Description and Conservation of The Giant Anteater, *Myrmecophaga tridactyla*

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The Giant Anteater (Myrmecophaga tridactyla) is the largest existing species in their superorder Xenarthra and have an unusually body compared to other mammals (Wetzel, 1982). They inhabit terrestrial areas stretching from Guatemala to Northern Argentina (Nowak, 1991). As of 2010, *M. tridactyla* ranged from Honduras to Northern Argentina and is thought to be extinct in Guatemala, Belize, Uruguay, Northern Argentina, Southern Paraguay and Southern Brazil (Figure 1, Superina et al., 2010; Eisenberg et al., 1999). There are three subspecies tentatively proposed by Gardner: *M.t. artata* in northeastern Colombia, northwestern Venezuela, and north and west of the Merida Andes; *M.t. centralis* from northwestern Colombia to northern Ecuador; and *M.t. tridactyla* found east of the Merida Andes from Venezuela to northern Argentina (2007). *M. tridactyla* is described in this piece at the species level and will not describe subspecies.

Figure 1: Range of *M. tridactyla* from Central America to Bolivia. Red area is known habitat of the Giant anteater and Blue area is possibly extinct (Superina et al., 2010).

The morphology of *M. tridactyla* is distinct and differs from other anteaters in body size, body characteristics, shape, fur, and sensing abilities. The length of the Giant Anteater's head and body is around 1000-1200 mm and the tail length is about 650-900mm (Nowak, 1991; Braga et al., 2010). *M. tridactyla,* on average, weighs between 18-39 kg (Nowak, 1991). Male's weight ranges from 26.4 to 36.4 kg and female's weight ranges from 25.5 to 31.8 kg (Shaw et al., 1987). Growth rate in the wild is slightly lower than in captivity in accordance to Shaw, Machado-Neto, and Carter's study, presumable because the high protein diets and restrictive movement of captive Giant Anteaters (1987). *M. tridactyla*

metabolism functions at a rate of 34 percent of what is expected for their body size (Constança de Sampaio et al., 2006). Most mammals have a body temperature of around 36-38^{o}C while *M. tridactyla* has an internal temperature of 33^{o}C (Constança de Sampaio et al., 2006). Lower than average body temperature and low functioning metabolism in the Giant Anteater's body functioning are possible due to their thick fur, which insulates heat at 94 percent of what is expected for their body size (Constança de Sampaio et al., 2006). This isolative property allows *M. tridactyla* to have a thermoneutral, or temperature tolerance, range of 15.0^{o}C to 36.0^{o}C. As a repercussion to *M. tridactyla* having low functioning metabolism, temperatures below 15.0^{o}C can cause the Giant Anteater's internal temperature to drop up to 2.0^{o}C (Constança de Sampaio et al., 2006). The response by *M. tridactyla* to ambient temperatures outside their thermoneutral range is to decrease activity and change habitat usage (Constança de Sampaio et al., 2006). Figure 2 in the appendix illustrates the variation of habitat preference for the Giant Anteater with different daily mean temperatures.

The Giant Anteater's activity levels throughout the day vary by region in response to temperature (Shaw et al., 1987; Constança de Sampaio et al., 2006). The average time of *M. tridactyla* first activity in the day is between 1300 and 1400 hour and the peak time of activity for *M. tridactyla* is between 1800 and 1900 hour (Shaw et al., 1987). Montgomery & Lubin and Mourao & Medri's research found *M. tridactyla* to have evening or nocturnal activity (1977, 2002). The contradictory findings are explained, in part, because human presence effects Giant Anteater's time of activity (Constança de Sampaio et al.,2006). The Giant Anteater's time of first activity and last activity, as well, depend on the mean ambient temperature of the day (Montgomery & Lubin, 1977; Mourao & Medri, 2002; Constança de Sampaio et al., 2006). Sleeping-site selection varies in correlation to temperature also (Constança de Sampaio et al., 2006). During average mean temperatures around 20^{o}C, the Giant Anteater primarily sleeps in savanna and grasslands (Figure 2 in the appendix, Constança de Sampaio et al., 2006). At more extreme cold and hot temperatures, forested areas are preferred for sleeping (Constança de Sampaio et

al., 2006). The Giant Anteater will sleep directly on the ground in a secluded spot and cover their body with their tail (Nowak, 1991; Grzimek, 1968). Captive individuals will repeatedly use the same bed site every night (Marrett, 1983). Behavior related to temperature can expect to be altered by human-induced climate change, with unknown consequences to the Giant Anteater. Also human presence is concluded to change this anteater species' behavior and time of activity (Mourao et al., 2002).The size of the Giant Anteater's body and susceptibility to ambient temperature makes *M. tridactyla* more prone to temperature fluctuations. For conservation, temperature extremes cause internal body temperature issues for the Giant Anteater that can cause negative impacts on their functioning as well as behavioral changes.

The thick fur of the Giant Anteater allows it to withstand cold temperatures in its habitat.

Figure 3: *M. tridactyla,* the Giant Anteater, has a distinct black line with white bordering across its body and the fur can range from grey to brown (Nowak, 1991; Grzimek, 1968). (Photo: Woon, May)

According to Nowak, *M. tridactyla* has coarse and stiff fur with long hair on the tail (1991). There is one black stipe with white border across their body and grey fur for the rest (Nowak, 1991; Grzimek, 1968). Eisenberg and Redford note the fur can vary in individuals to brown instead of grey (1999). Follicles of fur are tightly packed; this density can aid heat retention seen by Constança de Sampaio et al. (Anderson & Jones, 1967; 2006). The body's fur can be up to 24 cm long and the hair of the tail can get as long as 40 cm long, the length adding to its insulation properties (Grzimek, 1968). This fur is a key trait to the Giant Anteater's functioning but is also extremely flammable, making fires a threat to individual's survival (Silveira et al., 1999).

The large tail of the Giant Anteater also serves to provide coverage of their body while resting. They place their tail over themselves while sleeping or laying to cover their entire body (Grzimek, 1968; Nowak, 1991). The long, coarse hairs on the tail prevent heat loss during resting periods also (Constança

de Sampaio et al., 2006). Coloration of the tail helps to conceal the Giant Anteater while sleeping because it blends into the surrounding environment (Grzimek, 1968).

Attributes of the Giant Anteater's body that differ from other mammals include their snout, tongue, paws, claws, and tail. *M. tridactyla* has a unique, long snout that, as researcher Naples points out, has adaptive advantages (1999). The face and snout together are greatly elongated and reduced in diameter (Naples, 1999). The head as a whole is smaller in diameter compared to its neck unlike other mammals (Naples, 1999). The mouth of *M. tridactyla* is greatly restricted by the jaw joint that only allows minimal gaping movements (Naples, 1999). There are no teeth in the mouth, food taken in by the Giant Anteater is taken in by the tongue and removed by transverse ridges on the roof of the mouth as the tongue is extended out (Naples, 1999). The tongue can be extended a length equivalent to the head length (Naples, 1999). Anteater's control of their tongue is done through the movement of their head (Naples, 1999). The speed of the Giant Anteater's tongue is very rapid, the tongue can be cycled in and out up to 160 cycles per min (Naples, 1999). Food sticks to the tongue by a sticky saliva coating produced in large quantities; amounts of saliva unequal to any other mammal (Grzimek, 1968). All of these adaptations to the facial structure and tongue of *M. tridactyla* greatly increase their ability to maximize food intake.

Elongated claws and fingers allow *M. tridactyla* to increase nutrition intake. Claws of the Giant Anteater are greatly enlarged and sharp; used to forge for food (Eisenberg et al., 1999; Grzimek, 1968; Anderson & Jones, 1967). *M. tridactyla* walks on their knuckles with their claws curled inward for the front limbs and the back limbs walk on the soles of their feet (Grzimek, 1968). These adaptations to the front paws are seen to be advantageous in feeding as they can dig into ant mounds (Anderson & Jones, 1967). *M. tridactyla* has heightened sense of smell and hearing while showing an apparent reduction in eyesight (Grzimek, 1968). Despite its visual senses being not well developed, the Giant Anteater has a keen sense of smell which assists in finding food and detecting predators (Grzimek, 1968). Their hearing

is acute also: they are able to identify a predator's location up to 5 meters away from sounds alone (Grzimek, 1968). All the attributes seen by *M. tridactyla*; snout, tongue, paws, claws, and tail; differ from other animals and serve a purpose for the Giant Anteater.

When M. tridactyla forges for food, they walk with their nose close to the ground; rooting around with their snout (Eisenberg et al., 1999; Grzimek, 1968). One study by Shaw, Machado-Neto and Carter found that the Giant Anteater forged for food in galley forests and rarely in brush land (1987). This species is considered an insectivore mammal specialist. Feeding preferences of Giant Anteaters are ants and termites (Grzimek, 1968; Eisenberg et al., 1999; Nowak 1991; Anderson & Jones, 1967). They can eat around 30,000 ants and termites a day (Grzimek, 1968; Nowak, 1991). M. tridactyla visits many insect mounds in one day, and will intake termites or ants until soldier insects arrive and attack which is an average of 40 seconds (Eisenberg et al.; Constança de Sampaio et al., 2006). The Giant Anteater will stick its tongue into the opening of a mount to feed (Grzimek, 1968; Nowak, 1991; Eisenberg et al.). Other foods observed to be eaten by the Giant Anteater includes worms, large insect larvae, fruit, and berries (Grzimek, 1968). In captivity, M. tridactyla is fed eggs, milk, and mealworm (Nowak, 1991). Drinking of water is observed in this species to by licking dew off plants or digging into soils (Grzimek, 1968; Emmons et al., 2004). The feeding abilities of *M. tridactyla* aid it in maximizing their food intake.

The Giant Anteater's role as a predator is population control of insects through consumption (Grzimek, 1968; Nowak, 1991). *M. tridactyla* is preyed upon by jaguars and pumas in turn (Grzimek, 1968). The magnitude of fatality due to predation in this species is not known. One very important role this anteater plays in species interactions is providing fresh water to other animals that would otherwise have no drinking water (Emmons et al., 2004). When surface water is unavailable, the Giant Anteater is observed to dig with its claws into the ground, creating a small water hole for wolves, ocelots, raccoons, marsh deer, and birds (Emmons et al., 2004). Shaw, Machado-Neto and Carter observed *M. tridactyla* is

vulnerable to round worm parasitism and death by roundworms has been documented in individuals (1987). The number of deaths by parasitism is unknown.

The Giant Anteater is solitary excepts when courting and participating in territorial behavior (Shaw et al., 1987; Nowak, 1991). Males appear to be more territorial and maintain greater distance from one another (Shaw et al., 1987). The average distance between neighboring males is 1711 meters and 1,453 meters between neighboring females (Shaw et al., 1987). Distance on average between two Giant Anteaters of the opposite sex is 968 meters (Shaw et al., 1987). Male *M. tridactyla* tend to have less range overlap than females: an average of 6.1 percent overlap between males and an average of 28.8 percent overlap between females (Shaw et al., 1987). An estimated density of 1.3 km² in 1980 for the Giant Anteater was found in Serra da Canastra National Park (Shaw et al., 1987). Researchers Shaw, Machado-Neto and Carter propose *M. tridactyla* has a very slow turnover rate (1987). The Giant Anteater has a low population growth rate due to its life history of long gestation periods and single offspring (Silveira et al., 1999). The solitary behavior, large range, and little overlap between individuals require the Giant Anteater to have extensive and continuous reserved land to maintain a minimum viable population. The two major reserves in South and Central America the Giant Anteater is found in are 715 km² and 1318 km² (Shaw et al., 1987; Silveira et al., 1999). *M. tridactyla* will inhabit private land outside reserves (Vynne et al., 2011). The limitation in size of reserves the Giant Anteater is found in has also caused evidence inbreeding (Collevatti et al., 2007). Habitat fragmentation is attributed to the bottle-necking of *M. tridactyla* in South and Central America (Collevatti et al., 2007). The range requirement for genetically diverse populations of this species is not met and has resulted in inbreeding. This issue of poor diversity causes complications for future population conservation of the Giant Anteater.

Sexual dimorphism in *M. tridactyla* is not apparent, both the male and the female look identical (Braga et al., 2010; Eisenberg et al., 1999). Slight differences in average size and weight accompany the

two sexes (Shaw et al., 1987), but are an indistinguishable difference. Identification between members of *M. tridactyla* populations occur through the urogenital sinus (Eisenberg et al., 1999; Anderson & Jones, 1967). For scientists in the field, identification from a distance is not possible and requires trapping of individuals which can be expensive and can be dangerous to anteaters.

During courtship, the female raises her tail and posterior while walking (Shaw et al., 1987). The male follows closely behind the female and occasionally sniffs her (Shaw et al., 1987). During this time, the male and female continue normal forging behavior and sometimes feed together (Shaw et al., 1987). Courtship lasts about 2 days (Shaw et al., 1987). Giant Anteaters in captivity breed throughout the year (Merrett, 1983). Shaw, Machado-Neto and Carter found that wild Giant Anteaters possibly experienced delayed implantation due to abnormal observed gestation periods (1987). Disturbances during the long courtship time period could result in the loss of fertilization of female or cause on onset of delayed implantation.

The female has two teats and gives birth to one young at a time (Grzimek, 1968; Superina et al., 2010). Gestation period of the young ranges from 142 to 190 days (Eisenberg et al., 1999; Grzimek, 1968; Nowak, 1991; Superina et al., 2010). Eisenberg and Redford report the age of first reproduction is between 2 and 4 years (1999; Superina et al., 2010; Nowak, 1991). Female Giant Anteaters give birth while standing (Grzimek, 1968) and the newborn weights 1.0 to 2.0 kg at birth (Eisenberg et al., 1999; Nowak, 1991). After birth, the young climbs on the mother's back and opens its eyes after 6 days (Grzimek, 1968; Eisenberg et al., 1999). Newborns are weaned after 4 weeks (Nowak, 1991), but continue to be carried by the mother for 6-9 months (Eisenberg et al., 1999; Grzimek, 1968; Superina et al., 2010). Mentioned by Grzimek, it has been observed that the young are able to walk and run after four weeks

Figure 4: Mother carrying young on back at Nebraska Zoo (photo: Sperka, C).

and emit a short, shrill whistle (1968). After two years, offspring are fully grown (Grzimek, 1968). The long time period between young and the intensity of care for young results in low reproduction rates for females.

Antagonistic encounters occur between individuals and include slow circling, chasing, and blows with the front claws, which usually resulted in injury (Shaw et al., 1987). The Giant Anteater will mark its territory using scratch marks on trees with exposed lower trunks (Braga et al., 2010). Scratches are thought to be a form of communication and in one site, approximately 50% of the trees were marked (Braga et al., 2010). The number of scratched trees in an anteater's territory is related to the stress of the individual (Braga et al., 2010). Stress due to reproductive intraspecific competition may cause territorial individuals to mark trees in their territory more (Braga et al., 2010). In some instances, excessive trunk scratching has caused loss of claws (Braga et al., 2010). In captivity, territorial behavior is not observed and cohabitation is successful (Nowak, 1991). Inhabitants of the area observe *M. tridactyla* as being docile and never attack humans unless provoked (Grzimek, 1968; Nowak, 1991). The numerous markings and presence of antagonistic encounters indicates high stress levels in individuals in the wild related to territory and possibly due to habitat loss.

The climbing ability if *M. tridactyla* was not recognized until recently and earlier reports claim the Giant Anteater does not climb (Nowak, 1991; Young et al., 2003). Observations by Young, Coelho, and Wieloch verify that they indeed can climb termite mounds, trees, and man-made objects up to 2 meters tall (Young et al., 2003). Pressures that drive the Giant Anteater to climb include escaping fires, attaining food, and young reuniting with mother (Young et al., 2003). This type of behavior is rare and difficult for *M. tridactyla* (Young et al., 2003). Another rare behavior of the Giant Anteater is bathing. The speculated reason for this bathing behavior may be to rid biting insects or just enjoyment (Emmons et al., 2004). The Giant Anteater will take part in night bathing and, similarly, is also a skilled swimmer: taking to the water readily and crossing deep rivers (Nowak, 1991; Emmons et al., 2004). The rarely used

ability and difficulty of the anteater to climb has made them more susceptible to wild fires. The ability to swim across rivers is a way the Giant Anteater can escape fires.

The status of the Giant Anteater is Vulnerable in the International Union for Conservation of Nature (IUCN, 2004). The species is also listed on several Red Lists and is considered the most threatened mammal of Central America according to Red List assessors (Superina et al., 2010). In Belize, Guatemala, Uruguay, parts of Brazil, and Costa Rica, where the Giant Anteater once persisted, *M. tridactyla* is now considered extinct (Superina et al., 2010).

The main cause of rapid decline in Giant Anteater populations has to do with human presences and activity. A population decline of 30% in ten years, from 2000 to 2010, is estimated based on habitat loss, fires, and road kills (Superina et al., 2010). Further analysis into population decline revealed an annual decrease in anteater detection in Emas National Park from 2004 to 2008 (Vynne et al., 2010). Anteaters are hunted in South America as food, for game hunting, pelt trade, and as pests (Nowak, 1991; Mares, 1982; Superina et al., 2010; Reyes et al., 2010). *M. tridactyla* is also killed by native hunters because they are perceived to pose a threat by attacking hunt-dogs with their claws if provoked (Koster, 2008). The illegal trade of Giant Anteaters for pets is also noted as an issue (Superina et al., 2010). Habitat loss is a major factor in the extinction of *M. tridactyla* in parts of Central America (Nowak, 1991). The most harmful factor to anteater populations is grassland fires (Silveira et al., 1999). The species is very vulnerable to fires because its slow running-speed and flammable fur (Silveira et al., 1999). In the 1994 fire of Emas National Park, an estimate of 810 individuals out of 1714 total before the fire were killed directly by the burning event (Silveira et al., 1999). The Giant Anteater may also be susceptible to secondary effects of fire like smoke inhalation and injury (Silveira et al., 1999). Large and intense fires pose a threat to *M. tridactyla* as a result of infrequent burning and accumulation of dead biomass, while small fires are found to have no negative effect (Silveira et al., 1999). Native regions to this species historically have experienced controlled fires to enhance pastures and for hunting by indigenous people

(Silveira et al., 1999). High intensity of fires occurs when fire is suppressed for 3 or more years and the season (influences moisture and rain) of the fire (Silveira et al., 1999).

Conservation of *M. tridactyla* calls to improve fire practices and initiate controlled-burning events (Silveira et al., 1999; Superina et al., 2010). Practices that would reduce high-intensity grassland burning include fires every third year in May by sections (Silveira et al., 1999). There has been no implement of fire control, but is urgently needed to reduce Giant Anteater mortality (Silveira et al., 1999). A Population Management Plan is in active use in North American zoos, yet the plan has not been implemented in its native countries (Superina et al., 2010; Reyes et al., 2010). Enforcement of laws against hunting, pet, and pelt trade in their local habitat is lacking (Mares. 1982). The best strategy, proposed by Mares, for multifaceted conservation would be to inform and educate the local inhabitants of this species' home range (1982). One other approach to conservation, which has not been implemented, is to designate the Giant Anteater as a charismatic tourist species, offsetting economic development (Mourao & Medri, 2007). Ecotourism would be promoted based on the unusual shape of *M. tridactyla* and the appeal of it being the largest existing species in its superorder, Xenarthra (Mourao & Medri, 2007).

Appendix:

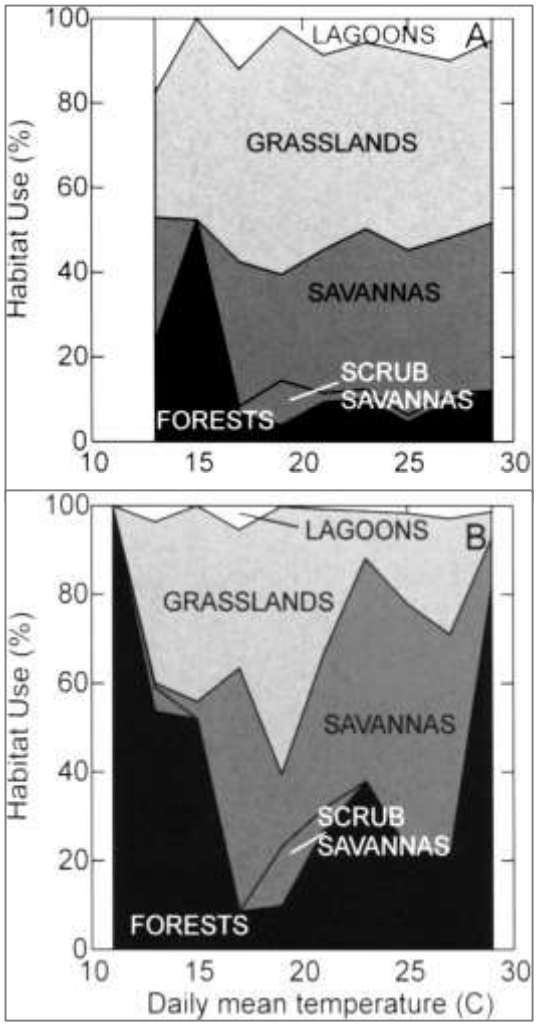

Figure 2: *M. tridactyla* habitat use for (A) activity and (B) resting during variable temperature (Constança de Sampaio et al., 2006).

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