



SOUTHERN BLACK-EARED OPOSSUM

Didelphis aurita Wied-Neuwied, 1826



FIGURE 1 - (FPMAM11PH) Adult, Kuruguaty, Departamento Canindeyú (Philip Myers undated).

TAXONOMY: Class Mammalia; Subclass Theria; Infraclass Metatheria; Magnorder Ameridelphia; Order Didelphimorphia; Family Didelphidae; Subfamily Didelphinae; Tribe Didelphini (Myers et al 2006, Gardner 2007). The genus *Didelphis* was defined by Linnaeus, 1758. There are five known species according to the latest revision (Gardner 2007) two of which are present in Paraguay. The generic name *Didelphis* is from the Greek meaning "double womb" in reference to the pouch as a second womb, and *aurita* is derived from the Latin for "long-eared" (Braun & Mares 1995). The species is monotypic (Gardner 2007).

Didelphis aurita was long considered conspecific with the Northern Black-eared Opossum *Didelphis marsupialis* Linnaeus 1758, but the distributions are disjunct, with this species very tightly associated with the Atlantic Forest biome of eastern Brazil, eastern Paraguay and northern Argentina. Cerqueira (1985)

considered the two forms to be part of a superspecies complex, and Cerqueira & Lemos (2000) documented clear morphometric differences between the two populations to support their specific status. Lemos, Marriog & Cerqueira (2001) demonstrated a Pleistocene cladogenesis through rapid differentiation of the two species.

The name *Didelphis azarae* Temminck 1824 was clearly applicable to this species given that the written description specifically mentions black ears. However this name has been misapplied almost since its inception in reference to *Didelphis albiventris*, and though it predates Wied-Neuwied's name *Didelphis aurita*, the confusion caused by its misapplication means that *D.aurita* is now the most frequently used name in the interests of maintaining stability (Gardner 2007). Synonyms adapted from Gardner (2007):

Didelphis azarae Temminck 1824:30. Type locality "Bresil".

[Didelphys] marsupialis Wied-Neuwied 1826:387. In part. Name combination.

[Didelphys] aurita Wied-Neuwied 1826:395. Type locality "Villa Viçosa an Flusse Peruhype", Bahía, Brazil.

Didelphys azarae JA Wagner 1843:38. Name combination.

Didelphys cancrivora JA Wagner 1843:41. Not *D.cancrivora* Gmelin (1788).

Gamba aurita var. *brasiliensis* Liais 1872:329. Implied type locality Brazil.

Didelphys marsupialis aurita Cope 1889:129. Name combination.

Didelphis koseritizi Ihering 1892:99. Type locality "Colonia do Novo Mundo" Rio Grande do Sul, Brazil.

[Didelphys (Marmosa)] koseriti Trouessart 1898:1240. Name combination and incorrect spelling.

[Didelphys (Didelphys) marsupialis] aurita Trouessart 1898:1234. Name combination.

Didelphis masrupialis cancrivora Bertoni 1914:68. Name combination.

[Didelphis (Didelphis)] leucopymnus Matschie 1916:268. Nomen nudum.

Didelphis aurita longipilis A.Miranda-Ribeiro 1935:35. Type locality "Côlonia Alpina" 16km N of Teresópolis, Rio de Janeiro, Brazil.

Didelphis aurita malanoidis A.Miranda-Ribeiro 1935:40. Type locality "Therezópolis" restricted to Cônia Alpina, 16km N of Teresópolis, Rio de Janeiro, Brazil by Ávila-Pires (1968).

Didelphis aurita longigilis Ávila-Pires 1968:169. Incorrect spelling.

ENGLISH COMMON NAMES: Southern Black-eared Opossum, Black-eared Opossum (Redford & Eisenberg 1992, Canevari & Vaccaro 2007), Big-eared Opossum (Wilson & Cole 2000, Gardner 2007), Gambá (Gardner 2007), Common Opossum (Esquivel 2001), Brazilian Common Opossum (IUCN 2008), Southern Common Opossum (Astúa de Morães et al. 2003).

SPANISH COMMON NAMES: Comadreja orejuda, Zarigüeya orejuda (Canevari & Vaccaro 2007), Zarigüeya común del sudeste (Emmons 1999), Comadreja grande (Redford & Eisenberg 1992), Comadreja de orejas negras (Chebez 1996, Massoia et al 2000), Mbicuré orejudo (Chebez 1996, Massoia et al 2000), Mbicuré negro (Chebez 1996), Mbicuré cangrejero (Chebez 1996, Massoia et al 2000), Comadreja negra (Massoia et al 2006).

GUARANÍ COMMON NAMES: **M** Mykurê hu (Villalba & Yanosky 2000), Mbicuré-hú (Chebez 1996, Massoia et al 2000, Canevari & Vaccaro 2007), **Ac** Guné (Villalba & Yanosky 2000), **Ac** Ngure (Esquivel 2001), Mykure (Esquivel 2001), Mbihkurê (Chebez 1996).

DESCRIPTION: The smaller of the two *Didelphis* opossums this species is characterised by its blackish or greyish pelage and golden-buff facial and base colour. Dorsal pelage greyish-white variably variegated with black so that it appears more or less dark. Long guard hairs (80-100mm long) are white to the base and are particularly long on the rump giving a shaggy appearance. Underfur golden-buff basally on the mid back, becoming more yellow-brown basally on the flanks and blackish on the apical third to half throughout. Ventral pelage shorter and woollier, brownish-white basally and tipped blackish-brown with scattered golden-buff hairs. Hairs bordering the marsupium darker brown to blackish-chestnut. Indistinct whitish patch on mid-chest. The rostrum is slightly elongated and somewhat triangular. Chin and throat golden-buff with hairs tipped dark brown except for on the lower throat. Head pattern indistinct with dark blackish median line and patches around the eyes offset against a golden-buff background of the rest of the head. Median line begins between the eyes and widens towards the nape. Eye patches begin halfway between the nose and eyes and reach almost to the base of the ears, being less well-defined and broader behind the eyes than in front. Head markings are typically more distinct on younger specimens. Ears are large, rounded and blackish. Limbs black, including the semi-naked toes. Feet are broad and claws are

long. Tail slightly shorter than head and body length, furred at the base and naked and bicoloured for the rest of its length. Black on the basal half and flesh-coloured on the distal half. This species is extremely variable in the extent of the dark colouration with some specimens almost black and others much paler in colour and appearing almost entirely golden-buff. There is also age variation in colouration, the youngest individuals typically having the strongest facial pattern and whitish or flesh-coloured ears; at which time they may be mistaken for juvenile *Didelphis albiventris*, though the base colour of the pelage is always yellowish and never white. Ears darken with age, with the basal area assuming dark colouration before the tips. Young individuals may also show less black at the base of the tail than adults. (Allen 1902).

CRANIAL CHARACTERISTICS: Cerqueira & Lemos (2000) gave the following skull measurements for both sexes of this species: *Greatest Skull Length* male 104.39mm (+/-8.82) female 95.13mm (+/-5.73); *Condylbasal Length* male 101.04mm (+/-7.52) female 93.26mm (+/-5.20); *Length of Mandible* male 84mm (+/-6.83) female 77.02mm (+/-4.61); *Length of Nasals* male 50.63mm (+/-4.63) female 46.38mm (+/-3.10); *Greatest Nasal Width* male 15.72mm (+/-1.58) female 14.22mm (+/-1.25); *Length of Palate* male 61.61mm (+/-3.84) female 58.66mm (+/-2.88); *Width of Palatal Shelf* male 17.16mm (+/-1.30) female 16.98mm (+/-1.43); *Interorbital Constriction* male 21.88mm (+/-2.59) female 19.03mm (+/-1.41); *Postorbital Constriction* male 11.38mm (+/-0.51) female 11.66mm (+/-0.48); *Width of Rostrum Across Frontals* male 18.43mm (+/-2.13) female 16.31mm (+/-1.30); *Width of Rostrum Across Jugals* male 27.15mm (+/-2.67) female 24.64mm (+/-1.78); *Zygomatic Width* male 55.92mm (+/-5.46) female 48.21mm (+/-3.37); *Width Across Molars* male 29.88mm (+/-1.51) female 29.37mm (+/-1.19); *Width Across Canines* male 19.81mm (+/-2.05) female 16.97mm (+/-1.28); *Width of Brain Case* male 28.14mm (+/-2.28) female 25.85mm (+/-1.48).

DENTAL CHARACTERISTICS: I5/4 C1/1 P 3/3 M 4/4 = 50. Cerqueira & Lemos (2000) gave the following measurements for both sexes of this species: *Length of Maxillary Tooth Row* male 41.49mm (+/-1.88) female 39.95mm (+/-1.51); *Length of Upper Molar Row* male 19.11mm (+/-0.95) female 18.75mm (+/-0.64); *Length of Lower Molar Row* male 21.42mm (+/-1.03) female 21.21mm (+/-0.82). Tyndale-Biscoe & MacKenzie (1976) summarised ageing in *Didelphis* opossums based on dental wear by defining 7 age classes as follows: *Dental Class 1:* (<4 months) dP3 M1 no cusp wear; *Dental Class 2:* (4-6 months) dP3 M2 no cusp wear; *Dental Class 3:* (5-7 months) dP3 M3 no cusp wear; *Dental Class 4:* (6-11 months) P3 M3 no cusp wear; *Dental Class 5:* (9-16 months) P3 M4 no cusp wear; *Dental Class 6:* (15-23 months) P3 M4, cusp wear on P3 and M1-2; *Dental Class 7:* (>22 months) P3 M4, cusp wear on P3 and M3-4. Astúa de Morães et al. (2001) describe supernumerary molars erupting behind on each side of the superior row in specimen AMNH 133034. Tooth shape is molariform on both sides, though slightly reduced and with a crown pattern resembling a normal M4 on the right side.

GENETIC CHARACTERISTICS: 2n=22 (Svartman & Vianna-Morgante 1999). Lemos et al (1999) report the occurrence of mtDNA like sequences in the nuclear genome of this genus.

TRACKS AND SIGNS: *Didelphis* prints are characteristically wider than they are long with a notably uneven appearance, especially on the hindfoot which shows fore toes displaced to one side and the opposable thumb on the other side. The tail being dragged behind the body often leaves an impression. **FP:** 4.3 x 5cm; **HP:** 3.2 x 6cm; **PA:** 12cm. (Villalba & Yanosky 2000, Massoia et al 2009).

EXTERNAL MEASUREMENTS: The smaller of the two Paraguayan *Didelphis*. Allen (1902) gave the following measurements for 3 adult males and 6 adult females from Brazil: **TL:** male 77.77cm (range 74.5-80.6cm) female 74.42cm (range 67.8-77cm); **HB:** male 41.7cm (range 40.5-42.6cm) female 39.38cm (range 35.8-41cm); **TA:** male 36.07cm (range 34-38cm) female 35.36cm (range 32-38.8cm); **FT:** male 5.43cm (range 4.8-6.1cm) female 5.38cm (range 4.1-6.1cm); **EA:** male 4.8cm (range 4.6-5cm) female 5.15cm (range 3.9-6cm).

Vieira (1997) gave the following mean measurements for the species (n=25): **HB:** 38.28cm; **TA:** 31.72mm; **FT:** 4.73cm; *Foot* 3.96cm; *Width Claw* 0.47cm; *Arm* 6.66cm; *Forearm* 7.42cm; *Leg* 7.72cm; *Foreleg* 8.47cm; *Forelimb* 14.08cm; *Hindlimb* 16.16cm; **WT:** 1098g (range 670-1560g). He noted that the relatively long forelimbs, long claws and broad feet were associated with a terrestrial/arboreal existence and a walking means of locomotion. More ponderous animals require sturdier forelimbs when climbing. The following mean post-cranial measurements were noted by Carvalho et al (2000) for Brazilian specimens (n=5): *Ulna* 67.3mm; *Forearm* 78.7mm; *Humerus* 59mm; *Tibia* 72.2mm; *Foreleg* 95.1mm; *Femur* 70.2mm.

Cáceres & Monteiro-Filho (1999) noticed a correlation between head length and age class, and stated that the measurement may be used to estimate body length. Mass was noted to increase during autumn in preparation for the winter season with fewer resources. Males undergo more rapid growth than females and are typically larger and heavier. Adult size is reached about 10 months. They gave the following external body measurements for differing age classes of males and females from southern Brazil:

Young (6-7 months old, dental class 3): **Head:** male 11.0cm female 10.4cm (+/-0.3); **Body:** male 26.7cm female 26cm (+/-2.3); **FT:** male 5.2cm female 4.9cm (+/-0.2); **WT:** male 760g female 726g (+/-126).

Subadult (7-11 months old, dental class 4): **Head:** male 12.8cm female 10.9cm (+/-0.1); **Body:** male 30cm female 29.7cm (+/-0.3); **FT:** male 5.7cm female 5.1cm (+/-0.1); **WT:** male 1250g female 900g (+/-80).

Young adult (10-16 months old, dental class 5): **Head:** male 13.3cm (+/-0.4) female 11.8cm (+/-0.3); **Body:** male 35.8cm (+/-2.9) female 32.4cm (+/-1.5); **FT:** male 6cm (+/-0.3) female 5.5cm (+/-0.2); **WT:** male 1643g (+/-158) female 1116g (+/-95).

Adult (15-23 months old, dental class 6): **Head:** male 14.6cm (+/-0.1) female 12.5cm (+/-0.1); **Body:** male 38.5cm (+/-1.1) female 33.5cm (+/-0.6); **FT:** male 6.2cm (+/-0.3) female 5.6cm (+/-0.1); **WT:** male 1793g (+/-135) female 1303g (+/-133).

Senile adult (>22 months old, dental class 7): **Head:** female 13.1cm (+/-0.3); **Body:** female 34.4cm (+/-0.1); **FT:** female 5.7cm (+/-0.1); **WT:** male 1643g (+/-158) female 1353g (+/-30).

SIMILAR SPECIES: The smaller representative of the genus *Didelphis* in Paraguay, these are large opossums with pointed snouts, dense, shaggy pelage and large, rounded ears. This species could only be confused with *Didelphis albiventris* but is easily separated on account of its golden-buff, not white base colour, dark blackish ears (as opposed to pinkish-white in the "White-eared Opossum") and its strict preference for humid forested environments; White-eared Opossum is far more catholic in its habitat tastes and is frequently found in dry, scrubby habitats and even in areas of human habitation. Furthermore note that the black head markings are much less distinct in this species. Note that juveniles and young individuals of this species may have more or less pale-tipped ears (the ears being wholly pale in the youngest individuals) and more strongly-marked facial patterns than adults, but they never have a white ground colour to the head as in *D.albiventris*.

DISTRIBUTION: Distributed in the Atlantic Forest of Brazil, Argentina and Paraguay. In Argentina they are confined to Provincia Misiones (Mares & Braun 2000). In Brazil they have been recorded from **XXXXX** Espírito Santo (Pinto et al 2009) and there is an additional isolated population in north-west Brazil in Alagoas and Pernambuco.

In Paraguay the distribution is limited to central-eastern Paraguay and is greatly reduced following the disappearance of much of the Alto Paraná Atlantic Forest. The species is known to occur in Departamentos Alto Paraná, Caazapá, eastern San Pedro, northern Caaguazú and southern Amambay (Brown 2004, Esquivel 2001, Gardner 2007).

HABITAT: An Atlantic Forest endemic species, this species is confined to primary and secondary humid forests where it is frequently found in the vicinity of streams or waterways. In Brazil it also occurs in *Araucaria* forests. The species is able to tolerate some degree of human interference in its habit, but shows much lesser affinity for areas of human habitation than *Didelphis albiventris* (Gardner 2007). Moura et al (2005) found that the species showed an affinity for rocky areas in PN Serra dos Orgãos, Brazil.

ALIMENTATION: Omnivorous, opportunistic and scansorial. Given its efficient digestive rates, this species is an important disperser of Atlantic Forest plants with the bulk of foods consumed passing through the digestive system within 24 hours (Grelle & García 1999). Moura et al (2009) consider the species an intraguild predator and though it rarely preys on small mammals its presence is enough to promote avoidance of it by other small mammals. Vieira & Izar (1999) captured this species in the canopy, at mid-levels and on the ground indicating that it uses all levels of the forest



Foraging Behaviour and Diet Santori et al (1995) studied fecal samples from the dry restinga of Brazil and considered the species omnivorous and opportunistic with a broad dietary range. Of 52 fecal samples 100% contained invertebrates, 30.8% contained vertebrate remains and 53.8% contained seeds. Of the sixteen fecal samples containing vertebrate remains, two contained unidentified mammal remains, two contained remains of the rodent *Akodon cursor* and one an unidentified bird. Thirteen samples contained the Tropidurid lizard *Tropidurus torquatus*, five a species of Skink *Mabuya* sp. and two an unidentified reptile. In order of prevalence the following invertebrate groups were found in samples: Blattaria 67.3%, Hymenoptera (Formicidae) 65.4%, Orthoptera (Tettigonidae) 30.8%, unidentified Coleoptera 26.9%, Diplopoda 23.1%, Diptera pupae 17.3%, Chilopoda 15.4%, Myriapoda 7.7% and Coleoptera (Scarabaeidae) 7.7%. The remaining groups were all present in one sample, representing 1.9% of the total sample: Mollusca, Crustacea, Araneidae, Acari, Opiliones, Scolopendramorpha, Unidentified Orthoptera, Coleoptera (Curculionidae), Coleoptera (Histeridae), Hemiptera, Unidentified Hymenoptera, Hymenoptera (wasps), Isoptera and Dermaptera. The presence of Dipteran pupae was considered a possible indication of scavenging behaviour, while the presence of ants and termites was considered to be the result of opportunistic feeding as no nest remains were found in the faeces. Seeds of the following plant species were found in order of prevalence: *Anthurium harrissii* (Araceae) 23.1%, Unidentified seeds 21.2%, *Paullinia weinmanniaefolia* (Sapindaceae) 11.5%, *Pilosocereus* sp. (Cactaceae) 9.6%, *Passiflora* sp (Passifloraceae) 5.8%, *Rhypsalis* sp. (Cactaceae) 3.8%, *Psidium* sp (Myrtaceae) and unidentified Solanaceae 1.9%. Fruit consumption was seen as a way of increasing water intake in this dry environment.

Cáceres & Monteiro-Filho (2001) consider the diet typical of an insectivorous-omnivorous species. Working in Curitiba, Paraná State, Brazil they examined 157 fecal samples (65 in dry season, 92 in wet season) of trapped individuals and found that 100% contained invertebrates, 59% contained vertebrate remains and 78% contained fruit. Strong seasonality was discovered in some food items with some vertebrates and most fruits consumed more often during the wet season. The following results were obtained for the dry season (d) and wet season (w) respectively, with the value referring to the number of scats in which the item was present: Vertebrates (d45% w70%) included birds mainly *Turdus rufiventris* 27% (d14% w37%), mammals 15% (d18% w12%), reptiles mainly *Liotyphlops beui* 14% (d2% w23%) and fish 1% (d2% w0%) with unidentified bones representing 11% (d9% w12%). Predictable seasonality in reptile predation represents its seasonal availability. Invertebrates (d100% w100%) included Diplopoda 76% (d89% w67%), Opiliones 69% (d72% w67%), Coleoptera mainly Scarabaeoidea 72% (d57% w83%), Hymenoptera mainly Formicidae 33% (d32% w32%), Gastropoda 28% (d20% w34%), Decapoda 26% (d28% w25%), Blattaria 24% (d17% w28%), Isopoda 13% (d17% w10%), Orthoptera 10% (d5% w14%), Lepidoptera larvae 6% (d14% w1%) and other invertebrates 10% (d12% w8%). Fruit (d58% w92%) included: *Passiflora actinia* 39% (Passifloraceae d25% w49%), *Solanum sanctaebatharinae* 23% (Solanaceae d22% w24%), *Piper gaudichaudianum* 21% (Piperaceae d0% w36%), *Solanum granulosoleprosum* 13% (Solanaceae d2% w21%), *Melothria cucumis* 11% (Cucurbitaceae d6% w14%), *Cyphomandra corymbiflora* 6% (Solanaceae d5% w7%), *Solanum swartzianum* 6% (Solanaceae d0% w11%), *Morus nigra* 6% (Moraceae d0% w11%), *Vassobia breviflora* 4% (Solanaceae d0% w8%), *Rubus rosifolius* 4% (Rosaceae d0% w7%), *Cucumis* sp. 3% (Cucurbitaceae d6% w1%), *Psidium guajava* 3% (Myrtaceae d0% w4%), *Erythroxylum deciduum* 3% (Erythroxylaceae d0% w4%), *Physalis pubescens* 2% (Solanaceae d0% w3%), *Hovenia dulcis* 2% (Rhamnaceae d0% w3%), *Asterostigma lividum* 1% (Araceae d3% w0%), *Vitis* sp 1% (Vitaceae d0% w2%) and *Syagrus romanzoffiana* 1% (Arecaceae d0% w2%)- The following were all recorded in one winter sample only *Casearia decandra* (Flacourtiaceae), *Rubus* sp (Rosaceae), *Solanum maioranthum* and *Solanum pseudoquina* (both Solanaceae). Unidentified seeds accounted for 6% (Vitaceae d8% w5%) Items of human refuse 10% (d9% w10%), were also found in samples suggesting scavenging at rubbish tips. Fruit were considered to be of particular importance for young animals and lactating females.

Ceotto et al (2009) studied the diet of the species in a disturbed rural area in Sumidouro, Rio de Janeiro. As with previous studies they found no difference in diet between sexes. However, unlike in the restinga, the relative frequency of fruit was higher in humid months suggesting generalist usage of a seasonally abundant food item in this humid environment, whilst other food items remained constant throughout the year. The species was found to take less vertebrate prey than sympatric *Philander frenatus*, whilst consumption of fruit and invertebrates was approximately the same in both species. However

D. aurita consumed a wider variety of fruit and whilst the diversity of invertebrates was similar in both species the composition was different, with *Philander* consuming crustacea and mollusca, whilst *D. aurita* took mainly litter-dwelling arthropods. It was suggested that these dietary differences reduce competition and allow for co-existence of the two species. The dietary flexibility and ability to take advantage of seasonally-abundant foodstuffs is likely responsible for its survival capacity in diverse habitats, at least in Brazil.

Cáceres & Monteiro-Filho (2007) examined germination rates of seeds consumed by *Didelphis* opossums in southern Brazil, finding that germination rates of seeds that had passed through opossum guts were similar to those of control groups for thirteen species of pioneer plants, with the exception of *Rubus rosifolius* which required gut passage for germination. Fruits of Solanaceae, Cecropiaceae, Rosaceae, Myrtaceae, Moraceae, Rhamnaceae, Cucurbitaceae, Flacourtiaceae, Passifloraceae, Piperaceae and Araceae are consumed and effectively dispersed by this species (Cunha & Vieira 2005). Cáceres (2003) noted that the consumption of *Solanum sanctaecatharinae* increased greatly when the plant was in fruit in Curitiba, southern Brazil. Grelle & García (1999) noted that the fruits of *Cecropia hololeuca* are consumed from the ground rather than taken directly from the trees.

Fecal samples of two individuals at Poço das Antas, Brazil contained invertebrates from the orders Orthoptera, Arachnida, Coleoptera, Diptera and Hymenoptera, and some unidentified seeds (Carvalho et al 1999). Cáceres (2006) listed the following additional fruits in the diet of this species in Brazil: *Monstera adansonii*, *Philodendron appendiculatum*, *P. corcovadense*, *P. cf imbe* (all Araceae), and *Coussapoa microcarpa* (Cecropiaceae).

Investigating predation of Araceae, Vieira & Izar (1999) noted that 100% (n=60) of seeds of *Anthurium harrisii*, 92% (n=100) of *Philodendron appendiculatum* and 80% (n=40) of *Philodendron corcovadense* collected from the faeces of this species successfully germinated.

Diet in Captivity Astúa de Morães et al (2006) caught individuals at Rio Doce State Park, Minas Gerais, Brazil using ground Tomahawk traps baited with bacon and peanut butter. Astúa de Morães et al. (2003) experimentally tested the proportions of protein, lipid, carbohydrate and fibre in the diet of adults (n=36) and juveniles (n=18) of this species under laboratory conditions. Mean proportions per 100g dry weight of food were: protein ad. 16.28g (+/-8.75), juv. 7.32g (+/-4.63); lipid ad. 5.08g (+/-5.40), juv. 1.53g (+/-1.41); carbohydrate ad. 26.70g (+/-19.38), juv. 10.87g (+/-10.60); fibre ad. 1.94% (+/-0.43), juv. 1.77% (+/-0.41). Santori et al (2004) described and illustrated the gut morphology of this species and associated it with dietary habits, whilst Santori et al (1995) made comparisons with *Philander frenatus*.

REPRODUCTIVE BIOLOGY: Polygynous with males dispersing in order to maximise their mating opportunities with the largely resident females. Passamani (2000) calculated a sex ratio of 1 male to 1.3 females in Espirito Santo, Brazil. Presence of wounds on males during periods of high density suggests they react agonistically to each other when in search of a mate. (Mendel et al 2008).

Seasonality The stimulus for breeding in *Didelphis* is the amount of daylight and acts primarily on the sexual cycle of the female. (Rademaker & Cerquiera 2006).

Females in Curitiba, Brazil had pouched young in August (Cáceres 2003) and a female in Misiones, Argentina had 12 pouched young (CRL=45mm) in November (Mares & Braun 2000). Gentile et al (2000) found breeding to begin in either July or August in Sumidouro, a rural area in Rio de Janeiro State and that from August to January almost all females were engaged in reproductive activity. Last weaning occurred in March. Kajin et al (2008) found reproduction to be seasonal in PN Serra dos Orgãos, Brazil, with breeding beginning in July (mid- dry season) and most females with pouched young in August. By February (end of the wet season) the breeding period was over but females were still lactating. Passamani (2000) noted that 75% of 14 females captured during the rainy season in Espirito Santo had pouched young.

Loretto & Vieira (2005) noted two breeding attempts in any one year in the same region, with the first matings taking place in June and second matings in November. Reproductive success is linked to rainfall and resource availability.

Pregnancy Females began breeding at approximately 170 days old. Mean litter size was 7.33, with a range of 6-10 (n=16). Fecundity was greater in adults than subadults, but increased reproduction was found to reduce survival rate. Generation time was between 231.4 to 469 days. Kajin et al (2008). Passamani (2000) reports litters of 6 to 11 with a mean of 7.4.

Rademaker & Cerquiera (2006) demonstrated that latitude has a positive effect on litter size and the duration of the breeding season (which decreases with latitude) is negatively related to litter size. Gentile et al (2000) found sex ratio of litters to be 1:1, with the greatest mortality of pouched young being at the beginning of lactation.

GENERAL BEHAVIOUR: Activity Levels Predominately nocturnal, terrestrial and scansorial. Cáceres & Monteiro-Filho (2001) found the species most active during the first hours of the night in Curitiba, showing some synchrony with small mammal species that occasionally figure in their diet. Using a spool and line technique in Serra dos Orgãos, Brazil Cunha & Vieira (2005) detected no increase in arboreal behaviour during the wet season when plentiful fruit crops might have been expected to alter the foraging strategy. Juveniles were found to be slightly more arboreal than adults and it was hypothesised that this may be related to their increased vulnerability to ground-based predators. Individuals were observed to reach a maximum height of 20m in the canopy.

Locomotion The species is an excellent climber and able to climb vertical tree-trunks, reversing the hind feet and using the claws to grip. Cunha & Vieira (2002) note that *Didelphis* opossums move on thin limbs even when broader and apparently more stable limbs are available, distributing their weight across all four limbs and using the prehensile tail as a fifth limb.

Delciellos & Vieira (2006) studied arboreal locomotion of this species on horizontal branches in PN Serra dos Orgãos, Rio de Janeiro State, Brazil. A maximum velocity of 2.49 (+/-0.74) x body length/second was recorded on support branches of 10.16cm diameter, and a minimum velocity of 1.95 (+/-0.07) x body length/second was recorded on support branches of 5.08cm diameter. Minimum number of strides per second was 2.22 (+/-0.05) on support branches of 5.08cm and maximum number of stride lengths per second was 2.93 (+/-0.15) on a flat surface. Range of stride length was from 0.82 to 0.95 x body length. Maximum velocity is reached by increasing stride frequency rather than increasing stride length, this likely being related to maintaining the stability of a large animal on a thin branch being of greater importance than final velocity (Delciellos & Vieira 2007).

Delciellos & Vieira (2009) investigated climbing performance of this species on nylon ropes of three diameters 0.6cm, 0.9 and 1.25cm. Respective velocities (stride length x stride frequency) of 0.24 (+/-0.17), 0.36 (+/-0.20) and 0.42 (+/-0.16) were recorded for the three rope diameters. Number of strides per second respectively were 0.80 (+/-0.27), 0.93 (+/-0.19) and 1.01 (+/-0.10) for the three rope diameters. Stride length when related to body length was 0.29 (+/-0.10), 0.38 (+/-0.12) and 0.42 (+/-0.14) respectively.

Home Range Cáceres (2003) studied space use and territoriality in a mark-recapture study in Curitiba, southern Brazil. He noted that territories are established in aggregated patterns with low levels of overlap. Four female individuals were responsible for 68% of the 190 recaptures leading to the conclusion that females hold year-round territories. Males were considered migratory or residents of neighbouring forest patches that only occasionally made incursions into the study area. Home range size of males (2.3-2.7ha) were larger than those of females (0.6-1.7ha). Additionally larger range size was correlated to greater age and body mass in females. Davis (1945) had earlier found that males wander more than females during a study of the species in Teresópolis, Brazil and that individual territories overlap. Greater mobility of males can lead to greater oscillations in their density when compared with females (Mendel et al 2008).

Loretto & Vieira (2005) demonstrated that males used larger areas in a less intensive manner during the breeding season and that females used larger areas less intensively during the dry season than they did during the wet season. They correlated movements of males with reproductive effort whilst movement of females was associated with resource availability.

Vieira & Cunha (2008) found home range size and intensity of use to be correlated to body mass. Female territories were estimated to overlap by 15% in the non-breeding season, but this figure reduced to 6% during the breeding season. Gentile & Cerquiera (1995) performed a mark-recapture study on this species in the Brazilian restinga at Barra de Maricá, Rio de Janeiro State, Brazil. Sampling a 4ha site they found that 61% of movements were less than 60m from the original capture site. They considered the species to be highly mobile with local populations part of a metapopulation with a range not restricted to the sampling area. Gentile et al (2004) correlated population density with litter fall with a 6 to 7 month time lag in Rio de Janeiro, Brazil.

Passamani (2000) calculated that females remained in his trapping area for a mean of 2 months and a maximum of 4 months, with a mean recapture rate of 4.1. Males remained in the trapping area for a mean of 2.3 months with a maximum of five months and a mean recapture rate of 3.2.

Mortality On the B2-277 bordering PN Iguacu in Paraná State, Brazil *D. aurita* and *D. albiventris* represented 16.2% of the mammals hit by cars. (Lima & Obara 2004). The species experiences high mortality whilst in the pouch and shortly after weaning. Life expectancy thus increases after weaning, but declines again through life. Few adults survive more than one breeding season and population turnover is high. (Kajin et al 2008).

Martins et al (2008) found this species in 1 of 12 (8.3%) scats of Puma *Puma concolor* in São Paulo, Brazil. This represented 6% of the relative biomass consumed by in the study area.

Parasites Limardi (2006) notes the following ectoparasites of this species in Brazil: Siphonoptera *Ctenocephalides felis* (Pulicidae). Acari: Metastigmata *Ixodes loricatus*, *Amblyomma striatum* (Ixodidae). Acari: Mesostigmata *Bdellonyssus* sp., *Ornithonyssus wernecki* and *O. brasiliensis* (Macronyssidae). Acari: Astigmata *Didelphiblichus serrifer* (Atopomelidae). Labruna et al (2009) used this species as the host for adult Ixodid ticks *Ixodes luciae* in the laboratory. Horta et al (2007) reported *Ixodes loricatus*, *Amblyomma cajennense* and *A. dubitatum* from specimens in São Paulo and Evans et al (2003) *Ixodes loricatus* from Rio Grande do Sul.

Oliveira et al (2010) recorded the following fleas on this species in the Atlantic Forest of Rio de Janeiro State: *Adoratopsylla (Tritopsylla) intermedia* (Ctenophthalmidae) with a frequency of 97.3%; *Polygenis (Polygenis) occidentalis* (Rhopalopsyllidae) with a frequency of 1.8%; *Ctenocephalides felis* (Pulicidae) with a frequency of 0.9%.

Guimarães et al (1987) experimentally compared this species as a host for mosquitoes against humans and domestic fowl. They found it to be the least preferred of the three hosts, with just 130 records of 2593 total feedings in 299 hours representing feeding on this species. The vast majority of these feedings (125) were diurnal. The following mosquitoes fed on the opossum, in order of numbers of records: *Phoniomyia theobaldi* Lane & Cerquiera 1942 (49); *Phoniomyia pilicauda* (Root 1928) (26); *Limatus durbami* Theobald 1901 (16); *Wyeomyia (Dendromyia) personata* Lutz 1904 (8); *Wyeomyia (Dendromyia) knabi* Lane & Cerquiera 1942 (5); *Trichoprosopon (Rhunchomyia) similis* Lane & Cerquiera 1942 (5); *Trichoprosopon (Rhunchomyia) frontosus* (Theobald 1903) (3); *Trichoprosopon (Trichoprosopon) digitatum* Rondani 1848 (3); *Wyeomyia (Dendromyia) mystes* (Dyar 1942) (3); *Culex (Melanoconion) sp* Theobald 1903 (3); *Wyeomyia (Dendromyia) confusa* (Lutz 1905) (2); *Sabethes (Sabethes) quasicyaneus* Peyassu 1922 (2); *Trichoprosopon (Rhunchomyia) theobaldi* Lane & Cerquiera 1942 (2); *Wyeomyia (Dendromyia) aporonoma* Dyar & Knab 1906 (1); *Trichoprosopon (Rhunchomyia) reversus* Lane & Cerquiera 1942 (1); *Anopheles (Kerteszia) cruzii* Dyar & Knab 1909 (1).

Thatcher (2006) lists the following endoparasites of this species in Brazil: Cestoda *Mathevotaenia bivittata* (Anoplocephalidae). Nematoda *Dracunculus fuelleborni* (Dracunculidae); *Gongylonemoides marsupialis* (Gongylonematidae); *Dipetalonema pricei* (Oncocercidae); *Thominx auritae* (Trichuridae); *Travassostrongylus callis*, *T. orloffi*, *Viannaia viannai*, *V. hamata* and *V. pusilla* (Trichostrongylidae). Acanthocephala *Oligacanthorhynchus microcephala* (Oligacanthorhynchidae). This species is the type host of the nematode *Cruzia tentaculata* (Noronha & Pinto 2006, Adnet et al 2009).

Vicente et al (1997) listed the following nematodes in this species from Brazil: *Acanthocheilonema pricei* (Vaz & Pereira, 1934) Bain, Baker & Chabaud, 1982; *Aspidodera raillieti* Travassos, 1913; *Aspidodera* sp. Travassos, 1945; *Echinocoleus auritae* (Travassos, 1914) Lopez-Neyra, 1947; *Eucoleus fluminensis* (Freitas, 1946) Lopez-Neyra, 1947; *Cruzia tentaculata* (Rud., 1819) Travassos, 1917; *Cruzia* sp. Travassos, 1945; *Dracunculus fuelleborni* Travassos, 1934; *Gnathostoma turgidum* Stossich, 1902; *Gongylonema* sp. Travassos, 1945; *Gongylonemoides marsupialis* (Vaz & Pereira, 1934) Freitas & Lent, 1937; *Heterostrongylus* sp. Travassos, 1925; *Lagochilascaris turgida* (Stossich, 1902) Travassos, 1924; *Longistriata didelphis* (Travassos, 1914) Travassos & Darriba, 1929; *Nematodirus (Mecistocirrus) didelphis* Travassos, 1914; *Turgida turgida* Dujardin, 1845; *Strongyloides* sp. Froes, 1976.

The flagellate protozoan *Tetratrichomonas didelphidis* is found in the intestine, cecum and colon of this species and depends upon *Escherichia coli* as a growth promoting partner. The morphology of this parasite was described by Tasca et al (2001).

Two coccidians have been described from the intestines of this species in Brazil, *Eimeria didelphydis* Carini (1936) and *Eimeria gambai* Carini (1938). Teixeira et al (2007) describe an additional species *Eimeria auritanensis* from Rio de Janeiro and a redescription of *E.gambai*.

Jansen et al (1988) experimentally infected this species with monogenetic insect trypanosomatids *Critibidia deami* Carvalho 1973, *Leptomonas samueli* Carvalho 1973 and *Herpetomonas samuelpeessoai* (Roitman et al 1976) and though they multiplied in the lumen of the scent glands there was no evidence of them invading the tissue of the animal.

Longevity Kajin et al (2008) found the longest lived individual in their nine-year study at PN Serra dos Orgãos, Brazil to have survived 600 days.

Physiology Nogueira et al (1999) describe the penile morphology of this species.

VOCALISATIONS: No information.

HUMAN IMPACT: The species is hunted for sport and food (Hanazaki et al 2009) in some areas of Brazil. Hanazaki et al (2009) describe the mundéu trap used by the Caiçaras tribe of SE Brazil for hunting this species as follows "...the trap) consists of two parallel rows of sticks fixed on the ground in an "U" shape, and a heavy trunk assembled to fall over the animal when it reaches the bait on the bottom of the "U". The traps are used from April to June, but are disassembled in this month because of the belief that the animals are breeding.

As with other *Didelphis* opossums is persecuted for its supposed taste for domestic poultry (though such predation has not been proved in this species - Massoia et al 2006). Limited commercial hunting for the fur trade has little impact on the species.

Moreira (1955) found that when subjected to the cow-pox virus the disease developed normally with an incubation period of five days.

Chaga's Disease The causative agent of Chaga's disease is *Trypanosoma cruzi*, a digenetic kinetoplastid and enzootic parasite of almost 100 mammal species, including humans. Though typically transmitted to humans via the Reduviid bug *Triatoma infestans*, oral infection with the disease does occur and is often associated with acute forms of the disease. This species was first discovered as a host for *Trypanosoma* by Guimarães & Jansen (1943). Roque et al (2008) found that all 5 specimens that they captured tested serologically positive for *Trypanosoma cruzi* in an area of Santa Catarina State, Brazil that had recently suffered an outbreak of Chaga's disease. Parasites were recovered from one of these animals and were of the TC I strain. Marcilli et al (2009) report the presence of the TC I and TC IIb strains in this species.

Carreira et al (1996) performed a histopathological study of the natural and experimental infections of opossums with *T.cruzi* under different conditions. They found infection to be more severe in naturally infected animals, but never as serious as in Chaga's disease. Parasitism of naturally-infected animals predominated in the heart, lungs and oesophagus.

Dean et al (1984) found stages of the life cycle of *Trypanosoma cruzi* that usually corresponded to the intestinal lumen of the insect vector in the lumen of the anal glands of this opossum, showing that the protozoan was performing both the invertebrate and the vertebrate cycle in the opossum. Steindel et al (1988) found the protozoan in the anal glands of this species in Santa Catarina and suggested that contact with anal secretions may also be an important source of infection in areas where Triatomine bugs are scarce. Deane & Jansen (1986) noted the presence of an unidentified *Trypanosoma* that was neither *T.cruzi* or *T.rangeli* in the anal glands of specimens from Rio de Janeiro state. Jansen et al (1994) found no evidence of transmission between mothers and their young, in fact concluding that maternal antibodies confer partial protection to the offspring. Didelphids are born without antibodies which are conferred to them by the mother during suckling (Hindes & Mizell 1976).

Santos et al (2005) reported colonies of *Triatoma vitticeps* infected with *Trypanosoma cruzi* associated with nests of this opossum in Espírito Santo. However *T.vitticeps* is considered a poor vector of Chaga's disease as it does not defecate after feeding (Gonçalves et al 1988).

Rickettsia Fevers *Rickettsia* is a genus of non-motile spore-forming bacteria carried by ticks, fleas and lice and responsible for a variety of sometimes serious diseases in humans. Horta et al (2007) found ticks infected with *Rickettsia belli* associated with this opossum in São Paulo, Brazil, but this exhibits low pathogenicity in humans. Antibodies against *R.parkeri* and *R.rickettsii* were also present in some animals and

these have more serious consequences for human health, the former causing American Tick Bite Fever and the latter Rocky Mountain Spotted Fever.

Leishmaniasis Yoshida et al (1993) isolated and described the parasitic protozoa *Leishmania forattinii* from the liver and spleen of this species. This species is one of the potential causal agents of leishmaniasis in humans. However *D.aurita* does not appear to be an important transmitter of leishmaniasis. Aguiar et al (1986) offered the species as bait for the capture of *Lutzomyia* sand flies (vectors for *Leishmania*) and achieved lower capture rates for the opossum at different levels (n=1059 at ground level, n=96 at canopy level) of the forest than for either humans or chicken when used as bait: opossum (3% at ground level, 8% at canopy level); humans (89% ground, 42% canopy) or chickens (8% ground, 50% canopy).

CONSERVATION STATUS: Globally considered to be of Low Risk Least Concern by the IUCN, see <http://www.iucnredlist.org/details/40500> for their latest assessment of the species because of its wide distribution, occurrence in protected areas and large population. The Centro de Datos de Conservación in Paraguay consider the species to be in danger in Paraguay giving it the code **N2**. In Paraguay the distribution is confined to remaining patches of Atlantic Forest in a relatively small area of the north-central and northeastern Orient. Fragmentation of the Atlantic Forest has been severe in this area and the species has undoubtedly declined as a result. It is considerably less numerous than the related *Didelphis albiventris* (which replaces it) and it does not tolerate the same degree of human disturbance of its habitat - though it apparently does so in Brazil in areas where *D.albiventris* does not occur. Typically the two species do not occur together and where they do this species is found in denser, more forested habitat, whilst *D.albiventris* is in more open and disturbed areas. Mendel et al (2008) found that the population density of females depends to some extent on litterfall and the associated macroarthropods that occur within it, with a delay of 6 to 7 months after the initial fall during which time the arthropod and hence opossum populations respond to the increased litter levels. The species is probably of national conservation concern given its dependence on undisturbed forest and the rapid expansion of *Didelphis albiventris* into perturbed areas.

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