

# New records of small mammals in American barn owl, *Tyto furcata* pellets from southeastern Ecuador

## Nuevos registros de pequeños mamíferos en egagrópidas de lechuza campanaria americana, *Tyto furcata*, en el sureste de Ecuador

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Owl pellet analysis is an efficient alternative for assessing small mammal community composition. In Ecuador previous analyses exist of American barn owl, *Tyto furcata*, pellets from the Pacific lowlands and Interandean valleys, underlining high rodent consumption. We describe for first time, the diet of *T. furcata* in the southern Amazonian region of Ecuador, highlighting the abundance and distribution of prey mammals. We collected pellets of a *T. furcata* in the town of Paquisha; located in the western foothills of the mid-Nangaritza River basin of the Cordillera del Cóndor. We disaggregated the pellets, separated bones structures such as skulls and pairs of mandibles to estimate the minimum number of prey individuals. We identified prey using taxonomic keys and by comparison with museum reference material. We found principally small mammals as prey: 2 Didelphidae and 5 Cricetidae. Delicate long-tailed mouse, *Oligoryzomys delicatus*, constitutes the southernmost record of its distribution; Bishop's slender opossum, *Marmosops bishopi*, is the species' first record in Zamora Chinchipe province. Yungas grass mouse, *Akodon aerosus*, and *O. delicatus* were the most abundant prey, so we can suggest that they are both common in this locality. Owl pellets analysis of *T. furcata* was efficient to record small mammal diversity in this previously poorly researched area. Skulls found increase museum material, poorly represented for some species and also in the province. Finally, we highlight *T. furcata* as a predator of these small mammals, an important aspect of the species' natural history and of its prey.

**Key words:** Natural history; rodents; species diversity; Strigiformes; trophic ecology; Zamora Chinchipe.

El análisis de egagrópidas de búhos es una alternativa eficiente para evaluar la composición de la comunidad de pequeños mamíferos. En Ecuador, existen análisis previos de egagrópidas de la lechuza de campanario americana, *Tyto furcata* en las tierras bajas del Pacífico y en los valles interandinos, resaltando un alto consumo de roedores. Describimos por primera vez la dieta de *T. furcata* en la región amazónica, sureste del Ecuador, resaltando la abundancia y distribución de los mamíferos presa. Colectamos egagrópidas de un individuo de *T. furcata* en Paquisha, cuenca del río Nangaritza, ladera oeste de la Cordillera del Cóndor. Disgregamos las egagrópidas, separamos huesos y otros restos de presas. Usamos las estructuras únicas como los cráneos y pares de mandíbulas para identificar y estimar el número mínimo de individuos de presa. Identificamos las presas usando claves taxonómicas y por comparación con material de referencia museológico. Encontramos principalmente pequeños mamíferos como presas: 2 didelphidos y 5 cricétidos. El ratón colilargo delicado, *Oligoryzomys delicatus*, es el registro más austral de su distribución; la marmosa esbelta de Bishop, *Marmosops bishopi*, es el primer registro en la provincia de Zamora Chinchipe. El ratón campestre de las Yungas, *Akodon aerosus* y *O. delicatus* fueron las presas más abundantes, por lo que podemos sugerir como comunes en la localidad. El análisis de las egagrópidas de *T. furcata* fue eficiente para registrar la diversidad de pequeños mamíferos en esta área previamente poco estudiada. Los cráneos encontrados aumentaron el material museológico, antes poco representado para algunas especies y también en la provincia. Finalmente destacamos a *T. furcata* como depredador de estos pequeños mamíferos, un aspecto importante de la historia natural del ave y de las presas.

**Palabras clave:** Diversidad de especies; ecología trófica; historia natural; roedores; Strigiformes; Zamora Chinchipe.

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Owls (Aves: Strigiformes) usually swallow their prey whole or in large pieces, and then regurgitate a pellet containing indigestible matter such as bones, fur, feathers and other keratinous material (Marti 1973). These regurgitated bones, mainly skulls and jaws, provide ecological and biogeographical information on communities of small mammals. Large set of data about prey species and their frequencies, richness, and diversity with low field effort, can be obtained from these kinds of samples (Ferri et al. 2021).

The American barn owl, *Tyto furcata* (Temminck, 1827), has a widespread American distribution, and occupies a broad range of open urban to rural habitats. Its diet is principally made up of small mammals of which most are rodents (Marti et al. 2020). In Ecuador, previous work on this species' diet is also based on its pellets and come from rural areas or agricultural habitats in the Pacific lowlands (Moreno 2010; Brito et al. 2015), and cities and rural areas in Andean valleys (Moreno and Román

2013; Vásquez-Ávila *et al.* 2018; Cadena-Ortiz *et al.* 2019). All of these underlines the high consumption of rodents. This note describes for first diet records of *T. furcata* in the south Amazonian region of Ecuador, our objective being to document the species' diet composition to fill distributional gaps of mammalian species.

Pellets were collected during 2 periods (November 2019 and November 2022), within the indoor coliseum (3° 55' 56" S, 78° 40' 38" W; 800 m; Figure 1) in the town of Paquisha, Zamora Chinchipe province. Paquisha lies adjacent to the Nangaritza River in the western foothills of the Cordillera del Cóndor, southeastern Ecuador. Paquisha is an urbanized area of 1 km<sup>2</sup> surrounded by cattle pastures and field crops; remnants of native forest are restricted to riverbanks and in scattered patches. It has a population of 3,854 people; its economy is based principally on mining, and to a lesser extent on agriculture and livestock (INEC 2010). From 2018 to the present, one of the authors of this note, F. Castillo, who lives in Paquisha, has frequently seen an individual of *T. furcata* roosting inside the coliseum and 2 other individuals 200 m from the coliseum, under the bridge that crosses the Nangaritza River, roosting right above the water.

The collected pellets from the coliseum were air dried during 3 days, then soaked them in water, and disaggregated them to separate bones and other prey remains. We used the unique structures, such as skulls and pairs of mandibles, to estimate the minimum number of prey individuals involved. For the identification of prey, we used taxonomic keys (Diaz-Nieto *et al.* 2016; Brito *et al.* 2021) and also, some were compared with reference material deposited at the Instituto Nacional de Biodiversidad (INABIO). In order



**Figure 1.** An American Barn Owl *Tyto furcata* inside of the indoor coliseum of Paquisha, Ecuador. The arrow indicates a pellet just regurgitate.

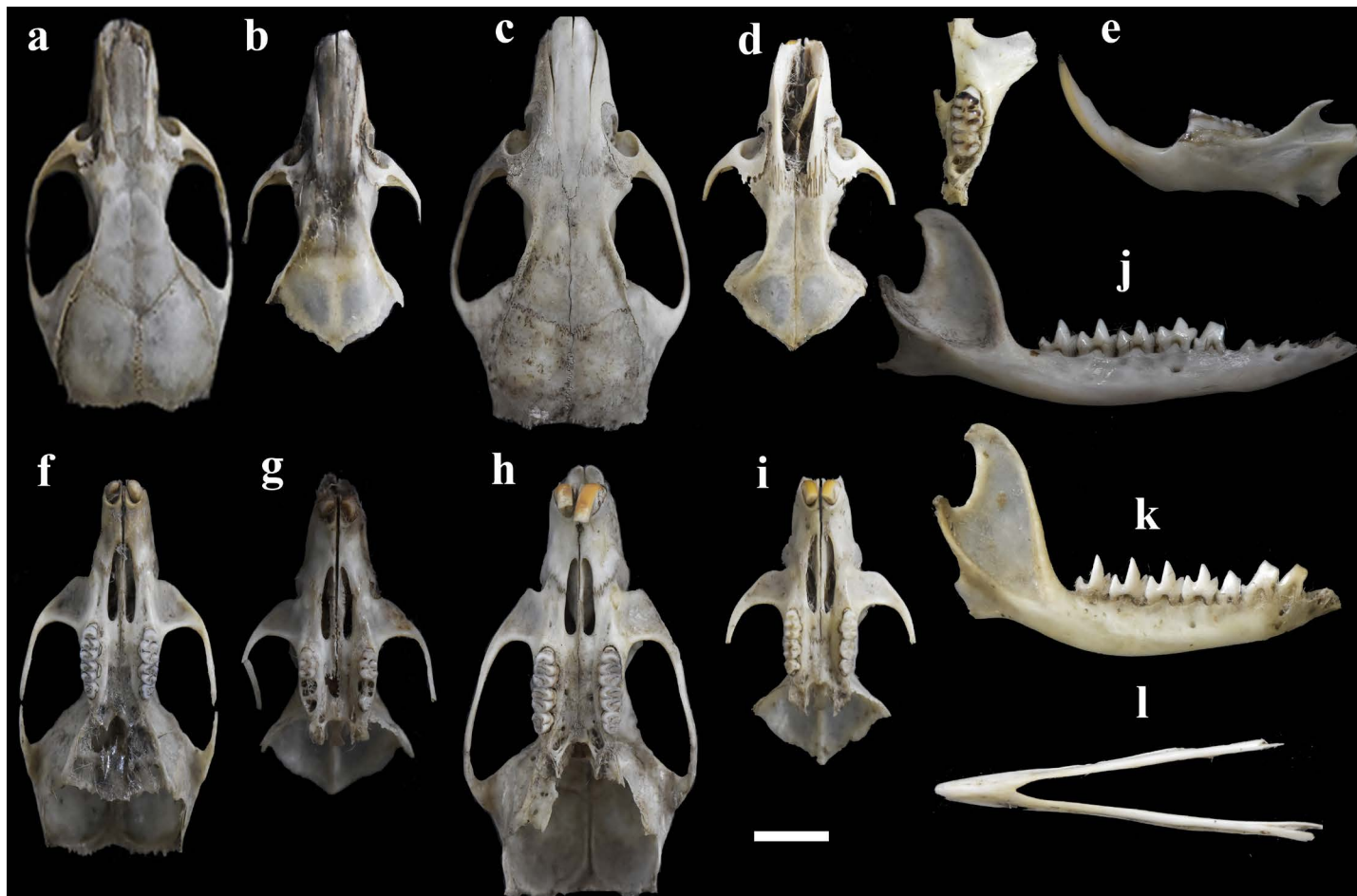
to identify if *T. furcata* has a preference for prey according to its weight in this locality, we made a spreadsheet on Microsoft Excel ver. 12.0, to estimate a correlation between frequency and weight of species. The weight was averaged from museum specimens available at INABIO, at least two adults of each sex (Table 1).

During our first sampling, we collected 17 pellets and 38 g of pellet debris, and turned up 48 individuals of 6 species: Yungas grass mouse, *Akodon aerosus* (13 ind.), delicate long-tailed mouse, *Oligoryzomys delicatus* (16 ind.), Yungas Amazonian Hylaeamys, *Hylaeamys yunganus* (8 ind.), Western Amazonian water rat, *Nectomys apicalis* (3 ind.); Bishop's slender opossum, *Marmosops bishopi* (5 ind.), Waterhouse's mouse opossum, *Marmosa waterhousei* (3 ind.). The second sampling resulted in 4 pellets and 9 g of pellet debris which contained 14 individuals of 3 species: Alberto Carcelén's spiny mouse, *Neacomys carceleni* (8 ind.), *M. bishopi* (5 ind.) and a bird, not identified (Table 1; Figure 2).

The Cordillera del Cóndor, as an isolated mountain ridge, is a hotspot of species richness and endemism of plants (Schulenberg and Awbrey 1997) and animals (Guayasamin and Bonaccorso 2011). Despite this, few studies on mammals have been carried out there, although these have already made it possible to describe endemic mammals, such as *Caenolestes condorensis* (Albuja and Patterson 1996) or *Neacomys auriventer* (Brito *et al.* 2021). In addition, an expedition in the upper Nangaritza river basin, with a sample effort of 25,680 hr, only 2 cricetids were captured (*A. aerosus* and *Thomasomys* sp.; Boada 2011); this highlight again the value of owl pellet analysis as an efficient alternative for assessing small mammal community composition.

**Table 1.** Small mammals recovered from *Tyto furcata* pellets, Paquisha, Zamora Chinchipe, Ecuador.

Order/Family/Species	Individuals	Average weight (g)
<b>Didelphimorphia</b>		
<b>Didelphidae</b>		
<i>Marmosops bishopi</i> (Pine, 1981)	10	33.0
<i>Marmosa waterhousei</i> (Tomes, 1860)	3	27.8
<b>Rodentia</b>		
<b>Cricetidae</b>		
<i>Akodon aerosus</i> Thomas, 1913	13	28.5
<i>Oligoryzomys delicatus</i> (J. A. Allen & Chapman, 1897)	16	21.7
<i>Hylaeamys yunganus</i> (Thomas, 1902)	8	40.5
<i>Nectomys apicalis</i> Peters, 1861	3	155.7
<i>Neacomys carceleni</i> Hershkovitz, 1940	8	15.9
<b>Aves</b>	1	?
<b>Total</b>	62	



**Figure 2.** Preys recovered from *Tyto furcata* pellets, Paquisha, Ecuador. Dorsal (upper) and ventral (bottom) views of skull of: *Hylaeamys yunganus* (a, f); *Neacomys carceleni* (b, g); *Nectomys apicalis* (c, h); *Oligoryzomys delicatus* (d, i). Dorsal and lateral views of jaws of *Akodon aerosus* (e). Lateral views of jaws of: *Marmosa waterhousei* (j); *Marmosops bishop* (k). Ventral view of mandible of bird (l). Scale bar = 10 mm.

The prey found in *T. furcata* pellets from Paquisha brought to light biogeographical information as to the southernmost world distribution record for *O. delicatus* and the first record in Zamora Chinchipe province for *M. bishopi*. Also, we can suggest that the most prey recorded herein, *A. aerosus* and *O. delicatus*, are common in Paquisha, considering to *T. furcata* as an opportunist predator with wide trophic niche, i.e., minimum prey selectivity (Cadena-Ortiz et al. 2019), and that we found a non-significant correlation between prey frequency and its weight ( $r_2 = 0.246$ ;  $P = 0.257$ ), so in Paquisha *T. furcata* could hunt the most abundant prey regardless of the amount of biomass.

Recovered skulls also increase museum material and become a potential source of DNA (Taberlet and Fumagalli 1996). Previously in INABIO, *N. apicalis* was only represented by 7 specimens; *M. waterhousei*, only by 3, and none from Zamora Chinchipe province; and for *N. carceleni*, only 4 for Zamora Chinchipe. Finally, we provide evidence of the ecological relationship of all the small mammals recorded in these pellets and *T. furcata* as their predator. The present findings unveil the first records of *M. bishopi* and *M. waterhousei* as prey of *T. furcata*. Previously, the only Didelphid recorded was *Marmosops cauae* (Brito et al. 2015). Also, from known Cricetidae prey, only *A. aerosus* was previously recorded as prey of *T. furcata* (Brito et al. 2015).

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## Literature cited

- ALBUJA, L., AND B. D. PATTERSON. 1996. A new species of northern shrew-opossum (Paucituberculata: Caenolestidae) from the Cordillera del Cóndor, Ecuador. *Journal of Mammalogy* 77:41–53.
- BOADA, C. 2011. Mamíferos de los Tepuyes de la Cuenca Alta del Río Nangaritza, Cordillera del Cóndor. Pp. 76–86 in RAP Boletín de Evaluación Ecológica Rápida 58 (Guayasamin, J. M., and E. Bonaccorso, eds.). Conservación Internacional. Quito, Ecuador.
- BRITO, J., ET AL. 2015. Mamíferos pequeños en la dieta de la lechuza *Tyto alba* (Strigiformes: Tytonidae) en dos localidades del occidente de Ecuador, con ampliación distribucional de *Ichthyomys hydrobates* (Rodentia: Cricetidae). *Papéis Avulsos de Zoologia (São Paulo)* 55:261–268.
- BRITO, J., ET AL. 2021. A new species of spiny mouse, genus *Neacomys* (Cricetidae: Sigmodontinae) from Cordillera del Cóndor, Ecuador. *Mastozoología Neotropical* 28:507.
- CADENA-ORTIZ, H., ET AL. 2019. Diet of barn owls (*Tyto alba*) in two Ecuadorian dry forest locations. *Ornitología Colombiana* 17:eNB03.

- DÍAZ-NIETO, J. F., *ET AL.* 2016. DNA sequencing reveals unexpected recent diversity and an ancient dichotomy in the American marsupial genus *Marmosops* (Didelphidae: Thylamyini). *Zoological Journal of the Linnean Society* 176:914–940.
- FERRI, V. P., *ET AL.* 2021. Small mammals from barn owl *Tyto alba* pellets in a Mediterranean agroforestry landscape of central Italy. *Natural History Sciences* 8:3–10.
- GUAYASAMIN, J. M., AND E. BONACCORSO (EDS.). 2011. RAP Boletín de Evaluación Ecológica Rápida 58. Conservación Internacional. Quito, Ecuador.
- INSTITUTO NACIONAL DE ESTADÍSTICA Y CENSOS (INEC). 2010. Fascículo Provincial Zamora Chinchipe. Resultados de Población y Vivienda de 2010. [https://www.ecuadorencifras.gob.ec/wp-content/descargas/Manu-lateral/Resultados-provinciales/zamora\\_chinchipe.pdf](https://www.ecuadorencifras.gob.ec/wp-content/descargas/Manu-lateral/Resultados-provinciales/zamora_chinchipe.pdf). Accessed on November 9, 2022.
- MARTI, C. D. 1973. Food consumption and pellet formation rates in four owl species. *The Wilson Bulletin* 85:178–181.
- MARTI, C. D., *ET AL.* 2020. Barn Owl (*Tyto alba*). *In: Birds of the World* (S. M. Billerman, ed.). Version 1.0. Cornell Lab of Ornithology, Ithaca. New York, U.S.A. <https://doi.org/10.2173/bow.brnowl.01>. Accessed on November 9, 2022.
- MORENO, P. 2010. Mamíferos presentes en la dieta de la lechuza de campanario (*Tyto alba*) en Valdivia, provincia de Guayas, Ecuador. *ACI Avances en Ciencias e Ingenierías* 3:B87–B90.
- MORENO, P., AND J. L. ROMÁN. 2013. Clasificación del género *Reithrodontomys* en el Ecuador y comentarios sobre la alimentación de la lechuza de campanario (*Tyto alba*) en los alrededores de Quito. *Boletín Técnico, Serie Zoológica* 89:16–23.
- SCHULENBERG, T., AND K. AWBREY. 1997. The Cordillera Del Condor Region of Ecuador and Perú: a biological assessment (Rapid Assessment Program Working Papers 7). Conservation International. Washington, D. C., U.S.A.
- TABERLET, P., AND L. FUMAGALLI. 1996. Owl pellets as a source of DNA for genetic studies of small mammals. *Molecular Ecology* 5:301–305.
- VÁSQUEZ-ÁVILA, B. E., *ET AL.* 2018. La lechuza Campanaria, *Tyto alba* (Strigiformes: Tytonidae) como regulador de plagas en un ecosistema urbano altoandino en el sur del Ecuador. *ACI Avances en Ciencias e Ingenierías* 10:42–51.

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