

Research article

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## Small non-volant mammals of the Provincia de El Oro, Ecuador: results of a field survey and annotated checklist

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**Abstract.** From 2015 to 2022 we sampled small (< 1 kg) non-volant mammals in most regions of the Provincia de El Oro in southwestern Ecuador. A total of 228 individuals belonging to 37 species were collected and recorded. Based on a complete account of this collection, supplemented by additional museum specimens and reliable literature reports, we present an annotated checklist including the 46 species of small non-volant mammals currently known from Provincia de El Oro. The compilation provided represents one of the most comprehensive data sets on non-volant mammals collected from southwest Ecuador. A gazetteer of the collection localities of all specimens is provided and some taxonomic and biogeographical issues are discussed. Ten of the registered species (22%) are in some category of threat in Ecuador: eight are Vulnerable (VU), one is Endangered (EN), and one is Critically Endangered (CR). The record of the Water Mouse *Neusticomys orcesi* (Jenkins & Barnett, 1997) corresponds to the second locality for this rodent, while also representing the lowest altitudinal record (2,000 m a.s.l.). Shrub and herbaceous and native forest vegetation are the most fragmented habitats, with 2,546 and 2,403 patches, respectively. In addition, these ecosystems concentrate the highest species richness, including endemic and endangered species. The present report establishes a baseline for future inventory efforts in the west of Ecuador. Such basic information is essential for natural resource management and conservation to be successful.

**Key words.** Diversity, fragmented ecosystems, *Neusticomys orcesi*, piedmont forest, montane forest.

### INTRODUCTION

The tropical Andes of South America are one of the most biodiverse regions of the planet, with high levels of endemism (Myers et al. 2000; Voss 2003; Ceballos & Ehrlich 2006; Prado et al. 2014; Sklenář et al. 2014; Patton et al. 2015), and where several globally threatened species are concentrated (Amori et al. 2013). Despite this, study efforts and vouchers are poorly represented in publications and museum collections (Patton et al. 2015).

Several papers have been published in an attempt to fill information gaps in the Andes of Ecuador, such as in the Andean areas of the provinces (from north to south): Carchi (Tirira & Boada 2009; Ojala-Barbour et al. 2019), Imbabura (Lee et al. 2010; Curay et al. 2022), Pichincha (Curay et al. 2019), Napo (Voss 2003; Lee et al. 2006, 2008), Cotopaxi (Jarrín-V 2001; Lee et al. 2022), Morona

Santiago (Lee et al. 2011; Brito & Ojala-Barbour 2016), and Azuay (Barnett 1999). In the Provincia de El Oro, although the first mammal studies were conducted in the early 20th century (Anthony 1921, 1923, 1924a, 1924b, 1926), few subsequent works have been carried out (Baker et al. 2009; Carrera et al. 2010; Velazco & Patterson 2014; Brito & Valdivieso-Bermeo 2016; Torres-Porras et al. 2017; Brito et al. 2018, 2022).

We define small non-volant mammals as all those species whose mass ranges below 1 kg when adult, which includes most rodents, Eulipotyphla, and also various marsupials, some primates, lagomorphs, and carnivores (Patton et al. 2015; Wilson et al. 2005, 2017). As a result of our field surveys in the Provincia de El Oro between 2015 and 2022, here we provide a checklist of 46 species of small non-volant mammals, complemented with specimens preserved in national natural history museums and

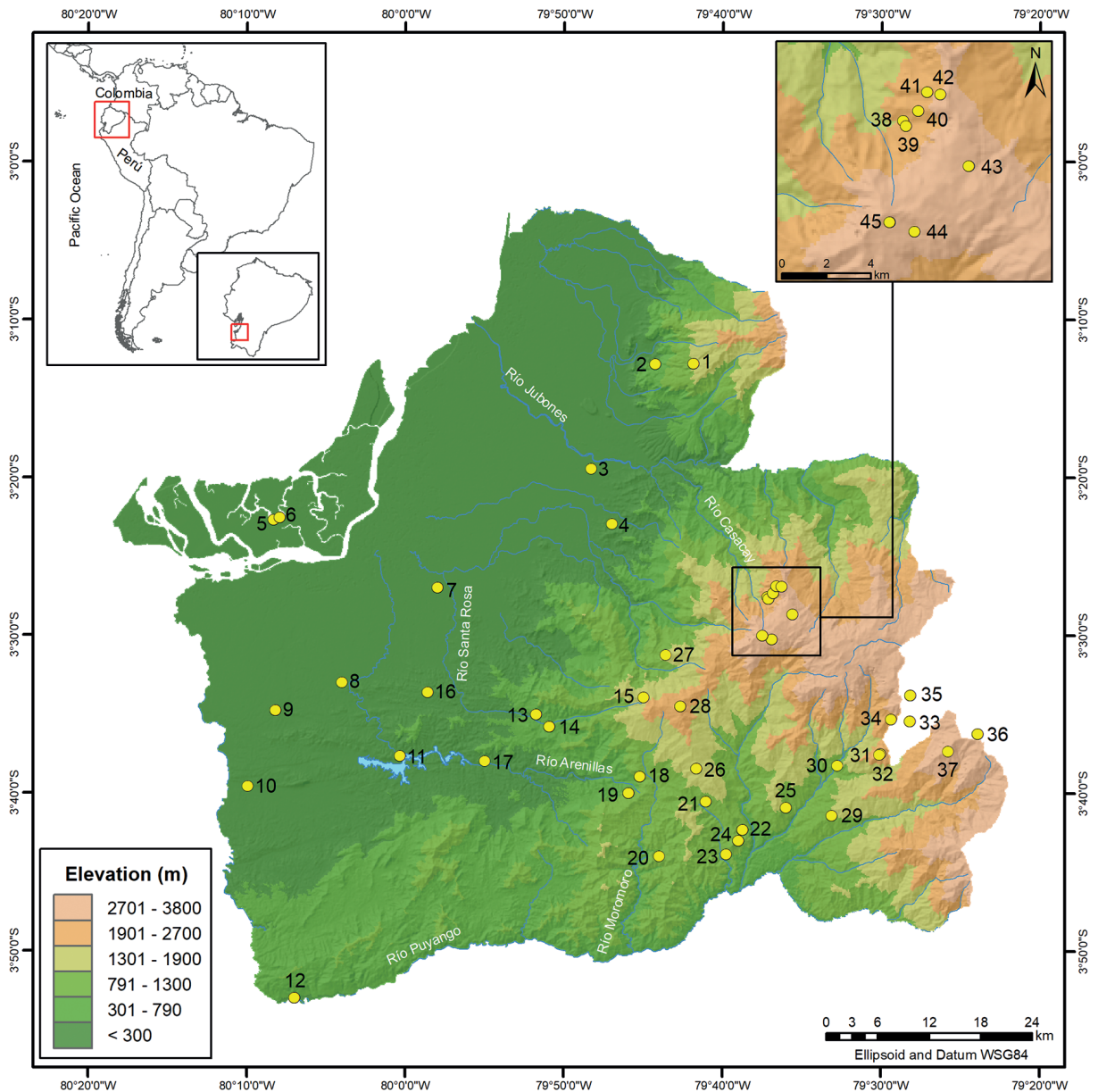
literature. This report is intended to establish a baseline for future inventory efforts in western Ecuador.

**MATERIAL AND METHODS**

**Study area.** The Provincia de El Oro is in the southwestern region of Ecuador (Fig. 1). Part of the province is crossed by the western Andes, while the majority corresponds to the coastal region (Garzón-Santomaro et al. 2019a).

In the Provincia de El Oro, the tropical rainforests of the Chocó biogeographic region (coastal tropical rainforest) and the dry equatorial forest of Tumbes (coastal tropical dry forest) are found together. El Oro is the Ecuadorian province where the Andes are closest to the sea (ca. 20 km), with an altitudinal gradient between 0 and 3,900 m a.s.l. (Garzón-Santomaro et al. 2019a).

**Data collection.** From 2015 to 2022 we sampled 20 localities, trying to cover most of the ecosystems of the Provincia de El Oro. The mammals were captured with Sherman-like traps (7.5 × 9 × 29 cm), and Tomahawk-like



**Fig. 1.** Map Provincia de El Oro showing localities from which materials were recorded. Details of the numbered localities are shown in Table 1.

**Table 1.** Locations indicated in the text and in Fig. 1.

Number	locality	latitude	longitude	altitude	source
1	El Retiro	-3.213330	-79.697777	1,690	Brito et al. (2018)
2	Cascadas de Manuel	-3.213610	-79.737777	345	Brito et al. (2018)
3	Pasaje	-3.324400	-79.805318	29	Wekslers (2006)
4	Pasaje. La loma	-3.382390	-79.783416	80	Ramírez-Jaramillo (2019)
5	Jambeli	-3.378480	-80.139130	5	Orihuela-Torres et al. (2019)
6	Las Casitas. Jambeli	-3.375830	-80.132500	1	Orihuela-Torres et al. (2018)
7	Santa Rosa	-3.450000	-79.966660	100	Rossi et al. (2010); Wekslers & Löss (2015)
8	Los Pozos	-3.550000	-80.066670	50	Tribe (2015)
9	Reserva Ecológica Arenillas	-3.579720	-80.136944	45	Brito et al. (2018)
10	Arenillas. El Cubo destacamento	-3.659990	-80.165830	112	this study
11	Tahuin	-3.627770	-80.005830	132	Brito et al. (2018)
12	Puyango	-3.883333	-80.116600	350	Rossi et al. 2010; this study
13	El Guayabo	-3.583600	-79.862520	550	this study
14	Sabayan	-3.596517	-79.848960	478	this study
15	El Biron	-3.565833	-79.750020	1,835	Brito et al. (2018)
16	El Biron Alto	-3.560640	-79.976844	1,651	this study
17	Piedras	-3.633330	-79.916660	300	Voss (1992)
18	Reserva Buenaventura	-3.649160	-79.753611	543	Torres-Porras et al. (2017)
19	Cresta Polo	-3.666660	-79.765550	979	this study
20	Moromoro	-3.733333	-79.733333	1,060	Brito et al. (2018)
21	Piñas	-3.675413	-79.684280	1,100	Anthony (1922)
22	San Patricio	-3.705277	-79.645830	811	this study
23	San Roque	-3.731256	-79.662694	930	this study
24	Portovelo	-3.716666	-79.650000	609	Anthony (1921)
25	Zaruma	-3.681935	-79.599977	1,150	Anthony (1921)
26	El Chiral	-3.641000	-79.694000	1,630	Anthony (1921)
27	Paccha	-3.520833	-79.726380	1,444	Brito et al. (2018)
28	Yacuvíñay	-3.574999	-79.711389	2,410	this study
29	Güishiguiña	-3.690248	-79.551947	1,650	this study
30	Salvias	-3.637504	-79.545890	1,215	Wekslers (2006)
31	Chivaturco	-3.625000	-79.501111	2,433	this study
32	Chivaturco. Cumbre	-3.626048	-79.501848	2,500	this study
33	Taraguacocho	-3.590884	-79.469717	3,277	Anthony (1921)
34	Sabadel	-3.588758	-79.489921	3,300	this study
35	Cerro de Arcos	-3.550830	-79.478333	3,668	this study
36	Laguna de Chinchilla	-3.603861	-79.398778	3,664	this study
37	Via Salvias-Zaruma	-3.622521	-79.429915	1,899	Wekslers (2006)
38	Gallo Cantana	-3.459450	-79.619840	2,053	this study
39	Cabecera del Río Casacay	-3.461667	-79.618717	2,003	this study
40	Ashigsho. vía a Gallo Cantana	-3.455410	-79.613760	2,489	this study
41	Ashigsho. Rancho Triste	-3.447850	-79.610150	2,539	this study
42	Ashigsho. Tanque	-3.448720	-79.604900	2,801	this study
43	Shiñinguro	-3.477778	-79.593333	3,169	this study
44	Payana	-3.504444	-79.615278	3,141	this study
45	Chillacocha	-3.500556	-79.625278	3,338	this study

**Table 2.** Collecting localities of small non-volant mammals in Provincia de El Oro (our study).

number	locality	traps/night	n° specimens	n° species
12	Puyango	300	6	3
13	El Guayabo	1,200	10	5
14	Sabayan	1,200	16	5
16	El Biron Alto	600	7	1
19	Cresta Polo	300	6	2
22	San Patricio	200	3	1
28	Yacuvíñay	300	20	3
31	Chivaturco	200	2	2
32	Chivaturco. Cumbre	200	16	4
34	Sabadel	150	5	3
35	Cerro de Arcos	150	12	6
36	Laguna de Chinchilla	150	17	6
38	Gallo Cantana	150	26	4
39	Cabecera del Rio Casacay	80	5	4
40	Ashigsho. vía a Gallo Cantana	150	13	4
41	Ashigsho. Rancho Triste	600	28	6
42	Ashigsho. Tanque	150	7	3
43	Shiñinguro	200	5	2
44	Payana	200	12	6
45	Chillacocha	350	12	5
<b>Total</b>		<b>6,830</b>	<b>228</b>	<b>25</b>

traps (14×14×40 cm), which allowed for 6,830 trap-nights. The traps were arranged in linear sampling transects, with two traps per station, combining a Sherman and a Tomahawk trap, with a separation of approximately 10 m between stations. The bait consisted of a mixture of oats with vanilla and coconut essence (Brito & Ojala-Barbour 2016). For the handling and care of the specimens, the recommendations of Sikes et al. (2016) were followed. Vouchers were deposited at the Instituto Nacional de Biodiversidad, Quito, Ecuador (MECN; formerly known as Museo Ecuatoriano de Ciencias Naturales), and Museo Escuela Politécnica Nacional (MEPN), Quito, Ecuador.

#### Identification, checklist structure and presentation.

Taxonomic identification of rodents was based on Patton et al. (2015), Pardiñas et al. (2017), and Brito et al. (2022); marsupials based on Ojala-Barbour et al. (2013), Astúa (2015), and Patterson (2016); shrews based on Zeballos et al. (2018); and rabbits based on Ruedas et al. (2019). In all cases they were also compared with museum specimens.

The updated list of 46 known small non-volant mammals in El Oro is organized according to taxonomic rank following Wilson & Reeder (2005), for squirrels we fol-

low de Vivo & Carmignotto (2015), and Abreu-Júnior et al. (2020). Details of our collection localities, as well as those reported in the literature, are listed in Table 1, and the sampling effort at each locality is provided in Table 2. The compendium contains the locality of the record for each species, a brief identification, and museum material. It also details new records, and taxonomic and/or natural history comments for each species inhabiting the Provincia de El Oro. Finally, for the conservation status at the global level we followed the IUCN (2021), and at the national level we followed Tirira (2021).

**Landscape fragmentation and diversity.** Currently there is a wide availability of geospatial data that allows explanation of the relationships of species with the landscape. We obtained the land cover and land use of the Provincia de El Oro at a scale of 1:25 000 from 2015 (official mapping at the best scale) produced by the Ministerio de Agricultura y Ganadería de Ecuador (MAG 2009-2015). With these data we calculated eight composition metrics and one landscape configuration metric (Table 3), and to estimate the species richness present in each landscape we used information from 45 localities (Table 1).

The land cover and land use format of the Provincia de El Oro was transformed from shapefile (.shp) to raster



**Table 3.** Landscape fragmentation metrics in the Provincia de El Oro.

metric	native forest	páramo	shrub and herbaceous vegetation	agricultural land	unit
class area	1,323	129	662	3,000	km <sup>2</sup>
number of patches	2,403	31	2,546	1,648	–
patch density	1.82	0.24	3.85	0.55	number per 100 hectares
mean of contiguity index	0.88	0.57	0.9	0.91	–
largest patch index	11.8	62.7	19	27.2	percentage
landscape division index	0.97	0.47	0.95	0.85	proportion
aggregation index	97.3	98.9	96.9	98.5	percentage
fractal dimension index	1.14	1.14	1.13	1.12	–

(.tif) with a spatial resolution of 7.5 meters to calculate landscape metrics. The data were processed using QGIS 3.16.6 Hannover software. Using the R landscapemetrics package for categorical map patterns, eight metrics proposed in Hesselbarth et al. (2021) were calculated to estimate the degree of landscape fragmentation (Native Forest, Páramo, Shrub Vegetation, Herbaceous Vegetation and Agricultural Land). The interactions between patches within the mosaic were also calculated, since these elements, by influencing the ecological characteristics of the species, can be a tool for defining conservation strategies (McGarigal et al. 1995).

## RESULTS

We recorded a total of 320 specimens belonging to 37 species, of which 228 specimens were collected as vouchers. Nine additional species occur in the Provincia de El Oro, including one species from previous collections preserved in Quito and eight species reported in the literature. Altogether, the total number of small non-volant mammal species currently known from the province of El Oro is 46 (see taxonomic accounts). Six species are endemic to Ecuador (13%). Ten of the species (22%) are in some category of threat in Ecuador (Tirira 2021), eight are Vulnerable (VU), one is Endangered (EN), and one is Critically Endangered (CR).

Our results show that the main landscape matrix of the Provincia de El Oro is agricultural land (Fig. 2A), occupying 3,000 km<sup>2</sup> (51.8% of the total area of the province) and harboring 23 species of small non-volant mammals. The native forest (26 spp., and 4 endemics) has an area of 1,323 km<sup>2</sup>, which is equivalent to 22.84% of the province and is structured by 2,403 patches, with a patch density of 1.82 per 100 hectares, where the index of the largest patch has a value of 11.8%. In addition, the division index obtained was 0.97 indicating that the native forest fragments are scattered and tend to be isolated within the landscape matrix. While the shrub and

herbaceous vegetation (23 spp., and 2 endemics) has an area of 662 km<sup>2</sup> made up of 2,546 patches with a density of 3.85 per 100 ha where the largest patch has a value of 19% showing that it has a higher degree of fragmentation in relation to native forests.

## Taxonomic accounts

### Order Didelphimorphia Gill, 1872

#### Family Didelphidae Gray, 1821

##### *Caluromys derbianus* (Waterhouse, 1841)

Material. 1 specimen collected (MECN 492).

Locality. San Roque (23).

Identification. Dorsal coat reddish brown, ventral color yellowish white. Head light gray, with a dark brown stripe in the center of the face. Ears hairless. Prehensile tail 30–50% wooly at its base, while tip of tail bare and whitish.

Conservation status. National, Vulnerable (VU); Global, Least Concern (LC).

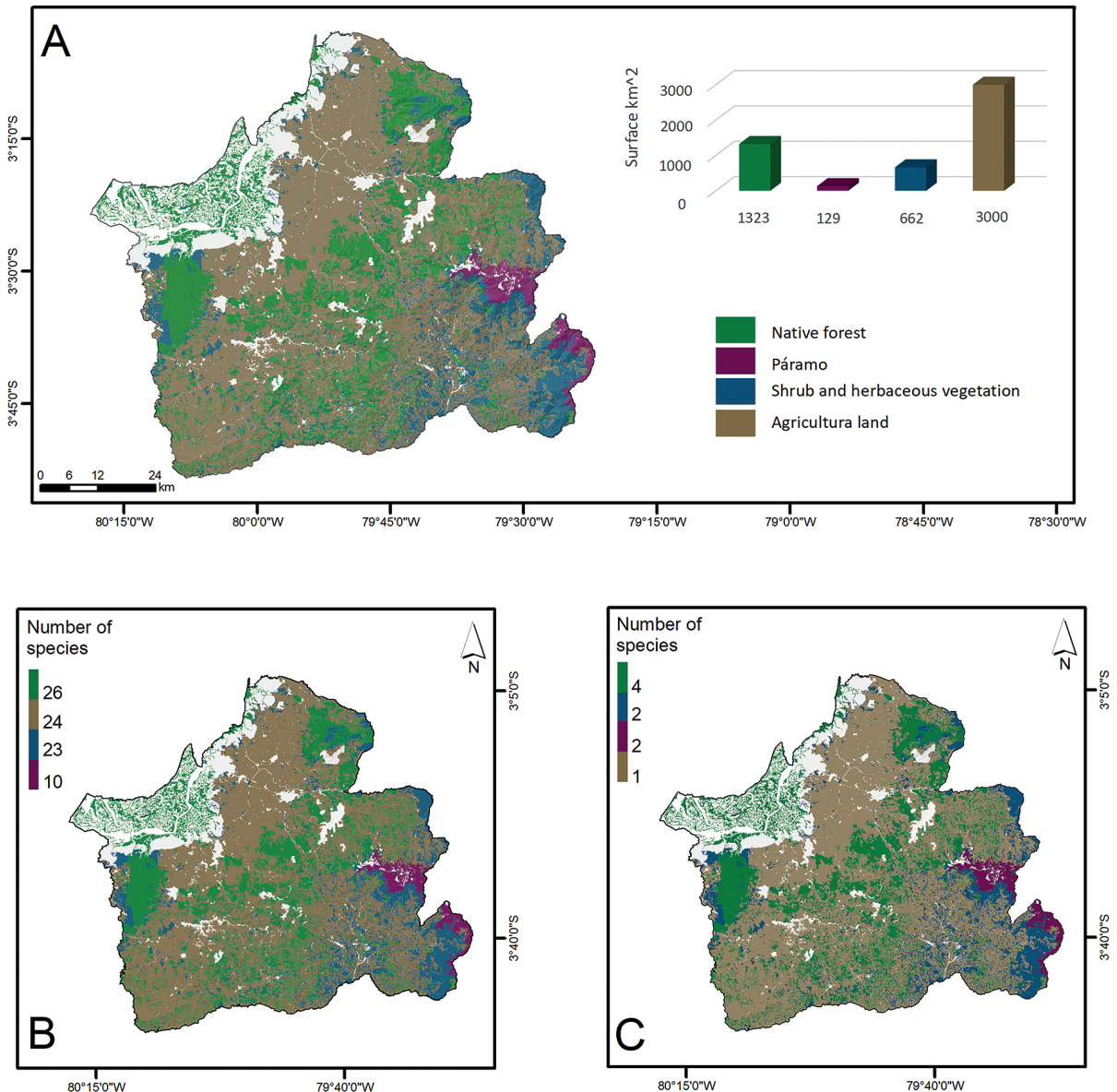
##### *Chironectes minimus* (Zimmermann, 1780)

Material. None.

Literature records. Moromoro (Brito et al. 2018).

Identification. Silver-gray dorsum with four broad bands running laterally across the dorsum, these are blackish in color. The pattern of its coloration makes it distinguishable from all other opossums. The hind legs have an interdigital membrane up to the end of each phalanx (Astúa 2015).

Conservation status. National, Near Threatened (NT); Global, Least Concern (LC).



**Fig. 2.** A. Land cover in the Provincia de El Oro. B. Species richness by land cover. C. Species endemism by land cover.

*Didelphis marsupialis* Linnaeus, 1758

Material. None.

Localities. Cascadas de Manuel (2), Reserva Ecológica Arenillas (9), Tahuin (11), Puyango (12), Cresta Polo (19), San Patricio (22).

Literature records. Reserva Buenaventura (Torres-Porras et al. 2017).

Identification. Dorsum with pale yellow hairs interspersed with black hairs. Ears large and black (Fig. 3A). Tail naked, black at its base and white at its tip.

Conservation status. National and Global, Least Concern (LC).

*Didelphis pernigra* J. A. Allen, 1900

Material. None.

Localities. Biron Alto (15), Yacuviñay (28), Sabadel (34), Cerro de Arcos (35), Laguna de Chinchilla (36), Ashigsho, via Gallo Cantana (40), Ashigsho, Tanque (42), Shiñinguro (43), Payana (44), Chillacocho (45).

Identification. Dorsum is black to deep gray. White head with a black mask that starts at the nose and goes behind the eyes and extends faintly to the base of the ears. The ears are pink or black but have white tips (Astúa 2015).

Conservation status. National and Global, Least Concern (LC).

***Marmosa isthmica*** Goldman, 1917

Material. None.

Literature records. Santa Rosa and Puyango (Rossi et al. 2010).

Identification. Dorsal dark brownish to pale brown, with the sides of the body slightly paler. Tail is long (approximately 130% of the head-body length), and the proximal 10% is covered with hair. Ventral is yellowish beige to orange from chin to anus, with the hairs on the sides having a yellowish gray to orange base (Astúa 2015).

Conservation status. National: Least Concern (LC); Global: Not evaluated.

***Marmosa perplexa*** Anthony, 1922

Material. None.

Literature records. Piñas (Anthony 1922; Voss & Giarla 2021).

Identification. The second upper premolar (P2) has an incomplete lingual cingulum. The postprotocrista of upper third molar (M3) is short (terminating at or near the base of the metacone), and lower molars (m1–m3) lack posterior cingulids (Voss & Giarla 2021).

Conservation status. National, Vulnerable (VU); Global, Not evaluated.

Remarks. With type locality in Ecuador: Trail from Zaruma to Loja near Punta Santa Ana, 3650 feet (1113 m) above sea level, in the western Andean foothills of Loja province, Ecuador (Anthony 1922).

***Marmosa phaea*** Thomas, 1899

Material. 1 specimen collected (MECN 4869).

Locality. Puyango (12).

Identification. Dorsal color brown (Fig. 3B) and ventral color cream-orange. Tail long (141% of the head-body length), naked, and brown, with small white spots at its tip. Skull with sparsely developed crest (Voss et al. 2014), postorbital processes well developed, a complete lingual cingulum on upper second premolar (P2), and long postprotocristae (Voss & Giarla 2021).

Conservation status. National and Global, Vulnerable (VU).

Remarks. The locality of Puyango is the southernmost record of the species.

***Marmosa simonsi*** Thomas, 1899

Material. 1 specimen collected (MECN 6036).

Localities. El Guayabo (13).

Literature records. Puyango (Gutiérrez et al. 2010; Rossi et al. 2010).

Identification. Dorsal color is grayish. There is no midline on the face as in some congeners. The tail is long (approximately 121% of the head-body length), and the most proximal 10% is covered with hair. Ventral hair is yellowish (Fig. 3C), with the hairs on the chest, abdomen and inner part of the limbs with a gray base (Astúa 2015).

Conservation status. National, Near Threatened (NT); Global, Not evaluated.

Remarks. With type locality in Ecuador: Puná Island, Guayas, Ecuador (Thomas 1899).

***Marmosops caucae*** (Thomas, 1900)

Material. 6 specimens collected (MECN 4635, 6948, 4675, 4682, 4684, 6975).

Localities. San Patricio (22), Cresta Polo (19), Ashigsho, vía Gallo Cantana (40).

Literature records. Portovelo (Díaz-Nieto et al. 2016).

Identification. Fur dense and short. Hair on back grayish brown (Fig. 3D). Ventral color yellowish white. Tail bare and bicolor. Skull without cranial ridges.

Conservation status. National and Global, Least Concern (LC).

***Philander melanurus*** (Thomas, 1899)

Material. 2 specimens collected (MECN 5028, 5754).

Localities. Reserva Buenaventura (18), El Guayabo (13).

Literature records. Reserva Buenaventura (Curay et al. 2019), Cresta Polo and Reserva Ecológica Arenillas (Brito et al. 2018).

Identification. Dorsum blackish gray from head to tail. Head gray, with two whitish spots above eyes (Fig. 3E). Chin white. Phalanges of feet and hands pink.

Conservation status. National, Least Concern (LC); Global, Not evaluated.

Remarks. With type locality in Ecuador: Paramba, Rio Mira, Imbabura, Ecuador; alt. 1100 m (Thomas 1899).

**Order Paucituberculata Ameghino, 1894**

**Family Caenolestidae Trouessart, 1898**

***Caenolestes caniventer*** Anthony, 1921

Material. 8 specimens collected (MECN 4811, 4812, 4830, 4841, 4900, 6933, 6938, 7018).

Localities. Yacuniñay (28), Ashigsho, Rancho Triste (41), Ashigsho, vía Gallo Cantana (40), Chillacocha (45), Payana (44).

Literature records. El Chiral (Anthony 1921; Ojala-Barbour et al. 2013).

Identification. Dorsum blackish brown. Ventral color grayish, with whitish hair tips that give it a grayish ap-





**Fig. 3.** Marsupials recorded in the Provincia de El Oro. **A.** *Didelphis marsupialis* recorded in the San Patricio. **B.** *Marmosa phaea* (MECN 4869) recorded in the Puyango. **C.** *Marmosa simonsi* (MECN 6036) recorded in the El Guayabo. **D.** *Marmosops caucacae* (MECN 4635) recorded in the Cresta Polo. **E.** *Philander melanurus* (MECN 5754) recorded in the El Guayabo (Photos by J. Brito).

pearance (Fig. 4). Skull robust, resting on the bulla and canines (Fig. 5). Anterorbital vacuity open and post palatine foramen curved (Ojala-Barbour et al. 2013). Prongs 1.6 times longer than glans, relatively cylindrical and striated, progressively tapering to a hook-shaped distal tip (Brito et al. 2022).

Conservation status. National, Vulnerable (VU); Global, Near Threatened (NT).

Remarks. With type locality in Ecuador: “El Chiral, Western Andes; altitude, 5350 ft.; Prov. del Oro, Ecuador” (Anthony 1921:6).





**Fig. 4.** Gray-bellied Shrew Opossum, *Caenolestes caniventer* (MECN 7018) recorded in the Ashigsho, Provincia de El Oro. (Photo by J. Brito).

**Order Rodentia Bowdich, 1821**  
**Family Sciuridae Fischer, 1817**

*Microsciurus simonsi* Thomas, 1900

Material. None.

Localities. Sabayan (14), Biron Alto (16), Reserva Buenaventura (18).

Literature records. Cascadas de Manuel (Brito et al. 2018).

Identification. Dorsum dark brown with orange. Ears short and postauricular patches absent. Tail no longer than the body and not very bulky (Fig. 6A).

Conservation status. National, Vulnerable (VU); Global, Not evaluated.

Remarks. Species endemic to Ecuador, type Locality. "Porvenir, near Zaparal, Province of Bolivar, Ecuador. Altitude 1500 m" (Thomas 1900:294).

*Simosciurus neboxii* (I. Geoffroy St.-Hilaire, 1855)

Material. 2 specimens collected (MECN 504, 6154).

Localities. San Roque (23), Puyango (12), Reserva Buenaventura (18), San Patricio (22), Reserva Ecológica Arenillas (9), El Guayabo (13), Sabayan (14).

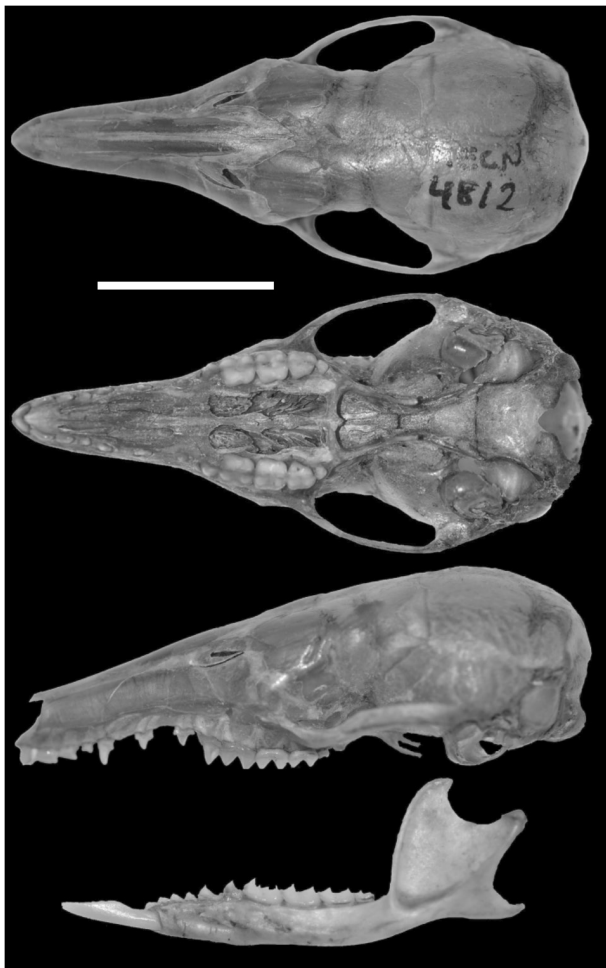
Identification. Dorsum light gray, posterior part on the drupe pale yellow; conspicuous white to grayish-white nuchal patch (Fig. 6B). Feet and hands dark brown.

Conservation status. National, Least Concern (LC); Global, Not evaluated.

*Syntheosciurus granatensis* (Humboldt, 1811)

Material. None.

Localities. Cascadas de Manuel (2), Tahuin (11), Piñas (21), Chivaturco (31).



**Fig. 5.** Dorsal, ventral and lateral view of the skull of *Caenolestes caniventer* (MECN 4812) recorded in the Chillacocha, Provincia de El Oro. Scale 10 mm. (Photos by J. Brito).

Literature records. Pasaje, La Loma (Ramírez-Jaramillo 2019), Reserva Buenaventura (Torres-Porras et al. 2017).

Identification. Back and belly reddish, interspersed with brown. Tail thick, bulging, ochraceous proximally and blackish at tip (Fig. 6C). Ventral orange.

Conservation status. National and Global, Least Concern (LC).

Remarks. Ramírez-Jaramillo (2019) reported a specimen with leucism for the locality of Pasaje, La Loma.

### Family Cricetidae Fischer, 1817

#### *Aegialomys xantheolus* (Thomas, 1894)

Material. None.

Localities. Reserva Ecológica Arenillas (9).

Literature records. Pasaje and Portovelo (Weksler 2006), and Jambelí (Orihuela-Torres et al. 2019).

Other specimens. MEPN 6069, 6070, 6500, 6503–6505, 6523, 6875.

Identification. Dorsal pelage color copper, weakly grizzled with brown; ventral pelage grayish cream; tail hirsute, longer than head body length (Prado & Percequillo 2017).

Conservation status. National and Global, Least Concern (LC).

#### *Akodon mollis* Thomas, 1894

Material. 55 specimens collected (MECN 4706, 4717, 4718, 4725–4727, 4783, 4800, 4808, 4831, 4833, 4845, 4847, 4849, 4886, 4887, 4889, 4890, 4894, 4896–4899, 4908, 4909, 4911, 5755, 5758–5760, 5765–5767, 6826, 6930, 6931, 6934, 6944, 6945, 6947, 6980, 6983, 6984, 6990, 6994, 7007–7009, 7013–7016, 7019).

Localities. Biron Alto (16), Yacuvñay (28), Chivaturco (31), Sabadel (34), Laguna de Chinchilla (36), Cabecera del Río Casacay (39), Ashigsho, vía Gallo Cantana (40), Ashigsho, Rancho Triste (41), Ashigsho, El Tanque (42), Shiñinguro (43), Payana (44).

Identification. Dorsal pelage dark olive (Fig. 7A). Tail short, furred, distinctly to indistinctly bicolored, with darker hairs above. Skull stocky with robust rostrum; long incisive foramina extend posteriorly beyond anterior margin of M1s.

Conservation status. National and Global, Least Concern (LC).

Natural history: A pregnant female with three fetuses was recorded in March 2022, and four males with scrotal testicles were recorded in November 2015.

#### *Chilomys neisi* Brito, Tinoco, García, Koch & Pardiñas, 2022

Material. 1 specimen collected (MECN 6187).

Localities. Ashigsho, Rancho Triste (41).

Identification. Dorsal fur dark neutral gray; venter coat dark neutral gray. Periocular ring jet black (Fig. 7B). Postauricular patch present. Long tail unicolor fawn except for apex, which is white. Long nasal; zygomatic plate straight; M1 without anteromedian flexus; m1 without anteromedian flexus; hemal arches absent. Proodont upper incisors with orange and smooth front enamel; crested and pentalophodont molars, noticeably thick enamel (Brito et al. 2022).

Conservation status. Not evaluated.

Remarks. Species endemic to Ecuador, type Locality. Ecuador, Provincia de El Oro, Cantón Chilla, Ashigsho, –3.44785, –79.61015; elevation 2,539 m (Brito et al. 2022).





**Fig. 6.** Squirrels of the Provincia de El Oro. **A.** *Microsciurus simonsi* recorded in the Cascadas de Manuel. **B.** *Simosciurus nebouxii* recorded in the San Patricio. **C.** *Syntheosciurus granatensis* recorded in the Paccha (Photos by G. Pozo).

**“*Handleyomys*” *alfaroi*** (J. A. Allen, 1891)

**Material.** 13 specimens collected (MECN 4631, 4634, 4640, 5752, 5753, 5756, 5762–5764, 6149).

**Localities.** El Guayabo (13), Sabayan (14), Cresta Polo (19).

**Identification.** Small; head and body of adults 97–122 mm long, tail 103–122 mm, hind leg length 25–28 mm, ear length 16–19, weight 29–39 g. Dorsal coat dark reddish brown (Fig. 7C); sides ocher to orange; belly grayish white or yellowish white, always with gray hair base. Short fur (5–7 mm). Tail bicolor in the proximal half and then dark to the tip. Skull small with short rostrum; temporal crests poorly developed; wide interorbital region. Alisphenoid strut absent.

**Conservation status.** National and Global, Least Concern (LC).

**Ecological notes.** Three males with scrotal testicles were recorded in November 2018.

**Taxonomic note.** Annotated as “*Handleyomys*” because of its provisional allocation as a member of *Handleyomys* (see Weksler 2015).

***Ichthyomys tweedii*** Anthony, 1921

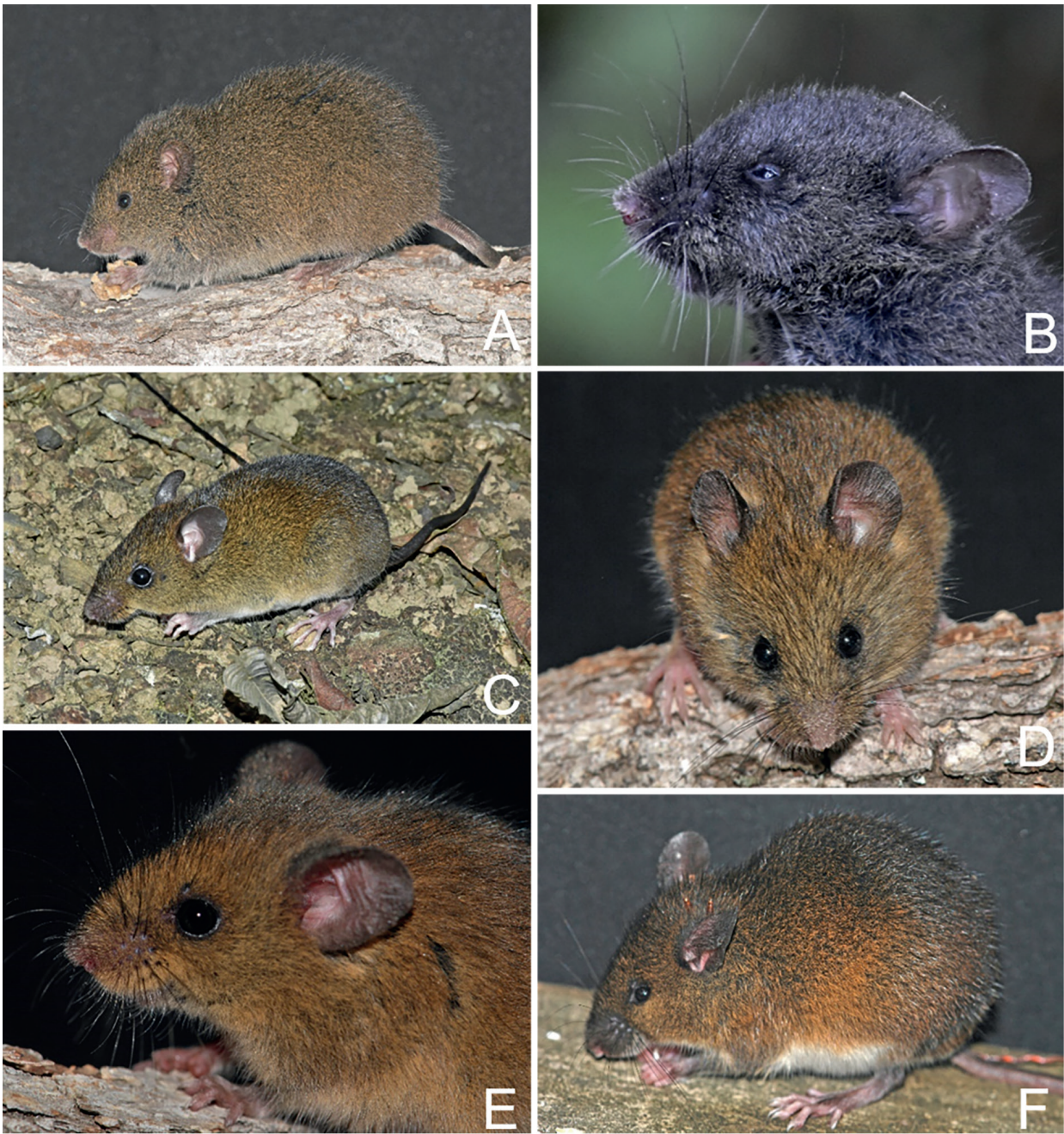
**Material.** 1 specimen collected (MECN 5772).

**Localities.** Sabayan (14).

**Literature records.** Portovelo (Anthony 1921).

**Identification.** Dorsal fur bright grayish brown. Venter coat white to yellowish gray. Eyes small, ears small but





**Fig. 7.** Some cricetid rodents of the Provincia de El Oro. **A.** *Akodon mollis* (MECN 4727) recorded in the Sabadel. **B.** *Chilomys neisi* (MECN 6187) recorded in the Ashigsho. **C.** “*Handleyomys*” *alfaroi* (MECN 5762) recorded in the El Guayabo. **D.** *Microryzomys altissimus* (MECN 4708) recorded in the Laguna de Chinchilla. **E.** *Microryzomys minutus* (MECN 4810) recorded in the Chillacochoa. **F.** *Nephelomys albigularis* (4834) recorded in the Payana (Photos by J. Brito).

visible on the coat (Fig. 8). Supraorbital vibrissa absent. Tail uniformly dark, shorter than the length of the head and body together, covered with fine hairs that hide the scales. Hindfoot long, paddle or wedge-shaped, with a narrow heel and broad sole. Soles blackish. Outer edges of feet and toes have a fringe of stiff, silver to white hairs that curve downward. Digits have small interdigital webs near bases. Cranially, rostrum broad, cranium massive

with widened zygomatic arches. Lower third molars bilobed (Voss 2015).

Ecological notes. The only individual was captured on the banks of a small canyon stream. For two days it was kept in captivity and fed with small fish (sardines), which were quickly devoured starting with the head of the fish (Fig. 8).





**Fig. 8.** Tweedy's Crab-eating Rat, *Ichthyomys tweedii* (MECN 5772), recorded in the Sabayan, Provincia de El Oro (Photo by J. Brito).

Conservation status. National, Endangered (EN); Global, Data Deficient (DD).

Ecological notes. A male with scrotal testes measuring 12 x 9 mm was recorded in November 2018.

Remarks. With type locality in Ecuador: "Portovelo, Prov. del Oro, Ecuador; altitude, 2000 ft." (Anthony 1921:1).

***Melanomys caliginosus*** (Tomes, 1860)

Material. None.

Literature records. Santa Rosa (Weksler & Löss 2015).

Identification. Robust, small, head-body length 95–117 mm. Dorsal fur dark brown, with tips of hairs orange. Dorsal surface of legs and hands black and covered with dark hairs. Tail short (91–92% of the head-body length). Skull with short incisive foramina, hourglass-shaped interorbital region, and presence of ridges.

Conservation status. National, Near Threatened (NT); Global, Least Concern (LC).

Remarks. With type locality in Ecuador: "Ecuador" (stated by J. A. Allen [1913:537] to be "doubtless Esmeraldas [Esmeraldas] (near sea level), Ecuador").

***Microryzomys altissimus*** (Osgood, 1933)

Material. 4 specimens collected (MECN 4704, 4708, 4828, 4719).

Localities. Payana (44), Cerro de Arcos 835), Laguna de Chinchilla (36).

Identification. Small, head-body length 70–73 mm. Dorsal coat olive-brown; belly yellowish gray (Fig. 7D). Tail long, greater than 110 mm and longer than the total length of the head and body combined, noticeably bicolored, dark above. Skull with long, wide incisive foramina. Dentary with small incisor tubercle (Carleton & Musser 1989).

Conservation status. National and Global, Least Concern (LC).

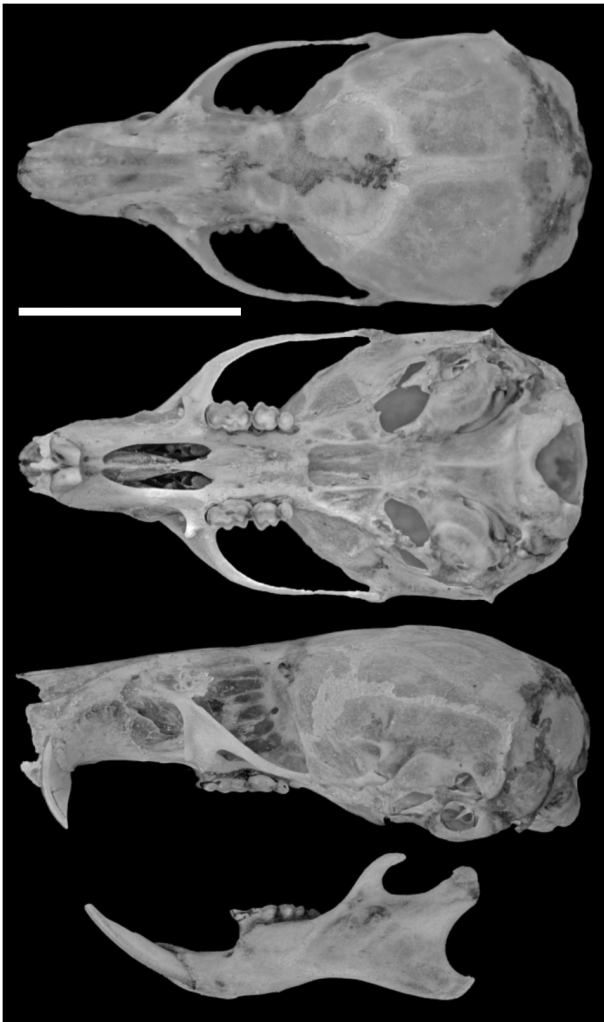
***Microryzomys minutus*** (Tomes, 1860)

Material. 2 specimens collected (MECN 4700, 4810).

Localities. Laguna de Chinchilla (36), Chillacocha (45).

Literature records. Tarahuacocha and El Chiral (Carleton & Musser 1989).

Other specimens. MEPN 5842, 5864.



**Fig. 9.** Dorsal, ventral, and lateral view of the skull of *Neusticomys orcesi* (MECN 6185) recorded in the Cabecera del Río Casacay, Provincia de El Oro. Scale 10 mm (Photos by J. Brito).

**Identification.** Small, head-body length 65–80 mm. Dorsal coat yellowish brown and belly yellow or pale orange (Fig. 7E). Tail long (161% of the head-body length), and dark. Hind legs with protruding pads. Skull with long and wide incisive foramina. Dentary with distinct incisor tubercle (Carleton & Musser 1989).

**Conservation status.** National and Global, Least Concern (LC).

**Remarks.** With type locality in Ecuador: probably near Pallatanga, on the western slope of the Cordillera, Chimborazo, Ecuador (see Carleton & Musser 1989:65).

#### *Nephelomys albigularis* (Tomes, 1860)

**Material.** 52 specimens collected (MECN 4784–4788, 4798, 4799, 4803, 4804, 4813, 4823–4825, 4833, 4834, 4888, 4892, 4903, 4913, 6825, 6828, 6936, 6937, 6940, 6943, 6946, 6949, 6950, 6970–6974, 6976, 6977, 6979,

6985, 6988, 6989, 6991, 6992, 6995, 6997, 6998–7006, 7010, 7011, 7017).

**Localities.** Ashigsho, Rancho Triste (41), Cabecera del Río Casacay (39), Chillacocha (45), Chivaturco (31), Ashigsho, vía Gallo Cantana (40), Payana (44), Yacuvíñay (29), Güishiguiña (29).

**Literature records.** El Chiral and Salvias (Weksler 2006).

**Other specimens.** MEPN 6045, 6046, 6098.

**Identification.** Dorsal coat ranges from grayish orange (in adults, Fig. 7F) to dark brown (in juveniles). Ventral coat whitish to yellowish (in adults) to grayish (in juveniles). Tail bicolor or weakly bicolor (few specimens with unicolor tail). Most specimens with small white spot in the gular region, and in only three specimens does this spot extend to the pectoral region. Skull with short incisive foramina (Percequillo 2015a). Alisphenoid strut usually absent, thin when present.

**Ecological notes.** Between November and December 2015, nine males with scrotal testicles and one pregnant female were recorded.

**Conservation status.** National, Vulnerable (VU); Global, Least Concern (LC).

**Remarks.** With type locality in Ecuador: “Taken *en camino* on my return from Pallatanga”; Provincia de Chimborazo, Ecuador (Tomes 1860: 264).

#### *Neusticomys orcesi* (Jenkins & Barnett, 1997)

**Material.** 2 specimens collected (MECN 6185, 6186).

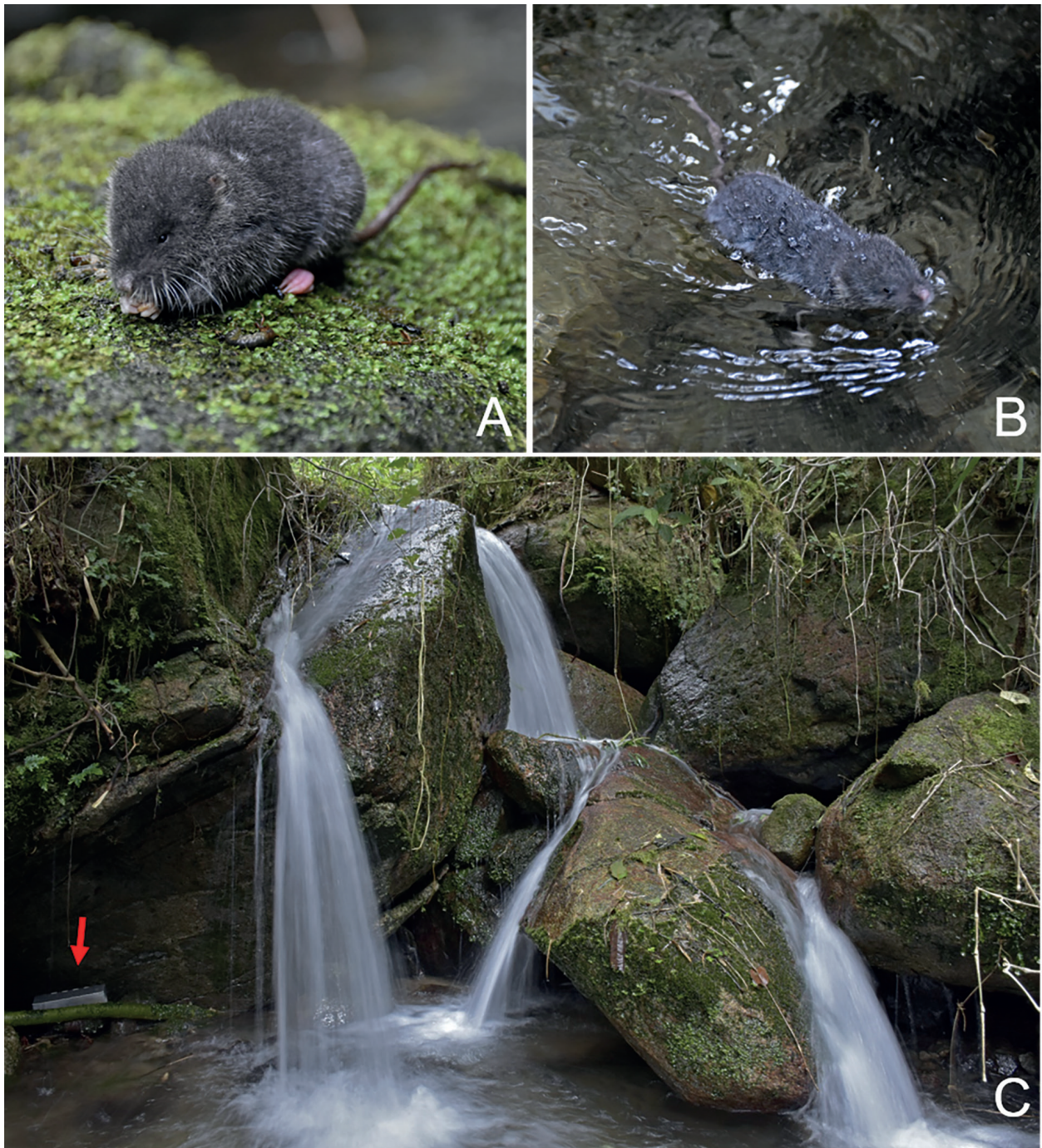
**Locality.** Cabecera del Río Casacay (39).

**Identification.** Dorsal fur dull grayblack brownish, ventral pelage slightly paler than dorsum. Pinnae conspicuous above fur on head. Philtrum present. Tail slightly shorter than head-and-body length, with abundant hair. Hind feet with a row of stiff hairs on the edge of the metatarsus and digits. Rostrum slender; inferior root zygomatic plate posterior to the first upper molar; petrosal well exposed; occipital condyles not projecting posteriorly beyond rest of occiput (Fig. 9).

**Ecological notes.** Two individuals were captured on the banks of a small mountain stream (Fig. 10B–C). They were kept in captivity for two days and fed with aquatic invertebrate larvae. The habitat was thickly vegetated with zurales (*Chusquea* sp.), and emergent trees such as *Cedrela* sp., and *Ficus* sp.

**Taxonomic notes:** This species was described within *Chibchanomys* (Jenkins & Barnett 1997; Voss 2015); very recently Salazar-Bravo et al. (2023), based on molecular and morphological evidence, transfer it to *Neusticomys*. Voss (2015) reports a record in Perú based on the specimen LSUMZ 14406 (Museum of Zoology of Louisiana State University, Baton Rouge). However, in the extensive revision of Salazar-Bravo et al. (2023), this animal is regarded as an undescribed species of *Chibchanomys*. Therefore, our specimens of *N. orcesi* collected in





**Fig. 10.** Orcés' Water Mouse. **A–B.** *Neusticomys orcesi* (MECN 6185), external appearance. **C.** Capture site in the Cabecera del Río Casacay, note the location of the trap, pointed by an arrow (Photos by J. Brito).

the Río Casacay correspond to the second locality for this species. In addition, it represents the lowest altitude record (2,000 m. a.s.l.). Previously the species was known only from around the Lake Luspa type locality in Cajas National Park (Ecuador), above 3,100 m. a.s.l. (Jenkins and Barnett 1997).

Conservation status. National, Critically Endangered (CR); Global, Data Deficient (DD).

Remarks. Species endemic to Ecuador, type Locality. Lake Luspa, Parque Nacional Cajas, Provincia Azuay, Ecuador, 02°50' S 79°30' W, altitude 3700 m (Jenkins & Barnett 1997: 124).





**Fig. 11.** A. *Oecomys bicolor* (MECN 5757) recorded in the El Guayabo. B. *Transandinomys talamancae* (MECN 6148) recorded in the Puyango, Provincia de El Oro (Photos by J. Brito).

***Oecomys bicolor*** (Tomes, 1860)

Material. 1 specimen collected (MECN 5757).

Locality. El Guayabo (13).

Identification. Small, head-body length 107 mm. Hair smooth and long (9 mm). Back orange, with gray base. Belly white, contrasting with back (Fig. 11A). Tail not so long (125 mm) in comparison to head-body length (116%), and with a small 6 mm brush at its tip. Skull with short rostrum, narrow interorbital with finely beaded supraorbital ledges (Fig. 12). Temporal ridges weakly defined. Zygomatic plates narrow and dorsal notches shallow. Incisive foramina relatively short and wide, their posterior margins do not reach the anterior margin of the first molars. Alisphenoid strut present, and wide. Ectotympanic bulla small, exposing much of the medial periotic. Dentary with small incisor tubercle.

Taxonomic notes: Our specimen corresponds to the first record of the genus in southwestern Ecuador. It is

known that *Oecomys bicolor* represents a complex of species (Carleton & Musser 2015). Within the complex, the trans-Andean forms, such as *O. dryas*, deserve special attention. We agree with Carleton & Musser (2015) and conceive that a systematic revision of *Oecomys* in western Ecuador, including genetic and morphological evidence, is needed.

Conservation status. National and Global, Least Concern (LC).

Remarks. With type locality in Ecuador: Gualaquiza, Río Gualaquiza, 885 m, Morona Santiago, Ecuador (Tomes 1860).

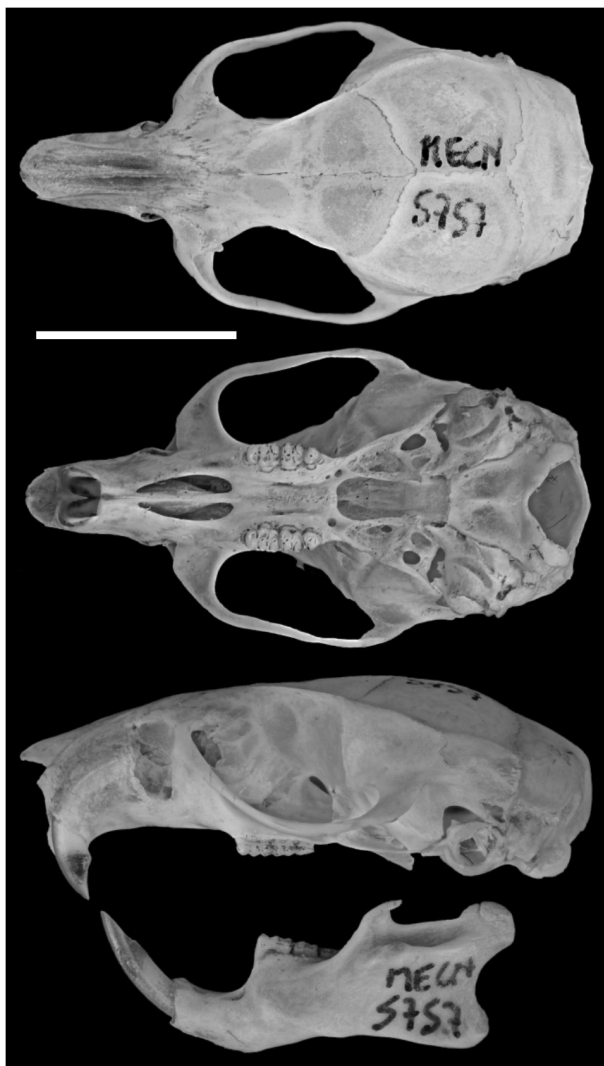
***Oligoryzomys destructor*** (Tschudi, 1844)

Material. None.

Literature records. Piñas (Weksler & Bombicino 2015).

Identification. Dorsal fur reddish brown, while belly yellowish white. Dorsal surfaces of feet covered by short





**Fig. 12.** Dorsal, ventral, and lateral view of the skull of *Oecomys bicolor* (MECN 5757) recorded in the El Guayabo, Provincia de El Oro. Scale 10 mm (Photos by J. Brito).

silver-gray hair, with hairs of nail base very long. Tail brown and slightly shorter than the head and body length; vibrissae black on basal half and white toward tip; nose hair silver white (Weksler & Bombicino 2015).

Conservation status. National: National and Global, Least Concern (LC).

#### *Oreoryzomys balneator* (Thomas, 1900)

Material. 1 specimen collected (MECN 4789).

Localities. Chivaturco (31).

Literature records. El Chiral (Anthony 1924b; Weksler 2006).

Identification. Small body size, with head and body length (85 mm); tail longer than head and body (113 mm); hindfeet narrow (25 mm); ears long and rounded (17 mm). Dorsal pelage short, whit hairs 6 mm in length,

darkly colored (Fig. 13A); ventral pelage is even shorter (5 mm), grayish. Throat with small white patch. Tail uniformly dark brown. Skull small (20.3 mm incisive condyle length). Superficial zygomatic notch. Very small lacrimals. Frontal parietal suture “U” shaped. Posterior border of zygomatic plate aligned with the procingulum of first upper molar (Fig. 14).

Taxonomic notes: Anthony (1924b) described *Oreoryzomys balneator hesperus* based on a specimen collected in El Chiral, Provincia de El Oro. Our specimen is morphologically like *O. b. hesperus*. In an in progress revision of *O. balneator* from several localities in Ecuador, it has been detected that it may be a complex of at least three different species (Brito, pers. obs.).

Conservation status. National, Near Threatened (NT); Global, Data Deficient (DD).

Remarks. With type locality in Ecuador: Mirador, Baños, Tungurahua, Ecuador (Thomas 1900).

#### *Phyllotis andium* Thomas, 1912

Material. None.

Literature records. Taraguacochoa (Rengifo & Pacheco 2015).

Identification. Dorsal fur brown with tips of some bright reddish-brown hairs giving it a marbled appearance. Ventral fur pale gray. Relatively large ears. Tail covered with light hairs and longer than the length of the head and body.

Conservation status. National: National and Global, Least Concern (LC).

Remarks. With type locality in Ecuador: Cañar, Provincia de Cañar, Ecuador. Alt. 2600 m (Thomas 1912).

#### *Phyllotis* sp.

Material. None.

Literature records. Jambelí (Orihuela-Torres et al. 2019).

Remarks. *Phyllotis* sp. was recovered from the pellets of the Northern Caracara *Caracara cheriway*, in the locality of Jambelí at 5 m (Orihuela-Torres et al. 2019). Currently, no species of *Phyllotis* has been reported from the Ecuadorian coast. However, there are some *Phyllotis* that can inhabit the coast, such as *P. amicus* and *P. gerbillus* in northern Peru and the border with Ecuador (Rengifo & Pacheco 2015). The collection of additional material in Jambelí is necessary to corroborate the status of this form.

#### *Rhipidomys latimanus* (Tomes, 1860)

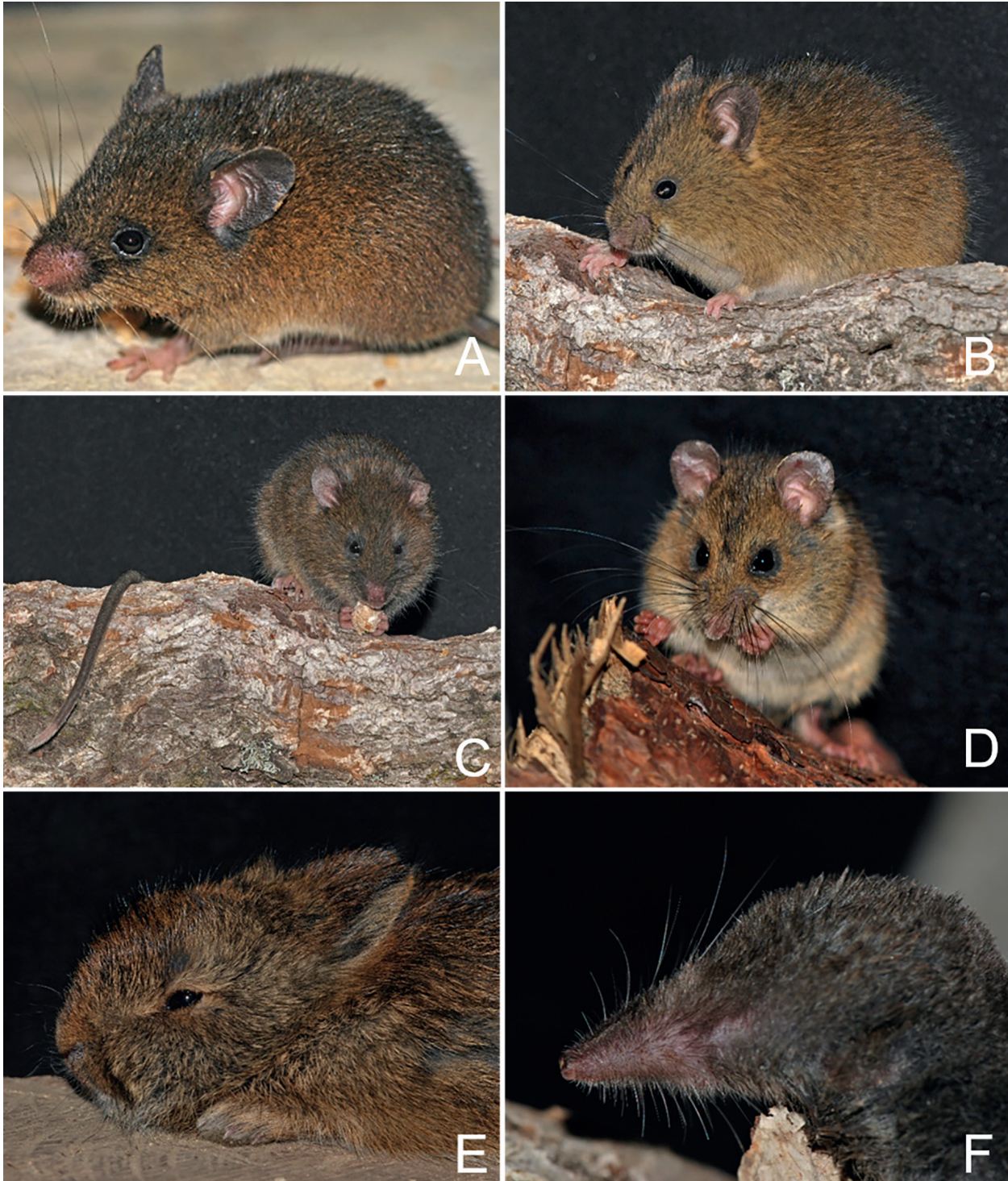
Material. None.

Literature records. El Retiro (Brito et al. 2018).

Identification. Dorsal coat orange to reddish brown. Ventral fur creamy white. Tail longer than the head and

body combined, dark brown, with a distinctive brush-like tuft of hairs distally. Eyes large.

Conservation status. National and Global, Least Concern (LC).



**Fig. 13.** Some small mammals of the Provincia de El Oro. **A.** *Oreoryzomys balneator* (MECN 4789) recorded in the Chivaturco. **B.** *Thomasomys auricularis* (MECN 4686) recorded in the Cerro de Arcos. **C.** *Thomasomys caudivarius* (MECN 4729) recorded in the Sabadel. **D.** *Thomasomys taczanowskii* (4822) recorded in the Chillacocha. **E.** *Sylvilagus andinus* (MECN 4685) recorded in the Cerro de Arcos. **F.** *Cryptotis montivagus* (MECN 4716) recorded in the Laguna de Chinchilla (Photos by J. Brito).





**Fig. 14.** Dorsal, ventral, and lateral view of the skull of *Oreoryzomys balneator* (MECN 4789) recorded in the Chivaturco, Provincia de El Oro. Scale 10 mm (Photos by J. Brito).

Remarks. With type locality in Ecuador: around Palatanga, Provincia de Chimborazo, Ecuador (Tomes 1860).

***Rhipidomys leucodactylus*** (Tschudi, 1845)

Material. None.

Literature records. Los Pozos (Tribe 2015).

Identification. Largest species within the genus (Tribe 2015). Dorsal coat brown, with yellowish tones, and with dark guard hairs. Venter coat woolly yellowish. Tail uniform reddish to dark brown, with a long tuft of hairs distally. Skull large and robust, with well-developed supraorbital ridges.

Conservation status. National and Global, Least Concern (LC).

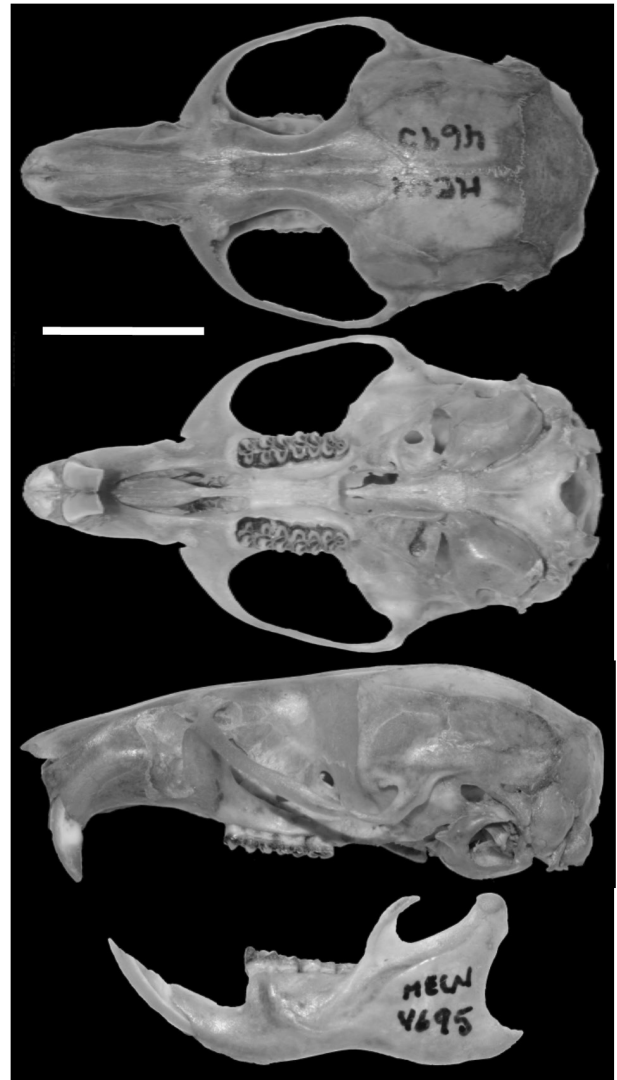
***Sigmodon peruanus*** J. A. Allen, 1897

Material. 1 specimen collected (MECN 6383).

Locality. Reserva Ecológica Arenillas (9).

Literature records. Piedras, Portovelo, and Santa Rosa (Voss 1992).

Identification. Dorsal fur grayish clay brown with intermingled black hairs and a few protruding hairs with white tips. Ventral coat grayish brown, with the base of the hairs dark gray. Dorsum of hind foot covered with grayish brown hairs. Tail shorter than the length of the head and body combined. Tail bicolor, dark above and



**Fig. 15.** Dorsal, ventral, and lateral view of the skull of *Thomasomys auricularis* (MECN 4686) recorded in the Cerro de Arcos, Provincia de El Oro. Scale 10 mm (Photos by J. Brito).

pale below. Molars lacking mesoloph or mesolophid, flat crowned, with principal cusps and crests connected in a more or less continuous sigmoidal pattern.

Conservation status. National, Near Threatened (NT); Global, Least Concern (LC).

Remarks. The only specimen recorded, represented by both dentaries, was retrieved from the stomach contents of *Leopardus garleppi* (MECN 6170).

#### *Thomasomys auricularis* Anthony, 1923

Material. 2 specimens collected (MECN 4686, 4695).

Locality. Cerro de Arcos (35).

Literature records. Taraguacochoa (Anthony, 1923).

Identification. Dorsal coat tawny olive, interspersed with blackish hairs (Fig. 13B). Ventral coat yellowish, more intense on the pectoral area. Post auricular patch of ochraceous color. Tail relatively long (122–134% of the head-body length), covered with small hairs. Incisive foramina long extending to the procingulum of the first upper molar. Auditory bulla large and inflated (Fig. 15).

Ecological notes. Two males with scrotal testicles were recorded in September 2015.

Conservation status. National, Vulnerable (VU); Global, Data Deficient (DD).

Remarks. Species endemic to Ecuador, type Locality. “Taraguacochoa, on trail from Zaruma to Zaraguro, altitude 10,250 feet, Cordillera de Chilla, Provincia del Oro, Ecuador.” (Anthony 1923:6).

#### *Thomasomys baeops* (Thomas, 1899)

Material. None.

Previous records: Taraguacochoa (Pacheco 2015).

Identification. Dorsal fur dull grayish brown, darker towards the midline of the back. Ventral coat silvery gray color. Tail longer than the body and head combined. Rostrum short; nasals short and narrow; braincase moderately inflated, and interorbital region narrow. Incisive foramina narrow with contracted ends and moderately long, reaching the upper first molars. Auditory bulla small and not inflated.

Conservation status. National and Global, Least Concern (LC).

Remarks. With type locality in Ecuador: Río Pita, above the Valle de los Chillos, Provincia de Pichincha, Ecuador. Alt. 3,500 m (Thomas 1899).

#### *Thomasomys caudivarius* Anthony, 1923

Material. 18 specimens collected (MECN 4687, 4689, 4690–4692, 4697, 4702, 4703, 4705, 4709, 4714, 4715, 4728, 4729, 4809, 4818, 7022).

Localities. Ashigsho, Rancho Triste (41), Cerro de Arcos (35), Chillacochoa (45), Laguna de Chinchilla (36), Sabadel (34).



**Fig. 16.** Dorsal, ventral and lateral view of the skull of *Thomasomys caudivarius* (MECN 4818) recorded in the Chillacochoa, Provincia de El Oro. Scale 10 mm (Photos by J. Brito).

Literature records. Taraguacochoa (Anthony 1923).

Identification. Dorsal coat with gray base and yellow apex (Fig. 13C). Ventral fur with gray base and pale orange apex. Tail uniformly dark (132.4% of the head-body length) and with tip (10–45 mm) generally white. Shallow zygomatic notch (Fig. 16).

Ecological notes. Three males with scrotal testes were recorded in September 2015.

Conservation status. National, Vulnerable (VU); Global, Least Concern (LC).

Remarks. With type locality in Ecuador: “Taraguacochoa, Cordillera de Chilla, 10,750 feet [3,277 m], Provincia del Oro, Ecuador” (Anthony 1923: 4).



***Thomasomys taczanowskii*** (Thomas, 1882)

Material. 34 specimens collected (MECN 4698, 4701, 4731, 4781, 4791, 4805, 4814, 4815, 4816, 4822, 4836, 4842, 4844, 4846, 4893, 4895, 4910, 4912, 6827, 6932, 6935, 6236, 6939, 6941, 6942, 6969, 6978, 6981, 6982, 6986, 6987, 6993, 7020, 7023).

Localities. Yacuvíñay (28), Chivaturco (31), Sabadel (34), Cerro de Arcos (35), Laguna de Chinchilla (36), Cabecera del Río Casacay (39), Ashigsho, vía Gallo Cantana (40), Ashigsho, Rancho Triste (41), Ashigsho, El Tanque (42), Shiñinguro (43), Payana (44), Chillacocha (45),

Literature records. Cordillera de Chilla (Pacheco 2015).

Identification. Dorsum fur grayish with reddish yellow hair tips (Fig. 13D). Ventral coat grayish white. Tail uniformly pale brown. Legs white, with a brownish appearance on the metacarpals and metatarsals. Skull with moderately broad orbital region. Inflated auditory bulla. Zygomatic arches converge anteriorly. Incisive foramina long and narrow, extending slightly between the anterocones of the first upper molars.

Conservation status. National, Not Evaluated (NT); Global, Least Concern (LC).

***Transandinomys talamancae*** (J. A. Allen, 1891)

Material. 15 specimens collected (MECN 4864, 4866–4868, 5750, 5751, 5768, 5769, 5770, 5771, 6035, 6037–6039, 6148).

Localities. Puyango (12), Sabayan (14).

Identification. Dorsal fur short (8–10 mm) and thick, orange-brown (Fig. 11B). Ventral coat whitish but with gray base. Tail slender and bicolored, dark above and whitish below. Tail equal to or slightly longer (119–325 mm) than the length of the head-body (120–132 mm), bare in appearance but finely covered with small hairs. Cranium has narrow interorbitals and poorly developed supraorbital ridges, short incisive foramina. Zygomatic plate wide and excavated. Deep zygomatic notch.

Ecological notes. In December 2016, four adult males were recorded with scrotal testicles (average 8 x 4 mm), plus one lactating female.

Conservation status. National and Global, Least Concern (LC).

**Family Echimyidae Gray, 1825*****Proechimys decumanus*** (Thomas, 1899)

Material. 1 specimen collected (MECN 5521).

Localities. Reserva Ecológica Arenillas (9).

Literature records. Santa Rosa (Patton & Leite 2015).

Other Material. MEPN 9965–9968.

Identification. Dorsal color sandy fawn with darker hairs intermingled. Tail bicolor, dark above and pale be-

low, covered with short fine hairs. Temporal ridges moderately developed and continuous across parietals from posterior end of supraorbital flange.

Conservation status. National and Global, Near Threatened (NT).

Remarks. With type locality in Ecuador: Chongón, Provincia de Guayas, west of Guayaquil, Ecuador (Thomas 1899).

***Proechimys semispinosus*** (Tomes, 1860)

Material. 1 specimen collected (MECN 6150).

Locality. El Guayabo (13), Sabayan (14).

Literature records. Santa Rosa (Thomas 1900).

Identification. Length of head and body 276 mm and the length of the tail (205 mm). Length of hind legs 65 mm; length of ears 25 mm; weight 450 g. Dorsal color dark reddish brown (Fig. 17), splashed with black, and sides only slightly paler to contrast with uniformly white belly. Tail dark brown above and pale below. Tail lined with sparse, elongated hairs. Dorsal coat stiff to the touch. Spines long (21 mm), wide (0.9). Each arisiform ends in an elongated and filamentous tip. Skull large (greatest skull length 65.8 mm). Species uniquely characterized among spiny rats by their well-developed temporal ridges extending from supraorbital ledge across length of parietals.

Conservation status. National, Near Threatened (NT); Global, Least Concern (LC).

Remarks. With type locality in Ecuador: Esmeraldas, Provincia de Esmeraldas, on the Pacific coast of Ecuador (Tomes 1860).

**Family Muridae Illiger, 1811*****Mus musculus*** Linnaeus, 1758

Material. 1 specimen collected (MECN 4832).

Localities. Payana (44).

Literature records. Las Casitas, Jambelí (Orihuela-Torres et al. 2018, 2019).

Remarks. Invasive alien species.

***Rattus rattus*** Linnaeus, 1758

Material. 3 specimens collected (MECN 6145, 5761, 4840).

Localities. El Guayabo (13), Sabayan (14), Payana (44).

Literature records. Las Casitas and Las Huacas-Jambelí (Orihuela-Torres et al. 2018, 2019).

Remarks. Invasive alien species.



**Fig. 17.** Tome's Spiny Rat, *Proechimys semispinosus* (MECN 6150) recorded in the Sabayan, Provincia de El Oro (Photo by R. García).

**Order Lagomorpha Brandt, 1855**  
**Family Leporidae Fischer, 1817**

***Sylvilagus andinus*** (Thomas, 1897)

Material. 1 specimen collected (MECN 4685).

Localities. San Patricio (22), Yacuvíñay (28), Chivaturco (31), Cerro de Arcos (35), Laguna de Chinchilla (36), Ashigsho, Rancho Triste (42), Shiñinguro (43), Payana (44), Chillacocho (45).

Literature records. Portovelo, Taraguacocho, and Vía Salvias Zaruma (Anthony 1923).

Identification. Coat blackish (Fig. 13E), mottled with black and fawn. Chin and ventral region of opaque whitish color. Ears short and rounded with grayish base, blackish brown towards the middle of its length. Cranium without dimples on the dorsal surface; postorbital process small (Ruedas et al. 2019).

Conservation status. National, Near Threatened (NT); Global, Data Deficient (DD).

Remarks. With type locality in Ecuador: W. slope of Cayambe Mountain, Provincia de Pichincha, Cantón Cayambe, Eastern Cordillera of Ecuador, altitude 4,000 m (Thomas 1897).

***Sylvilagus daulensis*** Allen, Richardson, and Chapman 1914

Material. None.

Museum specimens: Reserva Ecológica Arenillas (Ruedas et al. 2019).

Identification. Similar in coloration to the *Sylvilagus andinus*, but with more accentuated and colorful shades. Posteromedial aspect of petrosal extends between the bulla and the basioccipital almost to alisphenoid. *S. daulensis* is the only rabbit species inhabiting the southwestern coast of Ecuador (Ruedas et al. 2019).

Conservation status. National, Near Threatened (NT); Global, Not Evaluated.

Remarks. Species endemic to Ecuador, type Locality. Daule, Provincia de Guayas, Ecuador (Allen et al. 1914).

**Order Eulipotyphla Waddell, Okada, & Hasegawa, 199**

**Family Soricidae Fischer, 1817**

***Cryptotis montivagus*** (Anthony, 1921)

Material. 3 specimens collected (MECN 4711, 4713, 4716).

Locality. Laguna de Chinchilla (36).



Identification. Small, 78–88 mm head-body length. Back dark gray, ventral region paler than the back and silvery in appearance. Head long and pointed. Ears very short and often imperceptible among the fur. Eyes extremely small (Fig. 13F).

Conservation status. National, Near Threatened (NT); Global, Least Concern (LC).

Remarks. Species endemic to Ecuador, type Locality. “Bestion, Prov. del Azuay, Ecuador; altitude 10,000 ft” (Anthony 1921:5).

### Order Carnivora Bowdich, 1821

### Family Mustelidae G. Fischer, 1817

#### *Galictis vittata* (Schreber, 1776)

Material. None.

Locality. Reserva Ecológica Arenillas (García-Olaechea et al. 2021), Reserva Buenaventura (Brito et al. 2018).

Identification. Head small and flattened, ears wide, rounded and whitish. Small eyes. Top of the head, back, sides and tail gray. Face, throat, belly and legs black (Fig. 18A). Diagonal band of white or cream color runs from forehead to shoulders separated by a dorsal gray and ventral black color (Yensen & Tarifa 2003).

Conservation status. National, Data Deficient (DD); Global, Least Concern (LC).

#### *Neogale frenata* (Lichtenstein, 1831)

Material. None.

Locality. Ashigsho, Rancho Triste (41).

Identification. Dorsal coat dark chocolate brown (Fig. 18B), shiny and uniform. Pale orange chin and neck

including belly. Tail robust and hairy with a black tip. Surface of soles of legs hairy (Sheffield & Thomas 1997).

Conservation status. National and Global, Least Concern (LC).

Remarks. This species was recently transferred to the genus *Neogale* by Patterson et al. (2021).

### DISCUSSION

In Ecuador, only the Province de Pichincha has a published checklist of small non-volant mammals (Curay et al. 2019, see Supplementary Materials). This province is located in northwestern Ecuador, and its 9,536 km<sup>2</sup> area is home to 48 species, a richness similar to what we reported here for El Oro (46 spp.), although in a smaller area (5,767 km<sup>2</sup>). Other areas in western Ecuador with important diversity are the Reserva Otonga (26 spp.) in Provincia de Cotopaxi (Jarrín-V 2001; Pinto et al. 2018; Lee et al. 2022), and Lita (23 spp.) in the Provincia de Imbabura (Curay et al. 2022). However, these two reserves are concentrated in territories smaller than 50 km<sup>2</sup>.

The Equatorial-Pacific ecoregion is suffering an accelerated deforestation process (Curatola Fernández et al. 2015; Prieto-Torres et al. 2018; Kleemann et al. 2022). For example, in 2018 the fragmentation index increased by 11.6% in seasonal and semi-deciduous dry forests (Rivas et al. 2021). In El Oro the outlook is no more encouraging. Most of the ecosystems have been transformed into agricultural and livestock areas and now represent the main landscape matrix, with 52% of the total area of the province. This is of particular concern, as species with greater fragmentation have been shown to be at greater risk of extinction (Crooks et al. 2017).

The natural ecosystems with the greatest extension in the Provincia de El Oro are native forest and shrub veg-



**Fig. 18.** **A.** Greater Grison, *Galictis vittata* recorded in the Reserva Buenaventura (Photo by J.C. Sánchez). **B.** Long-tailed Weasel, *Neogale frenata* recorded in the Ashigsho, Provincia de El Oro (Photo by J.L. Mena-Jaen).



etation, which together represent 31.65% of the territory. However, these ecosystems also represent the highest degree of fragmentation; for example, the native forest is fragmented in 2,403 patches (major patch index 11.8%), and shrub and herbaceous vegetation is even more fragmented in 2,546 patches (major patch index has a value of 19). Only the páramo, shrub and herbaceous vegetation show a low degree of fragmentation. Despite being fragmented ecosystems, they support an important richness of vertebrates, including 629 species of birds (Garzón-Santomaro et al. 2019b), 130 species of mammals (Brito et al. 2018; this study), 87 species of reptiles, and 50 species of amphibians (Yáñez-Muñoz et al. 2019).

Furthermore, in the Province de El Oro, the highest concentration of richness (35 spp.), as well as endemic (6 spp.) and threatened (10 spp.) species of small non-volant mammals are found in native forest and shrub vegetation (Fig. 2A). Unfortunately, these ecosystems are suffering constant anthropogenic pressure, so that, for example, the seasonal piedmont forest has been categorized as an Endangered Ecosystem (Noh et al. 2020). In El Oro, only the coastal ecosystem (2% of the province's surface area) represented by the Reserva Ecológica Arenillas is protected, although it appears that the conservation of state protected areas is not guaranteed in the future either (Kleemann et al. 2022). Despite the above, united conservation of habitats is important to protect representative ecosystems, such as the piemontane forest and montane forest. In addition to maintaining biological diversity, these ecosystems protect the water sources that supply all the cities in the province.

Due to the rapid conversion of natural habitat, it is crucial to carry out inventories to catalog the species in each political jurisdiction (local, provincial, national, and regional) as well as determine their systematic identification, geographic distribution, and ecological function. This information is fragmentary, incomplete, and outdated in most countries of the world (Voss and Emmons 1996; Bauni et al. 2021). Ecuador is no exception; despite being one of the countries with the smallest territories in South America, there are still numerous areas with information gaps (Kleemann et al. 2022). This lack of information is evident in the coastal region between the provinces of Manabí and El Oro. Although the diversity of small non-volant mammals has been reported since 1860 (Thomas, 1899), few subsequent inventories have been conducted (Emmons & Albuja 1992; Bravo-Salinas et al. 2021), and other spot reports (e.g., Anderson & Jarrín-V 2002; Brito et al. 2015; Brito-Vera et al. 2022). Unfortunately, extensive habitat conversion along the Ecuadorian coast makes it unlikely that lowland forests can be effectively sampled for small non-volant mammals, but better opportunities may exist in the Cordillera Chongón-Colonche.

Finally, the diversity of small non-volant mammals in the Provincia de El Oro will not remain static for long.

Numerous species constitute species complexes (e.g., “*Handleyomys*”, *Oecomys*, *Oreoryzomys*, *Proechimys*, *Rhipidomys*, *Thomasomys* and *Transandinomys*; see Patton et al. 2015), which are waiting to be resolved. The use of integrative taxonomy might be the appropriate way to address these taxa.

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