



Status and distribution of Paraguayan Mustelidae

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Abstract. Five species of Mustelidae are known to occur in Paraguay – Tayra *Eira barbara*, Lesser Grison *Galictis cuja*, Greater Grison *Galictis vittata*, Giant Otter *Pteronura brasiliensis* and Neotropical Otter *Lontra longicaudis*. However, Paraguayan data regarding the distribution and status of these species in Paraguay is not easily obtainable, and scattered amongst numerous, often obscure publications. Paraguayan literature and specimens were reviewed to compile data on the distribution and status of these species in the country and records are presented in a hierarchical manner reflecting the reliability of each report. Data on these species in Paraguay are sorely lacking and our knowledge of distribution in the country is poor. The specimen record is incomplete and severely biased towards the Chaco region. Most species are apparently widespread and fairly common in the country. Giant Otter has a more restricted distribution, mainly in the Pantanal region. The precise distribution of the Greater Grison is unclear, probably because of widespread confusion of this species with the Lesser Grison.

Key words: conservation, *Eira barbara*, *Galictis cuja*, *Galictis vittata*, *Lontra longicaudis*, *Pteronura brasiliensis*.

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I. INTRODUCTION

The Paraguayan Mustelidae consists of five species in four genera (DE LA SANCHA et al. 2017; SALDÍVAR et al. 2017). However, because of the low density and secretive nature of many of the species, publications dealing specifically with Mustelids in Paraguay are limited to basic data on distribution and natural history (AZARA 1802; BERTONI 1932; BROOKS 1991; CARTES et al. 2013; RENGGER 1830; SMITH et al. 2013; SMITH 2020) and no species has been the subject of ecological study in the country. In a rapidly changing ecological landscape, an understanding of species distribution and biological requirements is quickly becoming a necessity. With a view towards consolidating the available data on the distribution and status of Paraguayan Mustelidae a review of the specimens, literature and reliable field records was performed. The results are presented here.

The history of Mustelid studies in Paraguay

The fauna of the Jesuit territory of “Paraquaria”, (which encompassed a large area of northern Argentina, Paraguay, southern Brazil and eastern Bolivia) were described by several early Jesuit missionaries, notably DOBRIZHOFFER (1784) who mentioned two species of Mustelid: “the otter” (*Lontra longicaudis*) and the “river-wolves” (*Pteronura brasiliensis*). DOBRIZHOFFER (1784) described *Lontra longicaudis* as “swarming” in Paraguay, noting that the indigenous people would hunt them during droughts and that “many hundreds are killed with stakes in one day”, feeding upon their flesh and making cloaks from their skin. On the other hand, he noted that the Albiponian women tamed the pups of the “river-wolves” and suckled them like their own children, but did not consume the flesh. Writing around the same time SÁNCHEZ LABRADOR (1910) noted two species of “lobos” or “perros de agua” (otter), a large one and a small one, noting the indigenous name “Egueleiche”.

The first systematic treatise dealing with the Paraguayan species was AZARA (1801, 1802) who described three species of mustelid: two, the Hurón Mayor (*Eira barbara*) and the Hurón Menor (*Galictis cuja*) in his grouping of Hurones (weasels); and a third, the Nutria (*Lontra longicaudis*) in his grouping of Zorros (foxes). He also included the Yagüaré (Molina's Hog-nosed Skunk *Conepatus chinga*, Mephitidae) with his Hurones, but noted that it "does not exist in Paraguay". He provided detailed descriptions of the behaviour and appearance of each species, as well as information on domesticating them. AZARA (1801) believed his Nutria to be the same as the *Saricoviene* of BUFFON, however, after examining the type in the Paris museum and noting that it was a "much larger animal", AZARA (1809) considered it "most likely" that this was the larger otter that he had observed in the rivers of "northern Paraguay", which he had hitherto attributed to differences in age. The *Saricoviene* of BUFFON has generally been associated with *Pteronura brasiliensis*, though the author's description contains several discrepancies with that species.

RENGGER (1830) cited the same species but applied scientific names for the first time, including a species description for an otter which he named *Lutra paranensis*. Such was the lack of mammalogical study in the country over the next century, the base list for Paraguay remained the same until BERTONI (1914) added an additional species Greater Grison *Galictis vittata* and was the first author to categorically list Giant Otter *Pteronura brasiliensis* for the country. Oddly, BERTONI (1939) later also included the Bush Dog *Speothos venaticus* in the family Mustelidae.

Nomenclatural confusion in the genus *Galictis* was reflected in BERTONI (1914, 1932, 1939) who clearly described two Paraguayan species in the genus, yet was so inconsistent in his application of the nomenclature (reflecting the scientific disagreement at the time), that the presence of both species in the country was long overlooked (YENSEN & TARIFA 2003a, b). SMITH et al. (2013) finally clarified the nomenclature and reconfirmed the presence of both species in Paraguay.

Confusion also existed over the nomenclature of the otters. RENGGER's (1830) name *Lutra paranensis* was originally applied correctly to the small Neotropical otter now known as *Lontra longicaudis* (IHERING 1893, 1910; BERTONI 1914, 1939; WERNECK 1937) by regional South American authors, but a paper by NEHRING (1900) associated the description with the Giant Otter *Pteronura brasiliensis*, and this conclusion was repeated by influential European works during the 20th century (POHLE 1919; CABRERA 1958; HARRIS 1968; NOONAN et al. 2017). This eventually led to the erroneous supposition that a dwarf, and perhaps now extinct subspecies of *P. brasiliensis* once inhabited the Paraná River

(CHEBEZ 2008). The case was finally explained and clarified by SMITH (2020).

Five species of Mustelidae in four genera are now known to occur in Paraguay. Though it seems that most species are widespread habitat generalists, little is known about the abundance, ecology and distribution of Mustelidae in Paraguay and the family is exceptionally poorly represented in the specimen record.

II. MATERIALS AND METHODS

Specimens of Mustelidae from the major zoological collections in Paraguay were reviewed during 2017-2020, identifications were confirmed by inspection of the specimens and locality data was collated from museum databases and specimen labels. The location of specimens in foreign museums was gleaned from the literature and from Vert Net (which returned 56 results for Paraguay and Mustelidae). 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 Mustelid specimens are as follows:

CBMI – Colección Biológica Museo de Itaipú, Hermandarias, Paraguay.

CONN – University of Connecticut Museum of Natural History, Storrs, USA.

CZPLT – Colección Zoológica Para La Tierra, Pilar, Paraguay

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

MJUF – Museo Jakob Unger, Filadelfia, Paraguay.

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

MCZ – Museum of Comparative Zoology, Cambridge, Massachusetts, USA.

MNHNPY – Museo Nacional de Historia Natural del Paraguay, San Lorenzo, Paraguay.

MTD – Museum für Tierkunde, Dresden, Germany.

RBINS – Royal Belgian Institute of Natural Sciences, Brussels, Belgium.

UMMZ – University of Michigan, Ann Arbor, USA.

Subfamily names follow DO NASCIMENTO (2004). Species accounts begin with the current common name in bold type. The valid scientific name and author is presented for each species 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-ex-

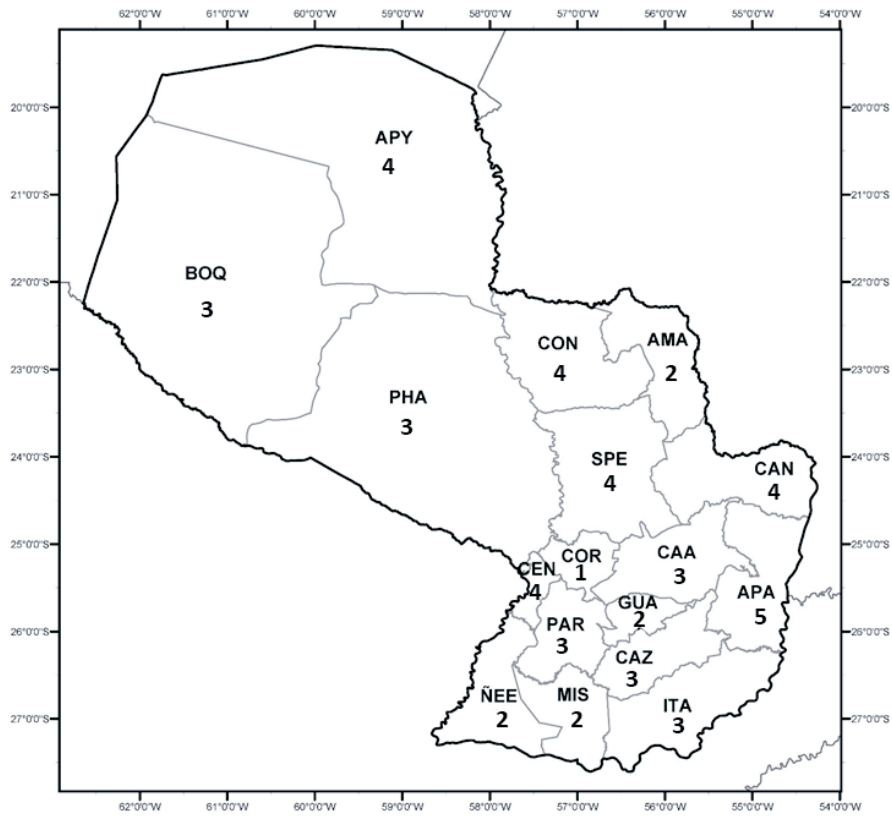


Fig. 1. Map showing the political departments of Paraguay and the number of species of Mustelids recorded in each. Departments as follows: Chaco region – Alto Paraguay (APY), Boquerón (BOQ), Presidente Hayes (PHA); Oriental region – Amambay (AMA), Alto Paraná (APA), Caaguazú (CAA), Canindeyú (CAN), Caazapá (CAZ), Central (CEN), Concepción (CON), Cordillera (COR), Guairá (GUA), Itapúa (ITA), Misiones (MIS), Neembucú (NEE), Paraguari (PAR), San Pedro (SPE)

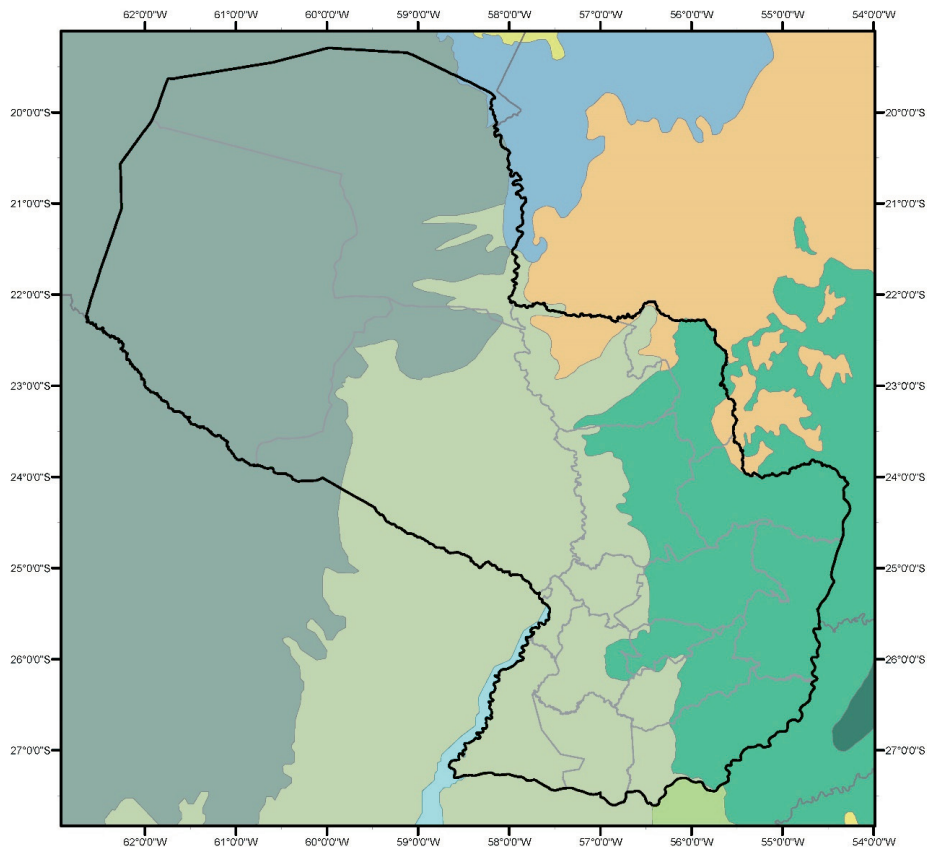


Fig. 2. Map showing Paraguayan ecoregions. Dark Green – Dry Chaco and Cerrados del Chaco; Light Green – Humid Chaco; Orange – Cerrado; Bright Green – Atlantic Forest.

planatory) single word descriptor of the subject of the publication, as follows: biogeography, checklist, conservation, distribution, ecology, first record, folklore, guide, mention, mortality, nomenclature, parasitology, specimen/s, taxonomy, tracks, translation of AZARA 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 that I could find published in the Paraguayan literature 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 (see Fig. 1), followed by the details of the record (in alphabetical order). For specimen records this involves the specimen number (museum codes in appendix 1) followed by the locality. These records are also mapped distinguishing the hierarchical categories so that readers may interpret their reliability for themselves (Figs 2, 3-7). Records corresponding to categories 4) published photographic record, 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. Every effort was made to be thorough in this regard, though undoubtedly some obscure references will have been missed. The maps included in NERIS et al. (2002) were omitted from this compilation. These maps were based on interviews with unidentified local people and contain numerous, obvious errors that I am 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.

The conservation status for all Paraguayan species was assessed by GIORDANO et al. (2017) and SALDÍVAR et al. (2017). A statement on the ecological affinities of each species in Paraguay is provided based on the ecoregions defined in GUYRA PARA-

GUAY (2005) and MERELES (2013). 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 north-eastern 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).

III. RESULTS

Lutrinae BONAPARTE, 1838

Neotropical Otter *Lontra longicaudis* (OLFERS, 1818)

Fig. 3

Lutra longicaudis OLFERS, 1818: 233. Type locality “Brazil”.

Lutra paranensis RENGGER (1830: description, ecology); BERTONI (1914: checklist, distribution, first record); SMITH (2020: nomenclature).

Mustela lutra brasiliensis HUNTER (1838: translation of AZARA).

Lutra longicaudis BROOKS et al. (1993: distribution); VON HUMBECK & SILVEIRA AVALOS (1995: distribution); LOWEN et al. (1996: distribution); ENTIDAD BINACIONAL YACYRETÁ (undated: guide).

Lontra longicaudis GAMARRA DE FOX & MARTIN (1996: specimens); YAHNKE et al. (1998: distribution); NERIS et al. (2002: distribution); CARTES (2004: ecology); NERIS & FRANCO RIVAROLA (2005: guide); MORALES (2007: conservation); CARTES et al. (2010: mortality); RAMÍREZ PINTO & VELÁZQUEZ (2010: checklist); RUMBO (2010: biogeography); VELÁZQUEZ & RAMÍREZ PINTO (2014: guide); GIORDANO et al. (2017: conservation); DE LA SANCHA et al. (2017: checklist); GONZÁLEZ et al. (2019: abundance, distribution); WEILER et al. (2019: guide); CABALLERO-GINI et al. (2020: distribution); SMITH (2020: nomenclature).

Lontra longicaudis GAMARRA DE FOX et al. (1998: conservation).

Lontra (Lutra) longicaudis ESQUIVEL (2001: guide); VILLALBA & YANOSKY (2000: tracks).

Lontra longicaudis ZUERCHER et al. (2001: conservation, distribution).

Lontra (Lutra) longicaudis FARIÑA & HOSTETTLER (2003: checklist).

Local names: Lobo de Río, Nutria (AZARA 1802), Aira (Aché: ESQUIVEL 2001), Chery (Aché: ESQUIVEL 2001), Lobo Pe (Guaraní: GAMARRA DE FOX & MARTIN 1996); Lobito de Río (GAMARRA DE FOX & MARTIN 1996), Chery miní (Aché: VILLALBA & YANOSKY 2000), Guaira, Guaira’o (Mbya, Ava, Pâi tavyterâ: VILLALBA & YANOSKY 2000), Jaguachî (Mbya: VILLALBA & YANOSKY 2000), Nutria de Agua (ESQUIVEL 2001), Lobo pe’i (NERIS & FRANCO RIVAROLA 2005), Nutria de Río (MORALES 2007), Lovope (WEILER et al. 2019).

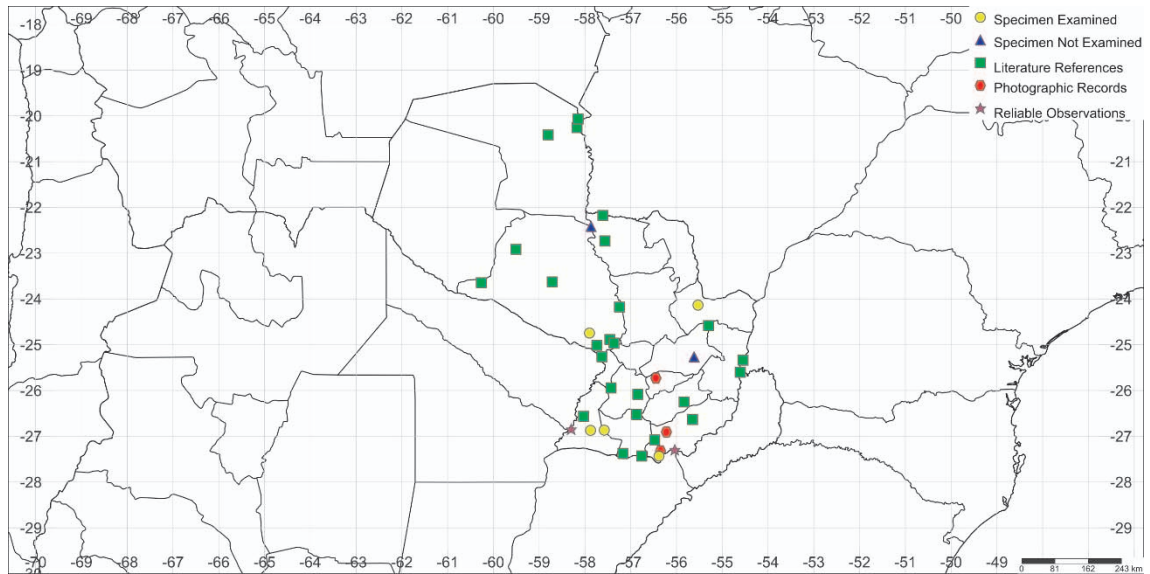


Fig. 3. Distribution of *Lontra longicaudis* in Paraguay.

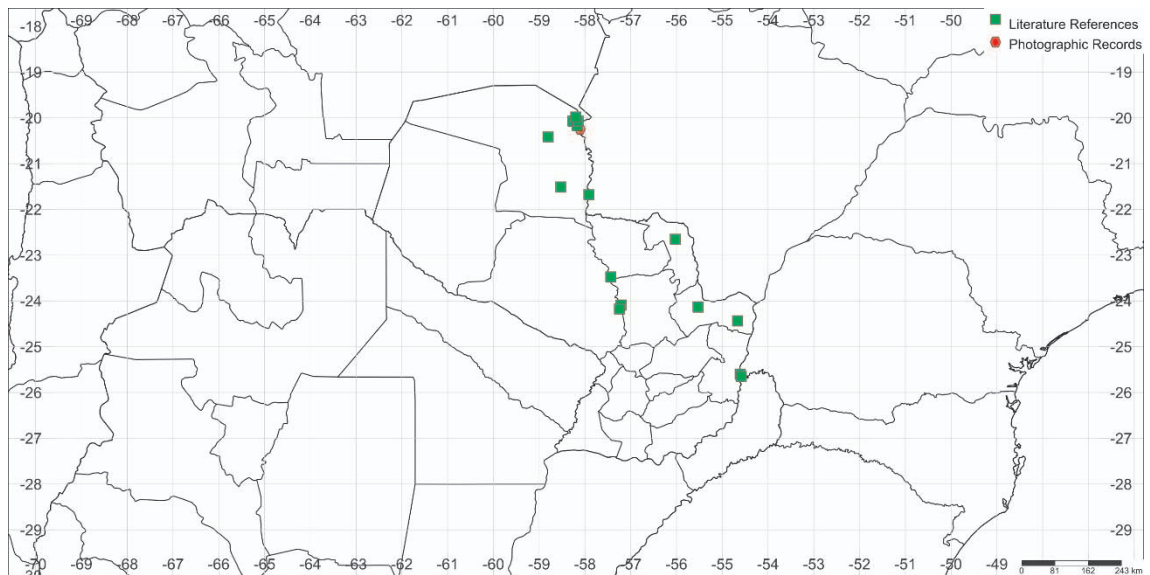


Fig. 4. Distribution of *Pteromura brasiliensis* in Paraguay.

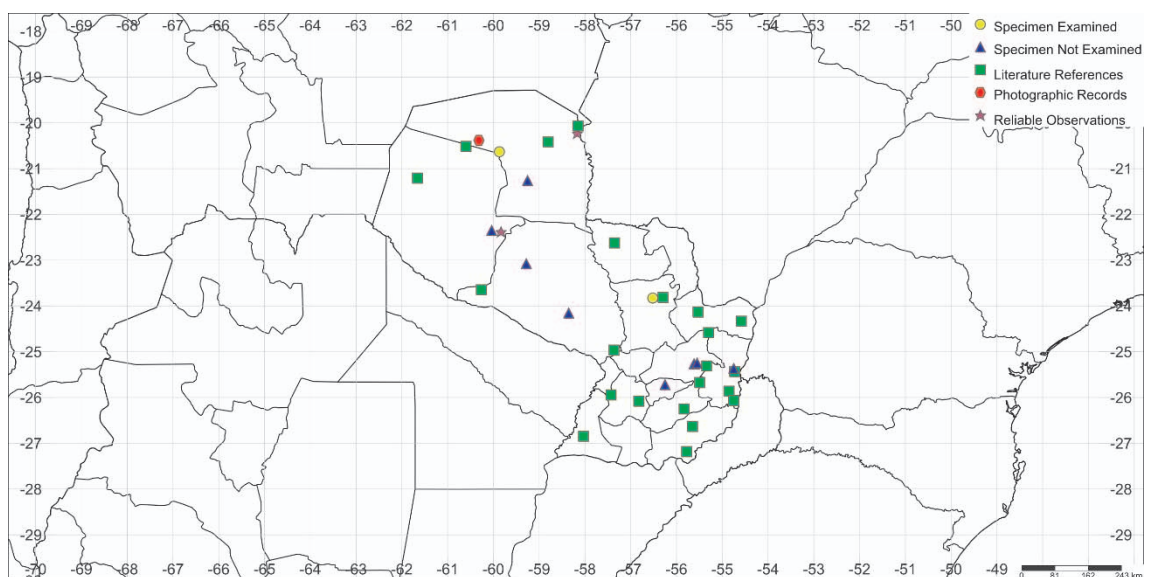


Fig. 5. Distribution of *Eira barbara* in Paraguay.

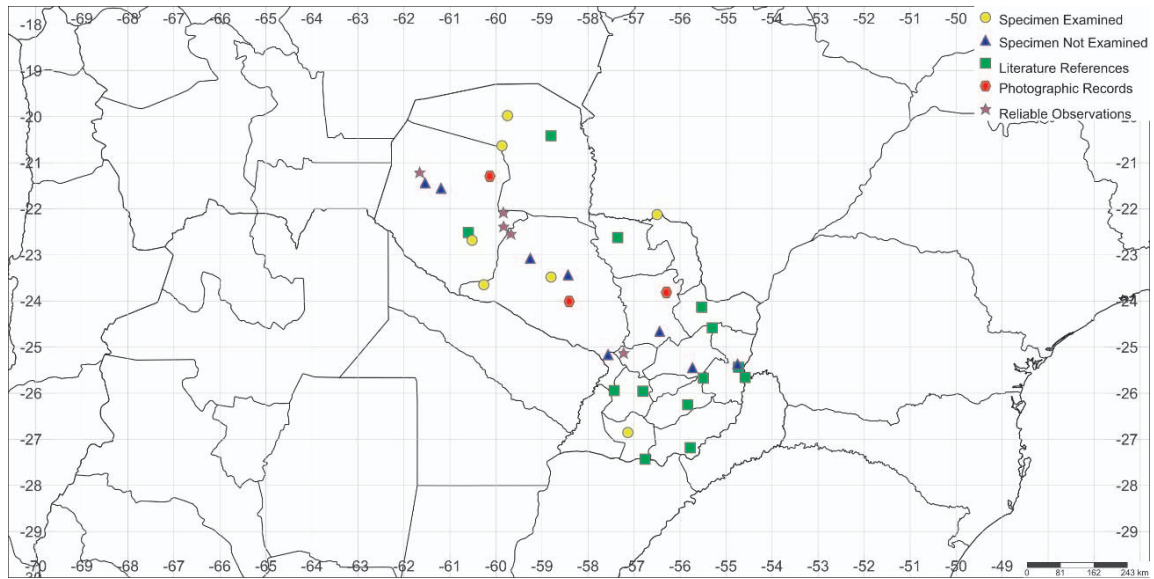


Fig. 6. Distribution of *Galictis cuja* in Paraguay.

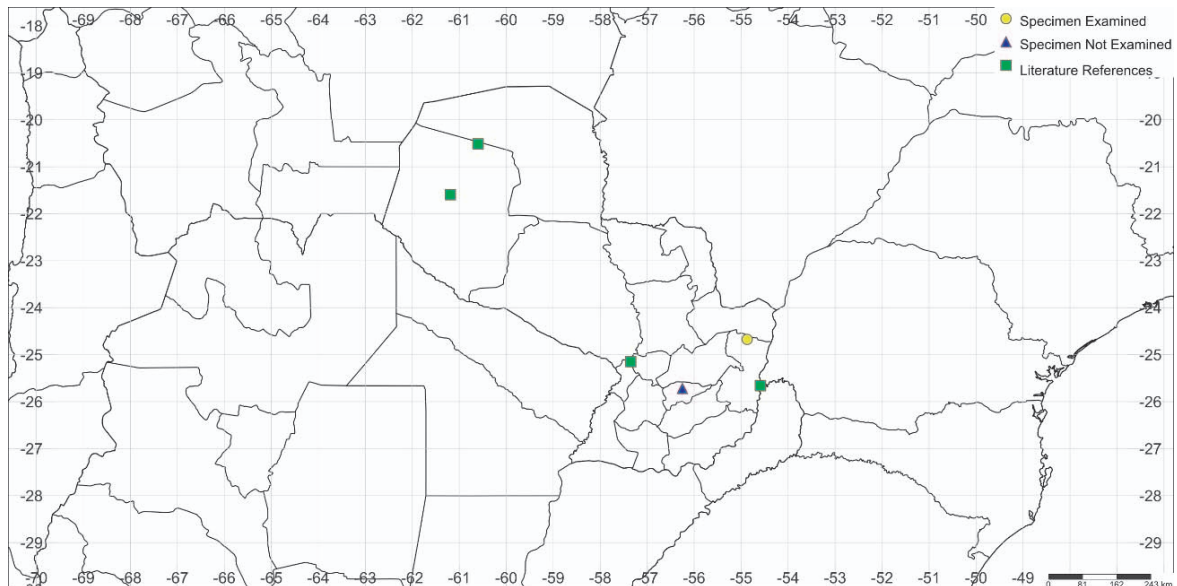


Fig. 7. Distribution of *Galictis vittata* in Paraguay.

Comments: In his English translation of the work of AZARA, HUNTER (1838) considered AZARA's Nutria to be *Mustela lutra brasiliensis* GMELIN, 1788, and noted that Cuvier considered the "Canadian and Brazilian otters to be the same species". He then provided the descriptions of the North American River Otter *Lontra canadensis* (SCHREBER, 1777) and the Sea Otter *Enhydra lutris* (LINNAEUS, 1758) from RICHARDSON (1829) "in order to clear up any obscurity." In fact, none of these names refer to the correct species, and the subspecies name provided by HUNTER (1838) in fact refers to the following species. SMITH (2020) provides comments on AZARA's (1802) description and how it conclusively relates to this species.

BERTONI (1914, 1939) reported the species as present on the Mondañh, Paraguay and Paraná rivers. The species is widespread at low density throughout the river systems of the country and is classified as Least Concern in Paraguay (SALDÍVAR et al. 2017).

I was unable to find concrete reports of the species from Amambay, Boquerón, and Cordillera, departments, but this would seem to be a reflection of low sampling (or publishing!) effort rather than a true reflection of absence from these regions. The species is known for example to occur on Lago Ypacaraí (which is bordered on its eastern banks by Cordillera department), and the species is mapped for these departments by NERIS et al. (2002) on the basis of interviews with unidentified local people. Potential presence in

the Dry Chaco of Boquerón department however, would perhaps be more marginal, or linked to water levels.

Examined specimens: **ALTO PARAGUAY**: no exact locality (MNHNPY 2906); **CANINDEYÚ**: Reserva Bosque Mbaracayú (MNHNPY 2034); **ITAPÚA**: Estancia Melgarejo, Isla Yacyretá (MNHNPY 1111); **ÑEEMBUCÚ**: 46 km E of Pilar by road (CZPLT-M-514); 72 km E of Pilar by road (CZPLT-M-515); **PRESIDENTE HAYES**: Ruta Transchaco (MNHNPY 2218); Ruta Transchaco km70 (MNHNPY 3276).

Specimens not examined: **CAAGUAZÚ**: Junction of the Iguazú and Yuquerí Rivers (MCZ 28092, 28093); Rio Iguazú below Numbucu (?); **PRESIDENTE HAYES**: West bank of Rio Paraguay, 4km NW of Puerto Foncierre 22°25'S, 57°52'W (UMMZ 166658).

Literature references: **ALTO PARAGUAY**: Parque Nacional Rio Negro (CARTES 2004); Puerto Diana (GAMARRA DE FOX & MARTIN 1996); Tres Gigantes (GONZÁLEZ et al. 2019); **ALTO PARANÁ**: Embalse de Itaipú Binacional (VON HUMBECK & SILVEIRA AVALOS 1995, GAMARRA DE FOX & MARTIN 1996); Mondaíh (BERTONI 1914); **CAAZAPÁ**: Reserva Natural Tapytá (VELÁZQUEZ & RAMÍREZ PINTO 2014); **CANINDEYÚ**: Reserva Natural Bosque Mbaracayú (ESQUIVEL 2001, ZUERCHER et al. 2001, FARIÑA & HOSTETTLER 2003); **CANINDEYÚ/CAAGUAZÚ**: Reserva Morombí (=Reserva Natural Privada Golondrina II) (BROOKS et al. 1993; LOWEN et al. 1996); **CENTRAL**: Bahía de Asunción (GUYRA PARAGUAY 2008); **CENTRAL/PARAGUARÍ**: Lago Ypoá (CARTES 2004; GUYRA PARAGUAY 2008); **CONCEPCIÓN**: Arroyo Tagatiyá (GUYRA PARAGUAY 2008); Estancia Estrella (GUYRA PARAGUAY 2008); **ITAPÚA**: Estancia Nueva Gambach (SMITH et al. 2006); Estero Kuruñaí (GUYRA PARAGUAY 2008); Isla Yacyretá (GUYRA PARAGUAY 2008); **MISIONES**: Estancia La Graciela (GUYRA PARAGUAY 2008); Yabebyry (GUYRA PARAGUAY 2008); **ÑEEMBUCÚ**: no exact locality (GAMARRA DE FOX & MARTIN 1996); Estancia Redondo (GUYRA PARAGUAY 2008); **PARAGUARÍ**: Parque Nacional Ybycuí (YAHNKE et al. 1998); **PRESIDENTE HAYES**: Estancias Golondrina-El Trebol (GUYRA PARAGUAY 2008); Estancia La Rafaela (GUYRA PARAGUAY 2008); Estancia Millón (CARTES 2004); Tinfunqué (CARTES 2004; GUYRA PARAGUAY 2008); **PRESIDENTE HAYES**: Estancia Playada (CABALLERO-GINI et al. 2020); **PRESIDENTE HAYES/BOQUERÓN**: Ruta Transchaco between km236 and km 505 (CARTES et al. 2010); **SAN PEDRO**: Rio Jejuí (CARTES et al. 2013).

Photographic records: **GUAIRÁ**: Yataity, Villarrica (https://www.youtube.com/watch?v=SSil_hoiYgw, Marcos SALDÍVAR MONTALBETTI); **ITAPÚA**: General Artigas (José PAREDES); San Cosmé y Damián (Robert

DERNA); **PRESIDENTE HAYES**: Ruta Transchaco (FPMAM455PH, Hugo DEL CASTILLO).

Reliable observations: **ITAPÚA**: Encarnación (Paul SMITH, own unpublished information); **ÑEEMBUCÚ**: Base Militar, Pilar (Rebecca SMITH, unpublished information).

Giant Otter *Pteronura brasiliensis* (GMELIN, 1788)

Fig. 4.

Lutra brasiliensis RAY, 1693: 189. No type locality given; stated as “in fluviis Americae meridionalis” by GMELIN (1788: 93); and subsequently restricted to “rfo São Francisco, en la orilla correspondiente al estado de Alagoas” Brazil by CABRERA (1958: 274).

Pteronura brasiliensis BERTONI (1914; checklist, distribution); MELQUIST (1984: conservation); BROOKS et al. (1993: distribution); YAHNKE et al. (1998: distribution); MERCOLLI et al. (1999: distribution); VILLALBA & YANOSKY (2000: tracks); ESQUIVEL (2001: guide); ZUERCHER et al. (2001: conservation, distribution); NERIS et al. (2002: distribution); FARIÑA & HOSTETTLER (2003: checklist); CARTES (2004: ecology); MORALES (2007: conservation); GUYRA PARAGUAY (2008: distribution); HORTON (2010: guide); RUMBO (2010: biogeography); MASI PALLARÉS (2011: ecology); CARTES et al. (2013: conservation, distribution); GIORDANO et al. (2017: conservation); DE LA SANCHA et al. (2017: checklist); GONZÁLEZ et al. (2019: distribution); SMITH (2020: nomenclature).

Local names: Arirai (BERTONI 1914), Chery vachu (Aché: ESQUIVEL 2001), Nutria gigante (ESQUIVEL 2001), Lobo de corbata (MASI PALLARÉS 2011), Arirai (Mbya, Ava: VILLALBA & YANOSKY 2000), Guairaka (Pái tavyterá: VILLALBA & YANOSKY 2000), Lobo marino (VILLALBA & YANOSKY 2000).

Comments: BERTONI (1914) reported the species for Paraguay from the rivers Mondaíh and Paraná. *Lutra paranensis* RENGGER, 1830 refers to *Lontra longicaudis* and not this species as long believed (SMITH 2020).

Presence in the Reserva Natural Bosque Mbaracayú (Canindeyú department) is on the basis of reports from Aché indigenous groups, with the last report in 1997, and another undocumented report by an unnamed fisherman of Curuguaty who claimed to have seen an individual in 1994 at the confluence of the Jejuí-Mi and Jejuí Guasu Rivers on the property of Sr. Nino Jiménez (ESQUIVEL 2001). There exists no documentation of the species in this area however, and ESQUIVEL (2001) noted that any population that may exist is probably unviable. I am unaware of the source of the supposed occurrence of this species in Parque Nacional Cerro Corá (Amambay department) as claimed by YAHNKE et al. (1998), and suggest it should be treated with caution (and likely historical).

The stronghold of the Paraguayan population is in the Pantanal area of the northern Paraguay River and its tributary, the Rio Negro (Alto Paraguay department) and it is classified as Critically Endangered in Paraguay (GIORDANO et al. 2017). Whether occa-

sional reports south of here refer to additional populations or wandering individuals is unclear. Historical presence on the Paraná river is beyond doubt, but it seems likely that the species has now been extirpated from this region. The map in NERIS et al. (2002) indicates the species as still occurring in Cordillera, Caa-guazú, Guairá, Ñeembucú and Presidente Hayes, in addition to those documented here. These records are based on reports by unidentified local people, and given the lack of documentation for any of these areas, I consider that they potentially greatly over-estimate the true distribution of this species in Paraguay, whilst also accepting the possibility that the species may wander into these departments along river systems.

Specimens: There are no known Paraguayan specimens.

Literature references: **ALTO PARAGUAY:** Carmelo Peralta (CARTES et al. 2013); Estancia Laguna Yacaré (CARTES et al. 2013); Few kilometres from the mouth of the Rio Negro (CARTES et al. 2013); Fortín Patria (MERCOLLI et al. 1999); Tres Fronteras, Rio Paraguay (CARTES et al. 2013); Tres Gigantes (HORTON 2010; GONZÁLEZ et al. 2019); Parque Nacional Rio Negro (CARTES 2004; GUYRA PARAGUAY 2008); **ALTO PARANÁ:** Mondañh (BERTONI 1914); Rio Paraná (BERTONI 1914); **AMAMBAY:** Parque Nacional Cerro Corá (YAHNKE et al. 1998); **CANINDEYÚ:** Estancia Itabó (GUYRA PARAGUAY 2008); Reserva Natural Bosque Mbaracayú (ESQUIVEL 2001; ZUERCHER et al. 2001; FARIÑA & HOSTETTLER 2003; GUYRA PARAGUAY 2008); **CONCEPCIÓN/SAN PEDRO:** Ypané River (MELQUIST 1984); **SAN PEDRO:** Mouth of the Río Jejuí (CARTES et al. 2013); Río Montelindo, Puerto Antequera (CARTES et al. 2013).

Photographic records: **ALTO PARAGUAY:** Rio Paraguay N of Bahía Negra (FPMAM460PH, Arne LESTERHUIS).

Guloninae GRAY, 1825

Tayra Eira barbara (LINNAEUS, 1758)

Fig. 5.

Mustela barbara LINNAEUS, 1758: 46. Type locality “Brasilia”, restricted by LÖNNBERG (1913) to “Pernambuco.”

Gulo barbarus RENGGER (1830: ecology).

Mustela barbara RENGGER (1830: ecology).

Mustela canadensis HUNTER (1838: translation of AZARA).

Galera barbara BERTONI (1914: checklist, distribution); BERTONI (1932: folklore, nomenclature).

Tayra barbara BERTONI (1939: checklist, distribution).

Tayra barbara barbara KRUMBIEGEL (1942: taxonomy).

Eira barbara barbara WETZEL & LOVETT (1974: specimens).

Eira barbara BROOKS (1991: conservation, distribution, ecology); BROOKS et al. (1993: distribution); VON HUMBECK & SILVEIRA AVALOS (1995: distribution); GAMARRA DE FOX & MARTIN (1996: specimens); LOWEN et al. (1996: distribution);

GAMARRA DE FOX et al. (1998: conservation); YAHNKE et al. (1998: distribution); VILLALBA & YANOSKY (2000: tracks); ARESKOUG (2001: ecology); ESQUIVEL (2001: guide); NERIS et al. (2002: distribution); ZIEGLER et al. (2002: specimen); FARIÑA & HOSTETTLER (2003: checklist); HILL et al. (2003: use); CARTES (2004: ecology); NERIS & FRANCO RIVAROLA (2005: guide); MORALES (2007: conservation); ITAIPÚ BINACIONAL (2010: guide); RUMBO (2010: biogeography); MASI PALLARÉS (2011: ecology); VELÁZQUEZ & RAMÍREZ PINTO (2014: guide); GIORDANO et al. (2017: conservation); DE LA SANCHA et al. (2017: checklist); GONZÁLEZ et al. (2019: abundance, distribution); OWEN & SMITH (2019: mention); WEILER et al. (2019: guide); CABALLERO-GINI et al. (2020: distribution).

Local names: Hurón mayor (AZARA 1802); Eirá (BERTONI 1914), Taira (ESQUIVEL 2001), Airá (Aché: VILLALBA & YANOSKY 2000), Yrara (Mbya: VILLALBA & YANOSKY 2000), Eira (Ava, Pâi tavyterâ: VILLALBA & YANOSKY 2000), Eira moro (NERIS & FRANCO RIVAROLA 2005), Mbaracayá eirá (MORALES 2007); Hurón grande (VELÁZQUEZ & RAMÍREZ PINTO 2014). The name Mbaracayá eirá used by MORALES (2007) is a misapplication of a common name that correctly refers to the Jaguarundi *Herpailurus yagouaroundi*.

Comments: The generic name *Galera* BROWNE, 1789 is based on a species of mongoose (ALLEN 1908). BERTONI (1939) used the generic name *Tayra* OKEN, 1816, following IHERING (1910). OKEN’s names are however unavailable and the next available generic name is *Eira* (HERSHKOVITZ 1949).

In his English translation of the work of AZARA, HUNTER (1838) considered AZARA’s Hurón Mayor to be a variety of the “Pekan” *Mustela canadensis* SCHREBER, 1777, a junior synonym of the Fisher *Pekania pennanti* (ERXLEBEN, 1777), an association that AZARA (1802) had earlier made, stating “I believe them to be the same species”. However, AZARA (1802) also correctly associated his description with the “Comadreja negra del Brasil” of Holmeus (= *Eira barbara*), though he incorrectly believed this to be the same as *Pekania*. BERTONI (1932) briefly mentions a legend that this species is able to transform into a Jaguarundi *Puma yagouaroundi* (Felidae) and vice versa. Indeed, AZARA (1802) had earlier commented how the indigenous Guaraní frequently confused these two animals.

This is a common species in most of the country where suitable habitat is present. It occurs in all ecoregions and is classified as Least Concern in Paraguay (SALDÍVAR et al. 2017). I am unable to find concrete reports of the species from Amambay, Cordillera or Misiones departments, but this would seem to be a reflection of low sampling effort rather than a true reflection of absence from these regions, and the species is mapped for these departments by NERIS et al. (2002) on the basis of interviews with unidentified local people.

Examined specimens: Mounted specimen lacking data MJUF; **ALTO PARAGUAY:** Parque Nacional Defensores del Chaco (MNHNPY 797); **SAN PEDRO:** Yaguarete Forests (MNHNPY 3363).

Specimens not examined: **ALTO PARAGUAY**: 139 km W of Puerto Sastre (CONN 19510); **ALTO PARANÁ**: Vivero Forestal Itaipú, Hernandarias (CBMI 0104); **BOQUERÓN**: Filadelfia and surroundings (MTD-B 24882; ZIEGLER et al. 2002); **CAAGUAZÚ**: Junction of the Iguazú and Yuquerí Rivers (MCZ 29055); Yuquerí River (MCZ 28648, 28649, 28720, 28721, 28722); **GUAIRÁ**: Colonia Independencia (AMNH 77696); **PRESIDENTE HAYES**: Estancia Juan de Salazar (CONN 15965, 16051, 16227, 16641; WETZEL & LOVETT 1974); Rio Negro (AMNH 36507, FMNH 146358).

Literature references: **ALTO PARAGUAY**: Parque Nacional Rio Negro (CARTES 2004); Tres Gigantes (GONZÁLEZ et al. 2019); **ALTO PARANÁ**: Área de Itaipú (VON HUMBECK & SILVEIRA AVALOS 1995); Estancia Don Oscar (GUYRA PARAGUAY 2008); Estancia San Antonio (BROOKS et al. 1993; LOWEN et al. 1996); **BOQUERÓN**: Gran Siete (ARESKOUG 2001); Parque Nacional Teniente Enciso (GAMARRA DE FOX & MARTIN 1996); **CAAZAPÁ**: Parque Nacional Caaquazú (LOWEN et al. 1996); Reserva Natural Tapytá (VELÁZQUEZ & RAMÍREZ PINTO 2014); Reserva Natural Privada Ypetí (=Estancia La Golondrina I) (BROOKS et al. 1993, LOWEN et al. 1996); **CANINDEYÚ**: Reserva del Bosque Mbaracayú (GAMARRA DE FOX & MARTIN 1996; LOWEN et al. 1996; ESQUIVEL 2001; HILL et al. 2003; OWEN & SMITH 2019); Reserva Privada Itabó (BROOKS et al. 1993; LOWEN et al. 1996); **CANINDEYÚ/CAAGUAZÚ**: Reserva Morombí (=Reserva Natural Privada Golondrina II) (BROOKS et al. 1993; LOWEN et al. 1996); **CENTRAL/PARAGUARÍ**: Lago Ypoá (CARTES 2004); **CONCEPCIÓN**: Parque Nacional Serranía San Luís (GAMARRA DE FOX & MARTIN 1996); **ITAPÚA**: Hotel El Tirol (SMITH et al. 2005a); Estancia Nueva Gambach (SMITH et al. 2006); **ÑEEMBUCÚ**: no locality given (GAMARRA DE FOX & MARTIN 1996); **PARAGUARÍ**: Parque Nacional Ybycuí (YAHNKE et al. 1998); **PRESIDENTE HAYES**: Estancia Playada (CABALLERO-GINI et al. 2020); Tinfunqué (CARTES 2004); **SAN PEDRO**: Rancho Laguna Blanca (SMITH et al. 2005b).

Photographic records: **ALTO PARAGUAY**: Cerro León (FPMAM846-850PH, Paul SMITH).

Reliable observations: **ALTO PARAGUAY**: Bahía Negra (Paul SMITH, own unpublished information); **BOQUERÓN**: Loma Plata (Paul SMITH, own unpublished information).

Ictonychinae POCOCK, 1921

Lesser Grison *Galictis cuja*
(MOLINA, 1782)

Fig. 6.

Mustela Cuja MOLINA, 1782:291. Type locality “Chili”. First restricted to “S. Chili (Temuco)” by THOMAS (1912: 46), then to “alrededores de Santiago” by CABRERA (1958: 261).

Gulo villatus RENGGER (1830: ecology).

Mustela vison HUNTER (1838: translation of AZARA).

G.[rison] vittatus BERTONI (1914: checklist); BERTONI (1932: specimen, taxonomy).

Grisonella huronax BERTONI (1932: specimen, taxonomy); BERTONI (1939: checklist, distribution).

Galictis cuja SEESE et al. (1981: parasitology); BROOKS (1991: conservation, distribution, ecology); VON HUMBECK & SILVEIRA AVALOS (1995: distribution); GAMARRA DE FOX & MARTIN (1996: specimens); LOWEN et al. (1996: distribution); GAMARRA DE FOX et al. (1998: conservation); YAHNKE et al. (1998: distribution); ARESKOUG (2001: ecology); ESQUIVEL (2001: guide); NERIS et al. (2002: distribution); FARIÑA & HOSTETTLER (2003: checklist); CARTES (2004: ecology); NERIS & FRANCO RIVAROLA (2005: guide); ITAIPÚ BINACIONAL (2010: guide); RAMÍREZ PINTO & VELÁZQUEZ (2010: checklist); RUMBO (2010: biogeography); BORNHOLDT et al. (2013: taxonomy); SMITH et al. (2013: nomenclature); VELÁZQUEZ & RAMÍREZ PINTO (2014: guide); DE LA SANCHA et al. (2017: checklist); GIORDANO et al. (2017: conservation); GENGLER (2018: distribution); WEILER et al. (2019: guide); ENTIDAD BINACIONAL YACYRETÁ (undated: guide).

Galictis sp. ZIEGLER et al. (2002: specimen).

Local names: Hurón menor (AZARA 1802), Dyaguapé (BERTONI 1914), Yaguá kambé, Yaguapé (BERTONI 1939), Huroncito (ESQUIVEL 2001), Grisón (ESQUIVEL 2001), Juapê (Aché: ESQUIVEL 2001), Jaguambe (CARTES 2004), Huronpe'i (NERIS & FRANCO RIVAROLA 2005), Hurón pe (GUYRA PARAGUAY 2008), Jagua Pe (VELÁZQUEZ & RAMÍREZ PINTO 2014).

Comments: The name Yaguapé and its variants translate roughly as “dwarf dog” or “flattened dog” in reference to the short legs (RENGGER 1830; BERTONI 1932). SMITH et al. (2013) clarified the nomenclature used in the early Paraguayan literature for this and the following species. The animal illustrated for this species in ENTIDAD BINACIONAL YACYRETÁ (undated) is in fact a domestic Ferret (*Mustela putorius furo*).

In his English translation of the work of AZARA, HUNTER (1838) considered AZARA’s Hurón Menor to be “undoubtedly identical” to the American Mink *Mustela vison* (SCHREBER, 1777) (= *Neovison vison*). AZARA (1802) himself associated his description with the Grison of Allamand (in BUFFON 1803), which, though outwardly very similar, in fact refers to the following species. RENGGER (1830) stated that this species was so rare in Paraguay that he never encountered it himself, but noted that it was frequent in the Chaco and that the indigenous people often brought it for sale as a pet to Asunción. However due to “hostilities” between the indigenous and the “inhabitants of Paraguay” he had been unable to procure a specimen and thus relied on a description from his colleague Dr. PARLET (an English doctor who was resident in Paraguay) (RENGGER 1836).

An adult of this species was seen to bathe in puddles on the Transchaco road at around 3pm on 1 December 2018 close to the headquarters of Parque Nacional Teniente Enciso. It emerged from nearby brush and was observed to lie on its back in the puddle and flick water onto its body with the limbs as it bathed. On an-

other occasion an individual was observed stalking a lizard (*Teius teyou*) which it was unsuccessful in capturing.

Often common, the species occurs in all habitats throughout the country and is classified as Least Concern in Paraguay (SALDÍVAR et al. 2017). I was unable to find concrete reports of the species from Guairá or Ñeembucú departments, but this would seem to be a reflection of low sampling effort rather than a true reflection of absence from these regions, and the species is mapped for Ñeembucú (not Guairá) by NERIS et al. (2002) on the basis of interviews with unidentified local people. It would seem likely to be present in all departments throughout the country.

Examined specimens: Mounted specimen lacking data MJUF; **ALTO PARAGUAY:** Agua Rica, 2km W of Aguadulce (MNHNPY 793); Parque Nacional Defensores del Chaco (MNHNPY 792, 796); **AMAMBAY:** Bella Vista Norte (MNHNPY 1122); **BOQUERÓN:** Fortín Teniente Acosta (MNHNPY 1036); **MISIONES:** 123km E of Pilar by road (CZPLT-M-952); **PRESIDENTE HAYES:** NW of Pozo Colorado (MNHNPY 1906); Tinfunqué (MNHNPY 795).

Specimens not examined: “Paraguay” RBINS 370348; **ALTO PARANÁ:** Vivero Forestal Itaipú, Hernandarias (CBMI 0021, 0096, 0101); **BOQUERÓN:** 2km N of km589 Transchaco Highway (CONN 18486); Garrapatal’i, 7 km SW of km620 Transchaco Highway (CONN 17499); **CAAGUAZÚ:** Sommerfeld Colony (USNM 293164); **PRESIDENTE HAYES:** 23°26’S, 58°26’W (MACN 47373; BORNHOLDT et al. 2013); km6 Transchaco Highway (CONN 18147); Juan de Salazar, 1.5 km W of line camp (CONN 18148); **SAN PEDRO:** Tapiracuai, Ruta 10 (UMMZ 174833).

Literature references: **ALTO PARAGUAY:** Parque Nacional Rio Negro (CARTES 2004); **ALTO PARANÁ:** Área de Itaipú (VON HUMBECK & SILVEIRA AVALOS 1995); Puerto Bertoni (BERTONI 1914); **BOQUERÓN:** Fortín Toledo (BROOKS 1991); Gran Siete (ARESKOUG 2001); **CAAZAPÁ:** Reserva Natural Tapytá (VELÁZQUEZ & RAMÍREZ PINTO 2014); Ypetí (GUYRA PARAGUAY 2008); **CANINDEYÚ:** Reserva Morombí (VELÁZQUEZ & RAMÍREZ PINTO 2014); Reserva Natural Bosque Mbaracayú (ESQUIVEL 2001; FARIÑA & HOSTETTLER 2003); **CENTRAL/PARAGUARÍ:** Lago Ypoá (CARTES 2004); **CONCEPCIÓN:** PN Serranía San Luís (GAMARRA DE FOX & MARTIN 1996); **ITAPÚA:** Hotel El Tirol (SMITH et al. 2005a); Isla Yacyretá (GAMARRA DE FOX & MARTIN 1996); **PARAGUARÍ:** Isla Alta, Ybycuí (GENGLER 2018).

Photographic records: **BOQUERÓN:** Road from Teniente Martínez to Madrejón (FPMAM1093PH, Paul SMITH); **PRESIDENTE HAYES:** Ruta Transchaco km190 (FPMAM453PH, Hugo DEL CASTILLO); **SAN PEDRO:** Rancho Laguna Blanca (FPMAM1043PH, Karina ATKINSON).

Reliable observations: **BOQUERÓN:** Campo Loro (Paul SMITH, own unpublished information); Parque Nacional Teniente Enciso (Paul SMITH, own unpublished information); **CORDILLERA:** Granja Achira (Hugo DEL CASTILLO); **PRESIDENTE HAYES:** Laguna Capitán (Paul SMITH, own unpublished information); Loma Plata (Paul SMITH, own unpublished information).

Greater Grison *Galictis vittata* (SCHREBER, 1776)

Fig. 7.

Viverra vittata SCHREBER, 1776:pl. 124, text 1777:447 (dates fixed by SHERBORN 1891). Type locality “Surinam”.

Grison allamandi BERTONI (1914: checklist, first record); BERTONI (1939: checklist, distribution); BERTONI (1932: specimen, taxonomy).

Grison crassidens BERTONI (1932: specimen, taxonomy).

Galictis vittata ARESKOUG (2001; ecology); BORNHOLDT et al. (2013: taxonomy); SMITH et al. (2013: distribution, nomenclature, specimens); VELÁZQUEZ & RAMÍREZ PINTO (2014: guide); (DE LA SANCHA et al. (2017: checklist); GIORDANO et al. (2017: conservation).

Local names: Dyaguapé (BERTONI 1914); Ya-guapé (BERTONI 1939), Jagua Pe (VELÁZQUEZ & RAMÍREZ PINTO 2014), Hurón grande (VELÁZQUEZ & RAMÍREZ PINTO 2014).

Comments: Historical reports of this species in Paraguay were reviewed by SMITH et al. (2013) and nomenclatural usage was clarified. They considered the species widespread but clearly uncommon in Paraguay. There are few confirmed records of the species in Paraguay, but SMITH et al. (2013) noted that the under-recording of the species may be related to the widespread assumption that, until recently, only *Galictis cuja* was present in the country. It is classified as Data Deficient in Paraguay (SALDÍVAR et al. 2017). There are confirmed records from the Dry Chaco, Humid Chaco and Atlantic Forest ecoregions (BORNHOLDT et al. 2013; SMITH et al. 2013).

The inclusion of the species in a guide to the mammals of Reserva Natural Tapytá (Caazapá department) is not based on any firm evidence, but potential presence in that area is not ruled out (VELÁZQUEZ & RAMÍREZ PINTO 2014). Paraguayan records of this species were inexplicably treated as referring to *Galictis cuja* by NAGY-REIS et al. (2020) despite the availability of voucher specimens for revision by the numerous authors.

Examined specimens: **ALTO PARANÁ:** Super Carretera Itaipú at 24°40’30.3”S, 54°52’19.3”W (CBMI 284).

Specimens not examined: **GUAIRÁ:** Colonia Independencia (AMNH 77695).

Literature references: **ALTO PARANÁ:** Puerto Bertoni (BERTONI 1914); **BOQUERÓN:** km603 Ruta Transchaco 21°35’39.5”S, 61°11’21.7”W (SMITH et al. 2013); Gran Siete (ARESKOUG 2001); **CENTRAL:** Itá (BERTONI 1939).

IV. DISCUSSION

This paper represents a first attempt to critically quantify the available data on the distribution and status of Paraguayan Mustelids. The intention is to highlight the existing gaps in our knowledge, clarify misunderstandings and distinguish between different types of records, so that they may be assessed separately according to their level of documentation. Mustelids are poorly-represented in museum collections, and especially poorly-represented in Paraguayan museums where inadequate material is available for comparative studies. As is typical with Paraguay large and medium-sized mammals, specimen material is strongly biased towards those collected in the Chaco (Fig. 1), with most of the Oriental region poorly represented in collections.

On a positive note three (*Eira barbara*, *Galictis cuja* and *Lontra longicaudis*) of the five species of Mustelids present in the country are apparently widespread and frequently encountered, suggesting that their populations are healthy. The distribution of the Giant Otter *Pteronura brasiliensis*, on the other hand, has apparently contracted seriously in recent times and the species is now largely confined to the Pantanal region in the northern reaches of the Paraguay River. Though there are historic reports of the species on the Paraguayan sections of the Paraná River, there have been no recent reports from these areas. However, occasional reports of single individuals from outside the Pantanal region are suggestive of either occasional wandering or (less likely) additional undiscovered populations in the waterways of the Oriental region. Based on documented records it would seem that the Greater Grison *Galictis vittata* could potentially have a wide distribution across Paraguay. However, there are very few confirmed reports, perhaps due to widespread confusion of the species (which was only recently confirmed to be present in the country) with the common Lesser Grison (BORNHOLDT et al. 2013; SMITH et al. 2013). It would be desirable to collect additional data on the habitat preference and abundance of this species in Paraguay.

Ecological and population size data are completely lacking for Paraguay, and this is to some degree reflective of the secretive habits of many species. I am unaware of any published studies dealing specifically with the ecology or behaviour of these species in Paraguay.

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REFERENCES

- AZARA F. DE. 1801. Essais sur l'Histoire Naturelle des Quadrupèdes de la Province du Paraguay Tome 2. Charles Pougens. Paris, France, 499 pp.
- AZARA F. DE. 1802. Apuntamientos para la Historia Natural de los Quadrúpedos del Paraguay y Río de la Plata Tomo 2. Imprenta de la Viuda de Ibarra. Madrid, Spain, 328 pp.
- AZARA F. DE. 1809. Voyages dans l'Amérique Méridionale par Don Félix de Azara Tome Premier. Dentu, Paris, France, 388 pp.
- ALLEN J.A. 1908. The generic name *Galera* Browne. *Bulletin of the American Museum of Natural History*, **24**: 586-589.
- 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.
- BERTONI A. DE W. 1914. Fauna Paraguaya. Catálogos Sistemáticos de los Vertebrados del Paraguay. Peces, Batracios, Reptiles, Aves y Mamíferos Conocidos Hasta 1913. M. Brossa, Asunción, Paraguay, 86 pp.
- BERTONI A. DE W. 1932. Sobre mustélidos del Paraguay. Yaguapé (mamíferos). *Revista de la Sociedad Científica del Paraguay*, **2**: 104-105.
- BERTONI A. DE W. 1939. Catálogos sistemáticos de los vertebrados del Paraguay. *Revista de la Sociedad Científica del Paraguay*, **4**: 1-50.
- BONAPARTE L.C. 1838. Synopsis vertebratorum sytematis. *Nuovi Annali dell Scienze Naturali*, **2**: 105-133.
- BORNHOLDT R., HELGEN K., KOEPLI K-P., OLIVEIRA L., LUCHERINI M., EIZIRIK E. 2013. Taxonomic revision of the genus *Galictis* (Carnivora: Mustelidae): species delimitation, morphological diagnosis, and refined mapping of geographical distribution. *Zoological Journal of the Linnean Society*, **167**: 449-472.
- BROOKS D. 1991. Some notes on terrestrial mustelids in the central Paraguayan Chaco. *Mustelid and Viverrid Conservation*, **4**: 5-6.
- 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, 145 pp.
- BROWNE P. 1789. The civil and natural history of Jamaica. B. White and Son, London, United Kingdom.
- BUFFON G.L.L.C., DE 1803. Compendio de la Historia Natural de Buffon, Clasificado según el Sistema de Linéo por Renato Ricardo Castel, Traducido e Ilustrado por Don Pedro Estala, Presbitero. Tomo 9. Villalpando, Madrid, Spain, 330 pp.
- CABALLERO-GINI A., BUENO-VILLAFANE 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**: 5-14.
- CABRERA A. 1958. Catálogo de los mamíferos de América del Sur. *Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" Zoología*, **4**: 1-308.
- CARTES J.L. 2004. Importancia de la conservación de los humedales para los mamíferos. [In:] D.A.F. SALAS-DUEÑAS, F.

- MERELES, A. YANOSKY (eds). Humedales del Paraguay. Comité Nacional de Humedales. Asunción, Paraguay. Pp: 141-165.
- 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**: 191-202.
- CARTES J.L., DEL CASTILLO H., VELILLA M. 2013. Nuevo registro de *arirai* (*Pteronura brasiliensis*) para el departamento San Pedro, y evaluación de su estado en Paraguay. *Paraquaria Natural*, **1**(2): 8-11.
- CHEBEZ J. C. 2008. Los que se van 3 Mamíferos. Editorial Albatros, Buenos Aires, 333 pp.
- 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**: 241-260.
- DO NASCIMENTO F.O. 2014. On the correct name for some sub-families of Mustelidae (Mammalia, Carnivora). *Papéis Avulsos de Zoologia, São Paulo*, **54**(21): 307-313.
- DOBRIZHOFER M. 1784. Historia de Abiponibus Equestri, Bellicosaque Paraguariae Natione, Tomus 1. Josephi Nob. De Kurzbek. Viennae, Austria, 476 pp.
- ENTIDAD BINACIONAL YACYRETÁ. Undated. Mamíferos Refugio Faunístico Atinguy. EBY Departamento de Obras Complementarias, Ayolas, Paraguay 54 pp.
- ERXLEBEN J.C.P. 1777. Systema Regni Animalis per Classes, Ordines, Genera, Species, Varietates cum Synonymia et Historia Animalium. Classis 1 Mammalia. Impensis Weygandianis, Lipsiae, 636 pp.
- ESQUIVEL E. 2001. Mamíferos de la Reserva Natural del Bosque Mbaracayú, Paraguay. Fundación Moises Bertoni. Asunción, Paraguay, 87 pp.
- FARIÑA R., HOSTETTLER T. 2003. Vertebrados de la Reserva Natural del Bosque Mbaracayú. Checklist. Fundación Moises Bertoni. Asunción, Paraguay, 66 pp.
- GAMARRA DE FOX I., MARTIN A.J. 1996. Mastozoología. Lista de mamíferos del Paraguay. [In:] O. ROMERO MARTÍNEZ (ed.). Colecciones de Flora y Fauna del Museo Nacional de Historia Natural del Paraguay. Museo Nacional de Historia Natural del Paraguay. Ministerio de Agricultura y Ganadería. San Lorenzo, Paraguay. Pp. 469-573.
- GAMARRA DE FOX I., VAN HUMBECK J., SOSA W., PENAYO R., VILLALBA R. 1998. Mamíferos. [In:] DIRECCIÓN DE PARQUES NACIONALES Y VIDA SILVESTRE (ed.). Fauna Amenazada del Paraguay. Ministerio de Agricultura y Ganadería/Fundación Moises Bertoni. Asunción, Paraguay. Pp. 55-69.
- 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**: 59-66.
- GIORDANO A.J., GIMÉNEZ D., MARTÍNEZ V., ROJAS V., SALDÍVAR S., VELILLA M., AYALA R., LÓPEZ J., VELÁZQUEZ M., THOMPSON J.J., CARTES J.-L., DEL CASTILLO H., MUJICA N. 2017. Carnívora: Los Carnívoros. [In:] S. SALDÍVAR, V. ROJAS, D. GIMÉNEZ (eds). Libro Rojo de Mamíferos del Paraguay. Asociación Paraguaya de Mastozoología y Secretaría del Ambiente. Asunción, Paraguay. Pp. 79-101.
- GMELIN J.F. 1788. Caroli a Linné..... Systema Naturae per Regna Tria Naturae Secundum Clases Ordines, Genera, Species cum Characteribus, Differentiis, Synonymis, Locis – Editio Decima Tertia, Aucta, Reformata. Lipsiae: Georg Emanuel Beer, 500 pp.
- GONZÁLEZ A.R., BENÍTEZ 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.
- GRAY J.E. 1825. Outline of an attempt at the disposition of the Mammalia into tribes and families with a list of the genera apparently appertaining to each tribe. *Annals of Philosophy* (new series), **10**: 337-344.
- GUYRA PARAGUAY. 2005. Atlas de las Aves del Paraguay. Guyra Paraguay. Asunción, Paraguay, 212 pp.
- GUYRA PARAGUAY. 2008. Áreas Importantes para la Conservación de las Aves del Paraguay. Guyra Paraguay. Asunción, Paraguay, 466 pp.
- HARRIS C.J. 1968. Otters: A Study of the Recent Lutrinae. Weidenfeld and Nicolson, London, UK, 397 pp.
- HERSHKOVITZ P. 1949. Status of names credited to Oken, 1816. *Journal of Mammalogy*, **30**: 289-301.
- 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**: 1312-1323.
- HORTON E.Y. 2010. Gran Pantanal Paraguay. Guyra Paraguay. Asunción, Paraguay, 65 pp.
- HUNTER L., BARRETT P. 2011. A Field Guide to the Carnivores of the World. New Holland, London, 240 pp.
- HUNTER W.P. 1838. The Natural History of the Quadrupeds of Paraguay and the River La Plata Translated from the Spanish of Don Félix de Azara with a Memoir of the Author, a Physical Sketch of the Country and Numerous Notes. Volume 1. Adam and Charles Black, Edinburgh, Scotland, 340 pp.
- IHERING H., VON. 1893. Os mamíferos do Rio Grande do Sul. *Anuario do Estado do Rio Grande do Sul de Graciano A. de Azambuja*, **1893**: 96-123.
- IHERING H., VON. 1910 [1911]. Os mamíferos do Brazil meridional; Carnívora. *Revista Museo Paulista*, **8**: 147-272.
- ITAIPÚ BINACIONAL. 2010. Animales del Zoológico de Itaipú. Dirección de Educación Ambiental, Itaipú. Hernandarias, Paraguay, 38 pp.
- KRUMBIEGEL I. 1942. Die säugetiere der Südamerika – Expedition Prof. D. Kriegs. 17 Hyrare und Grisons (*Tayra* und *Grison*). *Zoologischer Anzeiger*, **139**: 81-108.
- LINNAEUS C. 1758. Systema Naturae per Regna Tria Naturae, Secundum Clases, Ordines, Genera et Species Redacta Tabulisque Aeneis Illustrata. Editio decima. – Laurentii Salvii, Holmiae, 824 pp.
- LÖNNBERG E. 1913. Mammals from Ecuador and related forms. *Arkiv Zoologi*, **8**(16): 1-36.
- 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, 155 pp.
- MASI PALLARÉS R. 2011. Vertebrados del Paraguay. Descripción y Hábitos con las Denominaciones en Guaraní. Smart C3, Asunción, Paraguay, 236 pp.
- MELQUIST W.E. 1984. Status Survey of Otters (Lutrinae) and Spotted Cats (Felidae) in Latin America. Completion Report, Contract N° 9006, IUCN. College of Forestry, Wildlife and Range Sciences, University of Idaho, USA, 269 pp.
- MERCOLLI C., CARTES J.-L., BARTRINA L., JIMÉNEZ B., GARCIA E., PENAYO R., ECHEVERRÍA N. 1999. Estancia Fortín Patria (Alto Paraguay, Paraguay). Informe técnico, Evaluación Ecológica Rápida. Fundación DeSdel Chaco – Fundación Moises Bertoni. Asunción, unpaginated.
- MERELES F.M. 2013. Acerca de las extensiones de Cerrados y Cerradones en el Paraguay. *Paraquaria Natural*, **1**: 35-38.
- MOLINA G.I. 1782. Saggio sulla Storia Naturale del Chili 1st Ed. Stamperia di S. Tommaso d'Aguiño, Bologna, Italy, 367 pp.
- MORALES M. A. 2007. Diversidad de Mamíferos en Paraguay. [In:] D.A. SALAS-DUEÑAS, J.F. FACETTI (eds). Biodiversidad del Paraguay: Una Aproximación a sus Realidades. Fundación Moises Bertoni. Asunción, Paraguay. Pp. 133-150.
- NAGY-REIS M., OSHIMA J.E.F., KANDA C.Z., PALMEIRA F.B.L., DE MELO F.R., MORATO R.G. et al. 2020. Neotropical carnivores: A dataset on carnivore distribution in the Neotropics. *Ecology*, **101**: e03128.

- NEHRING A. 1899[1900]. Über *Lutra (Pteronura) paranensis*, Renegger, und ein lebendes Welbeben dieser Art. Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin, **1900**: 221-228.
- 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, 100 pp.
- NERIS N., FRANCO RIVAROLA E.G. 2005. Mamíferos. [In:] N. NERIS (ed.). Guía ilustrada de Anfibios, Reptiles, Aves y Mamíferos del Paraguay. Natura Vita-Jica. Asunción, Paraguay. Pp. 153-193.
- NOONAN P., PROUT S., HAYSSSEN V. 2017. *Pteronura brasiliensis* (Carnivora: Mustelidae). *Mammalian Species*, **953**: 97-108.
- OKEN L. 1816. Lehrbuch der Naturgeschichte, Zweite Abtheilung. Fleischthiere. August Schmid und Comp., Jena, **3**(2): 1-1270.
- OLFFERS I. 1818. Bemerkungen zu Illiger's Ueberblick der Säugthiere, nach Ihrer Vertheilung über die Welttheile, Rücksichtlich der Südamerikanischen Arten [In:] F.I. BERTUCH (ed.). Neue Bibliothek der Wichtigsten Reisebeschreibungen zur Erweiterung der Erd- und Völkerkunde; in Verbindung mit Einigen Anderen Gelehrten Gesammelt und Herausgegeben. Verlage des Landes-Industrie-Comptoirs, Weimar. Pp. 192-237.
- 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**: 163-172.
- POCOCK R.I. 1921. On the external characters and classification of the Mustelidae. *Proceedings of the Zoological Society of London*, **89**: 803-837.
- POHLE H. 1919. Die Unterfamilie der Lutrinae. (Eine systematisch – tiergeographische Studie an dem Material der Berliner Museen). *Archiv für Naturgeschichte*, **85**: 1-246.
- RAMÍREZ PINTO F., VELÁZQUEZ M.C. 2010. Mamíferos. [In:] L. VILLALBA (ed.). La Naturaleza y Riqueza del Río Pilcomayo. Iniciativa Chaco Trinacional y Fundación Moisés Bertoni. Asunción, Paraguay. Pp. 23-25.
- RAY J. 1693. Synopsis methodica animalium quadrupedum et serpentina generis. Robert Southwell, London, England, 336 pp.
- RENGGER J.R. 1830. Naturgeschichte der Säugethiere von Paraguay. Schweghauserschen, Basel, Switzerland, 394 pp.
- RENGGER J.R. 1836. Reise nach Paraguay in den Jahren 1818 bis 1826 von Dr. J.R. Rengger. H.R. Sauerlender, Aarau, Switzerland, 495 pp.
- RICHARDSON J. 1829. Fauna Boreali-Americana; or the zoology of the northern parts of British America. Part first, the quadrupeds. John Murray, London, UK, 327 pp.
- 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., VELLILLA M., VILLALBA L., WEILER A. 2017. Los mamíferos amenazados del Paraguay. [In:] S. SALDÍVAR, V. ROJAS, D. GIMÉNEZ (eds). Libro Rojo de Mamíferos del Paraguay. Asociación Paraguaya de Mastozoología y Secretaría del Ambiente. Asunción, Paraguay. Pp. 25-32.
- SÁNCHEZ LABRADOR J. 1910. El Paraguay Católico. Homenaje de la Universidad Nacional de La Plata al XVII Congreso Internacional de los Americanistas en su reunión de Buenos Aires, en mayo 16 a 21 de 1910. Buenos Aires, Argentina, 225 pp.
- SCHREBER J.C.D. 1776-1777. Die Säugthiere in Abbildungen nach der Natur mit Beschreibungen. Part 3. Wolfgang Walther, Erlangen, Germany, 307 pp.
- SEESSEE 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.
- SHERBORN C.D. 1891. On the dates of the parts, plates and text of Schreber's 'Säugethiere'. *Proceedings of the Zoological Society of London*, **59**: 587-592.
- SMITH P., DEL CASTILLO H., BATJES H., BETUEL A., MONTIEL M., NOSSENT R., ONLEY D., WAINWRIGHT B., WECHSLER S. 2005a. An avifaunal inventory of Hotel Tirol, departamento Itaipúa, southern Paraguay. *FAUNA Paraguay Technical Publication*, **1**: 1-14.
- SMITH P., DEL CASTILLO H., BATJES H., MONTIEL M., WAINWRIGHT B. 2005b. An avifaunal inventory of Laguna Blanca, departamento San Pedro, northeastern Paraguay. *FAUNA Paraguay Technical Publication*, **2**: 1-16.
- SMITH P., DEL CASTILLO H., BANKOVICS A., HANSEN L., WAINWRIGHT B. 2006. An avifaunal inventory of San Rafael "National Park", departamento Itaipúa, southern Paraguay. *FAUNA Paraguay Technical Publication*, **3**: 1-13.
- SMITH P., OWEN R.D., DEL CASTILLO H., ORTIZ M., CABRERA A. 2013. Historical and recent records of greater grison *Galictis vittata* in Paraguay, with nomenclatural comments. *Small Carnivore Conservation*, **49**: 43-47.
- SMITH P. 2020. What is *Lutra paranensis* RENGGER, 1830? *Otter Specialist Group Bulletin*, **37**: 53-65.
- THOMAS O. 1912. Small mammals from South America. *Annals and Magazine of Natural History*, **8**(10): 44-48.
- VELÁZQUEZ M., RAMÍREZ PINTO F. 2014. Guía de los Mamíferos de la Reserva Natural Tapytá. Fundación Moisés Bertoni. Asunción, Paraguay, 127 pp.
- VILLALBA R., YANOSKY A. 2000. Guía de Huellas y Señales: Fauna Paraguaya. Fundación Moisés Bertoni. Asunción, Paraguay, 112 pp.
- VON HUMBECK J., SILVEIRA AVALOS W. 1995. Mamíferos. Pp.56-62. [In:] Itaipú Binacional (ed.) Catalogo de los Vertebrados del Área de Itaipú. *Itaipú Biota*, **2**:1-66.
- 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, 126 pp.
- WERNECK F.L. 1937. Notas para o estudo da orden Mallophaga. *Memorias do Instituto Oswaldo Cruz*, **32**: 13-27.
- 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**: 203-216.
- 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**: 263-268.
- YENSEN E., TARIFA T. 2003a. *Galictis vittata*. *Mammalian Species*, **727**: 1-8.
- YENSEN E., TARIFA T. 2003b. *Galictis cuja*. *Mammalian Species*, **728**: 1-8.
- 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., GIPSON P.S., HILL K. 2001. A predator-habitat assessment for Felids in the inland Atlantic Forest of eastern Paraguay: A preliminary analysis. *Endangered Species UPDATE*, **18**: 115-119.