Status and distribution of Paraguayan Procyonidae and Mephitidae (Mammalia: Carnivora)

Paul Smith[1,2]*, Sergio D. Ríos[3]

Abstract - Two species of procyonid (*Nasua nasua* and *Procyon cancrivorus*) and one species of mephitid (*Conepatus chinga*) have long been documented to occur in Paraguay, but very little has been published about their ecology in the country since the early 19th Century works of Azara and Rengger. Data on the distribution and status of these species in the country is collated from museum specimens, published literature and reliable observations to provide a basis for future research. A hierarchical approach is taken towards types of record and maps are provided that distinguish these for all species. All three species remain common in the Chaco region west of the Paraguay River, and all are considered of Least Concern. However, this region is experiencing high levels of deforestation and data to assess the potential declines of the species is unavailable. The two species of procyonid are also widespread in the Oriental region, but the status of *Conepatus chinga* there is unclear. There are multiple reports from the Atlantic Forest region but documentation is limited to fecal molecular samples. Clarifying the distribution of that species in the Oriental region is a priority for research.

Key words: *Conepatus chinga,* maps, *Nasua nasua*, Paraguay, *Procyon cancrivorus*.

Riassunto - Status e distribuzione dei procyonidae e mephitidae del Paraguay (Mammalia: Carnivora).

Due specie di procionidi (*Nasua nasua* e *Procyon cancrivorus*) e una specie di mefitidi (*Conepatus chinga*) sono documentate da tempo in Paraguay, ma molto poco è stato pubblicato sulla loro ecologia nel paese dai tempi del lavoro di Azara e Rengger dell'inizio del XIX secolo. Per fornire una base per future ricerche, sono stati raccolti dati sulla distribuzione e sullo stato di queste specie nel paese da esemplari museali, letteratura pubblicata e osservazioni affidabili. Per tutte le specie viene adottato un approccio gerarchico in base al tipo di record includendo le mappe che li caratterizzano. Le tre specie sono comuni a ovest del fiume Paraguay nella regione occidentale del Chaco e sono considerate di Minima Preoccupazione. Tuttavia, la regione sta sperimentando alti livelli di deforestazione e non sono disponibili informazioni per determinare il potenziale declino di alcune di queste specie. Le due specie di procionidi sono ampiamente distribuite anche nella regione orientale, ma lo status di *Conepatus chinga* è incerto. Esistono numerosi rapporti dall'ecoregione della Foresta Atlantica, ma la documentazione è limitata alle prove molecolari provenienti da campioni fecali. Chiarire la distribuzione di quella specie nella regione orientale è una priorità per la ricerca.

Parole chiave: *Conepatus chinga,* mappe, *Nasua nasua*, Paraguay, *Procyon cancrivorus*.

[1] FAUNA Paraguay, Encarnación, Itapúa, Paraguay.
<www.faunaparaguay.com>
[2] Para La Tierra, Centro IDEAL, Mariscal Estigarribia 321 c/ Tte. Capurro, Pilar, Dpto. Ñeembucú, Paraguay.
<www.paralatierra.org>
E-mail: faunaparaguay@gmail.com
[3] Departamento de Arqueología y Paleontología. Secretaría Nacional de Cultura. Asunción, Paraguay.
E-mail: sergiord40@gmail.com

* Corresponding author: faunaparaguay@gmail.com

Received for publication: 26 October 2023
Accepted for publication: 22 February 2024
Online publication: 10 April 2024

INTRODUCTION

The Paraguayan Procyonidae and Mephitidae consist of two and one species respectively, in three genera (de la Sancha *et al*., 2017; Saldivar *et al*., 2017). As with other Carnivore families there have been very few studies on the ecology of these species in Paraguay, with most publications referencing only presence or absence data and incidental observations. With a view towards consolidating the available data on the distribution and status of Paraguayan procyonids and mephitids a review of the specimens, literature and reliable field records was performed. The results are presented here.

The history of procyonid and mephitid studies in Paraguay

The earliest natural history work covering members of these two families in Paraguay is by Félix de Azara. Azara (1801, 1802) covered all three species of Paraguayan procyonids and mephitids. However, he did not report *Conepatus chinga* from Paraguay, stating that he had not found it north of 29.5° south. He included the Procyonidae in his family of Zorros (foxes) and the skunk in his family of Hurones (weasels). Rengger (1830) covered both species of procyonid, but split the coati into two species – *Nasua socialis* (Der gesellige Cuati – The Sociable Coati, p. 98) and *Nasua solitaria* (Der Cuati mondé oder einsame Cuati – The Coatimundi or Solitary Coati, p. 109), a species concept based on behaviour that was later disproved. These two works remain the most detai-

led first-hand accounts of the biology of these species in Paraguay to date. Not until Bertoni (1925) was the skunk officially included in the Paraguayan mastofauna.

In modern usage the Guaraní name *Aguara* is commonly employed to refer to "foxes". However, the word is not used exclusively for canids, and is also used in reference to the crab-eating raccoon *Procyon cancrivorus* (Aguara pope) or more rarely for Molina's hog-nosed skunk *Conepatus chinga* (Aguara ne). Cartes (2014) argues that the word *Aguara* is composed of two parts *Agua* meaning "rounded or bulky" and *Ra/Ragua* meaning "fur or pelage", interpreting the word as literally translating to "fierce animals with long fur or bulky tail". Rengger (1830) however, had earlier suggested that the name Aguara was onomatopoeic and derived from the call of certain canids (notably the maned wolf *Chrysocyon brachyurus*). On the other hand, *Jagua* (meaning in modern usage "dog") was initially used to refer to fierce animals with short fur (Cartes, 2014), but is also sometimes used interchangeably. For example, the most commonly used name for Molina's hog-nosed skunk is Jagua ne (and variations).

Apart from distribution papers, very little recent ecological data has been generated specifically on Paraguayan Procyonidae and Mephitidae, with the brief ecological data provided by Brooks (1991, 1993) the only targeted publications. Data on the families do appear in broader Paraguayan studies however. For example, the results of parasitological studies on carnivores were published by Schmidt (1977), Schmidt & Martin (1977), Seesee *et al*. (1981), Whitaker & Abrell (1987), Masi Pallarés (1990) and Dacak *et al*. (2021); road mortality by Cartes *et al*. (2010, 2011); indigenous practices and uses by Arenas (1987), Hill & Padwe (2000), Hill *et al*. (2003) and Centrón *et al*. (2013); and most recently Zuercher *et al*. (2022) provided data on diet of the carnivore community at the Reserva Natural del Bosque Mbaracayú, Canindeyú department. No studies focused on these families are currently underway in Paraguay.

The conservation status of Paraguayan procyonids and mephitids was recently reviewed and all species were found to be of Least Concern (Saldívar *et al*., 2017). None of the species are currently listed by CITES (CITES, 2017). The number of species present in each department is represented in Figure 1.

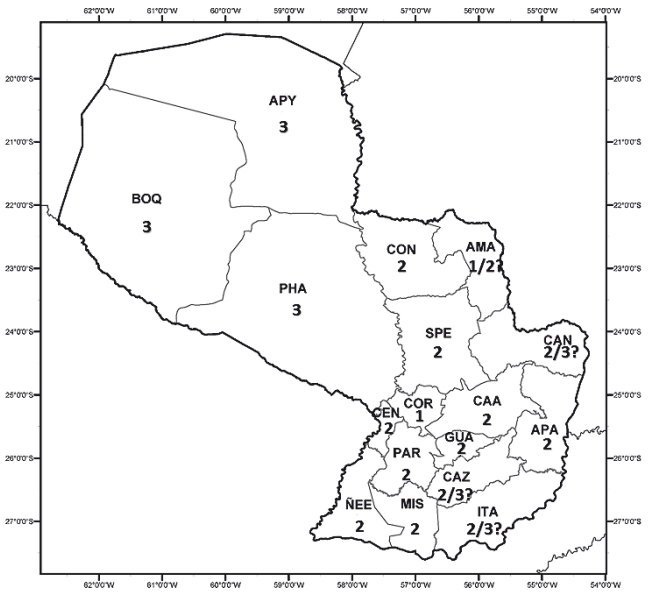

Fig. 1 - Map showing the political departments of Paraguay and the number of species of procyonids and mephitids recorded in each. For departments in eastern Paraguay with possible presence of skunk, the number is presented separated by "/" representing the number of species excluding / including the questionable report. Departments as follows: Chaco region - Alto Paraguay (APY), Boquerón (BOQ), Presidente Hayes (PHA); Oriental region - Amambay (AMA), Alto Paraná (APA), Caaguazú (CAA), Canindeyú (CAN), Caazapá (CAZ), Central (CEN), Concepción (CON), Cordillera (COR), Guairá (GUA), Itapúa (ITA), Misiones (MIS), Ñeembucú (ÑEE), Paraguarí (PAR), San Pedro (SPE). / Mappa dei dipartimenti politici del Paraguay con indicazione del numero di specie di procionidi e mefitidi rilevate in ciascuno di essi. Per i dipartimenti del Paraguay orientale con possibile presenza di *Conepatus chinga*, il numero è presentato separato da "/", che rappresenta il numero di specie esclusa / inclusa la segnalazione dubbia. Dipartimenti come di seguito: Regione del Chaco - Alto Paraguay (APY), Boquerón (BOQ), Presidente Hayes (PHA); Regione orientale - Amambay (AMA), Alto Paraná (APA), Caaguazú (CAA), Canindeyú (CAN), Caazapá (CAZ), Central (CEN), Concepción (CON), Cordillera (COR), Guairá (GUA), Itapúa (ITA), Misiones (MIS), Ñeembucú (ÑEE), Paraguarí (PAR), San Pedro (SPE).

MATERIALS AND METHODS

Specimens of Procyonidae and Mephitidae from the major zoological collections in Paraguay were reviewed during 2019-2023, identifications were confirmed by inspection of the specimens and locality data was collated from museum databases and specimen labels. The location of specimens in non-Paraguayan museums was gleaned from the literature and from VertNet (https://vertnet.org/), which returned 50 results for Procyonidae and 15 results for Mephitidae. Where possible specimens considered to represent significant geographical range extensions were reviewed with the assistance of museum curators. Those that did not present noteworthy distributions were assumed to be correct and not examined.

Collection codes for museums housing Paraguayan procyonid and mephitid specimens are as follows:

CBMI Colección Biológica Museo de Itaipú, Hernandarias, Paraguay.

CZPLT Colección Zoológica Para La Tierra, Pilar, Paraguay.

FMNH Field Museum of Natural History, Chicago, IL, USA.

HI Harrison Institute, Sevenoaks, Kent, United Kingdom.

MJUF Museo Jakob Unger, Filadelfia, Paraguay.

MACN Museo Argentino de Ciencia Naturales "Bernadino Rivadavia", Buenos Aires, Argentina.

MCZ Museum of Comparative Zoology, Cambridge, MA, USA.

MHNG Museum d'Histoire Naturelle Genève, Geneva, Switzerland.

MLP Museo de La Plata, La Plata, Argentina.

MNHNP Museo Nacional de Historia Natural del Paraguay, San Lorenzo, Paraguay.

MTD Museum für Tierkunde, Dresden, Germany.

NRM Naturhistoriska Riksmuseet, Stockholm, Sweden.

UMMZ University of Michigan, Museum of Zoology, Ann Arbor, MI, USA.

UCONN University of Connecticut, Museum of Natural History, Storrs, CT, USA.

Species accounts begin with the current common name, scientific name and author is presented for each species in bold type following Hunter & Barrett (2011). The original described name, author and type locality follow. There then follows a referenced list of the synonyms used in the Paraguayan literature with a (hopefully self-explanatory) single word descriptor of the subject of the publication, as follows: abundance, checklist, conservation, dictionary, distribution, ecology, education, ethnography, first record, folklore, guide, mention, mortality, parasitology, predation, specimen/s, taxonomy, tracks and use.

The synonymy deals only with Paraguayan literature or literature citing Paraguayan specimens and is not intended to be a complete list of synonymy for the species.

Local names: all local common names published in the Paraguayan literature known to us are provided. An attempt to reference the earliest published usage for each name is made.

Comments: addressing noteworthy or confusing themes in the Paraguayan literature.

There then follows a "hierarchical reliability" approach to the Paraguayan distribution of each species. This approach is taken so as to not unduly bias understanding by depending solely on the limited specimen record. The hierarchies are, in order of documented reliability: 1) examined specimen, 2) specimen not examined, 3) published literature record, 4) published photographic record, 5) reliable field observation by one of the authors or knowledgeable local observer. Records are presented with the political department in bold capitals, followed by the details of the record (in alphabetical order). For specimen records, this involves the museum code followed by the inventory number and by the collection locality. These records are also mapped distinguishing the hierarchical categories so that readers may interpret their reliability for themselves. Records corresponding to categories 4) published photographic record, and 5) reliable field observation; include only localities that are not covered by any one of the previous three categories.

The criteria for inclusion of literature was that it was published in Paraguay or specifically deals with Paraguay, or in the case of international publications that it makes specific reference to Paraguayan specimens. The maps included in Neris *et al*. (2002) were omitted from this compilation. These maps were based on interviews with local people and contain numerous, obvious errors that we are keen not to perpetuate here. Also excluded are the results of Rapid Ecological Evaluations produced and published locally, due to the tendency amongst authors to extrapolate distributions without the necessary evidence in an effort to enhance the results produced after limited field time. Every effort was made to be thorough in this regard, though undoubtedly some obscure references will have been missed.

A statement on the ecological affinities of each species in Paraguay is provided based on the ecoregions defined in Guyra Paraguay (2005) and Mereles (2013) (Fig. 2). These can be broadly defined as follows: Atlantic Forest (subtropical humid forests of eastern Paraguay); Cerrado (central South American bushy savanna of northern eastern Paraguay); Dry Chaco (low, arid thorn forest and scrub of the western Occidental region); Humid Chaco (palm savanna and marshlands of the Paraguay River Basin; Pantanal (gallery forests and swamps of the northeastern Chaco); Cerrados del Chaco (an area of Cerrado in the northern Chaco contiguous with the Chiquitania of Bolivia) and Mesopotamian Grasslands (flooded grasslands of the southern Oriental region).

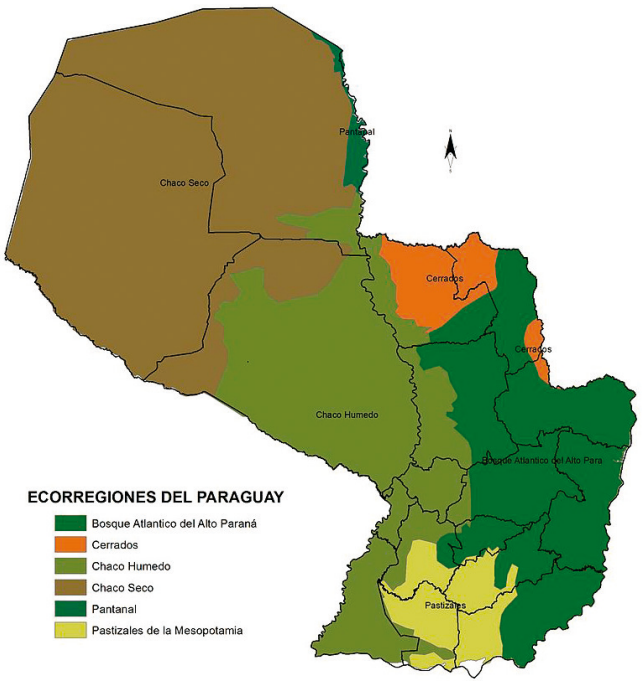

Fig. 2 - Map showing Paraguayan ecoregions. Brown (Dry Chaco and Cerrados del Chaco); olive green (Humid Chaco); orange (Cerrado); dark green east of Paraguay River (Atlantic Forest); dark green west of Paraguay River (Pantanal). / Mappa delle ecoregioni paraguaiane. Bruno (Chaco secco e Cerrados del Chaco); verde oliva (Chaco umido); arancione (Cerrado); verde scuro a est del fiume Paraguay (Foresta atlantica); verde scuro a ovest del fiume Paraguay (Pantanal).

RESULTS

PROCYONIDAE

Coati *Nasua nasua* (Linnaeus 1766) (Fig. 3)

[Viverra] nasua Linnaeus 1766: 64. Type locality "America." Restricted to "Pernambuco" by Cabrera (1957).

Nasua socialis Rengger (1830: ecology).

Nasua solitaria Rengger (1830: ecology); Seelwische (1980: ethnography); Masi Pallarés (1990: parasitology); Masi Pallarés (2011: guide).

Viverra Nasua Du Graty (1862: mention).

Nasua nasua Bertoni (1914: checklist); Bertoni (1939: checklist); Jover Peralta & Osuna (1952: dictionary);

Schmidt (1977: parasitology); Servicio Forestal Nacional (1982: guide); Hill & Hawkes (1983: use); Arenas (1987: use); Pérez *et al*. (1987: distribution); Stäbler (1987: guide); Whitaker & Abrell (1987: parasitology); Brooks (1993: ecology); Brooks *et al*. (1993: distribution); Van Humbeck B. & Silvera Avalos (1995: distribution); Dirección de Parques Nacionales y Vida Silvestre (1998: conservation); Gamarra de Fox & Martin (1996: specimens); Lowen *et al*. (1996: distribution); Gamarra de Fox *et al*. (1998: conservation); Yahnke *et al*. (1998: distribution); Hill & Padwe (2000: use); Villalba & Yanosky (2000: ecology, tracks); Esquivel (2001: guide); Neris & Colman (2001: folklore, use); Neris *et al*. (2002: distribution); Fariña & Hosttetler (2003: checklist); Hill *et al*. (2003: use); Cartes (2004: ecology); Neris & Franco Rivarola (2005: guide); Proyecto Kuatiañe'ẽ (2006: dictionary); Morales (2007: conservation); Nava *et al*. (2007: parasitology); Cartes *et al*. (2008: distribution); Naumann & Coronel (2008: education); Cartes *et al*. (2010: mortality); Horton (2010: guide); Itaipú Binacional (2010: guide); Ramírez Pinto & Velázquez (2010: distribution); Rumbo (2010: ecology); Cartes *et al*. (2011: mortality); Masi Pallarés (2011: guide); Centrón *et al*. (2013: use); Velázquez & Ramírez Pinto (2014: guide); Ortiz *et al*. (2016: guide); de la Sancha *et al*. (2017: list); Saldîvar *et al*. (2017: conservation); Epp (2018: guide); Gengler (2018: distribution); Villalba *et al*. (2018: guide); González *et al*. (2019: distribution); Owen & Smith (2019: distribution, specimens); Weiler *et al*. (2019: guide); Caballero-Gini *et al*. (2020: distribution); Smith *et al*. (2020: ecology); Weiler *et al*. (2020: ecology); Torres *et al*. (2022: guide); Zuercher *et al*. (2022: diet).

Nasua narica Bertoni (1939: checklist); Masi Pallarés (2011: guide).

Nasua nasua spadicea Wetzel & Lovett (1974: specimens); Seesee *et al*. (1981: parasitology).

Nasua nasua aricana Schmidt & Martin (1978: parasitology).

Local names: Cuatí (Morales, 2007); **ACHE:** Kane (Hill & Hawkes, 1983); Ka'ré (Lowen *et al*., 1996); Kare (Esquivel, 2001); Karẽ, Kuchĩ, Tavua, Tabua (Proyecto Kuatiañe'ẽ, 2006); **AVA:** Pytachai (Villalba & Yanosky, 2002); Pychai (Villalba & Yanosky, 2000); **GUARANÍ:** Cuati, Cuati mondé (Rengger, 1830); Kuatí (Bertoni, 1914); Kuatí-mondé (Bertoni, 1914); Cuatĩ, Cuatĩmondé, Cuatĩhaeñó (Jover Peralta & Osuna, 1952); Koati, kuati (Servicio Forestal Nacional, 1982); **MBYA:** Chi'y (Villalba & Yanosky, 2000); Kuatî (Lowen *et al*., 1996); Kuati monde (Villalba & Yanosky, 2000); **NIVACLÉ:** Jim (Seelwische, 1980); **SPANISH:** Coati (Neris & Colman, 2001). The Tupí-Guaraní name Kuatí (and variations) has seen different published explanations including: "belt nose" describing the manner in which the animal sleeps (Gompper & Decker, 1998); "pointed nose" (contraction of *Aku'a* and *ti*) (Cartes, 2014), "finger nose" (Kua, finger and tî, nose) (Ortiz *et al*., 2016), and "hole nose" (from *kua* and *ti*) in reference to the foraging behaviour (Smith, 2024). The Aché name *Kane* mentioned by Hill & Hawkes (1983) applies to the Ornate Hawk-Eagle *Spizaetus ornatus* according to Proyecto Kuatiañe'ẽ (2006).

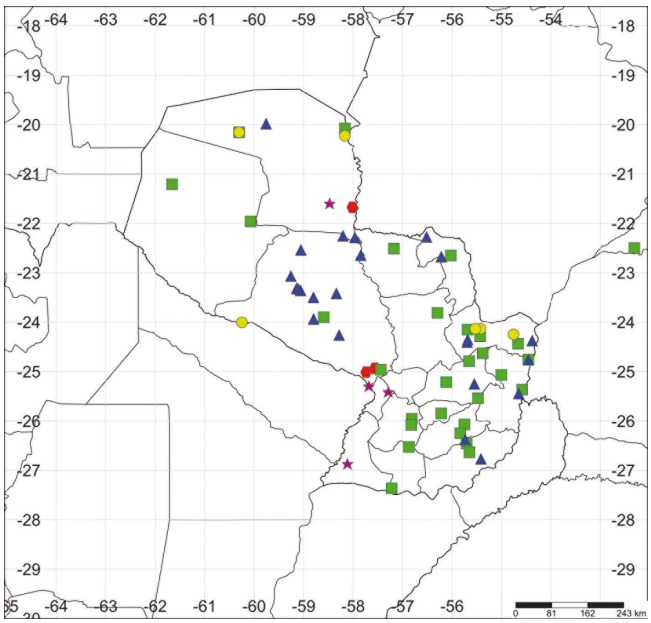

Fig. 3 - Distribution of *Nasua nasua* in Paraguay. Specimen examined (yellow circle); Specimen not examined (blue triangle); Literature reference (green square); Photographic record (red hexagon); Reliable observation (purple star). / Distribuzione di *Nasua nasua* in Paraguay. Esemplare esaminato (cerchio giallo); esemplare non esaminato (triangolo blu); riferimento bibliografico (quadrato verde); documentazione fotografica (esagono rosso); osservazione affidabile (stella viola).

Comments*:* This is the Cuatí of Azara (1802; Tome 1: 293) and Le Couati of Azara (1801; Tome 1: 334). Azara noted that the species could be seen alone, in pairs or in groups, providing detailed observations on behaviour, including personality traits of a captive individual and a literature review that contemplated the variation shown by the species.

Rengger (1830) split the Coati into two species – *Nasua socialis* (Der gesellige Cuati – The Sociable Coati, p. 98) and *Nasua solitaria* (Der Cuati mondé oder einsame Cuati – The Coatimundi or Solitary Coati, p. 109), a species concept based on behaviour and supposed colour and size differences that was later disproved. Indeed, Azara (1801, 1802) had earlier discussed the fact that this concept was erroneous, noting that the larger size of the Cuatí Mondé was because solitary animals were generally males, and dismissing the idea of colour differences as not consistent with his findings. However, Rengger (1830) provides a staunch defence of his position pointing out all of the perceived flaws in Azara's reasoning. Nonetheless, ignoring this error of reasoning Rengger's text is an extremely detailed account of the behaviour of the species.

Nasua narica (Linnaeus 1766) is now the scientific name of the Central American white-nosed coati, but the two species have often been considered conspecific in the past (Corbett & Hill, 1986; Decker, 1991). The variable pelage colouration of coatis has led to a number of different specific and subspecific names being used, but individuals with different coat colours may even appear in the same litter (Allen, 1879).

Paraguayan specimens are currently attributed to *N. n. aricana* Vieira 1945: 404 (Kays, 2009), but have in the

past been attributed to *N. n. spadicea* Olfers 1818: 227. This followed restriction of the type locality of *N. n. spadicea* to Paraguay by Hershkovitz (1959) on the basis that Olfers included Le Couati of Azara (1801) in his synonymy. Less often populations are assigned to *N. n. solitaria* Schinz 1821: 199, the subspecies present in the Atlantic Forests on the Brazilian and Argentinian banks of the Paraná River. A revision of the subspecies limits to determine the correct names applicable to Paraguayan populations is desirable. According to Cartes *et al* (2010, 2011) it is one of the most frequent mammalian victims of roadkill along the Ruta Transchaco, but this does not concur with our own experience.

Bertoni (1914, 1939) stated that Ihering (1910) considered *Nasua solitaria* Wied 1826 to be a synonym of *N. narica* Linneaus 1766 (*sensu lato*), however the same author had earlier considered the two distinct (Rengger, 1830: Ihering, 1893, 1894). Bertoni (1914, 1939) notes correctly that solitary animals are indeed the same species, but his comment that he had failed "to find adults amongst the social groups" is misleading (Smith, 2024). Typically, it is only adult males that are solitary (Gompper & Decker, 1998), and in some populations the males are also social (Hirsch, 2011). This greatly outdated misconception of solitary and social species was propagated recently by Masi Pallarés (2011) who used three scientific names for this species in a confused text. *Nasua nasua* was apparently intended as a "catch all" name for the Paraguayan Coatis, with two names then applied under this heading: *N. narica* which was given the common name "Coatí-pytâ" ("red coati") and does not even apply to the same species, and *N. solitaria* named "Coatí-común" ("common coati"). The diagnosis provided for the two is far from diagnostic and should be ignored by future researchers.

Geographical distribution*:* A widespread habitat generalist that is found throughout the country in all ecoregions, with a preference for areas with some forest cover. The species is found equally in humid forests of the Oriental region, and dry forests of the Chaco region, but it is absent from the most xeric forests of the western Dry Chaco. We could find no confirmed records from Cordillera department but the species undoubtedly occurs there too. There is a locality named Kuatiʾi ("little Coati") in Caazapá department.

Examined specimens*:* "Chaco" (MJUF) **ALTO PARAGUAY:** Bahía Negra (MNHNP 801; Gamarra de Fox & Martin, 1996); **BOQUERÓN:** Parque Nacional Defensores del Chaco (MNHNP 784, 785, 786, 787, 788, 798, 833; Gamarra de Fox & Martin, 1996); **CANINDEYÚ:** Katueté (MNHNP 789; Gamarra de Fox & Martin, 1996); Lagunita, Reserva Bosque Mbaracayú (MNHNP 1051); Reserva Natural del Bosque Mbaracayú (MNHNP 1052; Brooks *et al*., 1993; Gamarra de Fox & Martin, 1996; Lowen *et al*., 1996; Hill & Padwe, 2000; Esquivel, 2001; Fariña & Hosttetler, 2003; Hill *et al*., 2003; Guyra Paraguay, 2008; Zuercher *et al*., 2022); **PRESIDENTE HAYES:** Tinfunké, Retiro Tres Marías (MNHNP 1979).

Specimens not examined: "Chaco Boreal" (NRM 600070, 600203); "Paraguay" (CBMI 0254, 0258; MACN 1008, 1009; MLP 5.12, 16.11, 19.32, 19.33, 19.35, 22.18, 25.30, 25.361, 25.362, 26.77, 28.38, 28.39, 28.40, 30.189, 30.223, 31.66, 31.267; NRM 602368; USNM 526); **ALTO PARAGUAY:** 4 km NW of Dos Estrellas (UF 20658); 30 km W of Puerto Casado on the rail road (FMNH 54328; Gamarra de Fox & Martin 1996); Agua Dulce, 123 km E of Mayor Pablo Lagerenza (UCONN 19827); Puerto Casado (MLP 45.21); **ALTO PARANÁ:** Hernandarias Vivero Forestal (CBMI 0007, 0062, 0077); Reserva Limoy (CBMI 0025; Pérez *et al*., 1987; PS, FPMAM889VI); **AMAMBAY:** 4 km SW of Cerro Corá (UMMZ 125568; Gamarra de Fox & Martin, 1996); 15 km S of Bella Vista, old Indian camp (MHNG-MAM 1629.006, 1629.007; Roguin, 1986; Gamarra de Fox & Martin, 1996); **CAAGUAZÚ:** Yuquerí River (MCZ 28094, 29615); **CANINDEYÚ:** 6,3 km by road NE of Curuguaty (UMMZ 124457); 13.3 km N by road of Curuguaty (UMMZ 126118, 126119; Gamarra de Fox & Martin, 1996); Refugio Carapá (CBMI 0010); **ITAPÚA:** 8 km N of San Rafael (UMMZ 126120; Gamarra de Fox & Martin, 1996); Capitán Meza (MLP 47.374, 47.376); **PRESIDENTE HAYES:** 1.5 km SW, E of Juan de Salazar, Campos Flores (UCONN 16833); 85 km east of Loma Plata, Laguna Pora de Colonia Fernheim (UCONN 19565); km 210 Ruta Transchaco (MHNG-MAM 1629.066; Roguin 1986, Gamarra de Fox & Martin, 1996); km 304 Ruta Transchaco (UCONN 16639); km 305 Ruta Transchaco, Retiro (UCONN 17014, 17015); km 312 Ruta Transchaco (UCONN 18095; Wetzel & Lovett, 1974); Estancia Juan de Salazar (UCONN 16275, 16638, 16640, 16648, 16736; Wetzel & Lovett, 1974); Estancia Juan de Salazar, 5 km E of Transchaco Highway bridge (UCONN 16644); Estancia Juan de Salazar, 6 km N of Rio Verde station (UCONN 16229); Pozo Colorado (UCONN 17498); Puerto Pinasco, Movat, Tanja (AMNH-M 77694); Rio Negro, km 146 Ruta Transchaco (UCONN 18157); Waikthlatingmayalwa (UMZC Vertebrates K 1594, 1594.2; HI 128).

Literature references: **ALTO PARAGUAY:** Estación Los Tres Gigantes (Horton, 2010; González *et al*., 2019); **ALTO PARANÁ:** Refugio Biológico Tati Yupi (Pérez *et al*., 1987); Reserva Biológica de Itabó (Pérez *et al*., 1987); "Itaipú area of influence" (Van Humbeck B. & Silvera Ávalos, 1995; Gamarra de Fox & Martin, 1996); **AMAMBAY:** Parque Nacional Cerro Corá (Yahnke *et al*. 1998); **BOQUERÓN:** Parque Nacional Defensores del Chaco (Yahnke *et al*., 1998); Estancia Montanía (21º57'48''S, 60 º 04'19''W) (Weiler *et al*., 2020); Parque Nacional Teniente Enciso (Gamarra de Fox & Martin, 1996); **CAAGUAZÚ:** Estancia Kaa'guy Rory (Lowen *et al*., 1996; Guyra Paraguay, 2008); Serranía San Joaquín (Guyra Paraguay, 2008); **CAAZAPÁ:** Parque Nacional Caaguazú (=Parque Nacional Caazapá) (Gamarra de Fox & Martin, 1996; Lowen *et al*., 1996); Reserva Privada Ypeti (=Reserva Privada Golondrina I) (Brooks *et al*., 1993; Lowen *et al*., 1996; Guyra Paraguay, 2008); Reserva Tapytá (Velázquez & Ramírez Pinto, 2014); **CAAZAPÁ/ITAPÚA:** Parque Nacional San Rafael (Lowen *et al*., 1996); **CANINDEYÚ:** Estancia Felicidad (Guyra Paraguay, 2008); Reserva de Patrimonio Aché de Kuetuvy (Centrón et al., 2013); Reserva Natural Privada Itabó (Brooks *et al*., 1993; Lowen *et al*., 1996); **CANINDEYÚ/CAAGUAZÚ:** Reserva Natural Privada Morombi (=Reserva Privada Golondrina II) (Brooks *et al*., 1993; Lowen *et al*., 1996; Guyra Para-

guay, 2008); **CONCEPCIÓN:** Parque Nacional Serranía San Luis (Gamarra de Fox & Martin, 1996); **GUAIRÁ:** Ybyturuzú (Guyra Paraguay, 2008); **ITAPÚA:** Estancia Nueva Gambach (Procosara) (Smith *et al*., 2020); **MISIONES:** Estancia La Graciela (Guyra Paraguay, 2008); Yabebyry (Guyra Paraguay, 2008); **PARAGUARÍ:** Isla Alta (Gengler, 2018); Parque Nacional Ybycuí (Servicio Forestal Nacional, 1982; Gamarra de Fox & Martin, 1996); **PRESIDENTE HAYES:** 22º30'S. 59º13'W (Brooks, 1993); Estancia Playada (Caballero-Gini *et al*., 2020); Estancia Santa Asunción (Guyra Paraguay, 2008); Pilcomayo (Ramírez Pinto & Velázquez, 2010); **SAN PEDRO:** Rancho Laguna Blanca (Smith *et al*., 2020).

Photographic records: **ALTO PARAGUAY:** 5 km west of Carmelo Peralta (SDR); **ITAPÚA:** Estancia Nueva Gambach (Procosara) (T. Faust, FPMAM408PH); **PRESIDENTE HAYES:** Estancia Santa Maria del Doce (Fundación La Piedad) (J.L. Cartes, FPMAM403PH); Estancia Golondrina (SDR).

Reliable observations: **ALTO PARAGUAY:** Estancia Jaguarete Pora (PS); **CENTRAL:** Asunción (Carolina Álvarez); Oga Guazú, Ypacaraí (Carolina Álvarez); **ÑEEMBUCÚ:** Km 17 East of Pilar on Ruta 4 (Jorge Ayala).

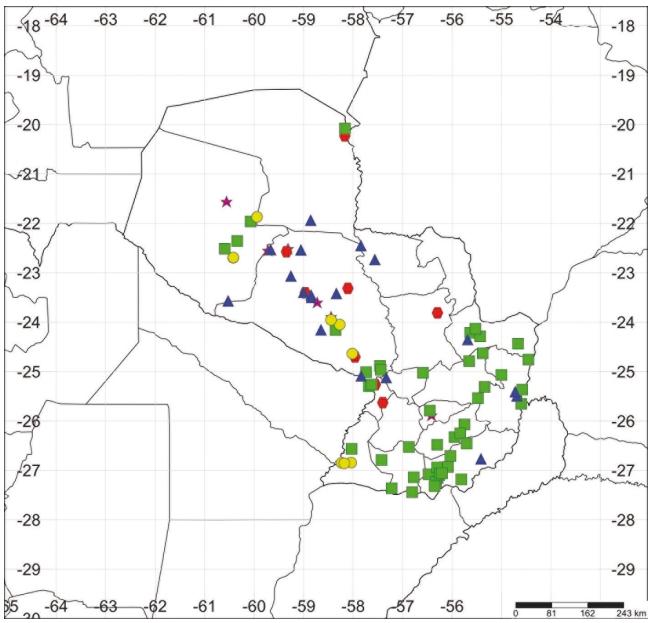

Fig. 4 - Distribution of *Procyon cancrivorus* in Paraguay. Specimen examined (yellow circle); Specimen not examined (blue triangle); Literature reference (green square); Photographic record (red hexagon); Reliable observation (purple star). / Distribuzione di *Procyon cancrivorus* in Paraguay. Esemplare esaminato (cerchio giallo); esemplare non esaminato (triangolo blu); riferimento bibliografico (quadrato verde); documentazione fotografica (esagono rosso); osservazione affidabile (stella viola).

Crab-eating Raccoon *Procyon cancrivorus* (G. Cuvier 1798) (Fig. 4)

Ursus cancrivorus G. Cuvier 1798: 113. Type locality "Cayenne".

Procyon cancrivorus brasiliensis Bertoni (1914: checklist, distribution); Migone (1916: parasitology); Bertoni (1939: checklist, distribution); Jover Peralta & Osuna (1952: dictionary); Gatti (1985: dictionary).

Procyon cancrivorus Rengger (1830: ecology); Schmidt & Martin (1978: parasitology); Seelwische (1980: ethnography); Pérez *et al*. (1987: distribution); Brooks (1993: ecology); Brooks *et al*. (1993: distribution); Van Humbeck & Silvera Avalos (1995: distribution); Gamarra de Fox & Martin (1996: specimens); Lowen *et al*. (1996: distribution); Dirección de Parques Nacionales y Vida Silvestre (1998: conservation); Gamarra de Fox *et al*. (1998: conservation); Taber *et al*. (1997: predation); Yahnke *et al*. (1998: distribution); Hill & Padwe (2000: mention); Villalba & Yanosky (2000: ecology, tracks); Areskoug (2001: ecology); Esquivel (2001: guide); Neris & Colman (2001: folklore, use); Neris *et al*. (2002: distribution); Ziegler *et al*. (2002: specimen); Fariña & Hosttetler (2003: checklist); Cartes (2004: ecology); Fast Schartner (2004: guide); Neris & Franco Rivarola (2005: guide); Smith *et al*. (2005: distribution); Guyra Paraguay (2008: distribution); Cartes *et al*. (2010: mortality); Cartes *et al*. (2011: mortality); Ramírez Pinto & Velázquez (2010: distribution); Rumbo (2010: ecology); Masi Pallarés (2011: guide); Centrón *et al*. (2013: distribution); Velázquez & Ramírez Pinto (2014: guide); Ortiz *et al*. (2016: guide); de la Sancha *et al*. (2017: list); Saldîvar *et al*. (2017: conservation); Epp (2018: guide); Ortega & Weiler (2018: mortality); Villalba *et al*. (2018: guide); González *et al*. (2019: distribution); Weiler *et al*. (2019: guide); Caballero-Gini *et al*. (2020: distribution); Weiler *et al*. (2020: distribution, ecology); Dacak *et al*. (2021: parasitology); Torres *et al*. (2021, guide); Zuercher *et al*. (2022: diet); Salinas *et al*. (2022: abundance, distribution); Entidad Binacional Yacyretá (undated: guide).

Procyon cancrivorus nigripes Wetzel & Lovett (1974: specimen); Seesee *et al*. (1981: parasitology).

Procyon carnivorus Hill & Hawkes (1983: use).

Procyon cancrivourus Proyecto Kuatiañe'ẽ (2006: dictionary).

Local names: **ACHE:** Bejywa (Hill & Hawkes, 1983); Mbechacramá (Brooks *et al*., 1993); Mbeyuvá (Lowen *et al*., 1996); Bejyva (Esquivel, 2001); Mbechakrá (Villalba & Yanosky, 2000); Baejyva, Chãkrama bei, Chãkytã (Proyecto Kuatiañe'ẽ, 2006); **AYOREO:** Guiduja guesai (Neris & Colman, 2001); **ENLHET**: Alpomhajuk (Fast Schartner, 2004); **GUARANÍ**: Agüará Popé (Azara, 1802); Aguarapopé (Rengger, 1830); Aguará-popé (Bertoni, 1914); Aguara pope (Seelwische, 1980); Pópé (Lowen *et al*., 1996); Popé (Lowen *et al*., 1996); Yaguá-chinì, Yaguá-popé (Gatti, 1985); **MENNONITE DIALECT**: Langteeja Foss (Fast Schartner, 2004); **NIVACLÉ**: st-saapjatanôj (Seelwische, 1980); **SPANISH:** Mapache (Areskoug, 2001); Mapache comedor de cangrejos (Esquivel, 2001); Osito lavador (Areskoug, 2001) Mayuato (Velázquez & Ramírez Pinto, 2014). Aguara pope (current Guaraní spelling) and variations translates roughly as "fox with flat hands" (Rengger, 1830). The Spanish name Osito lavador translates as "little washing bear", in reference to the behaviour of washing food prior to consumption.

Comments: This is the Popé of Azara (1802; Tome 1: 278) and l'Agouarapopé of Azara (1801; Tome 1: 324). He described the species as "very scarce" in Paraguay

(having encountered only two individuals) and made comparisons between it and the crab-eating fox *Cerdocyon thous*, noting that the two species are "often confused". He also provided a detailed literature review of the time. Rengger (1830) also describes the species as rare in Paraguay and carefully describes the differences between this species and the northern raccoon *Procyon lotor* (Linnaeus 1758). The subspecies present in Paraguay is *P. c. nigripes* (Mivart 1885), with restricted type locality "Paraguay" (Allen, 1916: 573).

Geographical distribution: A widespread species associated with watercourses across Paraguay. The presence of water is necessary for sustained presence, but the species will expand its range into drier areas during wet periods, when dry courses fill. Occurs in all ecoregions throughout the country, but especially numerous in the Humid Chaco and Pantanal ecoregions of the Paraguay River Basin. We were able to trace confirmed reports of the species in all departments except Amambay, though the species undoubtedly occurs there.

Examined specimens: "Chaco" (MJUF); **BOQUERÓN:** no locality (MNHNP 1186); Estancia La Gama (MNHNP 1039, 1040; Gamarra de Fox & Martin, 1996); Jesudi Comunidad Ayoreo (MNHNP 3062); Estancia Waldbrunner, 25 km from Neuland (MNHNP 1037; Gamarra de Fox & Martin, 1996); **ÑEEMBUCÚ:** 6 km east of Pilar on Ruta IV (CZPLT-M 958); 10.6 km north of Pilar (CZPLT-M 511); Estancia Santa Ana (CZPLT-M 1086, 1100); **PRESIDENTE HAYES:** Estancia Pozo Azul (MNHNP 782, 1194; Gamarra de Fox & Martin, 1996); Ruta Transchaco km 104 (MNHNP 783; Gamarra de Fox & Martin, 1996); Ruta Transchaco km 168 (MNHNP 1038; Gamarra de Fox & Martin, 1996).

Specimens not examined: "Paraguay" (MLP 19.31, 25.193, 25.359), **ALTO PARAGUAY:** 144 km NE of Filadelfia (UCONN 20104); **ALTO PARANÁ:** Arroyo Acaray Mi (CBMI 0024); Hernandarias (CBMI 0015, 0099); **BOQUERÓN:** surroundings of 22°32'S 59°40'W (MTD 24887; Ziegler *et al*., 2002); **CANINDEYÚ:** 13 km north of Curuguaty by road (UMMZ 146502; Gamarra de Fox & Martin, 1996); **CONCEPCIÓN:** Arroyo Tagitaya-Mi (MHNG-MAM 1690.089; Roguin, 1986; Gamarra de Fox & Martin, 1996); **CORDILLERA:** NE of Emboscada, just off Ruta III (UMMZ 178350); **ITAPÚA:** Capitán Meza (MLP 47.375); **PRESIDENTE HAYES:** 2 km N of Pozo Colorado on the Ruta Transchaco (TTU 80577); 2 km N of line camp, Juan de Salazar (UCONN 16769; Wetzel & Lovett, 1974); 8 km NE Juan de Salazar (UMMZ 146503; Gamarra de Fox & Martin, 1996); 85 km east of Loma Plata, Laguna Pora de Colonia Fernheim (UCONN 20346); 130 km NW by road from Villa Hayes (MVZ 145339; Gamarra de Fox & Martin, 1996); 275 km NW by road from Villa Hayes (MVZ 145340, 145341; Gamarra de Fox & Martin, 1996); km 75 on the road to General Díaz (TTU 80576); Estancia Appendice, km 293 Ruta Transchaco (MHNG-MAM 1690.067; Roguin, 1986; Gamarra de Fox & Martin, 1996); Estancia Juan de Salazar (UCONN 15766, 16276); Potrero Doña Cinthia, 30 km W of Villa Hayes (MSB 57391); Waikthlating-mayalwa (UMZC Vertebrates K 1631); west bank of Rio Paraguay, 4 km N of Puerto Foncierre (UMMZ 166714).

Literature references: **ALTO PARANÁ:** Estancia San Antonio (Brooks *et al*., 1993; Lowen *et al*., 1996); Puerto Bertoni (Bertoni, 1914); Refugio Biológico Tati Yupi (Pérez *et al*., 1987); Reserva Biológica Limoy (Pérez *et al*., 1987); Reserva Biológica de Itabó (Pérez *et al*., 1987); "Itaipú area of influence" (Van Humbeck & Silverra Avalos, 1995; Gamarra de Fox & Martin, 1996); **ALTO PARAGUAY:** Estación Los Tres Gigantes (González *et al*., 2019); **BOQUERÓN:** Estancia Montanía (21º57'48''S, 60º04'19''W) (Weiler *et al*., 2020); Fortín Toledo (Brooks, 1993); Gran Siete (Areskoug, 2001); **CAAGUAZÚ:** Estancia Kaa'guy Rory (Lowen *et al*., 1996); **CAAZAPÁ:** Arrozal Codas (Guyra Paraguay, 2008); Parque Nacional Caaguazú (=Parque Nacional Caazapá) (Lowen *et al*., 1996); Estero Cabacuá (Guyra Paraguay, 2008); Reserva Privada Ypeti (=Reserva Privada Golondrina I) (Brooks *et al*., 1993; Lowen *et al*., 1996); Reserva Tapytá (Guyra Paraguay, 2008; Velázquez & Ramírez Pinto, 2014); **CAAZAPÁ/ITAPÚA:** Parque Nacional San Rafael (Lowen *et al*., 1996); **CANINDEYÚ:** Estancia Jiménez (Lowen *et al*., 1996); Reserva de Patrimonio Aché de Kuetuvy (Centrón *et al*., **2013);** Reserva Natural Privada Itabó (Brooks *et al*., 1993; Lowen *et al*. 1996); Reserva Natural del Bosque Mbaracayú (Brooks *et al*., 1993; Lowen *et al*., 1996; Hill & Padwe, 2000; Esquivel, 2001; Fariña & Hosttetler, 2003; Zuercher *et al*., 2022); **CANINDEYÚ/CAAGUAZÚ:** Reserva Natural Privada Morombi (=Reserva Privada Golondrina II) (Lowen *et al*., 1996); **CENTRAL:** Asunción (Bertoni, 1914); Bahía de Asunción (Guyra Paraguay, 2008); **CORDILLERA:** Reserva Natural Privada Sombrero (Lowen *et al*., 1996; Guyra Paraguay, 2008); **GUAIRÁ:** near Villarrica (Rengger, 1830); **ITAPÚA:** Arroyo Tymaka (Guyra Paraguay, 2008); Estero Kuruñai (Guyra Paraguay, 2008); Estero Ñu Guazú (Guyra Paraguay, 2008); Estero San José (Guyra Paraguay, 2008); Estero de San Mauricio (Guyra Paraguay, 2008); Estero Ypyta (Guyra Paraguay, 2008); Hotel El Tirol (Smith *et al*., 2005); Isla Yacyretá (Gamarra de Fox & Martin, 1996, Guyra Paraguay, 2008); La Yegreña (Guyra Paraguay, 2008); San Cosme y Damián (Salinas *et al*., 2022); San Miguel Potrero (Guyra Paraguay, 2008); **MISIONES:** Campo Llano (Guyra Paraguay, 2008); Estancia La Graciela (Guyra Paraguay, 2008); Refúgio de Vida Silvestre Yabebyry (Gamarra de Fox & Martin, 1996; Lowen *et al*., 1996; Guyra Paraguay, 2008); Santiago (Salinas *et al*., 2022); **ÑEEMBUCÚ:** Estancia Redondo (Guyra Paraguay, 2008); **PRESIDENTE HAYES:** Estancia Golondrina-El Trebol (Guyra Paraguay, 2008); Estancia La Rafaela (Guyra Paraguay, 2008); Estancia Playada (Caballero-Gini *et al*., 2020); Pilcomayo (Ramírez Pinto & Velázquez, 2010); Rio Negro (Guyra Paraguay, 2008).

Photographic records: **ALTO PARAGUAY:** Bahía Negra (PS, FPMAM416VI); **CENTRAL:** Bahía de Asunción (SDR); Parque Guasu Metropolitano, Asunción (Aníbal Domaniczky, CON Paraguay); **PARAGUARÍ:** Arroyo Caañabé on the Ruta Nueva Italia to Carapeguá (Marcos Saldívar, CON Paraguay); **PRESIDENTE HAYES:** Estancia Aurora (R. Zotti, FPMAM410PH); Campo María (PS, FPMAM415PH); Ruta Transchaco km 90 (PS, FPMAM411PH); Ruta Transchaco km 290

(PS, FPMAM1006PH); **SAN PEDRO:** Rancho Laguna Blanca (Para La Tierra).

Reliable observations: **ALTO PARAGUAY:** Carmelo Peralta (SDR); **BOQUERÓN:** 80km N of Mariscal Estigarribia towards Pablo La Gerenza (Nelson Pérez); **GUAIRÁ:** Road between Villarrica and Ñumi (Nelson Pérez); **ITAPÚA:** Artigas (Jose Paredes); Coronel Bogado (PS); **PRESIDENTE HAYES:** Montelindo, Ruta Transchaco km 212 (Nelson Pérez); Chaco Lodge (PS); Laguna Capitán (PS); Pirahu (PS).

MEPHITIDAE

Molina's hog-nosed skunk *Conepatus chinga* (Molina 1782) (Fig. 5)

Viverra chinga Molina 1782: 342. Type locality "Chili", restricted by Cabrera (1957) to "alrededores de Valparaiso" (Chile).

Conepatus Bertoni (1914: mention).

Conepatus suffocans forma *marputio* Bertoni (1925: first record, taxonomy).

[Conepatus chilensis] forma *maipurito* Bertoni (1939: checklist, distribution).

Conepatus chilensis Jover Peralta & Osuna (1952: dictionary); Gatti (1985: dictionary).

Conepatus suffocans Seelwische (1980: ethnography).

Conepatus chinga suffocans Seesee *et al*. (1981: parasitology).

Conepatus chinga budini Roguin (1986: specimens, taxonomy).

Conepatus humboldtii Roguin (1986: taxonomy); Morales (2007: conservation).

Conepatus chinga Brooks 1991 (conservation, ecology, mortality); Gamarra de Fox & Martin (1996: specimens); Lowen *et al*. (1996; distribution); Neris *et al*. (1996: use); Gamarra de Fox *et al*. (1998: conservation); Yahnke *et al*. (1998: distribution); Hill & Padwe (2000: mention); Villalba & Yanosky (2000: ecology, tracks); Areskoug (2001: ecology); Esquivel (2001: guide); Neris & Colman (2001: folklore, use); Cartes (2004: ecology); Klassen *et al*. (2005: guide); Neris & Franco Rivarola (2005: guide); Yeo *et al*. (2005: mention); Smith *et al*. (2006: distribution); Rumbo (2010: ecology); Acosta & López (2013: mention); Velázquez & Ramírez Pinto (2014: guide); de la Sancha *et al*. (2017, list); Saldîvar *et al*. (2017: conservation); Villalba *et al*. (2018: guide); Epp (2018: guide); Weiler *et al*. (2019: guide); Weiler *et al*. (2020: distribution, ecology); Zuercher *et al*. (2022: diet, distribution).

Local names: **AVA:** Jaguane'i (Villalba & Yanosky, 2000); **GUARANÍ:** Yaguá-né (Bertoni, 1939); Jagua në (Seelwische, 1980); Yaguané (Jover Peralta & Osuna, 1952); Jaguané (Neris *et al*., 1996); Jaguane' (Areskoug, 2001); Jaguane (Neris *et al*., 2002); Jagua ne (Fariña & Hostettler, 2003);Yaguapé (Morales, 2007); **MBYA:** Yaguané (Lowen *et al*., 1996); Jaguane (Villalba & Yanosky, 2000); **MENNONITE DIALECT**: Stinkkatze (Epp, 2018); **SPANISH:** Zorrino común (Seelwische, 1980); Huroncito (Morales, 2007); Zorrino comon (sic) (Areskoug, 2001); Zorrino (Neris & Colman, 2001). Yaguané and variations translates roughly as "smelly dog".

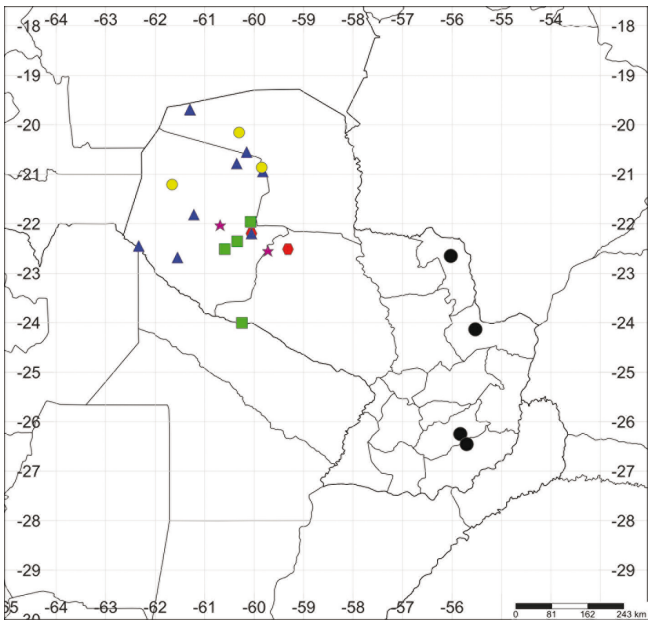

Fig. 5 - Distribution of *Conepatus chinga* in Paraguay. Specimen examined (yellow circle); Specimen not examined (blue triangle); Literature reference (green square); Photographic record (red hexagon); Reliable observation (purple star). / Distribuzione di *Conepatus chinga* in Paraguay. Esemplare esaminato (cerchio giallo); esemplare non esaminato (triangolo blu); riferimento bibliografico (quadrato verde); documentazione fotografica (esagono rosso); osservazione affidabile (stella viola).

Comments: This is the Yagüaré of Azara (1802; Tome 1: 187) and l'Yagouaré of Azara (1801; Tome 1: 211), but he did not report the species from Paraguay. The subspecies present in Paraguay is *C. c. suffocans* (Illiger 1811) which is based on Azara's *l'Yagouaré* and has restricted type locality "Santa Fe, Argentina" (Thomas, 1902: 240). The nomenclature of the South American skunks was confused for a long time, with different coat variations being described as different species (Ihering, 1910; Agnolin *et al*., 2019), however all Paraguayan reports refer to the same species *Conepatus chinga* (Schiaffini *et al*., 2013; Teta *et al*., 2020).

Azara (1801, 1802) called it a species of *campos* (open habitats), describing the defensive behaviour of the species, the variations in coat colour and the extensive uses that the indigenous people of the Pampas have for it. He noted two false beliefs about the species that were later repeated in numerous natural history publications. 1) that the indigenous people capture it by grabbing it by the tail and lifting it rapidly upwards and that this means the animal does not spray its "pestilence" and 2) that other skunks are attracted to a dead skunk, so that people chase them some distance from their house before they kill them, to avoid attracting more.

Bertoni (1914) mentioned that he had heard "news of *Conepatus*" but that the reports required confirmation. The first published report of the species in Paraguay is Bertoni (1925) as *Conepatus suffocans* (Illiger 1811), adding that "the forest species" *Conepatus chilensis* (Desmarest, 1818) may also occur in the country. Though this two taxa approach was very much the taxonomy of the

time (Hensel, 1872; Ihering, 1910), the two names are now considered synonyms of *Conepatus chinga*. In Bertoni (1939), only *Conepatus chilensis* "form *maipurito*" was listed, this referring to skunks of the variation with an entirely white back (Smith, 2024). *Viverra mapurito* Gmelin 1788 is based on the Moufette Mapurito de Mutis (*Act. Holmiens*, 1768) of "Nueva Hispania".

Bertoni (1939) listed the species from the Chaco and had changed this text to a requirement for confirmation referring to "the east and south" (presumably broadly corresponding the Oriental region). This is apparently the first print reference to the possibility of skunks occurring east of the Paraguay River. Yahnke *et al*. (1998) (for Parque Nacional Cerro Corá), Smith *et al*. (2006) (for Área para Parque Nacional San Rafael) and Velázquez & Ramírez Pinto (2014) for (Reserva Tapytá) all reference the species in the humid forests of the Oriental region, but no physical evidence or documentation of any of these claims is available. However, there are previous published reports by locals of the presence of the species at the latter site that lend credibility (Lowen *et al*., 1996). Nonetheless this is complicated by the fact that the local name Yaguane is sometimes used erroneously for grisons *Galictis* (properly called Yaguape) and vice versa, and these animals are also superficially similar in colouration and appearance. Camera-trapping projects in the forests of the Oriental region have so far failed to capture any evidence of skunks.

The most detailed modern published data on this species for Paraguay is by Brooks (1991) who notes that the species is both diurnal and nocturnal, is sometimes shot for preying on poultry eggs and that historically it was used in ethno-medicine. He estimated a population density of 1 per 1.4 km^2.

Geographical distribution: Possibly confined to the Dry Chaco region where it is rather common in the more xeric regions, and apparently largely absent from the Humid Chaco and Pantanal ecoregions. Distribution in the humid forests of the Atlantic Forest region is certainly possible (as they are present in the forests of Paraná state, Brazil and Misiones province, Argentina), but there remains tantalizingly little evidence to support it. If the species is present in the Atlantic Forest ecoregion, then it is at extremely low density. Zuercher *et al*. (2022) report it for the Mbaracayú Forest Reserve, Canindeyú department based on molecular identification of scat samples (n=6), but extensive camera trapping at this locality over multiple years has never captured the species and the indigenous Aché who inhabit the area do not have a name for the animal (M. Velázquez, pers. comm.). In addition, reports from other localities in the Oriental region are rare, mostly old and undocumented.

Examined specimens: "Chaco" (MJUF); **ALTO PARAGUAY:** Parque Nacional Defensores del Chaco (MNHNP 794; Gamarra de Fox & Martin, 1996; Yahnke *et al*., 1998); **BOQUERÓN:** Parque Nacional Teniente Enciso (MNHNP 791; Gamarra de Fox & Martin, 1996; Yahnke *et al*., 1998); Teniente Martínez (MNHNP 790; Gamarra de Fox & Martin, 1996).

Specimens not examined: **ALTO PARAGUAY:** 28.8 km W by road of Fortín Madrejón (UMMZ 124451, 124452); 48 km W and 26 km N of Pablo Lagerenza (UCONN 20025); 49 km NE and 27 km N of Pablo Lagerenza (UCONN 19531); **BOQUERÓN:** 10 km S of Teniente Martínez (MSB 54082); 25 km SW of Copagro (UCONN 19048); 50 km WSW of Fortín Madrejón (AMNH 248467, 248468, 248469, 248470); Estancia Iparoma, 20 km N of Filadelfia (UCONN 19828); Estancia La Conquista near to Pratt's Gill (MHNG-MAM 1689.068; Roguin, 1986; Gamarra de Fox & Martin, 1996); Guachalla, Rio Pilcomayo 580 km W of Asunción (FMNH 54329, 54330); **PRESIDENTE HAYES:** 85 km east of Loma Plata, Laguna Pora de Colonia Fernheim (UCONN 19829).

Literature references: "Chaco" (Bertoni, 1939); **AMAMBAY:** Parque Nacional Cerro Corá ? (Yahnke *et al*., 1998); **BOQUERÓN:** Estancia Montanía (21º57'48''S, 60 º 04'19''W) (Weiler *et al*., 2020); Fortín Toledo (Brooks, 1991); Gran Siete (Areskoug, 2001); **CAAZAPÁ:** Reserva Tapytá ? (Lowen *et al*., 1996; Velázquez & Ramírez, Pinto 2014); **CANINDEYÚ:** Reserva Natural del Bosque Mbaracayú ? (Hill & Padwe, 2000; Zuercher *et al*., 2022); **ITAPÚA:** Área para Parque Nacional San Rafael ? (Smith *et al*., 2006); **PRESIDENTE HAYES:** Estancia Tinfunqué (Gamarra de Fox & Martin, 1996).

Photographic records: **BOQUERÓN:** Estancia Iparoma (SDR); **PRESIDENTE HAYES:** Chaco Lodge (H. del Castillo, FPMAM918PH).

Reliable observations: **BOQUERÓN:** Mariscal Estigarribia (PS); **PRESIDENTE HAYES:** Laguna Capitán (PS, SDR).

DISCUSSION

Unlike many other Paraguayan carnivores (Smith, 2022a, 2022b), the species treated here are frequently-observed, often widespread and appear to be under no imminent conservation threat (Saldívar *et al*., 2017). These species are not hunted for their fur or as game animals but, being euryecious mammals, they are able to tolerate significant disturbance and habitat alterations. However, all species do depend on at least some forest cover (Areskoug, 2001; Weiler *et al*., 2020), and the continued deforestation of the Chaco region (where for now these species remain common) is a concern for their long-term survival. With no population estimates available for any of these species in Paraguay and no long term studies focused on them, we are not in a position to monitor any potential declines accurately.

Acknowledgements

I. Gamarra de Fox (Museo Nacional de Historia Natural del Paraguay) and G. Hicks (Colección Zoológica Para La Tierra) provided assistance in the revision of specimens. Julio R. Contreras and Robert Owen donated essential literature that was used in this work and Pablo Teta assisted with MLP specimen data. The authors were assisted by, and are grateful to, the Pronii program of CONACyT Paraguay. The anonymous librarians behind the Biodiversity Heritage Library project are thanked for ma-

king scarce works available that were key to this project. Carolina Álvarez, Marcos Saldívar and Nelson Pérez (CON Paraguay), Jorge Ayala (Para La Tierra), Myriam Velázquez (Fundación Moises Bertoni) and José Paredes for sharing their observations. The map for Figure 2 is from Wiki Commons produced by user Fernandolpd and made available on the page https://commons.wikimedia.org/wiki/File:Ecorregiones_PY.jpg.

REFERENCES

Acosta N. & López E., 2013 – Reservorios mamíferos del *Trypanosoma cruzi* en Paraguay. *Memorias del Instituto de Investigación en Ciencias de la Salud*, 11: 90-96.

Agnolin F. L., Derguy M. R., Godoy I. N. & Chimento N. R., 2019 – Mamíferos argentinos: descripción de nuevas especies de las colecciones de Elio Massoia y Julio R. Contreras (Rodentia, Chiroptera, Carnivora). *Historia Natural*, 9 (2): 107-181.

Allen J. A., 1879 – On the coatis (genus *Nasua*, Storr). *Bulletin of the United States Geological and Geographical Survey*, 5: 153-174.

Allen J. A., 1916 – Mammals collected on the Roosevelt Brazilian expedition with field notes by Leo E. Miller. *Bulletin of the American Museum of Natural History*, 35: 559-610.

Arenas P., 1987 – Medicine and magic among the Maká Indians of the Paraguayan Chaco. *Journal of Ethnopharmacology*, 21 (3): 279-295.

Areskoug, V., 2001 – Utilisation of remnant dry-forest corridors by the native fauna in a pastural landscape in the Paraguayan Chaco. CBM:s Skriftserie, 3: 25–38.

Azara F. de, 1801 – Essais sur l'Histoire Naturelle des Quadrupèdes de la Province du Paraguay. Tome 2. *Charles Pougens*, Paris (France).

Azara F. de, 1802 – Apuntamientos para la Historia Natural de los Quadrúpedos del Paragüay y Río de la Plata. Tomo 2. *Imprenta de la Viuda de Ibarra*, Madrid (Spain).

Bertoni A. de W., 1914 – Fauna Paraguaya. Catálogos sistemáticos de los vertebrados del Paraguay. Peces, batracios, reptiles, aves y mamíferos conocidos hasta 1913. *Establecimiento Gráfico M. Brossa*, Asunción (Paraguay).

Bertoni A. de W., 1925 – Noticias zoológicas. *Conepatus suffocans* Ill. Dyaguaré. *Revista de la Sociedad Científica del Paraguay*, 2 (1): 68.

Bertoni A. de W., 1939 – Catálogos sistemáticos de los vertebrados del Paraguay. *Revista de la Sociedad Científica del Paraguay*, 4: 1-50.

Brooks D., 1991 – Some notes on terrestrial mustelids in the central Paraguayan Chaco. *Mustelid and Viverrid Conservation*, 4: 5-6.

Brooks D., 1993 – Observations on Procyonids in Paraguay and adjacent regions. *Small Carnivore Conservation*, 8: 3-4.

Brooks T. M., Barnes R. B., Butchart S. H. M., Clay R. P., Esquivel E. Z., Etcheverry N. I., Lowen J. C. & Vincent J. P., 1993 – Bird surveys and conservation in the Paraguayan Atlantic Forest. BirdLife International Study Report No. 57. *BirdLife International*, Cambridge (UK).

Caballero-Gini A., Bueno Villafañe D., Laino R. & Musalem K., 2020 – Diversity of mammals and birds recorded with camera-traps in the Paraguayan Humid Chaco. *Boletín del Museo Nacional de Historia Natural del Paraguay*, 24 (1): 5-14.

Cabrera A., 1957 [1958] – Catálogo de los mamíferos de América del Sur. *Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" Ciencias Zoologicas*, 4: 1-308.

Cartes J. L., 2004 – Importancia de la conservación de los humedales para los mamíferos. In: Humedales del Paraguay. Salas-Dueñas D. A., Mereles F. & Yanosky A. (eds.). *Comité Nacional de Humedales*, Asunción (Paraguay): 141-165.

Cartes J. L., 2014 – Raíces guaraníes en la nomenclatura tradicional de los Mamíferos en Paraguay. *Paraquaria Natural*, 2 (1): 6-14.

Cartes J. L., López de Kochalka N. E., Morales C., Motte M. & Vitale C., 2010 – Mortandad de fauna silvestre por atropellamiento en la Ruta 9 Carlos A. López (Transchaco). *Revista de la Sociedad Científica del Paraguay*, 15 (2): 191-202.

Cartes J. L., Morales C., Motte M., Vitale C. & López de Kochalka N. E., 2011 – Estudios faunísticos en la Ruta 9 "Carlos A. López" (Transchaco). Conclusiones generales. *Revista de la Sociedad Científica del Paraguay*, 16 (2): 195-223.

Centrón S., Zárate R., Chivugui A., Achipurangui M., Mayeregger E. & Cartes J. L., 2013 – Patrones de uso de la fauna en la Reserva de Patrimonio Aché de Kuetuvy, Canindeyú. *Paraquaria Natural*, 1 (1): 25-31.

CITES, 2017 – Convention on International Trade in Endangered Species of Wild Fauna and Flora, Appendices I, II and III. *CITES*.

Corbet G. B. & Hill J. E., 1986 – A world list of mammalian species. 2nd ed. *British Museum of Natural History*, London (UK).

Cuvier G., 1798 – Tableau Élémentaire de l'Histoire Naturelle des Animaux. *Baudouin*, Paris.

Dacak D., Petters J., Batista-Cirne L., Lucero M., Aliendre R., Guzmán J. & Ordoñez R., 2021 – Primer reporte de micoplasmosis en *Procyon cancrivorus* en cautiverio en Asunción, Paraguay. *Revista de Investigaciones Veterinarias del Perú*, 32, e19494.

Decker D. M., 1991 – Systematics of the coatis, genus *Nasua* (Mammalia: Procyonidae). *Proceedings of the Biological Society of Washington*, 104 (2): 370-386.

de la Sancha N., López-González C., D'Elía G., Myers P. & Ortíz M. L., 2017 – An annotated checklist of the mammals of Paraguay. *Therya*, 8 (3): 241-260.

Desmarest A. G., 1818 – Moufette Mephitis. In: Nouveau Dictionnaire d'Histoire Naturelle, appliquée aux arts, a l'Agriculture, à l'Économie rurale et domestique, à la Médecine, etc. Par une société de Naturalistes et d'Agriculteurs. Nouvelle Édition. *Abel Lanoir Imprimerie*, Paris, 21: 512-520.

Dirección de Parques Nacionales y Vida Silvestre, 1998 – Fauna Amenazada del Paraguay. *Ministerio de Agricultura y Ganaderia/Fundación Moises Bertoni*, Asunción (Paraguay).

du Graty A. L. M., 1862 – La República del Paraguay. *Imprenta de José Jacquin*, Bruselas (Belgium).

Entidad Binacional Yacyretá, undated – Mamíferos Refugio Faunístico Atinguy. *EBY Departamento de Obras Complementarias*, Ayolas (Paraguay).

Esquivel E., 2001 – Mamiferos de la Reserva Natural del Bosque Mbaracayú, Paraguay. *Fundación Moises Bertoni*, Asunción (Paraguay).

Epp N., 2018 – Die Natur des Paraguayischen Chaco. *Author*, Filadelfia (Paraguay).

Fariña R. & Hostettler T., 2003 – Vertebrados de la Reserva Natural del Bosque Mbaracayú. Checklist. *Fundación Moises Bertoni*, Asunción (Paraguay).

Fast Schartner H., 2004 – Guía Ecológica de la Cuenca Alta del Riacho Yakaré Sur. *Fundación para el Desarrollo Sustentable del Chaco*, Loma Plata (Paraguay).

Gamarra de Fox I. & Martin A. J., 1996 – Mastozoología. Lista de mamíferos del Paraguay. In: Colecciones de Flora y Fauna del Museo Nacional de Historia Natural del Paraguay. Romero Martínez O. (ed.). *Ministerio de Agricultura y Ganadería*, San Lorenzo (Paraguay): 469-573.

Gamarra de Fox I., Van Humbeck J., Sosa W., Penayo R. & Villalba R., 1998 – Mamíferos. In: Fauna Amenazada del Paraguay. Dirección de Parques Nacionales y Vida Silvestre (ed.). *Ministerio de Agricultura y Ganaderia/Fundación Moises Bertoni*, Asunción, (Paraguay): 55-69.

Gatti C., 1985 – Enciclopedia Guaraní-Castellano de Ciencias Naturales y Conocimientos Paraguayos. *Arte Nuevo Editores*, Asunción (Paraguay).

Gengler N., 2018 – Large-medium mammal diversity in fragmented habitat: A camera trap inventory surrounding a rural community in the Upper Paraná Atlantic Forest of Paraguay. *Boletín del Museo Nacional de Historia Natural del Paraguay*, 22 (2): 59-66.

Gmelin J. F., 1788 – Caroli a Linné [...] Systema Naturae per Regna Tria Naturae, Secundum Classes Ordines, Genera, Species cum Characteribus, Differentiis, Synonymis, Locis. Editio Decima Tertia, Aucta, Reformata. *Georg Emanuel Beer*, Lipsiae (Sweden).

Gompper M. E. & Decker D. M., 1998 – *Nasua nasua*. *Mammalian Species*, 580: 1-9.

González A. R., Benítez R. C., Ferreira M., Cantero N., Arias A., Matosso L. & Rojas Bonzi V., 2019 – Mamíferos medianos y grandes de la Reserva Pantanal Paraguayo: Estación Los Tres Gigantes, Alto Paraguay, Paraguay. *Paraquaria Natural*, 7 (1): 8-18.

Guyra Paraguay, 2005 – Atlas de las Aves del Paraguay. *Guyra Paraguay*, Asunción, (Paraguay).

Guyra Paraguay., 2008 – Áreas Importantes para la Conservación de las Aves del Paraguay. *Guyra Paraguay*, Asunción, (Paraguay).

Hensel R., 1872 – Beiträge zur Kenntniss der Säugethiere Süd-Brasiliens. *Abhandlungen der Königlich Preussischen Akademie der Wissenschaften*, Berlin.

Hershkovitz P., 1959 – Nomenclature and taxonomy of the neotropical mammals described by Olfers, 1818. *Journal of Mammalogy*, 40 (3): 337-353.

Hill K. & Hawkes K., 1983 – Neotropical hunting among the Ache of eastern Paraguay. In: Adaptive Responses of Native Amazonians. Hames R. B. & Vickers W. T. (eds.). *Academic Press*, New York (USA): 139-188.

Hill K. & Padwe J., 2000 – Sustainability of Aché hunting in the Mbaracayú Reserve, Paraguay. In: Hunting for Sustainability in Tropical Forests. Robinson J. G. & Bennett E. (eds.). *Columbia University Press*, New York (USA): 79-105.

Hill K., McMillan G. & Fariña R., 2003 – Hunting-related changes in game encounter rates from 1994 to 2001 in the Mbaracayú Reserve, Paraguay. *Conservation Biology*, 17 (5): 1312-1323.

Hirsch B. T., 2011 – Long-term adult male sociality in ring-tailed coatis (*Nasua nasua*). *Mammalia*, 75 (3): 301-304.

Horton, E. Y., 2008 – Salvemos San Rafael. Guyra Paraguay, Asunción (Paraguay).

Horton E. Y., 2010 – Gran Pantanal Paraguay. *Guyra Paraguay*, Asunción (Paraguay).

Hunter L. & Barrett P., 2011 – A field guide to the carnivores of the world. *New Holland Publisher Ltd.*, London, (UK).

Ihering H. von, 1893 – Os mammiferos do Rio Grande do Sul. Annuario do Estado do Rio Grande do Sul, para o anno 1893 de Graciano A. de Azambuja, 9: 96-123.

Ihering H. von, 1894 – Os Mammiferos do S. Paulo. *Diario Oficial*, São Paulo (Brazil).

Ihering H. von., 1910 [1911] – Os mammiferos do Brazil meridional; Carnivora. *Revista Museu Paulista*, 8: 147-272

Illiger C., 1811 – Prodromus Systematis Mammalium et Avium Additis Terminis Zoographicis Utriusque Classis. *C. Salfeld*, Berlin (Germany).

Itaipú Binacional, 2010 – Animales del Zoológico de Itaipú. *Dirección de Educación Ambiental, Itaipú*, Hernandarias (Paraguay).

Jover Peralta A. & Osuna T., 1952 – Diccionario Guaraní-Español y Español-Guaraní. *Editorial Tupã*, Buenos Aires (Argentina).

Kays R. W., 2009 – Family Procyonidae (Raccoons). In: Handbook of the Mammals of the World Volume 1: Carnivores. Wilson D. E. & Mittermeier R. A. (eds.). *Lynx Edicions*, Barcelona (Spain): 504-530.

Klassen P., Epp N. & Loewen H. T., 2005 – Unsere Heimat. Bildband zur Chaconatur. Nuestra Patria. Colección de imágenes del Chaco Paraguayo. *Artes Gráficas Zamphirópolos*, Asunción (Paraguay).

Linnaeus C., 1758 – Systema Naturae per Regna Tria Naturae, Secundum Clases, Ordines, Genera et Species Redacta Tabulisque Aeneis Illustrata. Editio decima. *Laurentii Salvii*, Holmiae (Sweden).

Linnaeus C., 1766 – Systema Naturae per Regna Tria Naturae, Secundum Clases, Ordines, Genera et Species Redacta Tabulisque Aeneis Illustrata. Editio duodecima reformata. *Laurentii Salvii*, Holmiae (Sweden).

Lowen J. C., Bartrina L., Clay R. P. & Tobias J. A., 1996 – Biological Surveys and Conservation Priorities in Eastern Paraguay. *CSB Conservation Publications*, Cambridge (UK).

Masi Pallarés R., 1990 – Nematodes de los vertebrados del Paraguay y otros parásitos del Nuevo Mundo. *EFACIM*, Asunción (Paraguay).

Masi Pallarés R., 2011 – Vertebrados del Paraguay. Descripción y Hábitos con las Denominaciones en Guaraní. *Smart C3*, Asunción (Paraguay).

Mereles F. M., 2013 – Acerca de las extensiones de Cerrados y Cerradones en el Paraguay. *Paraquaria Natural*, 1 (1): 35-38.

Migone L. E., 1916 – Parasitology of certain animals in Paraguay. *Bulletin de la Société de Pathologie Exotique*, 9 (6): 359-364.

Mivart S. G., 1885 – On the anatomy, classification and distribution of the Arctoidea. *Proceedings of the Zoological Society of London*, 53: 340-404.

Molina G. I., 1782 – Saggio sulla storia naturale del Chili. *Nella Stamperia di S. Tommaso d'Aquino*, Bologna (Italy).

Morales M. A., 2007 – Diversidad de Mamíferos en Paraguay. In: Biodiversidad del Paraguay: Una Aproximación a sus Realidades. Salas-Dueñas D. A. & Facetti J. F. (eds.). *Fundación Moises Bertoni*, Asunción (Paraguay): 133-150.

Nava S., Lareschi M., Rebollo C., Benítez Usher C., Beati L., Robbins R. G., Durden L. A., Mangold A. J. & Gulielmone A. A., 2007 – The ticks (Acari: Ixodida: Argasidae, Ixodidae) of Paraguay. *Annals of Tropical Medicine and Parasitology*, 101 (3): 255-270.

Naumann C. M. & Coronel M. C., 2008 – Atlas Ambiental del Paraguay. Con fines educativos. *Cooperación Técnica Alemana, Secretaría del Ambiente del Paraguay, Ministerio de Educación y Cultura*, Asunción (Paraguay).

Neris N. & Colman F., 2001 – Mamíferos. In: Especies silvestres del Paraguay: Guía de identificación de especies con importancia económica. Abad C. M. & Céspoli S. (eds.). *SEAM*, Asunción (Paraguay): 127-147.

Neris N. & Franco Rivarola E. G., 2005 – Mamíferos. In: Guía ilustrada de Anfibios, Reptiles, Aves y Mamíferos del Paraguay. Neris N. (ed.). *Natura Vita*, *Jica*, Asunción, (Paraguay): 153-193.

Neris N. N., López N. E., Pin A. & Quintana M., 1996 – Documento Base Sobre Biodiversidad. Asunción, Paraguay: Subsecretaría de Recursos Naturales y Medio Ambiente. *Deutsche Gesellschaft für Technische Zusammenarbeit*.

Neris N., Colman F., Ovelar E., Sukigara N. & Ishii N., 2002 – Guía de Mamíferos Medianos y Grandes del Paraguay: Distribución, Tendencia Poblacional y Utilización. *SEAM*, Asunción (Paraguay).

Olfers I. F. von., 1818 – Bemerkungen zu Illiger's Dberblick der Säugethiere nach ihrer Vertheilung tiber die Welttheile, rücksichtlich der Südamericanischen Arten (Species). Abhandlung X. In: Neue Bibliothek der wichtigsten Reisebeschreibungen zur Erweiterung der Erd- und Völkerkunde. W. L. von Eschweges. *Journal von Brasilien*, 15 (2): 192-237.

Ortega A. & Weiler A., 2018 – Diversidad de vertebrados muertos por atropellamiento vehicular y zonas de mayor impacto en la Ruta III General Elizardo Aquino, Paraguay. *Reportes Científicos de la FACEN*, 9 (1): 31-41.

Ortiz M. L., Fernández Barriocanal J. A., Pérez Villamayor N. A. & Duré A., 2016 – CIASI. Centro de Investigación de Animales de Itaipú. *Itaipú Binacional*, Hernandarias (Paraguay).

Owen R. D. & Smith P., 2019 – Mamíferos de la Reserva Natural del Bosque Mbaracayú, Departamento Canindeyú Representadas en Colecciones Científicas. *Revista de la Sociedad Científica del Paraguay*, 24 (1): 163-172.

Pérez N., Van Humbeck J. & Ortíz J., 1987 – Estudios Faunísticos. Seminario de la Itaipú Binacional Sobre Medio Ambiente. Foz do Iguaçu, Brazil, 2: 117-130.

Proyecto Kuatiañe'ẽ, 2006 – Ache Javukuaavãgi. Diccionario Ache-Español-Guaraní. *Universidad Evangélica del Paraguay*, Asunción (Paraguay).

Ramírez Pinto F. & Velázquez M. C., 2010 – Mamíferos. In: La Naturaleza y Riqueza del Río Pilcomayo. Villalba L. (ed.). *Iniciativa Chaco Trinacional y Fundación Moisés Bertoni*, Asunción (Paraguay): 23-25.

Rengger J. R., 1830 – Naturgeschichte der Saeugethiere von Paraguay. *Schweghauserschen*, Basel (Switzerland).

Roguin L. de, 1986 – Les mammifères du Paraguay dans les collections du Muséum de Genève. *Revue Suisse Zoologie*, 93 (4): 1009-1022.

Rumbo M., 2010 – Análisis biogeográfico de los mamíferos de Paraguay. *Boletín del Museo Nacional de Historia Natural del Paraguay*, 16: 18-29.

Saldívar S., Rojas V., Giménez D., Abba A. M., Ayala R., Barreto R., Cartes J. L., del Castillo H., Cuéllar E., Gamarra de Fox I., Giordano A. J., Kowalewski M., López J., Martínez V., Mujica N., Neris N., Ortíz M. L., Ramírez F., Ríos S. D., Ruíz Díaz M., de la Sancha N. U., Sánchez J., Smith P., Stevens R., Teta P, Thompson J., Torres J., Velázquez M., Velilla M., Villalba L. & Weiler A., 2017 – Los mamíferos amenazados del Paraguay. In: Libro Rojo de Mamíferos del Paraguay. Saldívar S., Rojas V. & Giménez D. (eds.). Asociación Paraguaya de Mastozoología y Secretaría del Ambiente, Asunción (Paraguay): 25-32.

Salinas P., Nuñez K. Ortiz F., Zárate G., Mendoza M. & Weiler A., 2022 – Mamíferos medianos y grandes en campos de cultivo de arroz en los departamentos de Misiones e Itapúa, Paraguay. *Reportes Científicos de la FACEN*, 13: 10-19.

Schiaffini M. I., Gabrielli M., Prevosti F. J., Cardoso Y. P., Castillo D., Bo R., Casanave E. & Lizarralde M., 2013 – Taxonomic status of southern South American *Conepatus* (Carnivora: Mephitidae). *Zoological Journal of the Linnean Society*, 167 (2): 327-344.

Schinz H. R., 1821 – Das Thierreich eingetheilt nach dem Bau der Thiere als Grundlage ihre Naturgeschichte und der vergleichenden Anatomie von dem Herrn Ritter von Cuvier, Staatsrath von Frankreich und beständiger Secretäa der Akademie der Wissenchaften U.S.M. Aus dem Französischen frei übersetzt und mit vielen Zusätzen versehen von H.R. Schinz. Bild 1. *J.S. Gotta*, Stuttgart ünd Tubingen (Germany).

Schmidt G. D., 1977 – *Oncicola martini* sp. n., and other Archiacanthocephala of the Chaco Boreal, Paraguay. *Journal of Parasitology*, 63 (3): 508-510.

Schmidt G. D. & Martin R. L., 1978 – Tapeworms of the Chaco Boreal, Paraguay, with two new species. *Journal of Helminthology*, 52 (3): 205-209.

Seelwische J., 1980 – Diccionario Nivacle-Castellano. *Biblioteca Paraguaya de Antropología*, Asunción (Paraguay), 1.

Seesee F. M., Worley D. E. & Martin R. L., 1981 – A survey of nematode parasites from carnivores of the Chaco Boreal, Paraguay. *Worldwide Furbearer Conference Proceedings*, 2: 846-858.

Servicio Forestal Nacional, 1982 – Guía de Algunos Vertebrados del Parque Nacional Ybycuí. *Ministerio de Agricultura y Ganadería*, Asunción (Paraguay).

Smith P., 2022a – Status and distribution of Paraguayan Canidae. *Canid Biology & Conservation*, 25.

Smith P., 2022b – Status and distribution of Paraguayan Mustelidae. *Acta Zoologica Cracoviensia*, 65 (1-2): 1-13.

Smith, P., 2024 – Bertoni's Mammals: An annotated interpretation of the 1939 "Catálogos Sistemáticos de los Vertebrados del Paraguay". *Zoological Bibliography*, 7 (1): 1-112.

Smith P., del Castillo H., Batjes H., Betuel A., Montiel M., Nossent R., Onley D., Wainwright B. & Wechsler S., 2005 – An avifaunal inventory of Hotel Tirol, Departamento Itapúa, southern Paraguay. *FAUNA Paraguay Technical Publication*, 1: 1-14.

Smith P., del Castillo H., Bankovics A., Hansen L. & Wainwright B., 2006 – An avifaunal inventory of San Rafael "National Park", Departamento Itapúa, southern Paraguay. *FAUNA Paraguay Technical Publication*, 3: 1-13.

Smith R. L., Briggs E. & Smith P., 2020 – Unusual behavioral responses of the South American Coati (*Nasua nasua*) to the Hooded Capuchin (*Sapajus cay*) in the Paraguayan Upper Paraná Atlantic Forest. *Neotropical Primates*, 26 (1): 23-29.

Stäbler D. E., 1987 – Tiere in Paraguay. Animales en el Paraguay. *Author*, Asunción, (Paraguay).

Taber A. B., Novaro A. J., Neris N. & Colman F., 1997 – The food habits of sympatric jaguar and puma in the Paraguayan Chaco. *Biotropica*, 29 (2): 204-213.

Teta P., D'Elía G., Jayat J. P., Rodrigues Gonçalves P., Libardi G. S., Alves de Oliveira J., Moratelli R., Percequillo A. R., Rodrigues do Prado J., Ortiz P. E., Hurtado N., Schiaffini M. I., de Abreu-Jr. E. F., Almeida Chiquito E., Giménez A. L. & Torres J., 2020 – On the distinction and availability of the new taxa proposed by Agnolin *et al*. 2019. *Mastozoología Neotropical*, 27 (1): 155-171

Thomas O., 1902 – On Mammals collected at Cruz del Eje, Central Cordova by Mr. P. O. Simons. *Annals and Magazine of Natural History*, 7 (9): 237-245.

Torres J., Sánchez H. & Gamarra de Fox I., 2021 – Guía de los Mamíferos de Asunción y su Área Metropolitana (AMA). *PNUD and Municipalidad de Asunción*, Asunción (Paraguay).

Van Humbeck B. J. & Silvera Avalos W., 1995 – Catálogo de los Vertebrados del Área de Itaipú. Estudio de Mamíferos. *Biota*, 2: 56-62.

Velázquez M. & Ramírez Pinto F., 2014 – Guía de los Mamíferos de la Reserva Natural Tapytá. *Fundación Moises Bertoni*, Asunción (Paraguay).

Vieira C., 1945 – Sobre uma coleção de mamíferos de Mato Grosso. *Arquivos de Zoologia*, 4 (10): 395-429.

Villalba R. & Yanosky A., 2000 – Guía de Huellas y Señales: Fauna Paraguaya. *Fundación Moises Bertoni*, Asunción (Paraguay).

Villalba L., Ortiz B. & Gengler N., 2018 – Principales Mamíferos del Chaco Central. *Wildlife Conservation Society*, Asunción (Paraguay).

Weiler A., Núñez K., Peris S., Silla F., Airaldi K., González de Weston G., Cubilla F., Salinas P., Zaldivar B., Valiente E., Chavez K., Ramos Y. & Tabilo D., 2019 – Guía para la identificación de mamíferos medianos y grandes del Chaco Seco. *Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Asunción*, San Lorenzo (Paraguay).

Weiler A., Núñez K. & Silla F., 2020 – Forest matters: Use of water reservoirs by mammal communities in cattle ranch landscapes in the Paraguayan Dry Chaco. *Global Ecology and Conservation*, 23 (9), e01103.

Wetzel R. M. & Lovett J. W., 1974 – A collection of mammals from the Chaco of Paraguay. *The University of Connecticut, Occasional Papers, Biological Science Series*, 2 (13): 203-216.

Whitaker J. O. & Abrell D. B., 1987 – Notes on some ectoparasites from mammals of Paraguay. *Entomological News*, 98: 198-204.

Wied-Neuwied M. P. zu, 1826 – Beiträage zue Naturgeschichte von Brasilien. Verzeichniss der Amphibien, Säugthiere un Vögel, welche auf einer Reise Zwischen dem 13ten dem 23sten Grade Südlicher Breite im Östlichen Brasilien Beobachtet Wurden. II Band. Mammalia, Säugthiere. *Gr. HS priv. Landes Industrie Comptoirs*, Weimar (Germany).

Yahnke C. J., Fox I. G. & Colman F., 1998 – Mammalian species richness in Paraguay: the effectiveness of national parks in preserving biodiversity. *Biological Conservation*, 84 (3): 263-268.

Yeo M., Acosta N., Llewellyn M., Sanchez H., Adamson S., Miles G. A., López E., González N., Patterson J. S., Gaunt M. W., Rojas de Arias A. & Miles M. A., 2005 – Origins of Chagas disease: *Didelphis* species are natural hosts of *Trypanosoma cruzi* I and armadillos hosts of *Trypanosoma cruzi* II, including hybrids. *International Journal of Parasitology*, 35 (2): 225-233.

Ziegler T., Unger J., Feiler A. & Lehr E., 2002 – The first Gran Chaco Expedition of the Museum für Tierkunde Dresden. Records of amphibians, reptiles and mammals from the Dry Chaco of Paraguay (Amphibia, Reptilia, Mammalia). *Faunistische Abhandlungen Staatliches Museum für Tierkunde Dresden*, 23: 219-238.

Zuercher G. L., Owen R. D., Torres J. & Gipson P. S., 2022 – Mechanisms of coexistence in a diverse Neotropical mammalian community. *Journal of Mammalogy*, 103 (3): 618-638.