1989) report *Amblyomma pseudoconcolor, A.calcaratum* and *A.maculatum* from this species in Minas Gerais, Brazil. Bechara et al (2000) collected *Amblyomma cajennense* and *A.scalpturatum* from this species in Nhecolândia Pantanal of Brazil, noting that the latter is not commonly recorded on Giant Anteater, though Guglielmone & Nava (2006) also record it in Argentina. In PN Emas, Goiás, Brazil Bechara et al (2002) noted *Amblyomma cajennense* and *A.nodosum* as associated with this species. Martins et al (2004) listed *Amblyomma cajennense, A.parvum* and *A.nodosum* from the Brazilian Pantanal. Martins et al (2006) reported *Amblyomma cajennense, A.calcaratum* and *A.nodosum* from a young male animal in a rescue centre in São Paulo, Brazil. Of 100 ticks collected from this species in Mato Grosso, Brazil Amorim et al (DATE) recorded 63 *Amblyomma cajennense*, 15 *A. dubitatum*, 10 *A. nodosum,* 10 *A. coelebes*, 1 *A. parvum* and 1 *A. naponense.*

Labruna et al (2011) recorded *Amblyomma cajennense, A.triste* and *A.nodosum* from infested animals on the banks of the Paraná River between Mato Grosso do Sul and São Paulo States, Brazil. They reported infestation rates of 15.3 (+/-14.2, range 0-54, n=18 infested, 2 uninfested) for *A.cajennense.* with adults and nymphs present, and 2.6 (+/-4.4, range 0-18, n=12 infested, 8 uninfested) for *A.nodosum* with all ticks adult and a single individual infested with one adult female *A.triste.*

Fonseca (1954) described the free-living mite *Edentalges quadrilobatus* (Psoroptidae) from this species.

Ferreira et al (1989) note that the acanthocephalan *Gigantorhynchus echinodiscus* (Gigantorhynchidae) has been documented from this species and isolated eggs of it from coprolites belonging to a myrmecophagid in Piauí, Brazil.

Vicente et al (1997) list the following nematodes for this species from Brazil in their catalogue: *Aspidodera fasciata* (Schneider, 1866) Railliet & Henry, 1913; *Aspidodera scoleciformis* (Diesing, 1851) Railliet & Henry, 1912; *Brevigraphidium dorsuarium* Freitas & Mendonça, 1960; *Caenostrongylus magnificus* Mendonça, 1959; *Graphidiops assimilis* Freitas & Mendonça, 1959; *Graphidiops dissimilis* Freitas & Mendonça, 1959; *Physaloptera papillotruncata* Molin, 1860; *Trifurcata major* Travassos, 1937.

Martinez et al (1999) note the presence of cestodes of the genus *Mathevotaenia* (Anoplocephalidae) in this species with a prevalence of 33.3% in three specimens tested.

The coccidian *Eimeria escomeli* (Rastegaieff, 1930) Levine and Becker, 1933 has been reported from this species (Gardner et al 1991).

Physiology Wislocki & Enders (1935) recorded body temperatures of 32-34ºC at air temperatures of 16-21ºC. Body temperature (33ºC) and basal metabolic rate (34% of typical eutherian) are low when compared to other mammals of similar size, presumably as a result of the myrmecophagous diet (Camilo-Alves & Miranda 2006). As a result it is one of the few tropical mammals with a dense shaggy coat so that minimal thermal conductance is 94% of what would be expected for their body mass. They have a wide range of thermoneutrality from 15ºC to 36ºC. They also use behavioural adaptations to minimise heat loss such as environmentally determined habitat selection (Camilo-Alves & Miranda 2006).

Fernandes & Young (2007) note that the method used by Wislocki & Enders (1935) of taking anal readings of body temperature causes stress and can artificially elevate readings. They took readings of the temperature of the tympanic membrane and found a range of 27-33.5ºC with a mean of around 29.1ºC. Minimum readings were recorded during sleep and it seems that the species uses shallow torpor as a means of energy economization, this occurring during the night whilst asleep. This species was more affected by air and substrate temperature than the related *Tamandua tetradactyla* and to a limited extent is able to take advantage of environmental heat to increase body temperature and save on energy expenditure. Activity level is an important predictor of body temperature in this species.

This species sniffs constantly and may be described as "macrosomatic", possessing olfactory discriminatory capabilities well beyond the capacity of human beings (McAdam & Way 1967). The myology of the feeding apparatus of this species was described by Reiss (1997). Jenkins (1970) describes the myology of the intercostal muscles.

Carregaro et al (2009) used allometric scaling in domestic dog to calculate dosage for the chemical restriant of this species. A combination of acepromazine (0.06 mg/kg), diazepam (0.3 mg/kg), ketamine (8.8 mg/kg), and buprenorphine (5.9 mg/kg) was used, and the animals were maintained under isoflurane anesthesia. Postoperative treatment consisted of ketoprofen, buprenorphine, and ceftiofur. Anesthetic induction was obtained in 10–15 min, achieving muscle relaxation and absence of excitement. Physiologic parameters were stable during the procedures, and postoperative treatment was effective.

VOCALISATIONS: 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)

HUMAN IMPACT: 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). The Ayoreo indigenous groups of the Chaco prize this species above all other

mammals and it disappears rapidly from areas where they are active. The Ayoreo may even travel to seek this species. (T & S Vinke in litt.).

Five villages of the Waimiri Atroari Indians of central Amazonia hunted a total of 3 animals in a year (Sep 1993-Oct 1994) in central Brazil (Souza-Mazurek et al 2000). 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). Koster (2006) reports on a hunter habitually killing the species in Nicaragua because of the threat it posed to his dogs after the dogs had pursued the animal and forced it to take a defensive posture. Locals in this area did not consume the animals because of a dislike for the taste.

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). Alves et al (2008) note that the meat is consumed as a treatment for rheumatism in Paraíba, Brazil.

Oddly the first specimens of anteaters to reach Europe led to the belief that all anteaters were females and that they mated with their noses. This incorrect belief was corrected by de Azara (Cowie 2011).

Paracoccidioidomycosis (PCM) is the most important and prevalent systemic mycosis in Latin America where it has been recorded principally in Brazil, Colombia and Venezuela. The etiological agent of the disease is the fungus *Paracoccidioides brasiliensis* and infection is primarily through inhalation of the spores (Restrepo et al 2001). Richini-Perreira et al (2009) found 2 of 2 individuals of this species to be infected, a prevalence mof 35%. This was the first report of infection in this species.

Animals wandering on to roads pose an accident risk to drivers.

CONSERVATION STATUS: The Giant Anteater is considered Vulnerable by the IUCN (Superina et al 2010), see http://www.iucnredlist.org/search/details.php/14224/all for the latest assessment of the species. It is listed on CITES Appendix II and features on red lists of species throughout its range. A population management program is underway in North American zoos and is being initiated in Brazil. Over its entire range there has been a population loss of at least 30% over the past ten years (Superina et al 2010). Though causes of the declines are understood, no measures are in place to counteract them. The last conservation assessment of the species in Paraguay considered it vulnerable (Morales 2007), and Smith (in press) concurs with that evaluation at the national level under IUCN criteria A3c.

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 weekend hunters and often taken as a pet (Superina et al 2010). The thick skin is durable and desirable for leatherwork, especially chaps and riding accessories. (Merritt 2008)

Local extinctions have occurred in most departments and it appears to be decreasing in most areas of the Orient where it still occurs. It is frequently encountered in the Chaco (particularly the Humid Chaco and Pantanal) where population pressure is low and vast amounts of pristine habitat remain, though alarming deforestation rates in the region since 2010 are rapidly changing the landscape in these areas. Additionally temporary flooding throughout this region creates an unseen threat in driving the species to higher ground in search of food. This results in a concentration of populations in higher areas making them more susceptible to predators, and brings them into increasing contact with humans who also seek higher ground for settlement in this area. Flooding may also be an unconfirmed factor in sudden abundance of the animal on and around the raised area that is the Ruta Trans Chaco (one of the few roads in this region that is always transitable), and the unpredictable nature of these occurrences a possible explanation for conflicting reports of high or low mortality on this road (Paul Smith pers. obs., Merritt (2008). Such periodic concentrations of population associated with increased mortality may also contribute to the genetic bottlenecking described by (Collevatti et al 2007) and a source of error in population estimates.

This species seems particularly susceptible to death attributable to uncontrolled fires. The intoxicating effects of smoke on this slow-moving animal and its highly-flammable pelage also increase its vulnerability to fires and during severe fires individuals commonly burn to death (Redford & Eisenberg 1992). 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. Increased deforestation for settlement in the Chaco are likely contributing to a steady decline throughout this region.

Driving the parks trails Silveira et al (1999) found 13 dead giant anteaters following a severe fire that burnt 100% of the grassland area in Emas NP, Brazil in 1994 with an additional 11 located outside of the transect area. Extrapolating these results to the entire park they estimated that between 332 and 810 individuals may have burned to death during the fire in an area of 127,912ha.

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 or availability of its food, it being equally as frequent in burned areas as unburnt areas in the cerrado of Brazil (Prada & Marinho-Filho 2004).

Mourão & Medri (2007) suggested that although this is typically considered an open country species, the importance of forest patches for thermoregulation may be under-estimated and therefore recommended that conservation of forest is also important for the survival of the species. They also suggested the promotion of ecotourism as a conservation tool.

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FIGURE 2 - (FPMAM1020PH) **Giant Anteater** *Myrmecophaga tridactyla.* Photo Paul Smith. Adult lateral. Tres Gigantes, Departamento Alto Paraguay, 22 July 2011.
FIGURE 3 - (FPMAM1022PH) **Giant Anteater** *Myrmecophaga tridactyla.* Photo Paul Smith. Adult feeding. Tres Gigantes, Departamento Alto Paraguay, 22 July 2011.


FIGURE 4 - (FPMAM1023PH) **Giant Anteater** *Myrmecophaga tridactyla.* Photo Paul Smith. Adult resting. Tres Gigantes, Departamento Alto Paraguay, 22 July 2011.
FIGURE 5 - (FPMAM1024PH) **Giant Anteater** *Myrmecophaga tridactyla.* Photo Paul Smith. Adult sleeping. Tres Gigantes, Departamento Alto Paraguay, 22 July 2011.


FIGURE 6- (FPMAM35PH) **Giant Anteater** *Myrmecophaga tridactyla.* Photo Paul Smith. Fore foot of roadkill. Ruta Trans-Chaco, Departamento Boquerón, July 2006.
FIGURE 7 - (FPMAM36PH) **Giant Anteater** *Myrmecophaga tridactyla.* Photo Paul Smith. Hind foot of roadkill. Ruta Trans-Chaco, Departamento Boquerón, September 2007.

FIGURE 8 -
Giant Anteater
Myrmecophaga tridactyla.
Skull courtesy of www.skullsunlimited.com.

FIGURE 9 - (FPMAM37PH) **Giant Anteater** *Myrmecophaga tridactyla.* Photo Paul Smith. Footprint. PN Tte Enciso, Departamento Boquerón, July 2006.
FIGURE 10 - (FPMAM1019PH) **Giant Anteater** *Myrmecophaga tridactyla.* Photo Paul Smith. Dung. Tres Gigantes, Departamento Alto Paraguay, 22 July 2011.