CHACO FAT-TAILED OPOSSUM

Thylamys pusillus (Desmarest, 1804)

FIGURE 1 - Adult, Bolivia (Louise Emmons).

TAXONOMY: Class Mammalia; Subclass Theria; Infraclass Metatheria; Magnorder Ameridelphia; Order Didelphimorphia; Family Didelphidae; Subfamily Thylamyinae; Tribe Thylamyini (Myers et al 2006, Gardner 2007). The genus *Thylamys* was defined by Gray, 1843 and Palma et al (2002) concluded that the genus was differentiated during the Pleistocene. The species currently recognised as *Thylamys* correspond roughly to the "*elegans*-group" as defined in the monograph by Tate (1933). There are nine known species according to the latest revision (Gardner 2007) two of which are present in Paraguay. The genus *Thylamys* is from the Greek meaning "pouched mouse". The species name *pusillus* is Latin meaning "very small or tiny" (Braun & Mares 1995). The species is monotypic, though Gardner (2007) notes that the taxon requires revision. No holotype was designated (Brown 2004).

The species was described by Desmarest (1804) as *Didelphis pusilla,* based on de Azara´s (1801: 290) account of two males which he called "Micouré´ sixième, ou Micouré nain" and with type locality "Saint Ignace-Gouazou". Tate (1933) restricted this to San Ignacio Guazú, Departamento Misiones, Paraguay. De

Azara´s original description was vague and fails to conclusively identify this species based on our current knowledge of Didelphids. He described his sixth opossum as small but coloured like the fourth opossum (now associated with *Thylamys macrurus*). However the name has also been applied to other taxa. Thomas (1888) ignored Azara´s reference to greyish pelage and associated the name with the composite reddish opossums today known as *Gracilinanus microtarsus* (Wagner 1842) and *Cryptonanus guahybae* (Tate 1931).

Thomas (1900) later recognised *Marmosa microtarsus* (Wagner) and *Marmosa pusilla* (Desmarest) as separate species, but applied the latter to the species today known as *Gracilinanus agilis* (Burmeister 1854). Tate (1933) used the name *Marmosa marmota verax* in the same sense that *Thylamys pusillus* is used here and his *Marmosa pusilla* appears to be based at least in part on this species. From this point on Desmarest´s name became associated with the genus *Thylamys*. Cabrera (1958) included *Marmosa marmota* as a synonym of *Marmosa grisea* (Bertoni 1914) =*Thylamys macrurus*. To further complicate matters O.Thomas (1896) used *Marmosa marmota* for material from Corrientes, Argentina which included an immature individual which he had previously described as "*Micoureus griseus* Desmarest 1827". He later received more material from the same location that he initially attributed to *Marmosa marmota,* but then later used as the basis of his *Marmosa citella* which is now considered a junior synonym of *Marmosa marmota,* in turn a junior synonym of *Thylamys pusillus*. Hershkovitz (1959) considered the species to be conspecific with *Thylamys macrurus* under the name *Marmosa pusilla*.

Of note is that the type locality given by Desmarest is in eastern Paraguay where this species apparently does not occur, or at least where it has never been conclusively recorded. This raises the possibility that the name has been erroneously applied to the Chaco *Thylamys* now known as *pusillus*, or that the species does or did occur east of the Paraguay, but has yet to be recorded there. However based on current knowledge of the biogeography of the genus the latter explanation would seem less likely than the former. Should Hershkovitz (1959) be correct in that Azara´s fourth and sixth opossums refer to the same species and that species is the *Thylamys* that inhabits the Oriental region of Paraguay, then the correct name for what is today known as *T.macrurus* would in fact be *T.pusillus*, and the Chaco form would require renaming from one of the subjective synonyms (eg *verax* Thomas, 1921). Envisioning the nomenclatural chaos that this would cause, Voss et al (2009) designated a neotype, an adult male specimen in the Museum of Vertebrate Zoology (MVZ 144311), consisting of a skin and skull collected by Philip Myers (original number 800) near the Trans-Chaco highway 460 km NW of Villa Hayes in Departamento Boquerón, Paraguay, on 7 April 1973.

Palma et al (2002) concluded from their molecular analysis that this species was derived from the more primitive *Thylamys macrurus* following a migration of that species across the Rio Paraguay. Synonyms adapted from Gardner (2007):

Didelphis pusilla Desmarest 1804:19. Based on de Azara (1801). Type locality "Saint Ignace-Gouazou" =San Ignacio Guazu, Departamento Misiones, Paraguay.
[*Didelphys*] *nana* Illiger 1815:107. Nomen nudum.
Didelphys nana Oken 1816:1140. Name unavailable.
[*D*]*idelphys. nana* Olfers 1818:206. Based on Desmarest (1804).
Sarigua pusilla Muirhead 1819:29. Name combination.
Didelphys [(*Grymaeomys*)] *pusilla* Burmeister 1854:140. Name combination.
Philander pusillus Cope 1889:130. Name combination.
Micoureus pusillus Ihering 1894:11. Name combination.
Micoureus griseus O.Thomas 1894:184. Not *Didelphis grisea* Desmarest (1827) and later redescribed as *Marmosa citella* O.Thomas (1912).
M[*armosa*]. *pusilla* O.Thomas 1896:314. Name combination.
Marmosa marmota O.Thomas 1896:313-314. Based on *Didelphys marmota* Oken (1816) but indication to O.Thomas (1894).
[*Didelphys* (*Marmosa*)] *pusilla* Trouessart 1898:1240. Name combination.
Marmosa citella O.Thomas 1912:409. Type locality "Goya, Corrientes, Argentina" =*Micoureus griseus.*
[*Didelphis* (*Thylamys*)] *citella* Matschie 1916:271. Name combination.
[*Marmosa* (*Marmosa*)] *pusilla* Cabrera 1919:38. Name combination.
[*Marmosa* (*Thylamys*)] *citella* Cabrera 1919:40. Name combination.
[*Marmosa* (*Thylamys*)] *marmota* Cabrera 1919:40. Name combination.

Marmosa verax O.Thomas 1921:520. Type locality "Mission west of Concepción, Paraguay"
Marmosa marmota verax Tate 1933:220. Name combination.
Marmosa janetta pulchella Cabrera 1934:126. Type locality "Robles, Santiago del Estero, Argentina"
[*Marmosa* (*Thylamys*)] *pusilla* Cabrera 1958:32. Name combination.
M[*armosa*]. *pusilla verax* Wetzel & Lovett 1974:206.Name combination.
[*Thylamys*] *pusillus* Reig, Kirsch & Marshall 1987:7. First use of modern name.
Thylamys pusilla Brown 2004:193. Incorrect gender.

ENGLISH COMMON NAMES: Chaco Fat-tailed Opossum, Chacoan Thylamys (Gardner 2007), Common Fat-tailed Mouse Opossum (IUCN 2009), Small Fat-tailed Mouse Opossum (IUCN 2009), Common Mouse Opossum (Canevari & Vaccaro 2007), Small Fat-tailed Opossum (Wilson & Cole 2000, Canevari & Vaccaro 2007).

SPANISH COMMON NAMES: Marmosa común (Massoia et al 2000, Redford & Eisenberg 1992), Comadrejita enana (Chebez 1996, Massoia et al 2000), Comadreja enana (IUCN 2009), Comadrejita común (Canevari & Vaccaro 2007), Comadrejita enana común (Canevari & Vaccaro 2007).

GUARANÍ COMMON NAMES: Anguyá guakí (Massoia et al 2000, Canevari & Vaccaro 2007).

DESCRIPTION: A small mouse opossum with short, dense, smooth fur. This species is similar in external appearance to *Thylamys macrurus* and is best separated by body and tail measurements. Dorsally they are darkest, being greyish-brown, fading to light grey on the flanks. Darker dorsal colouration extends down the centre of the head as a medial line. Ventrally they are creamy-white or pure white with self-coloured hair bases. Eyes large, surrounded by a poorly-defined narrow black patch that extends only slightly in front of the eye and onto the cheeks. Ears large, naked and reddish-brown in colour. Tail prehensile and 14-16% longer than head and body length. It appears essentially naked without magnification. Colour brownish-grey on the dorsal side basally, greyish distally and pale greyish on the ventral side for its entire length and lacks a whitish tip. Tail scales are tiny, rounded or square in shape and arranged in rings with three hairs pair scale. The prehensile tip lacks hairs. Fat is stored in the tail and some degree of incrassination is usually visible throughout the year. Limbs are grey dorsally and whitish ventrally, those of the forelimbs paler dorsally. Feet are small and white with ungual tufts and short digits. The toes are long with short claws that do not extend beyond the apical pads of the forefeet, but are slightly longer on the hindfeet. Six separate pads are present on each foot, with large granules and dermatoglyphs on the palmar and plantar surfaces. Females lack a marsupium and have bilaterally symmetrical rows of 15 teats, most inguinal in position with two pectoral pairs. (Canevari & Vaccaro 2007, Carmignotto & Monfort 2006, Solari 2003, Voss et al 2009).

CRANIAL CHARACTERISTICS: Skull robust, with broad zygomatic arch and slender rostrum (average ratio of zygomatic breadth to condylobasal length x 100 is about 55%–56%). Brain case moderately broad. Nasals long and rounded posteriorly. They show slight expansion at the maxillo-frontal suture, narrowing slightly behind it and the lateral margins are subparallel. Supraorbital crests well-developed and postorbital constriction is pronounced. Palate long. Posterolateral palatal foramina are large and exceed the lingual apices of the protocones of M4. Tympanic bullae well-developed, but small in comparison to other species.

Voss et al (2009) provide the following measurements for a sexed sample of 18 males and 15 females (unless stated) from Paraguay and Bolivia: *Condylobasal Length* male 26.6mm (+/-1) female 26.5mm (+/-1.2); *Greatest Zygomatic Width* male 15mm (+/-0.6) female 15.2mm (+/-0.9, n=14); *Width of Nasals:* male 2.3mm (+/-0.3) female 2.4mm (+/-0.3); *Palate Length:* male 14.3mm (+/-0.5) female 14.2mm (+/-0.6); *Palate Width:* male 8.5mm (+/-0.3) female 8.6mm (+/-0.3); *Interorbital Constriction:* male 4mm (+/-0.2) female 4.1mm (+/-0.2).

Carmignotto & Monfort (2006) give the following measurements for 7 specimens (6 males, 1 female) from Paraguay without distinguishing between the sexes. This sample includes some of those specimens cited by Voss et al (2009) above: *Basal Length:* 26.31mm (+/-0.83); *Greatest Cranial Length:* 26.83mm (+/-0.94); *Greatest Cranial Height:* 9.20mm (+/-0.28); *Width of Braincase:* 10.45mm (+/-0.26); *Greatest Zygomatic Width*: 15.06mm (+/-0.46); *Length of Nasals:* 11.01mm (+/-0.4); *Width of Nasals:* 2.47mm (+/-0.21); *Palate Length:* 13.76mm (+/-0.79); *Palate Width:* 8.24mm (+/-0.32); *Interorbital Constriction:* 4.00mm (+/-0.29); *Postorbital Constriction:* 4.59mm (+/-0.24); *Width of Rostrum:* 4.38mm (+/-0.42); *Width*

Across Bullae: 9.95mm (+/-0.34); *Width Between Bullae:* 4.16mm (+/-0.26); *Bullae Width:* 2.60mm (+/-0.08); *Minimum Pterygoid Bridge Width:* 2.32mm (+/-0.17); *Mandibular Length:* 19.49mm (+/-0.80).

DENTAL CHARACTERISTICS: I5/4 C1/1 P 3/3 M 4/4 = 50. Molar rows convergent and compressed antero-posteriorly. Canines well-developed but short. StyC is usually present on M1 and M2, but it is usually absent from M3. (Voss et al 2009).

Voss et al (2009) provide the following measurements for a sexed sample of 18 males and 15 females (unless stated) from Paraguay and Bolivia: *Length of Upper Toothrow:* male 10.3mm (+/-0.3) female 10.2mm (+/-0.4); *Length of Upper M1-M4:* male 5.4mm (+/-0.2) female 5.4mm (+/-0.2); *Length M1-M3:* male 4.6mm (+/-0.2) female 4.6mm (+/-0.2).

Carmignotto & Monfort (2006) give the following measurements for 7 specimens (6 males, 1 female) from Paraguay without distinguishing between the sexes. This sample includes some of those specimens cited by Voss et al (2009) above: *Length of Upper Toothrow:* 10.13mm (+/-0.29); *Length of Upper M1-M4:* 5.09mm (+/-0.08); *Length of Mandibular Row of Molars:* 5.65mm (+/-0.11); *Upper Canine Length:* 1.97mm (+/-0.30); *Upper Canine Width:* 1.14mm (+/-0.18); *Upper P3 Length:* 1.26mm (+/-0.05).

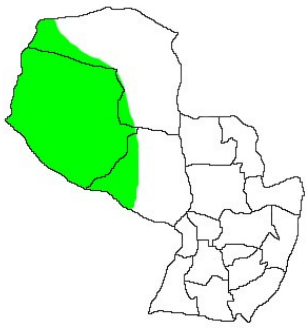
GENETIC CHARACTERISTICS: 2n=14 (Svartman & Vianna-Morgante 1999); FN=20. X chromosomes are small submetacentrics and Y chromosome absent in somatic cells (Palma 1995).

TRACKS AND SIGNS: No information.

EXTERNAL MEASUREMENTS: The smaller of the two Paraguayan *Thylamys*. Voss et al (2009) provide the following measurements for a sexed sample of 16 males and 15 females (unless stated) from Paraguay and Bolivia: **HB:** male 10.1cm (+/-1) female 9.90cm (+/-1.10, n=14); **TA:** male 11.7cm (+/-0.9) female 11.4cm (+/-1.2, n=14); **FT:** male 1.4cm (+/-0.1) female 1.4cm (+/-0.2); **EA:** male 2.1cm (+/-0.2) female 2.1cm (+/-0.2); **WT:** male 22g (+/-5) female 21g (+/-6). There is little variation in size between males and females.

Carmignotto & Monfort (2006) give the following measurements for 7 specimens (6 males, 1 female) from Paraguay without distinguishing between the sexes. This sample includes some of those specimens cited by Voss et al (2009) above: **HB:** 10.23cm (+/-0.93); **TA:** 11.65cm (+/-0.96) approximately 1.14x head and body length; **FT:** 1.38cm (+/-0.08); **EA:** 2.14cm (+/-0.16); **WT:** 25.03g (+/-6.15).

SIMILAR SPECIES: Members of the genus *Thylamys* can be distinguished from other mouse opossums by their noticeably bicoloured pelage, being darker dorsally and paler laterally, and by the densely-granulated soles of the feet. Furthermore female *Thylamys* have the teats arranged in bilaterally symmetrical rows and not in a circular pattern as in other mouse opossums. The only other member of the genus present in Paraguay is *Thylamys macrurus,* which is principally distinguished by its larger size, being typically >40g in weight and with a tail typically greater than 135mm in length (compared to <35g and tail much less than 135mm in this species). The two species of *Thylamys* are apparently allopatric, this species being so far only conclusively recorded in the Chaco west of the Rio Paraguay, whilst *T.macrurus* appears to be confined to eastern Paraguay. Note that this species does not show a whitish tip to the tail which is usually present in *T.macrurus*. Cranially the posterolateral foramen exceeds M4 in this species, though it does not in *T.macrurus*.



DISTRIBUTION: The geographical range of this species is poorly known and further confused by various taxonomic changes and errors in the published literature. Carmignotto & Monfort (2006) consider the species to be adequately documented only from southern and eastern Bolivia, the Chaco of Paraguay, northwestern Argentina and Uruguay. Their examination of the specimens proved that published records of this species from northeastern and central Brazil (Gardner 1993, Eisenberg & Redford 1999) are actually referrable to *Thylamys karimii,* which was formerly considered conspecific, whilst Schaller´s (1983) records of "*Marmosa pusilla*" from Matto Grosso do Sul, are in fact *Gracilinanus agilis*. They consider that the species has not been documented for Brazil.

Voss et al (2009) restricted this distribution further to the Dry Chaco of Paraguay and southeastern Bolivia. They stated that though the species may be present in the Chaco Austral of northern Argentina, the specimens that they examined from that region were morphologically distinct enough to be considered a separate species *T.bruchi*. Records from the Bolivian highlands (including most of the material cited by Anderson 1997) are in fact *T.venustus*, Brazilian records refer to *T.karimii* and Patagonian records are *T.pallidior*. They listed the folowing specimens from Paraguay: ***Departamento Alto Paraguay***: Gabino Mendoza (TTU-TK65601, 65632, 65635), Fortín Pikyrenda (TTU-TK 65592, 65612), Palmar de las Islas (TTU-TK 65458, 65463). ***Departamento Boquerón***: Estancia "El 43" (TTU-TK 60217, 60227), Fortín Toledo (FMNH 164097), Experimental Farm (FMNH 164095, 164096), Guachalla (FMNH 54369), Orloff (FMNH 63862), Parque Cué (TTU-TK 63360, 63367), Parque Nacional Teniente Agripino Enciso (TTUTK 65031, 65104, 65215, 66463, 66468, 66469, 66476), Schmidt Ranch (FMNH 164086), 410 km NW Villa Hayes (MVZ 144312, 144313), 460 km NW Villa Hayes (MVZ 144311); Chaco, 50 km WNW Madrejon (UMMZ 124676); Nueva Asunción, 1 km SW km 620 [of] Trans-Chaco Road (UMMZ 176357); 19 km by road WSW km 588 [of] Trans-Chaco Road (UMMZ 176358, TWN 240, 275, 390). (Carmignotto & Monfort (2006) listed an additional Paraguayan specimen from Dr. Pedro P Peña, Departamento Boquerón (USNM 390027)). ***Departamento Presidente Hayes***: 295 km NW Villa Hayes (MVZ 144310).

Though Gardner (2007) maps the species for Provincia Misiones, Argentina its occurrence there was considered hypothetical by Chebez (1996) who noted that the only evidence for its occurrence are remains of a species similar to *Thylamys* recovered from the pellets of a Barn Owl (Massoia et al 1989). Mares & Braun (2000) note that in Argentina the species is known from Provincias Chaco, Formosa, Santiago del Estero, Corrientes, Entre Rios and Salta. Given the emended diagnosis of the species provided by Voss et al (2009) it is unlikely that any of these records refer to this species.

The type locality is San Ignacio-Guazú, Departamento Misiones, Paraguay. This locality is in eastern Paraguay apparently outside the known range of this species, and no *bona fide* specimens have ever been found east of the Rio Paraguay. See the taxonomic section for notes on the vagaries of de Azara´s original description and the reasons for suspecting that de Azara may have been referring to a different species given our current understanding of Didelphid taxonomy.

HABITAT: This is a Chaco endemic species is confined to xeric, wooded, scrubby and frequently thorny habitats in the Dry Chaco. Voss et al (2009) describe the vegetation at the neotype locality: "trapped on the ground in dense thorny vegetation that included quebracho (*Schinopsis* sp. and/or *Aspidosperma quebracho-blanco*), palo santo (*Bulnesia sarmientoi*), palo borracho (*Chorisia insignis*), and several species of cacti; however, a small, apparently natural grassy opening was also adjacent to the trap site." Such vegetation is typical of the Dry Chaco of Paraguay. Expanding on this description they describe typical habitat as "xerophytic woodlands that are dominated by low (usually <15 m), thorny, deciduous trees including quebracho, palo santo, palo borracho, and labón (*Tabebuia nodosa*). The understory typically includes algarrobo (*Prosopis* spp.), *Maytenus* spp., *Mimosa* spp., *Ephedra* spp., and several species of cacti. Dense patches of spiny bromeliads (caraguatá: *Bromelia hieronymi, B. serra*) provide groundcover that is nearly impenetrable to mammalian or avian predators."

ALIMENTATION: ***Foraging Behaviour and Diet*** Considered primarily an insectivore with omnivorous tendencies (Cannevari & Vaccaro 2007), though no detailled information has ever been published on the diet of the species. Fruit likely plays a significant part in the diet at least seasonally. The species is able to accumulate fat in the tail during times of plentiful resources, which help it to survive leaner times in its harshly seasonal environment.

REPRODUCTIVE BIOLOGY: Little published information. ***Seasonality*** Canevari & Vaccaro (2007) state that females apparently reproduce twice a year giving birth to 14 or 15 young per brood.

GENERAL BEHAVIOUR: ***Activity Levels*** Considered nocturnal and arboreal in behaviour (Cannevari & Vaccaro 2007). Specimens have been taken on the ground in pitfall traps as well as in trees and shrubs (Gardner 2007).

Refuges This species spends the day in burrows holes or abandoned nests (Cannevari & Vaccaro 2007).

VOCALISATIONS: No information.

HUMAN IMPACT: None.

CONSERVATION STATUS: Globally considered to be of Low Risk Least Concern by the IUCN because of its wide distribution, occurrence in protected areas and large population. See http://www.iucnredlist.org/details/40519 for the latest assessment of the species. However the emended distribution suggested by Voss et al (2009) considerably reduced the species ranges and renders it endemic to the Chaco Boreal of Paraguay and southeastern Bolivia. The species is apparently still common in the Paraguayan Chaco, though rarely encountered other than by trapping studies. Though its distribution has been traditionally remote, an alarming recent increase in deforestation in the region is rapidly changing the landscape. The species has likely declined as a result of deforestation in the areas around the Mennonite colonies in the Central Chaco and will continue to do so as the agricultural frontier expands in the region. That said it probably occurs in most if not all of the protected areas in the Dry Chaco, but to date has been documented only for PN Rio Negro, Departamento Alto Paraguay (questionably) and the now defunct PN Tinfunque, Departamento Boquerón/Presidente Hayes (Yanosky 1998), PN Tte Enciso and PN Defensores del Chaco (Voss et al 2009).

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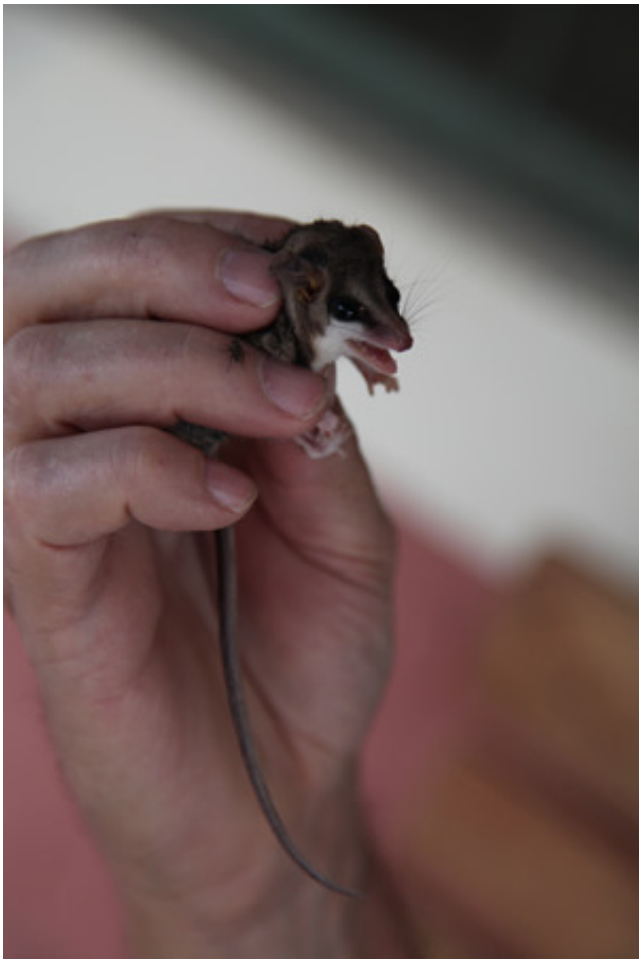

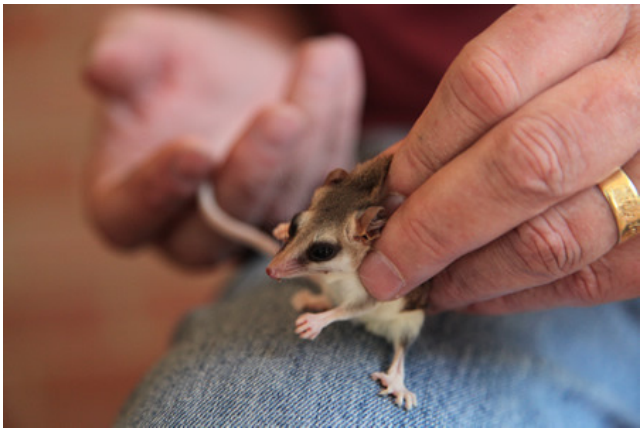

FIGURE 2 - (FPMAM419PH) Adult, PN Tte Enciso, Departamento Boquerón (Jon Hall August 2010). Left

FIGURE 3 - (FPMAM1060PH) Adult, Madrejón, Departamento Alto Paraguay (Jon Hall August 2010). Below.

FIGURE 4 - (FPMAM327PH) **Chaco Fat-tailed Opossum** *Thylamys pusillus.*
Adult skull lateral. Paraguay. Photo Ulf Drechsel www.pybio.org.
FIGURE 5 - (FPMAM325PH) **Chaco Fat-tailed Opossum** *Thylamys pusillus.*
Adult skull dorsal. Paraguay. Photo Ulf Drechsel www.pybio.org.

FIGURE 6 **-** (FPMAM326PH) **Chaco Fat-tailed Opossum** *Thylamys pusillus.*
Adult skull ventral. Paraguay. Photo Ulf Drechsel www.pybio.org.
FIGURE 7 **- Chaco Fat-tailed Opossum** *Thylamys pusillus.*
Adult mandible. Paraguay. Photo Ulf Drechsel www.pybio.org.