



# BROWN FOUR-EYED OPOSSUM

*Metachirus nudicaudatus*

(E. Geoffroy St-Hilaire, 1803)



**FIGURE 1** - Adult, Brazil (Nilton Caceres undated).

**TAXONOMY:** Class Mammalia; Subclass Theria; Infraclass Metatheria; Magnorder Ameridelphia; Order Didelphimorphia; Family Didelphidae; Subfamily Didelphinae; Tribe Metachirini (Myers et al 2006). A single species is recognised in this genus, defined by Burmeister in 1854. The generic name is Greek meaning “behind the hand or before the hand”, the specific name *nudicaudatus* is taken from the Latin meaning “naked tail”. Gardner (2007) recognised five subspecies, that present in Paraguay being *M.n.modestus* O.Thomas (1923). However the species is in need of revision and one or more of the subspecies may in fact be separate species (Gardner 2007).

There has been considerable debate as to which generic name should take precedence for this species. Pine (1973) argued that the colour description provided by Tiedemann (1808) in his description of *Philander* referred to the pouchless Brown Four-eyed Opossum and that *Metachirops* Matschie 1916 is the correct designation for the “Grey Four-eyed Opossums”. This was based on the mistaken belief that

*Philander* Brisson, (1762) was non-Linnean and therefore unavailable. Hershkovitz (1976) argued that the current use of *Philander* and *Metachirus* is correct and has been followed by most authors ever since. Synonyms adapted from Gardner (2007):

*Didelphis nudicaudata* Geoffroy St-Hilaire 1803:142. Type locality "Cayenne" French Guyana.

*Didelphis myosuuros* Temminck 1824:38. Type locality "Brésil", restricted to Ipanema, São Paulo by Pohle (1927).

*Didelphis nudicauda* Lesson 1827:212. Incorrect spelling.

*Philander nudicaudus* Gray 1843:100. Name combination and incorrect spelling.

*Didelphys* [*Metachirus*] *myosuurus* Burmeister 1854:135. Name combination and incorrect spelling.

*Cuica myosuuros* Liais 1872:330. Name combination.

[*Didelphys* (*Metachirus*)] *nudicaudata* Trouessart 1898:1236. Name combination.

*Metachirus tschudii* JA Allen 1900:195. Type locality "Guayabamba" Amazonas, Peru.

*Metachirus bolivianus* JA Allen 1901:412. Name combination.

*Metachirus nudicaudata* Bertoni 1914:69. Incorrect gender.

[*Didelphis* (*Metachirus*)] *tschudii* Matschie 1916:268. Name combination.

[*Didelphis* (*Metachirus*)] *bolivianus* Matschie 1916:268. Name combination.

[*Didelphis* (*Metachirus*)] *colombianus* Matschie 1916:268. Name combination.

[*Didelphis* (*Metachirus*)] *phaeurus* Matschie 1916:268. Name combination.

*Lutreolina nudicaudata* Bertoni 1939:6. Name combination.

[*Philander*] *nudicaudatus* Pine 1973:391. Name combination.

**ENGLISH COMMON NAMES:** Brown Four-eyed Opossum (Nowak 1991, Redford & Eisenberg 1992, Wilson & Cole 2000); Rat-tailed Opossum (Cimardi 1996).

**SPANISH COMMON NAMES:** Comadreja de anteojos (Massoia et al 2001); Cuica común (Emmons 1999, Redford & Eisenberg 1992); Zarigüeya de cuatro ojos marrón (Emmons 1999); Comadreja de cuatro ojos marrón (Massoia et al 2001); Guayquica amarilla (Massoia et al 2001), Cuica cola de rata, Guaiquica amarilla, Cuica amarilla, Cuica amarillenta, Guaquica (sic) amarillenta (Massoia et al (2006).

**GUARANÍ COMMON NAMES:** Yupatí (Massoia et al 2001), Guakí, Anguyá-guakí (Massoia et al 2006).

**DESCRIPTION:** Though this species bears a close physical resemblance to *Philander* the two genera are not closely related. Slender with a long, conical snout and short, dense, silky pelage. Dorsally they are brownish with a cinnamon tinge and sometimes with a darker wash to the rump. Some individuals are more grey-brown with a cinnamon-orange tinge to the sides. Ventrally they are whitish or pale cream, extending up to the cheeks and being sharply demarcated from the dorsal colouration laterally. Head boldly-marked, dark blackish-brown with a small creamy-white patch above each eye and a larger creamy-white patch above each ear. Ears dark brown. Tail long and mostly naked, being furred only for the basal 5-25mm and greyish in colouration with only sparse hairs along its length. The large feet are pinkish. Scrotum pink in males. The marsupium is lacking in females, though indistinct lateral folds in the abdomen may be present. Females possess a mean of 9 mammae, arranged in two rows of four with a median teat between them (4-1-4).

**CRANIAL CHARACTERISTICS:** Skull is narrow and slender. Older individuals with elevated supraorbital ridges extending posteriorly to the parietals but not meeting along the midline. Palate with large and conspicuous maxillopalatine fenestrae. Maxillary and palatine fenestrae are absent. Bullae small, widely-separated and incompletely ossified.

Mares & Braun (2000) give the following measurements for two males from Misiones, Argentina: *Greatest Skull Length* 58.7mm, 58mm; *Condylbasal Length* 54.6mm, 53.5mm; *Interorbital Width* 9.7mm, 9.8mm; *Zygomatic Width* 31.4mm, 30.6mm; *Width of Braincase* 18.5mm, 18.5mm; *Palate Length* 32.2mm, 31.5mm; *Length of Nasals* 28.5mm, 28mm; *Width of Rostrum* 9.6mm, 9.7mm; *Mandibular Length* 45.1mm, 43.3mm.

The following mean post-cranial measurements were noted by Carvalho et al (2000) for Brazilian specimens (n=3): *Ulna* 35.4mm; *Forearm* 40.8mm; *Humerus* 35.2mm; *Tibia* 49mm; *Foreleg* 50.3mm; *Femur* 39.3mm.

Sanchez-Villagra (2002) notes that the subarcuate fossa in this species is relatively smaller than in Old World marsupials of similar size. For three specimens of skull size 26.88mm (+/-0.89) the subarcuate fossa volume was 7.97 $\mu$ l (+/-0.93).

**DENTAL CHARACTERISTICS:** I5/4 C1/1 P 3/3 M 4/4 = 50. Upper P1 about half the size of P2. Upper canines well-developed, though they are less than twice the height of P3. Molar series fairly long. Mares & Braun (2000) give the following measurements for two males from Misiones, Argentina: *Length of Upper Tooth Row* 24.6mm, 24mm.

**GENETIC CHARACTERISTICS:** 2n=14. FN=20. Six autosome pairs: three large submetacentric pairs (1-3), one pair of medium metacentric chromosomes (4) and two smaller acrocentric or subtelocentric pairs (5 and 6). X chromosome small. Y chromosome heterochromatic and approximately a quarter of the size of autosome 6 (Svartman & Vianna-Morgante 1999)

**TRACKS AND SIGNS:** No information.

**EXTERNAL MEASUREMENTS:** A large and robust, cat-like Didelphid, with tail slightly longer than the head and body (c118% HB length). Males are slightly larger than females. **HB:** Male 23.39cm (17-30cm), Female 22.29cm (15-26.5cm); **TA:** Male 30.77cm (22.7-37.3cm), Female 29.8cm (17.8-36.3cm); **FT:** Male 4.37cm (3.5-5.2cm), Female 4.14cm (3.4-4.7cm); **EA:** Male 3.54cm (2.8-4cm), Female 3.57cm (3.1-4.3cm); **WT:** Male 281.5g (102-480g), 235.9g (91-345g). (Eisenberg & Redford 1999).

Unsexed sample **TL:** 57cm (46.9-63.8cm); **HB:** 26.17cm (21-33cm); **TA:** 30.84cm (24.2-39.5cm); **FT:** 4.41cm (3.9-5.2cm); **EA:** 2.96cm (2.2-3.9cm); **WT:** 225.56g (91-630g). (Massoia et al 2001, Emmons 1999, Redford & Eisenberg 1992). Crouzeilles et al (2010) give a **WT:** 358g (+/124) for 21 individuals.

Mares & Braun (2000) give the following measurements for two males from Misiones, Argentina: **TL:** 57.2cm, 56.9cm; **HB:** 24.5cm, 24.7cm; **TA:** 32.7cm, 32.2cm; **FT:** 4.6cm, 4.1cm; **EA:** 3.5cm, 3.2cm.

**SIMILAR SPECIES:** The only other species to share the "eyes" of *Metachirus* is *Philander frenatus*, which is most easily distinguished by its dark greyish, not brown pelage. When viewed frontally note that the white spots above the eyes are smaller and more widely-spaced in this species. The second pair of "eyes" are much more extensive and located behind the ears, those of *Philander* being reduced and located in front of the ears. Note that the ears of this species are entirely dark, as opposed to pale pinkish in *Philander*. The tail of *Philander* is proportionately shorter and furred at the base for the first 6 to 8 cm, as well as being bicoloured with a clearly demarcated tip - that of this species is naked to the base and either uniformly coloured or becoming gradually paler along its length. Structurally the snout is more pointed and the legs are longer in this species. Note also that female *Metachirus* do not possess a pouch, whilst those of *Philander* do.

**DISTRIBUTION:** Widely distributed from Nicaragua south to Paraguay and northern Argentina. In Argentina the species is known only from the departments of Iguazú and Montecarlo in northeastern Provincia Misiones, with a possible record from Belgrano (Chebez 2009, Massoia et al 2006), with a disjunct (and possibly erroneous) record from Provincia Formosa reported by Brown (2004). In Bolivia Anderson (1997) lists the subspecies *M.n.bolivianus* from Departamentos Pando, La Paz, Beni, Cochabamba and Santa Cruz. In Brazil the species is apparently absent from much of the central region, but there are records from the States of Acre, Amazonas, Bahía, Distrito Federal, Espírito Santo, Mato Grosso, Minas Gerais, Pará, Pernambuco, Rio de Janeiro, Rondônia, São Paulo, Santa Catarina and Sergipe (Brown 2004, Pinto et al 2009 **ADD MORE REFERENCES HERE!**)

In Paraguay it is found only in the Oriental region and is absent from the Chaco. Brown (2004) listed the following specimens from Paraguay Departamento San Pedro; Aca Poi (Wharton, 1950, USNM); Tacuati, Aca Poi, S bank Rio Ypané (Wharton, 1950, USNM); Departamento Caaguazú; Caaguazú. Summerfield Colony no. 1 1 (Wharton, 1953, USNM); Departamento Paraguari; Parque Nacional Ybycuí (Myers, 1978, UMMZ); Departamento Canendiyú; Curuguaty (Myers, 1978, UMMZ).



**HABITAT:** Generally in forested habitats, including secondary growth, edge habitats and low stature forest. In Minais Gerais, Brazil they were found in all forest types (Redford & Eisenberg 1992). Nowak (1991) states that the species occurs in dense forests and thickets in open, brushy country, but Emmons (1999) notes that they prefer mature forest with an open undergrowth. Moura et al (2005) found that 70% of specimens tracked avoided areas with dense canopy cover. Most specimens in Venezuela were trapped on the ground near streams (Nowak 1991). Stevens & Husband (1998) did not find the species within 80m of forest edge in the Brazilian Atlantic Forest, but Pires et al (2005) found no preference for forest interior over forest edge in a highly fragmented landscape in Rio de Janeiro State, Brazil. Pires et al (2002) stated that the species frequently moves between forest fragments with 10% of 22 recaptures showing evidence of interfragmentary movements and all movements being performed by males.

**ALIMENTATION:** Omnivorous, consuming fruits, small vertebrates, birds eggs and invertebrates (Redford & Eisenberg 1992). This species is principally terrestrial and this is reflected in the diet.

**Foraging Behaviour and Diet** Cáceres (2004) studied fecal samples of 44 trapped individuals in southern Brazil and found the species to be principally insectivorous. Invertebrate remains were present in 100% of samples, composed of the following frequencies: Coleoptera 68%, Opiliones 64%, Diplopoda 50%, Hymenoptera (Formicidae) 39%, Orthoptera 23%, Blattaria 23%, Decapoda 14%, Lepidoptera larvae 7% and Pulmonata 5%. Vertebrate remains occurred in just 9% of samples, principally birds 5%, mammals 2% and reptiles 2%. Fruit remains were found in 7% of samples: *Anthurium* sp. 2%, *Philodendron* sp. 2% (both Araceae) and *Nidularium* sp. 2% (Bromeliaceae).

In Rio de Janeiro State, Brazil Carvalho et al (1999) found Hymenoptera, Arachnida and termites in 75% of all fecal samples, Coleoptera in 50% of samples and Hemiptera and Diplopoda in 25% (n=4). Seeds were also present, notably those of *Cecropia* sp. The presence of seeds represents frugivory rather than granivory and Cáceres (2004) considered the species an occasional seed dispersers of certain plant species. Of the fruit seeds found in fecal samples by Cáceres (2004) the following percentage germination rate was recorded *Anthurium* sp. 88%, *Philodendron* sp. 22% and *Nidularium* sp. 77%.

Santori et al (1995) studied fecal samples from the restinga of Brazil and considered the species principally insectivorous with a preference for Blattaria, Coleoptera, termites and ants, the latter apparently being taken opportunistically as no sign of nest remains were found in stomachs. Of 19 fecal samples 84.2% contained invertebrates, 26.3% contained vertebrate remains and 10.3% contained seeds. Of the six fecal samples containing vertebrate remains, one contained unidentified mammal remains and five contained reptiles (3 containing the Tropidurid lizard *Tropidurus torquatus*, 1 a species of Skink *Mabuya* sp. and the other an unidentified reptile). In order of prevalence the following invertebrate groups were found in samples: Blattaria 94.7%, Hymenoptera (Formicidae) 78.9%, Coleoptera 73.7%, Isoptera 68.4%, Arachnida 15.8% and Orthoptera 15.8%. The remaining groups were all present in one sample, representing 5.3% of the total sample: Diptera pupae, Hemiptera, Unidentified Hymenoptera, Myriapoda and Diplopoda. The presence of Dipteran pupae was considered a possible indication of scavenging behaviour. Seeds were found in three samples, two were unidentifiable, the third belonged to *Pilosocereus* sp. (Cactaceae).

**Diet in Captivity** Cáceres (2004) and Morães Junior (2004) trapped animals in wire traps in southern Brazil using banana and cod liver oil as bait. Crouzeilles et al (2010) used banana, oats, peanut butter and bacon as bait.

Astúa de Morães et al. 2003 experimentally tested the proportions of protein, lipid, carbohydrate and fibre in the diet of adults (n=22) and juveniles (n=4) of this species under laboratory conditions. Mean proportions per 100g dry weight of food were: protein ad. 8.74g (+/-4.86), juv. 6.53g (+/-1.52); lipid ad. 1.91g (+/-2.30), juv. 1.04g (+/-0.07); carbohydrate ad. 12.88g (+/-10.27), juv. 3.40g (+/-1.99); fibre ad. 1.96% (+/-0.90), juv. 1.23% (+/-0.44). Santori et al (2004) described and illustrated the gut morphology of this species and associated it with dietary habits.

**REPRODUCTIVE BIOLOGY:** Limited data available, but apparently polyestrous.

**Seasonality** Crouzeilles et al (2010) captured females with young in February, April, June, November and December (n=7) in Rio de Janeiro State, and lactating females in April, June and October (n=4). Juveniles were captured in April, June and November. Breeding occurs in November in Central America. Díaz & Flores (2008) report two subadult females (dental age class 5, mass 260 and 280g) in

reproductive condition in Amazonian Peru, one in February and one in June and both with 9 pouched young (crown-rump length 18 and 20mm).

**Pregnancy** Litter size ranges from 1 to 9 with a mean of 5.

**Development** Juveniles are carried on the mothers back until able to stand alone (Redford & Eisenberg 1992, Nowak 1991).

**GENERAL BEHAVIOUR: Activity Levels** Typically solitary, terrestrial and nocturnal in behaviour. An individual radio-tracked in Rio de Janeiro, Brazil was exclusively nocturnal in behaviour, presenting activity peaks between 20.00h and 23.00h and with activity tailing off after 02.00h. (Morães Junior 2004). Cunha & Vieira (2002) used a spool and line technique to follow 19 individuals of this species in PN Serra dos Orgãos, Brazil and found that only one individual moved above and only once to a height of just 1m in over 3200m of paths followed. Emmons (1999) describes the species as furtive and shy and extremely difficult to observe because of their propensity to flee at the slightest disturbance. However she notes that the species seems to be more active and easier to see after rain.

Crouzeilles et al (2010) noted that the species numbers peaked in wetter years during their long term mark-recapture study, similar to patterns found earlier by Gentile et al (2004), Fonseca & Kierluff (1989) and Bergallo (1994).

**Locomotion** Agile on the ground, they have powerful hindquarters that enable them to run rapidly. 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 2.88 (+/-0.22) x body length/second was recorded on support branches of 5.08cm diameter, and a minimum velocity of 2.21 (+/-0.15) x body length/second was recorded on support branches of 2.54cm diameter. Minimum number of strides per second was 2.96 (+/-0.16) on support branches of 2.54cm and maximum number of stride lengths per second was 3.65 (+/-0.15) on support branches of 5.08cm diameter. Range of stride length was from 0.75 to 0.85 x body length.

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 0.14 (+/-0.06), 0.30 (+/-0.20) and 0.39 (+/-0.39) were recorded for the three rope diameters. Number of strides per second respectively were 0.85 (+/-0.33), 0.97 (+/-0.47) and 1.09 (+/-0.64) for the three rope diameters. Stride length when related to body length was 0.18 (+/-0.09), 0.29 (+/-0.09) and 0.32 (+/-0.11) respectively.

**Home Range** A female radio-tracked in Rio de Janeiro, Brazil for three nights during November 2001 covered a home range of 8.4ha, moving a mean of 549.9m (+/-49.5m) per night (Morães Junior 2004). Vieira & Cunha (2008) found home range size and intensity of use to be correlated to body mass. 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 71.8% of movements were within the range 41-200m 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 recruitment in Rio de Janeiro, Brazil. Population density near Manaus, Brazil was estimated at 25.6/km<sup>2</sup>.

**Refuges** Loretto et al (2005) noted that the thirteen nests found during their trapping study were located on the ground in areas of undisturbed forest with deep litter layer and tall trees. Nests were spherical and built on the forest floor or between tree roots using leaves interwoven with roots. Entrance to nests were concealed but measured 10 x 10cm. Nest sites appear to be changed at least every two months.

**Defensive Behaviour** When disturbed runs rapidly and silently away across the forest floor (Emmons 1999). Loretto et al (2005) noted that all animals disturbed at the nest chose to run away, except for a female bearing young who gnashed the teeth, made clicking noises and hissed at the intruder. The individual raised itself up and down against the roof of the nest creating a pulsating movement of an area of leaves much larger than the animal itself. They hypothesised that this defensive behaviour was exhibited only by females bearing young because of the risks associated with losing young when running rapidly through the forest. Morães Junior (2004) also stated that an animal disturbed at the nest grunted and gnashed its teeth but did not mention the reproductive condition of the animal. Considered the most

aggressive opossum species by Enders (1935), who noted that an individual shipped live with a *Philander* of similar size totally dominated the other animal so that it showed signs of "being bitten severely about the head and neck" and was "totally cowed", whilst the *Metachirus* was unmarked. However Kirsh (1977) stated quite the opposite and described the species as almost quiet when handled.

**Mortality** Husson (1978) reports the species as being preyed upon by *Asio clamator* in Surinam. An individual hit by a car in PN Iguazú, Misiones, Argentina was found on 23 October 1994 (Massoia et al 2006).

**Parasites** Limardi (2006) listed the following ectoparasites from Brazilian specimens: Siphonoptera *Adoratopsylla sinuata* (Ctenophthalmidae). Acari: Astigmata *Didelphoecius validus* and *Metachiroecius brasiliensis* (Atopomelidae).

Oliveira et al (2010) recorded the flea *Adoratopsylla (Tritopsylla) intermedia* (Ctenophthalmidae) on this species in the Atlantic Forest of Rio de Janeiro State.

Vicente et al (1997) listed the following nematodes in this species from Brazil: *Aspidodera subulata* (Molin, 1860) Railliet & Henry, 1912; *Cruzia tentaculata* (Rud., 1819) Travassos, 1917; *Physaloptera mirandai* Lent & Freitas, 1937; *Travassostrongylus quator* Freitas, 1937; *Travassostrongylus quintus* Freitas, 1937; *Travassostrongylus sextus* Freitas, 1937; *Travassostrongylus tertius* Travassos, 1935; *Viannaia conspicua* Travassos, 1914; *Viannaia pusilla* Travassos, 1914.

Thatcher (2006) noted the following endoparasites in Brazil: Trematoda *Podospthalium pedatum* (Alariidae). Cestoda *Linstonia iberingi* and *Mathevotaenia bivittata* (Anoplocephalidae). Nematoda *Aspidodera subulata* (Aspidoderidae); *Cruzia tentaculata* (Cruziidae); *Physaloptera mirandai* (Physalopteridae); *Travassostrongylus orloffi*, *T.tertius* and *Viannaia pusilla* (Trichostrongylidae). Acanthocephala *Gigantorhynchus ortizi* (Gigantorhynchidae).

**Longevity** Maximum lifespan is estimated at 3 to 4 years (Hunsaker 1977).

**Physiology** Nogueira et al (1999) describe the penile morphology of this species. The genus has peculiar morphological characteristics (the length of the urethral grooves, the insertion of Levator muscles, and accessory structures derived from the corpora spongiosa= glans folds) which make it quite distinct from other Neotropical Didelphids.

**VOCALISATIONS:** Typically silent but threatened individuals grunt and gnash the teeth (Emmons 1999, Morães Junior 2004).

**HUMAN IMPACT:** Occasional damage to fruit crops and cornfields has led to them receiving a bad reputation in parts of their range where they are more abundant (Nowak 1991). In Paraguay this species is rarely encountered and interviews with locals performed by Lowen et al (1996) failed to find any reference to the species. Its human impact in Paraguay is therefore minimal.

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. Marcilli et al (2009) report the presence of the TC I strain in this species.

**CONSERVATION STATUS:** Globally considered to be of Low Risk Least Concern by the IUCN, see <http://www.iucnredlist.org/search/details.php/40509/all> for the latest assessment of the species. This species occurs in naturally low populations and is easily overlooked as a result of its furtive habits. It is likely under-recorded in Paraguay but has no doubt disappeared from large areas of its former range as a result of conversion of forest to agriculture. Flores (2006) states that in Argentina the species is only found in undisturbed areas and classifies it as potentially vulnerable in that country. A similar conservation designation in Paraguay would seem correct.

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**FIGURE 2 - Brown Four-eyed Opossum *Metachirus nudicaudatus*.** Adult. Bolivia. Photo Lousie Emmons.

**FIGURE 3 - Brown Four-eyed Opossum *Metachirus nudicaudatus*.** Adult head detail. Bolivia. Photo Lousie Emmons.