Boletín del Museo Nacional de Historia Natural, Chile, 74(1): 01-05 (2025) Versión Online ISSN: 0719-935X
https://boletinmnhn.cl/
https://publicaciones.mnhn.gob.cl/668/w3-channel.html DOI: https://doi.org/10.54830/bmnhn.v74.n1.2025.966

NOTA CIENTÍFICA

COMPARATIVE SKULL MORPHOLOGY BETWEEN THE NATIVE CAT "COLOCOLO" AND THE DOMESTIC CAT, BASED ON SAMPLES DEPOSITED IN SCIENTIFIC COLLECTIONS

Alejandro Valladares-Gómez[1*] and R. Eduardo Palma[2]

[1]Departamento de Química y Biología, Facultad de Ciencias Naturales, Universidad de Atacama, Copiapó, Chile.

[2]Laboratorio de Biología Evolutiva, Facultad de Ciencias Biológicas, Pontificia Universidad Católica de Chile, Santiago, Chile.

Correspondence address: Avda. Copayapu 485, C.P. 1530000, Copiapó. Chile. *Corresponding author: alejandro.valladares@uda.cl (AVG) Tel: 52 225 5608 (REP: eduardo.palma@uc.cl)

ABSTRACT

In this study we compared the skull morphology between the colocolo cat (*Leopardus colocola*) and the domestic cat (*Felis catus*) based on samples deposited in scientific collections. We observed cranial and mandibular differences between both species that can be identified relatively easy to naked eye. These differences were related to the shape of the posterior edge of the palate, the shape of the presphenoid bone, the dental formula and the relative position of mental foramen in the mandible.

Key words: cats, Felidae, *Felis catus*, *Leopardus colocola*, skull, morphology

RESUMEN

Morfología craneal comparada entre el gato nativo "colocolo" y el gato doméstico, basada en muestras depositadas en colecciones científicas. En este estudio se comparó la morfología del cráneo entre el gato colocolo (*Leopardus colocola)* y el gato doméstico (*Felis catus*) analizando muestras depositadas en colecciones científicas. Se observaron diferencias craneales y mandibulares entre ambas especies que pueden ser identificadas con relativa facilidad a simple vista. Estas diferencias se relacionaron con la forma del margen posterior del paladar, la forma del hueso preesfenoides, la fórmula dental y la posición relativa del foramen mentoniano en la mandíbula.

Palabras clave: cráneo, gatos, Felidae, *Felis catus*, *Leopardus colocola*, morfología

INTRODUCTION

Native species of the family Felidae or "cats" are distributed across the Earth, except in Antarctica, Australia, New Zealand, Madagascar, Japan, and almost all oceanic islands (Feldhamer *et al.* 2020). On the other hand, the domestic or feral cat (*Felis catus*) has been introduced nearly worldwide by humans as pets or because this species may predate on some rodents considered plages, being one of the most popular pets in Chile (Maldonado Aravena and Díaz-Vega 2019). Cats are very specialized carnivores, and the dentition is characterized by large canines and strong carnassials (Berkovitz and Shellis 2018). Cats have short and rounded rostrum, and a reduced number of molariform teeth, if compared with other carnivores such as canids (Feldhamer *et al.* 2020). Typical dental formula of Felidae is 3/3 1/1 2-3/2 1/1 = 28–30 (DeBlase and Martin 1974).

The "colocolo" cat (*Leopardus colocola*) is a native species of South America and have a wide geographic distribution. In Chile, three subspecies are recognized (Castro-Pastene *et al.* 2023; but see Nascimento *et al.* 2021): *L. c. wolffsohni*, distributed between Arica and Parinacota to Atacama regions, *L. c. colocola*, distributed between Antofagasta to Biobio regions, and *L. c. pajeros*, that present a discontinuous distribution between Aysén and Magallanes regions. *L. colocola* has a similar size to the domestic cat (*F. catus*), but the first species is more robust and weights between 2 to 4 kg (Castro-Pastene *et al.* 2023). However, skull morphological differences between both species have not been evaluated.

Considering the growing urbanization and human land use of landscapes of Chile, the presence of free-roaming domestic cats in rural zones could represent an "emergent threat for native wildlife" (López-Jara *et al.* 2021). This may be particularly the case of *L. c. colocola*, that inhabits along the central Chile, a region that suffers a strong anthropogenic pressure and landscape modification (Guzmán Marín *et al.* 2022). Hence, due the potential coexistence between native and domestic cats in rural areas of Chile, taxonomic identification of these cats may be critical to estimate their current habitat use and possible interactions. In this study, we compared skulls of the native cat "colocolo" (*L. colocola*) and the domestic cat (*Felis catus*) to identify morphologic differences that could help to recognize as a first examination if we are in presence of a colocolo or a domestic cat, especially during field work.

MATERIAL AND METHODS

Eight adult and one subadult skulls were analyzed, being six of them domestic cats (*Felis catus*), and three were recognized as the colocolo cat (*Leopardus colocola*). These samples were housed in the Area of Vertebrate Zoology of the Museo Nacional de Historia Natural (MNHN), Santiago and "Colección de Flora y Fauna Prof. Patricio Sánchez-Reyes (SSUC-ma)" of the Pontificia Universidad Católica de Chile, Santiago (see details in Appendix 1). When collection locality was available for samples of the colocolo cat (specimen's labels or curator dataset), the subspecies was assigned following Castro-Pastene *et al.* (2023). Skulls were analyzed visually to detect any interspecific differences between the colocolo and the domestic cat, that could be identified to "naked eye". On the other hand, dental formula was compared between both species. Cranial bones nomenclature followed Elbroch (2006), skull morphological description for the colocolo cat followed García-Perea (1994), and mandible nomenclature followed Lombardero *et al*. (2021).

RESULTS

At least, we detected two different cranial characters to naked eye, in ventral view, between the colocolo cat (Figure 1A) and the domestic cat (Figure 1B). These characters are related to the shape of posterior edge of the palate, and the shape of presphenoid bone. In samples of the colocolo cat, the posterior edge of the palate was observed as "U-shaped", in agreement with Garcia-Perea (1994). Additionally, we observed the two variations or morphotypes of this U-shaped pattern described by this last author: Type 1 or U-shaped edge with a medial notch (Figure 2A, 2B), and Type 2 or U-shaped edge with not a medial notch (Figure 2C). In contrast, in the domestic cat, the posterior edge of the palate was roughly observed as a "m-shape" (Figure 1B). Regarding the shape of the presphenoid, in the colocolo cat this bone was thin and elongated (roughly, as a "stick", Figure 1A), while in the domestic cat it was wider (roughly, as a "flame of a candle", Figure 1B).

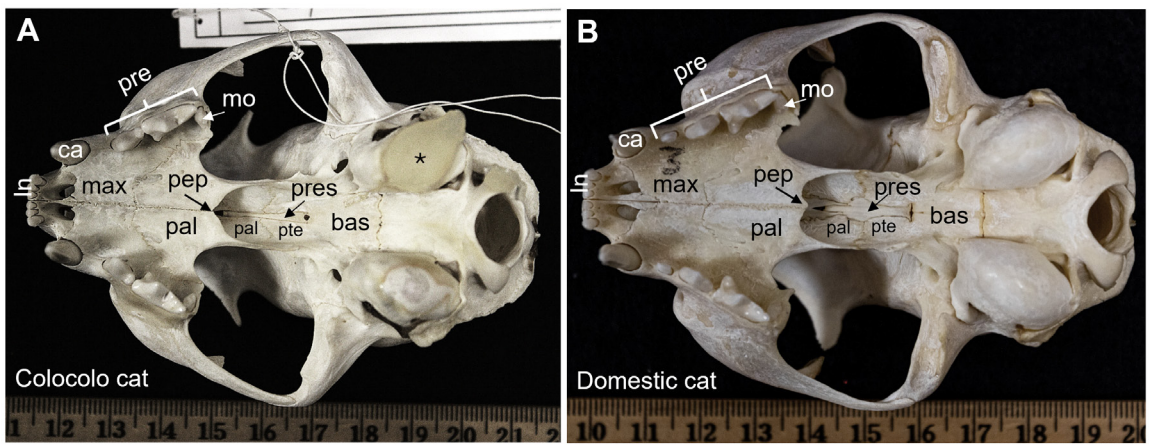

Figure 1. Ventral view of the crania of the colocolo (A, SSUC-ma 2012) and the domestic cat (B, SSUC-ma 2411). in = incisors, ca = canine, pre = premolars, mo = molar, max = maxillary, pal = palatine, pep = posterior edge of the palate, pres = presphenoid, pte = pterygoid, bas = basisphenoid. *glue residue. Scale in cm.

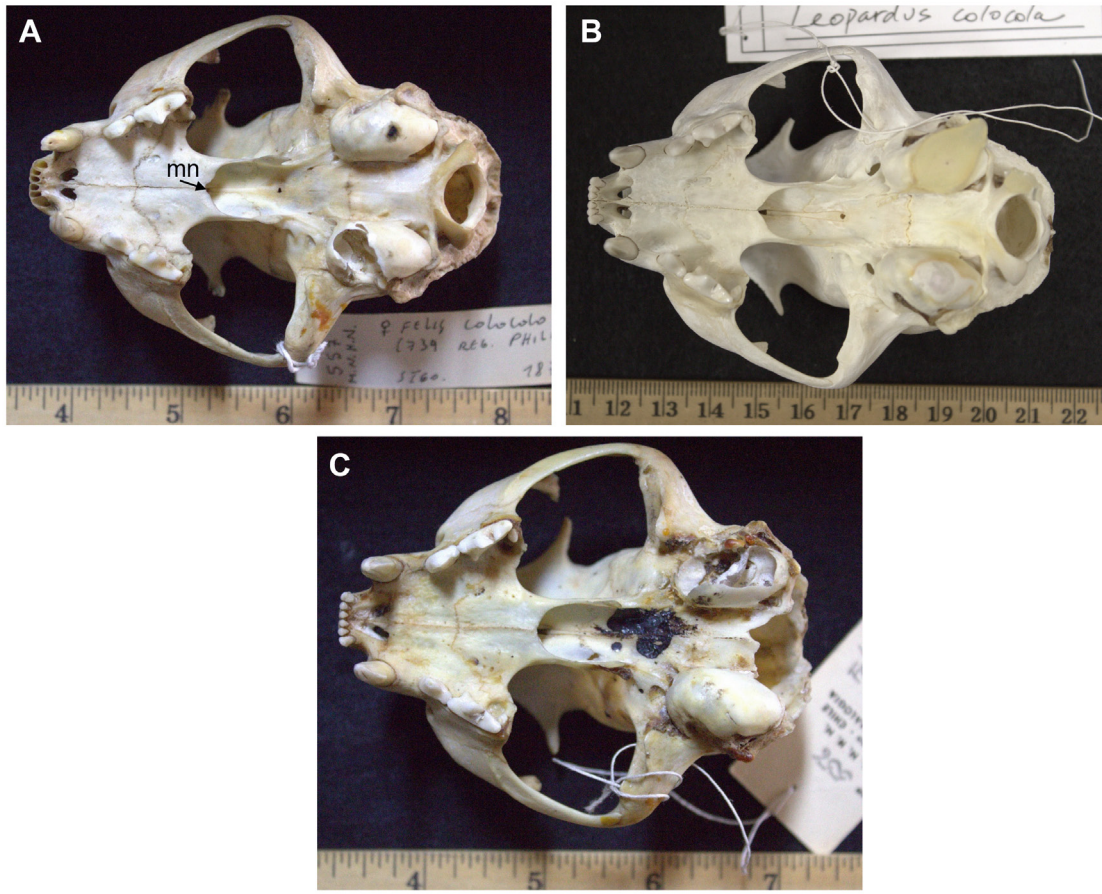

Figure 2. Ventral view of the crania of the colocolo cat showing the two morphotypes of the U-shaped posterior edge of the palate: Type 1 with a medial notch (A, MNHN557; B, SSUC-ma 2012), and Type 2 without a medial notch (C, MNHN556). mn = medial notch. Scale in inches (A, C) and in cm (B).

On the other hand, differences in the permanent dental formula were also observed (Figure 1, Figure 3). In the colocolo cat, the dental formula was 3/3 1/1 2/2 1/1 = 28. While in the domestic cat, the dental formula was 3/3 1/1 3/2 1/1 = 30. Only a single sample of domestic cat seemed to deviate of this observation, with 29 teeth, and two skulls appeared probably with lost incisors. Therefore, domestic cat presented a higher number of total permanent teeth, if compared with the colocolo cat, due to differences in the number of premolars of the upper jaw between both species.

Finally, we observed differences in the relative position of the mental foramen. Whereas the posterior mental foramen in the colocolo cat is located approximately between the lower premolars (P_3 and P_4), and the main mental foramen is located between the canine and the premolar (Figure 3A), in the domestic cat the posterior mental foramen is located approximately below the premolar P_3 (Figure 3B). The position of the main mental foramen in the domestic cat is similar to that of the colocolo cat.

DISCUSSION AND CONCLUSION

In this note we reported differences in two cranial characters between the colocolo cat and the domestic cat, which are relatively simple to identity to naked eye, in ventral view. The shape of posterior edge of the palate was “U-shaped” in the colocolo cat (García-Perea 1994), while this edge was “m-shaped” in the domestic cat. On the other hand, the presphenoid bone was thin and elongated in the colocolo cat,

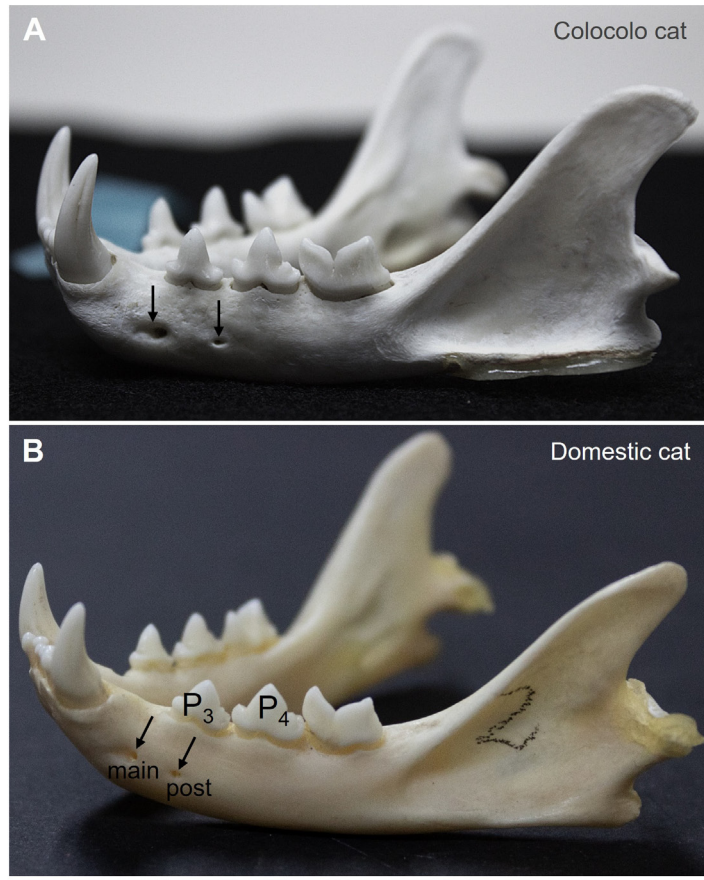

Figure 3. Mandible of the colocolo cat (A, SSUC-ma 2012) and the domestic cat (B, SSUC-ma 2410). Note the difference in the relative position of the mental foramen related to the premolars. main = main or middle mental foramen, post = posterior mental foramen.

if compared to the wider presphenoid observed in the domestic cat. Moreover, our observations suggested interspecific differences in the dental formula: colocolo cat 3/3 1/1 2/2 1/1 = 28, while in the domestic cat it was 3/3 1/1 3/2 1/1 = 30. The loss of an upper premolar characterizes the "Pampas" cats, being only occasionally observed and poorly developed (P^2, according to García-Perea 1994). On the other hand, when the mandibles were compared, the colocolo and the domestic cat showed differences in the relative position of the mental foramen.

The morphologic characters analyzed could facilitate the recognition of skull´s cats, especially in the field. Hence, this could be a first approximation based on a "naked eye morphology", until new evidence becomes available for an accurate species identification. Finally, we highlight the importance of the analysis of samples deposited in scientific collections guiding to resolve practical problems during field work.

ACKNOWLEDGEMENTS

Thank to J. Canto Hernández Chief of Area of Vertebrate Zoology, Museo Nacional de Historia Natural, and to D. Cotoras and B. Rosende, Director and Curator respectively, of the "Colección de Flora y Fauna Prof. Patricio Sánchez-Reyes", P. Universidad Católica de Chile, to access the skull samples and the associated information. S. Vargas and J. Casale for selected literature suggestions. AVG thanks to the Project ANID SIA año 2022 Folio 85220079.

REFERENCES

BERKOVITZ, B. and P. SHELLIS. 2018. The teeth of mammalian vertebrates. Academic Press Elsevier Inc. London, UK.

CASTRO-PASTENE, C.A., R.A. VILLALOBOS AGUIRRE, N. LAGOS SILVA, C.F. SEPÚLVEDA CABRERA, D. CROSS OSSA, N. VALENZUELA-AEDO, B.T. SEGURA SILVA, A. IRIARTE WALTON, F.A. HERNÁNDEZ MUÑOZ and M.R. SOTO-GAMBOA. 2023. Assessment of the current distribution of the colocolo cat *Leopardus colocola*, (Molina 1782) in Chile and its implications in the taxonomy of the species. Mastozoología Neotropical 30:e0853. DOI: 10.31687/saremMN.23.30.1.04.e0853

DEBLASE, A.F. and R.E. MARTIN. 1974. A manual of mammalogy with keys to families of the world. 2 edition. Wm. C. Brown Company Publishers. Dubuque, EE.UU.

ELBROCH, M. 2006. Animal skulls: a guide to North American species. 1 edition, Stackpole Books, Mechanicsburg, EE.UU.

FELDHAMER, G.A., J.F. MERRITT, C. KRAJEWSKI, J.L. RACHLOW and K.M. STEWART. 2020. Mammalogy: adaptation, diversity, ecology. 5 edition. Johns Hopkins University Press, Baltimore, EE.UU.

GARCÍA-PEREA, R. 1994. The Pampas cat group (Genus *Lynchailurus* Severtzov, 1858) (Carnivora: Felidae), a systematic and biogeographic review. American Museum Novitates 3096:1–36. URI: http://hdl.handle.net/2246/4992

GUZMÁN MARÍN, B.C., J.C. HERNÁNDEZ-HERNÁNDEZ, N.S. OLMOS DE AGUILERA, P.A. MUÑOZ PEÑA and M. KAISER. 2022. Felino pequeño, ciudad grande: *Leopardus colocola* (Carnivora: Felidae) en la región Metropolitana de Santiago de Chile y amenazas para su conservación. Boletín del Museo Nacional de Historia Natural, Chile 71:13–21. DOI: https://doi.org/10.54830/bmnhn.v71.n1.2022.210

LOMBARDERO, M., D. ALONSO-PEÑARANDO and M.M. YLLERA. 2021. The cat mandible (I): anatomical basis to avoid iatrogenic damage in veterinary clinical practice. Animals 11: 405. DOI: 10.3390/ani11020405

LÓPEZ-JARA, M.J., I. SACRISTÁN., A.A. FARÍAS., F. MARON-PÉREZ., F. ACUÑA., E. AGUILAR., S. GARCÍA., P. CONTRERAS., E.A. SILVA-RODRÍGUEZ and C. NAPOLITANO. 2021. Free-roaming domestic cats near conservation areas in Chile: spatial movements, human care and risks for wildlife. Perspectives in Ecology and Conservation 19:387–398. https://doi.org/10.1016/j.pecon.2021.02.001

MALDONADO ARAVENA, P. and R.I. DÍAZ-VEGA. 2019. El indiscutible impacto de los gatos no supervisados. La Chiricoca 28:117–124

NASCIMENTO, F.O.D., J. CHENG and A. FEIJÓ. 2021. Taxonomic revision of the pampas cat *Leopardus colocola* complex (Carnivora: Felidae): an integrative approach. Zoological Journal of the Linnean Society 191:575–611. https://doi.org/10.1093/zoolinnean/zlaa043

SALDIVIA PAREDES, M., M. DELGADO GUTIÉRREZ, A. DROPPELMANN DELGADO, M. BALLESTEROS, M. REYES and V. SANDOVAL. 2020. Descripción anatómica del cráneo del gato. Revista de Medicina Veterinaria 40:17–34. DOI: 10.19052/mv.vol1.iss40.3

APPENDIX 1

Specimens analyzed in this study:

Colocolo cat, *Leopardus colocola* (*n* = 3): MNHN 556 (Magallanes, *L. c. pajeros*) y 557 (Santiago, *L. c. colocola*); SSUC-ma 2012 (“cuesta Las Chilcas”, Prov. Choapa, Coquimbo).

Domestic cat, *Felis catus* (*n* = 6): SSUC-ma 2409, 2410, 2411, 2412, 2413 y 2414.

Recibido: 22/nov/2024; Aceptado: 20/dic/2024; Administrado por Jhoann Canto H.