

# CHAPTER 13

## NORTHERN PUDU *Pudu mephistophiles* (De Winton 1896)

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### GENERIC SYNONYMY

*Capra*: Molina, 1782: 310. Not *Capra* Linnaeus, 1758.

*Ovis*: Gmelin, 1788: 200. Not *Ovis* Linnaeus, 1758.

*Aries*: Fischer, 1814.

*Antelope*: de Blainville, 1816: 76. Not *Antelope* Pallas, 1766.

*Mazama* Rafinesque, 1817b: 437. Part, not *Mazama* Rafinesque, 1817a.

*Cervus*: Bennett, 1831: 27. Not *Cervus* Linnaeus, 1758.

*Antilocapra* Lesson, 1842: 182. Not *Antilocapra* Ord 1818.

*Coassus* Gray, 1850: 69. Part, not *Coassus* Gray, 1843.

*Pudu* Gray, 1852a(1850): 242. Type species *Coassus* [*Pudu*] *Pudu* [= *Capra puda* Molina] by monotypy. Described as a subgenus, elevated to full genus by Gray, 1852b: 240. (original publication is dated 1850, however, it was published in 1852).

*Nanelaphus* Fitzinger, 1873: 361.

*Pudua* Garrod, 1877: 18. Unjustified emendation of *Pudu* Gray, 1852.

*Pudella* Thomas, 1913: 588. Type species *Pudua mephistophiles* de Winton, 1896.

### SPECIES SYNONYMY

*Pudua mephistophiles* de Winton, 1896: 508, pl. 19. Part, not skulls. Type locality “Páramos de Papallacta”, Ecuador.

*Pudua mephistopheles* Thomas, 1908: 350. An incorrect subsequent spelling of *Pudua mephistophiles* de Winton, 1896.

[*Pudella*] *mephistophiles*: Thomas, 1913: 588. Name combination on new genus.

*Pudu* (*Pudella*) *mephistophiles* Lydekker, 1915: 217. First use of current name combination and spelling; also using the subgeneric name.

*Mazama fusca* Spillmann, 1931: 37, 41. Type locality Mt. Antisana, near the snow line, Pichincha, Ecuador.

*Pudella mephistophelis*, Cabrera and Yepes, 1940: 278. An incorrect subsequent spelling of *Pudua mephistophiles* de Winton, 1896.

*Pudu* (*Pudella*) *mephistopheles*, Lehmann, 1945: 76. An incorrect subsequent spelling of *Pudua mephistophiles* de Winton, 1896.

*Pudu* (*Pudella*) *mephistophiles wetmorei* Lehmann, 1945: 78, 80. Type locality: Páramo de San Rafael, Puracé, ESE Popayán, western slope of Cordillera Central, Colombia, 3400m. (Based on data analyzed by Hershkovitz, 1982, the subspecies may not be valid).

*M[azama]. mephistopheles*, Flerov 1952: 218. An incorrect subsequent spelling of *Pudua mephistophiles* de Winton, 1896; and name combination.

### COMMON NAMES

*Spanish names*: pudu, pudu norteño

Colombia: venadito de los páramos, venado conejo, venado churuco, venado cacique, cansaperros, venado chonta (Hershkovitz 1982; Rodríguez-Mahecha et. al. 1995). In some regions of Colombia, the name venado chonta is given to *Mazama rufina* (Hershkovitz 1982).

Ecuador: venadito de los páramos, ciervo enano, sacha-cabra (Hershkovitz 1982); Chita (De Velasco 1789).

Peru: venado conejo, venado enano, sacha-cabra, antagallo (Grimwood 1969; Hershkovitz 1982).

*Indigenous Names*: in the now extinct Cañari language it was known as “zhivre” in the southern Andean region of the Ecuador, particularly in the Cañar and Azuay provinces.

*English name*: Northern Pudu

### SUBSPECIES

Lehmann (1945) described a subspecies, *Pudu* (*Pudella*) *mephistophiles wetmorei*, using specimens from the area of Páramo de San Rafael in Cauca, Colombia (western side of the Cordillera Central), 3400 meters above sea level. The researcher based his work mainly on the coloration of the coat to establish a difference between the specimens of southern Colombia (*P. m. wetmorei*) and those of the Páramos de Papallacta in northern Ecuador (*P. m. mephistophiles*). Data from Frädriich (1975) and Hershkovitz (1982), where specimens coming from several localities of Ecuador and Colombia were compared, show that differences within each one of these proposed subspecies are greater than between them. Consequently, no remarkable differences in characters exist, including coat coloration that could satisfactorily separate the populations in subspecies.

Herskovitz (1982) recommends that no subspecies are to be recognized in *P. mephistophiles* for now, a suggestion followed in this chapter.

### MORPHOLOGICAL DESCRIPTION

Pudus are the smallest deer in South America, being *Pudu mephistophiles* even smaller than *Pudu puda* (Figure 1). They are distinguished from other cervids primarily by their size (less than 40 cm. high), by the small size of their extremities, and because of the consistent coalition of the cuboid-navicular bone and the medial and external cuneiform tarsal bones in a single element, a characteristic also present in the Asian cervids *Muntiacus* and *Elaphodus* (Herskovitz 1982). The number of caudal vertebrae is noteworthy, being eight, as opposed to 11 in *Mazama* and 10 or more in other cervids.

Shoulder heights reported vary between 25 and 40.5 cm (Herskovitz 1982). Eisenberg (1989) indicates the maximum height being at 38cm, while Eisenberg and Redford (1999) indicate 35 cm. Head and body length ranges from 60 to 74 cm, skull length ranges from 12.7 to 14.2 cm, and the tail length varies between 3 and 4 cm (Herskovitz 1982). Regarding weight, Herskovitz (1982) indicates an average of 5.8 Kg, while Eisenberg and Redford (1999) mention 5 Kg.



**Figure 1** - A female Northern Pudu, Páramo de Guamaní - Ecuador (4000 m.a.s.l.). Photo by Patricio Pillajo.

Herskovitz (1982) based his morphological descriptions on the analysis of 19 mature individuals of *Pudu mephistophiles* (9 females and 10 males), sixteen of which came from Colombia and three from Ecuador. His description follows. The coat is coarse, brittle and abundant. General coloration of the body is rufous, shifting to darker brown or even black on the back, the face is black including the muzzle, the chin and the external surface of the ears. The interior part of the ears has a coloration that varies between grayish-white and gray. The abdomen and ventral side of the legs vary between tawny and rufous brown; the flanks are olive-green with tonalities between creamy and reddish; and the feet are dark brown. Fawns have a thick coat of uniform color, unspotted, and lack the marked contrast between the head and body (Herskovitz 1982). In the northern pudu the shape of the lower incisives agrees

with that of less specialized deer, the first incisive ( $I_1$ ) is characterized by a rectangular or moderately spatulate crown, differing from the highly spatulate first incisive of the species in the genus *Mazama* (Herskovitz 1982). Contrary to the southern pudu, the upper canine persists in most adult northern pudus (Herskovitz 1982).

The rhinarium is bulbous, and the hindmost dorsal border projects backward along the medial line. The underdeveloped preorbital gland presents a facial opening; and the lachrymal orifice is superficial and disk shaped (Herskovitz 1982). Antlers take the form of spikes—one main beam without ramifications (Herskovitz 1982), which are shedded annually and can measure up to 9 cm (Herskovitz (1982).

### DISTRIBUTION

#### *Prehistorical*

According to Herskovitz (1982), the origins of the Pudu in spatial and chronological terms are unknown. The genera *Pudu* and *Mazama* are divergent lines of the Odocoileine that possibly lived in America during the early Pliocene or late Miocene; and it is probable that the genus *Pudu* was restricted to South America since the Pliocene. It is believed that the immediate ancestor of today's Pudu differs little from *P. mephistophiles*, and inhabited the range of temperate forests east of the Cordillera Oriental (Eastern Mountain Range of the Andes) in what are now Colombia, Ecuador, Peru and perhaps northern Bolivia, during what probably was the last glacial period. After Andean glaciers receded, the range of temperate forest and its fauna moved towards higher elevations, but remained in the same latitudes. The predecessors of the northern pudu might have followed these displacements, establishing in forests along the banks of big rivers like the Putumayo, Pastaza, Huallaga and Ucayali; while the predecessor populations of the southern pudu moved south, along the eastern lower flank of the Andes, even to extreme latitudes as Magellan's Strait and towards the west, crossing forested areas inside Chile. The geographical isolation resulting of these displacements reflects on the morphological differences between the two species of Pudu (Herskovitz 1982).

#### *Historical and Current*

Nowadays, the distribution of northern pudu is discontinuous mostly as a consequence of forest and grassland fragmentation due to anthropic action. It ranges from temperate zone forests and paramos from the Cordillera Central in southern Colombia through the Cordillera Oriental of Ecuador to the eastern Andean cloud forests in Peru, south to Junín department (Figure 2). Exact range is unknown and distributional gaps between records are unresolved. The only known natural gap is the dry forest south of the North Peru Low or Huancabamba depression (Vuilleumier 1984), which separates the northern population with the main Peruvian population (Barrio and Tirira 2008). The current extent of occurrence (EOO) is estimated to be 90,000-130,000 km<sup>2</sup> and is split between two populations; the southern

population 30,000-35,000 km<sup>2</sup> and the northern population 60,000-95,000 km<sup>2</sup> (Barrio and Tirira 2008).

All records of northern pudu in Colombia come from the Cordillera Central, between 1700 and 4000 m.a.s.l. (Eisenberg 1989), from the district of Roncesvalles in the Tolima department (Lizcano, in litt) - this record is further north than that of the one from the Páramo de Barragán east of Tulúa, in the department of Valle del Cauca (Lehman 1959; Hershkovitz 1982) - south to the paramos of the Azufral, Cumbal and Chiles in the department of Nariño (Hershkovitz 1982; Morales-Jimenez et al. 2004) close to the border with Ecuador. In addition, the occurrence of the species has been reported for the paramos of the departments of Huila, Cauca and Valle del Cauca (Lehman 1945; Hershkovitz 1982; Morales - Jimenez et al. 2004).

In Ecuador the northern pudu inhabits the high Andean ecoregion from 2800 up to 4500 m.a.s.l. (Arcos et al. 2007; Tirira 2007). There is evidence of its presence in most of the mountain provinces, especially in the Cordillera Oriental. The species has been reported for the paramos of the provinces of Carchi, Imbabura, Pichincha, Cotopaxi, Tungurahua; Chimborazo, Azuay, Loja and Zamora Chinchipe (Arcos et al. 2007; Tirira 2001, 2007).

In Peru the northern pudu ranges as two separated populations, with a collected specimen in the extreme northern Andes, in north Cajamarca (J. Barrio in litt.), and all the other records southeast of the Marañon dry forest. The southern population of the species occurs from the south of the department of Amazonas to Junin, based on reports and collected material from Amazonas,

San Martin, Cerro de Pasco, Huánuco and Junín (J. Barrio in litt.; Barrio and Tirira 2008; Grimwood 1969; Hershkovitz 1982).

**KNOWN POPULATIONS**

*in situ* populations

The status of wild populations remains unknown in all the geographic range, with knowledge only on presence or absence in specific areas, with some data on frequent sightings. The areas where the northern pudu population seems to be in good condition can be detected by the periodicity of records and accounts from local people. One of such areas, and probably the main stronghold throughout its distribution is the central and northern Eastern Andes of Ecuador (J. Barrio in litt), where a number of protected areas follows one after another from Chimborazo (Sangay National Park) to south of Carchi (northern limit of Cayambe-Coca Ecological Reserve) (Tirira 2007). To the north in Colombia, the habitat is more fragmented and no main or stable population has been detected.

The populations in central Peru are clearly isolated from populations in Peruvian northern Andes, Ecuador and Colombia. There are new records in the former larger gap between populations; however, the gap still covers the breadth of the Marañon dry forest (J. Barrio, in litt). Given the habitat type covering the gap, there is no expectation that an individual will ever appear there, unless by accident (Barrio and Tirira 2008). A known and seemingly stable population in Peru, given the periodicity of records in the area, is the one inhabiting the western side of the department of San Martin,

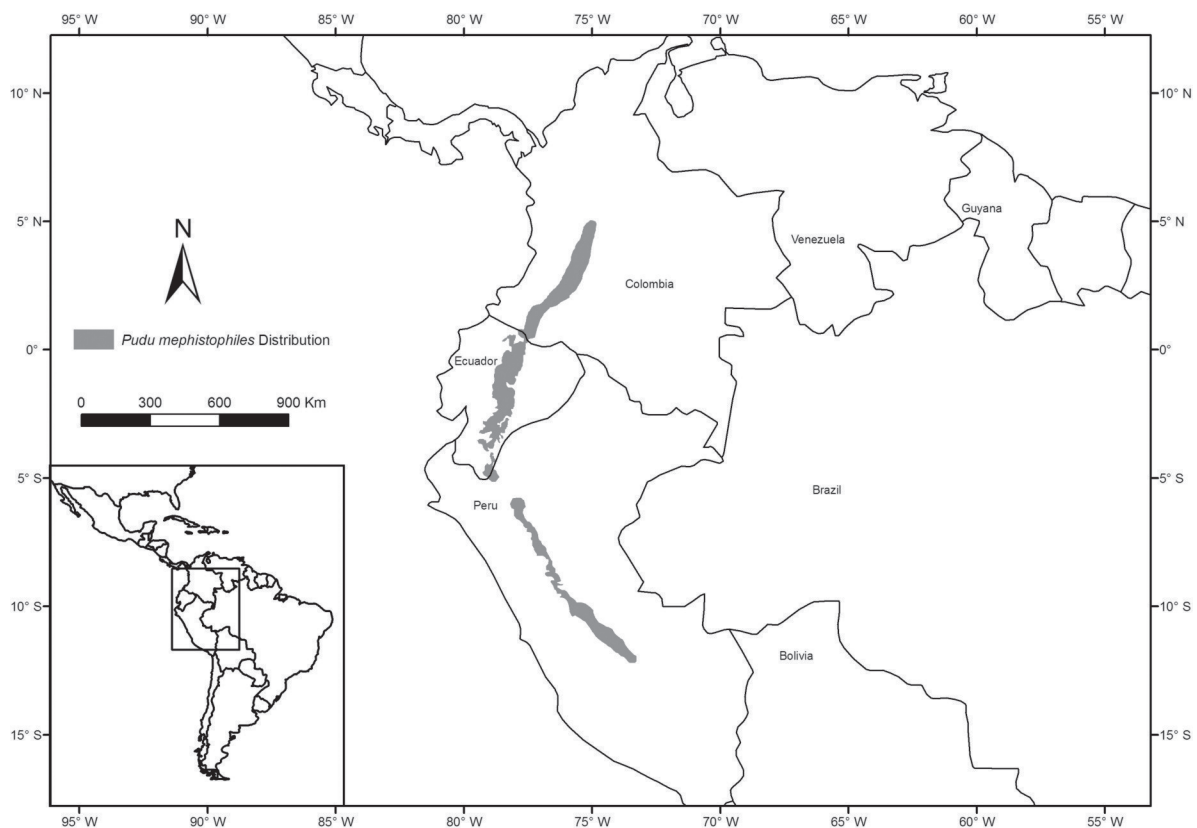


Figure 2 - Historical and current distribution of *Pudu mephistophiles*.

especially around Rio Abiseo National Park (J. Barrio in litt.).

### **ex situ populations**

There are no current captive populations in zoos, and individuals captured by local people do not survive long (Lehmann 1945). Northern pudus are occasionally captured alive by local people throughout its distribution (J. Barrio in litt.), as was already reported more than 60 years ago by Lehmann (1945). In 1968 two female northern pudus were shipped to the West Berlin Zoo from Ecuador but arrived dead (Herskovitz 1982). The only known northern pudus to actually live in a zoo was a pair arrived in West Berlin zoo in 1972, also from Ecuador; however, they only lived for 4 and 6 months (Czernay 1987; Herskovitz 1982).

### **HABITAT**

Along its distribution, the northern pudu inhabits several habitat types, especially high altitude mountain forests and humid grasslands known as paramo, above the tree-line (Barrio and Tirira 2008). The mountain forests used are humid rainforests such as elfin and cloud forests usually close to paramo grasslands, which are primarily used by the northern population (Barrio and Tirira 2008). The main altitude used by northern pudus ranges between 2,000 and 4,000 m (Barrio and Tirira 2008; Grimwood 1969; Herskovitz 1982), with records as high as 4,500 m in Ecuador (Tirira 2001, 2007). The paramo is characterized by being a humid grassland mixed with short flowering vegetation such as terrestrial bromeliads, mosses, lichens, “stumpy” tree-ferns, and bushes. The two most specious families of bushy plants at the habitat type northern pudu uses are the Asteraceae and the Melastomataceae.

The northern pudu moves preferably among non-grassy vegetation in the paramo, and when occurring inside forest it moves through the undergrowth. In the areas affected with human intervention, the northern pudu enters into agricultural fields (J. Barrio in litt.). Throughout its distribution, the habitat endures low temperatures, with frost frequent at night in the higher altitudes. The precipitation is high in all habitat types used, and can fall either as rain, snow or fog. The soil is very humid and in flat areas tends to be quite boggy.

### **SPATIAL USE AND HOME RANGE**

The northern pudu lives as solitary individuals, which is the way they are usually recorded. They might be territorial as expected given habitat use and size (Czernay 1987; Geist 1998), and both sexes probably overlap territories. No information has been recorded on spatial use; however for the southern pudu, territories vary between 16 and 26 ha (MacNamara 1983), and male territories are bigger and occasionally partially coincident with those of several females (Cohn 1986). The home range and spatial use might be somehow similar for northern pudus.

### **FEEDING ECOLOGY**

The northern pudu is assumed to feed on leaves and fruits (Geist 1998; Tirira 2007), and considered a

concentrated feeder (Geist 1998). The consumption of fruits has been mentioned by local people in Peru (J. Barrio in litt.; Grimwood 1969). The species is also known to occasionally enter into agricultural fields to feed on crops (J. Barrio in litt.).

### **REPRODUCTIVE BIOLOGY**

Reproduction is highly seasonal following Czernay (1987) and Geist (1998); however, the explanation is based on southern pudu data. Northern pudu distribution endures a less seasonal weather and environment, and a less seasonal reproduction period is expected for the species (J. Barrio in litt.). A single fawn is born after a gestation period of seven months (Hick, 1967; Eisenberg 1989; Herskovitz 1982), followed by a post-birth fertile period (Herskovitz 1982). At birth northern pudus weigh 400g (Czernay 1987; Geist 1998). In general, northern pudus attain adult size six months after being born and sexual maturity after a year (Geist 1998; Nowak 1991). It is estimated that pudus can live up to 15 years in the wild (Geist 1998).

### **BEHAVIOR**

The northern pudu has crepuscular and nocturnal habits (Czernay 1987; Grimwood 1969); however, given the lack of research on the species it is possible that the species is active at different hours of the day alternating with resting periods, as it is reported for the southern pudu (Cohn 1986). The northern pudu has solitary habits, but occasionally can be seen in pairs (Czernay 1987). Based on shape, the northern pudu has a saltatorial type of running (Geist 1998). Northern pudus would flee zig-zagging towards areas with steep slopes and dense vegetation when chased by dogs, (Grimwood 1969; Herskovitz 1982; Lehman 1945). According to local people, the northern pudu frequently climbs trees to feed on fruit (J. Barrio in litt.; Grimwood 1969).

### **CONSERVATION**

The northern pudu has been globally categorized as Vulnerable C2a(i) (Barrio and Tirira 2008) and is listed in Appendix II of CITES (CITES 2009). The northern pudu is considered to be vulnerable based on indirect estimates on population decline, inferred from the rate on habitat loss and expanding human settlements, and because remaining small populations are fragmented into numerous subpopulations (Barrio and Tirira 2008). This species occurs in very low densities throughout its range and is poorly known (Barrio and Tirira 2008). More information is necessary in order to quantitatively measure threats and rates of decline due to hunting and habitat conversion – following that it might also qualify for population reduction threat criteria; however, insufficient information is currently available (Barrio and Tirira 2008). Humans rarely kill the species today, but it was persecuted in the past (Barrio and Tirira 2008).

In Colombia it is considered endangered in the official list of endangered species from the Humboldt Institute (Rodríguez 1998). Natural Protected Areas with reported evidence are the Parque Nacional (PN) Natural Los Nevados in Caldas, Quindío, Tolima and Risaralda

departments (Morales - Jimenez, et al. 2004), the Santuario de Flora y Fauna Galeras in the Nariño department and the Reserva Natural El Azufral in the Tuquerres and Nariño departments.

In Ecuador the species is considered to be vulnerable (Tirira 2001), and has been recorded in the following protected areas: PN Cajas (Azuay province), PN Podocarpus (Loja province), PN Cotopaxi (Pichincha and Cotopaxi provinces), PN Llanganates (Cotopaxi and Tungurahua provinces), PN Sangay (Chimborazo and Morona Santiago provinces), Reserva Ecológica (RE) Antisana (Pichincha and Napo provinces), RE El Ángel (Carchi province), and in RE Cayambe Coca (Imbabura, Pichincha and Napo provinces). The large PN Sangay (502,105 ha), PN Llanganates (219,707 ha), RE Antisana (120,000 ha) and RE Cayambe-Coca (403,103 ha) form a corridor along the distribution of the northern pudu.

In 1990 was considered as a rare species in Perú (R.M. Nº 01082-90 -AG/DGFF September 16, 1990). Furthermore, in 2004 the species was categorized as endangered (Ministerio de Agricultura – Peru 2004). It has been recorded in the Santuario Nacional Tabaconas Namballe (Cajamarca department) PN Río Abiseo (San Martín department), and PN Yanachaga Chemillén (Pasco department).

The main northern pudu populations might be the ones occurring along several protected areas in the eastern Andes of Ecuador, including RE Cayambe Coca, PN Llanganates, and PN Sangay, which form an important large area of protection, undoubtedly encompassing a viable population of northern pudus by itself. A planned new protected area to the north of PN Río Abiseo in Peru, will significantly increase the distribution area with protection in Peru, and create a large contiguous protected area between PN Río Abiseo (274 520 ha) and the new area with over 150 000 ha (J. Barrio in litt.)

Major threats for the conservation of the species are habitat loss (transformation, fragmentation and degradation) and population decreases (Barrio and Tirira 2008). Habitat loss is due to changes in land use to develop and increase agricultural and livestock activities. Timber extraction and expansion and settlement of urban and industrial activities are also important causes of habitat loss. Poaching has direct effects on the species. At a subsistence level, dogs (Lizcano, in litt.) and firearms are used to hunt pudus for meat. Live individuals are captured to be kept as pets (Barrio and Tirira 2008).

The northern pudu populations probably have low densities and restricted geographic range, being more vulnerable to environmental changes (Barrio and Tirira 2008). Despite the fact that the species has legal protection and that it is reported for 12 protected areas in Colombia, Ecuador and Perú; scarce knowledge on biology and population dynamics and increased habitat loss are serious threats for these populations. It is urgent to implement conservation and management actions and encourage field research to obtain knowledge and fill important gaps, especially in biology and ecology to plan and integrate conservation policies at national and international level.

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