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Lycalopex sechurae (Carnivora: Canidae)

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Abstract: *Lycalopex sechurae* (Thomas, 1900) is a small canid commonly called the Sechura fox or Sechuran desert fox. It is distributed in coastal zones from southwestern Ecuador to west-central Peru; ranging in elevation from sea level to at least 1,000 m and possibly 2,000 m. *L. sechurae* is an opportunistic omnivore with the capability of being a strict vegetarian when necessary. Habitat preferences include desert environments and adjacent beaches, cultivated areas, dry forests, foothills, sea cliffs, and the western slopes of the Andes. *L. sechurae* increases seed dispersion for some plant species. It is considered Near Threatened by the International Union for Conservation of Nature and Natural Resources. DOI: 10.1644/848.1.

Key words: canid, carnivore, fox, opportunistic omnivore, Peruvian desert fox, Sechuran fox, seed disperser, South America

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Lycalopex sechurae (Thomas, 1900)
Sechuran Fox

Canis sechurae Thomas, 1900:148. Type locality "Sullana," Desert of Sechura, NW Peru.
[*Canis* (*Cerdocyon*)] *sechurae*: Trouessart, 1904:234. Name combination.
Pseudalopex sechurae: J. A. Allen, 1916:122. Name combination.
[*Canis*(]*Pseudalopex*[)] *sechurae*: Kraglievich, 1930:51. Name combination.
Dusicyon (*Dusicyon*) *sechurae*: Osgood, 1934:49. Name combination.
Lycalopex sechurae: Cabrera and Yepes, 1940:129. First use of current name combination.
Dusicyon (*Dusicyon*) *Sechurae elenensis* Hoffstetter, 1952:134. Type locality "La Carolina," Ecuador.
Dusicyon (*Pseudalopex*) *sechurae*: Langguth, 1969:5. Name combination.

CONTEXT AND CONTENT. Order Carnivora, suborder Caniformia, family Canidae, subfamily Caninae. The genus *Lycalopex* includes 6 living species (Wozencraft 2005): *L. culpaeus*, *L. fulvipes*, *L. griseus*, *L. gymnocercus*, *L. sechurae*, and *L. vetulus*. No subspecies currently are recognized for *L. sechurae*.

NOMENCLATURAL NOTES. As for the other species currently considered in *Lycalopex*, the taxonomic generic status of *L. sechurae* is unresolved. The controversy focuses on the validity of *Dusicyon* Hamilton-Smith, 1839, *Lycalopex* Burmeister, 1854, and *Pseudalopex* Burmeister, 1856, and on the relationship between them (Berta 1987; Cabrera 1931, 1940, 1958; Clutton-Brock et al. 1976; Kraglievich 1930; Langguth 1969, 1970, 1975; Osgood 1934; Tedford et al. 1995; Van Gelder 1978; Wozencraft 2005; Zrzavý and Řičáncová 2004; Zunino et al. 1995). If the probable close relationship between the culpeo (*L. culpaeus*) and the Falkland Islands wolf (*D. australis*) is confirmed by further research, all species now belonging to *Lycalopex* should be passed under *Dusicyon*, by the principle of priority (Zrzavý and Řičáncová 2004).

Lycalopex comes from the Greek *lycos* for wolf and *alopex* for fox. The specific epithet, *sechurae*, is a Latinized

Fig. 1.—An adult male *Lycalopex sechurae* from Lambayeque, Peru, 2007. Used with permission of the photographer Rob Williams.

word for from Sechura. Common names include Sechuran fox, Sechura desert fox, and Peruvian desert fox (English); renard de Sechura (French); Sechurafuchs and Perufuchs (German—Asa and Cossíos 2004); perro de monte de Sechura and zorra pampera (Spanish, Ecuador—Tirira 2001); zorro de Sechura, juancito, and zorro costeño (Spanish, Peru—Pulido 1998; Tovar 1971); and pacha zorro, pacter, and pacterillo (probable origins in indigenous languages, Peru—Asa and Cossíos 2004).

DIAGNOSIS

The most remarkable external difference among *Lycalopex sechurae* and its congenerics is the coat color: unlike other *Lycalopex* species, *L. sechurae* has little or no reddish coloring on the body and face (Clutton-Brock et al. 1976). In some areas, *L. sechurae* is sympatric with *L. culpaeus* and probably, in the southern limit of its distribution area, with the South American gray fox (*L. griseus*—Asa and Cossíos 2004). *L. culpaeus* is generally larger than *L. sechurae* and has a reddish coloration (Novaro 1997), and *L. griseus* has a rufescent head and a black spot on the chin (González del Solar and Rau 2004). The principal differences with nonsympatric species of *Lycalopex* are: the Darwin's fox (*L. fulvipes*) is noticeably darker (Jiménez and McMahon 2004); the hoary fox (*L. vetulus*) has a well-marked dark stripe along dorsal line of the tail and the general color is normally brighter (Dalponte and Courtenay 2004); and the pampas fox (*L. gymnocercus*) has a reddish head and a dark band along the trunk and tail dorsum (Lucherini et al. 2004). In contrast to other species of *Lycalopex* except *L. vetulus*, the skull of *L. sechurae* has a strong inflation of the nasofrontal sinuses, which results in a convex lateral profile of the rostrum (Beebe 1976; Langguth 1969).

GENERAL CHARACTERS

Lycalopex sechurae (Fig. 1) is a small canid. The head is small, with ears about two-thirds the length of the head. The skull (Fig. 2) lacks an interparietal crest (Clutton-Brock et al. 1976; Langguth 1970). The frontal and nasofrontal sinuses and the postorbital processes are well developed (Langguth 1969, 1970). The canines are "foxlike" and the palatine bones extend backward beyond the posterior edge of M2 (Clutton-Brock et al. 1976).

General color of pelage is grayish, with pale underfur and agouti guard hairs, whereas the underparts are white, fawn, or cream-colored. The face is gray with a narrow rufous-brown ring around the eyes, dark muzzle, and white upper lip and chin (Thomas 1900). Backs of ears are rufous. The throat and chest are white with a gray band or collar across the chest. The front limbs (up to the elbows) and the back limbs (up to the heels) are usually reddish. The tail of

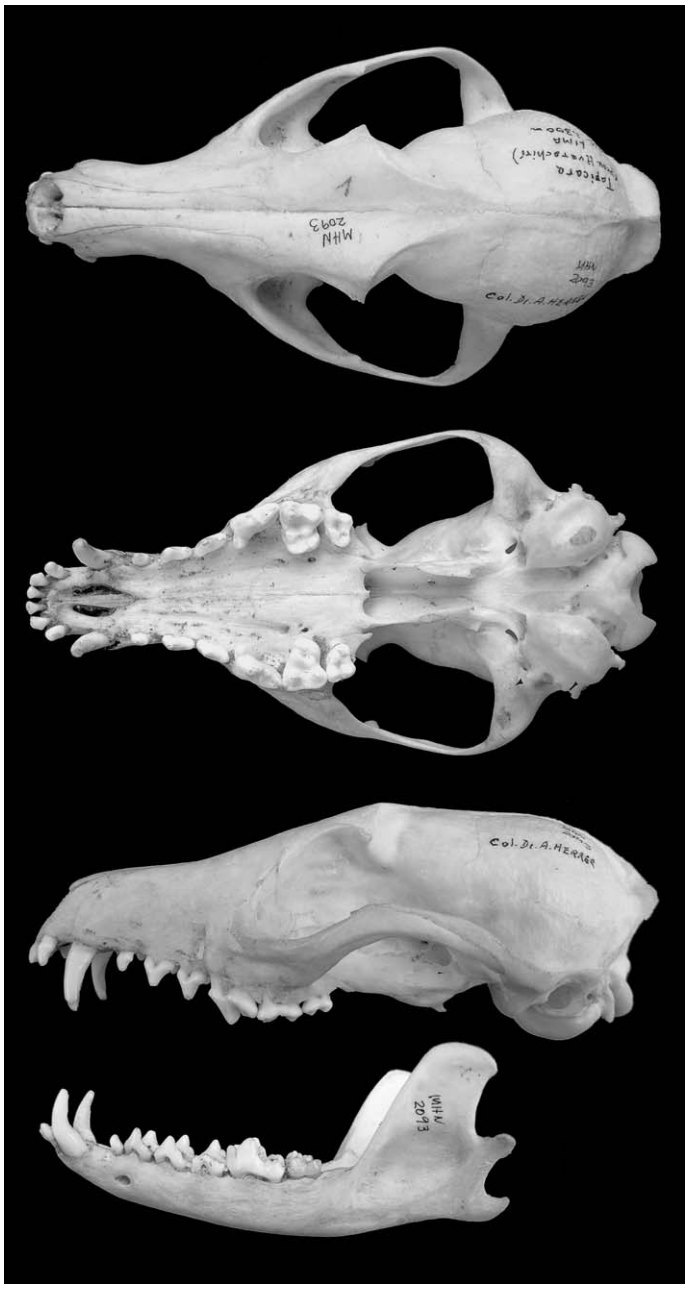

Fig. 2.—Dorsal, ventral, and lateral views of skull and lateral view of mandible of an adult male *Lycalopex sechurae* (MUSM [Museo de Historia Natural de la Universidad de San Marcos] 2093) from Huarochirí, Lima, Peru. Condylobasal length is 119.4 mm.

L. sechurae is slender, relatively long (>40% of the length of head and body), and densely furred, and it ends in a dark tip (Asa and Cossíos 2004; Thomas 1900).

Average external measurements (mm; range and *n* in parentheses) for male *L. sechurae* from northern Peru were: length of head and body, 652 (500–780, $n = 5$); length of tail, 294 (270–340, $n = 5$); length of hind foot, 120 ($n = 1$); length of ear, 68 (60–80, $n = 5$); shoulder height, 288 (220–360, $n = 4$—Asa and Cossíos 2004; Thomas 1900). Body mass of

adult males was 2.6–4.2 kg, with a mean of 3.6 kg (n = 4—Asa and Cossíos 2004). Comparable data for female *L. sechurae* are not available.

Average cranial and tooth measurements (mm; range and n in parentheses) for male and female *L. sechurae*, respectively, were: condylobasal length, 119.1 (111.0–126.6, n = 15) and 113.4 (107.7–121.3, n = 13); zygomatic width, 65.4 (56.8–69.2, n = 16) and 61.3 (51.6–65.9, n = 12); palatal length, 58.3 (53.5–62.9, n = 17) and 56.1 (51.6–60.8, n = 13); interorbital width, 21.5 (19.1–23.6, n = 16) and 20.4 (18.3–22.8, n = 13); width of braincase, 42 (40.0–43.4, n = 16) and 41.8 (37.8–43.7, n = 13); length of rostrum, 37.3 (33.7–41.6, n = 17) and 35.4 (32.1–39.0, n = 13); length of mandible to condyle, 90.4 (82.6–97.9, n = 17) and 86.9 (81.6–92.7, n = 13); length from p1 to p4, 26 (23.6–29.0, n = 17) and 25.8 (24.1–27.3, n = 13); and length from m1 to m3, 22.2 (20.8–24.1, n = 17) and 22.3 (20.3–24.3, n = 13—Beebe 1976). Other cranial, dental, and postcranial measurements are presented by Thomas (1900) and Beebe (1976).

DISTRIBUTION

Lycalopex sechurae is distributed from southwestern Ecuador to west-central Peru (Asa and Cossíos 2004; Fig. 3). Its southern distribution is not defined, but it reaches at least 12°S near Lima, Peru (Grimwood 1969; Pacheco 2002). The known current northern record is about 3°30′S (Reserva Ecologica Arenillas, Ecuador—Freile and Santander 2005). A record of a specimen from 1°S near Manta, Ecuador (Allen 1916), was made, but it has been not corroborated. Elevational occurrence ranges from sea level to ≥1,000 m, and perhaps to 2,000 m in some areas (Tirira 1999).

FOSSIL RECORD

Late Pleistocene fossils of *Lycalopex sechurae* were reported from La Carolina (Hoffstetter 1952) and Salinas (Beebe 1976) in southern Ecuador and from Talara (Lemon and Churcher 1961) and San Sebastian (Martínez 2004) in northern Peru. Average ages of the Talara and Salinas deposits were estimated at 13,994 and 18,400 years, respectively (Churcher 1966). Fossils from Talara are abundant, representing at least 130 individuals, and were 1st named as *Dusicyon* (Lemon and Churcher 1961) and subsequently assigned to *L. sechurae* (Beebe 1976). Salinas fossils represented ≥22 individuals (Beebe 1976). Fossils from La Carolina were assigned to the new subspecies *Dusicyon* (*Dusicyon*) *sechurae elenensis* (Hoffstetter, 1952), but further research using larger samples concluded that there were no significant differences between fossil and current specimens and that *L. sechurae* should still be considered monotypic (Beebe 1976; Martínez and Cadenillas 2006).

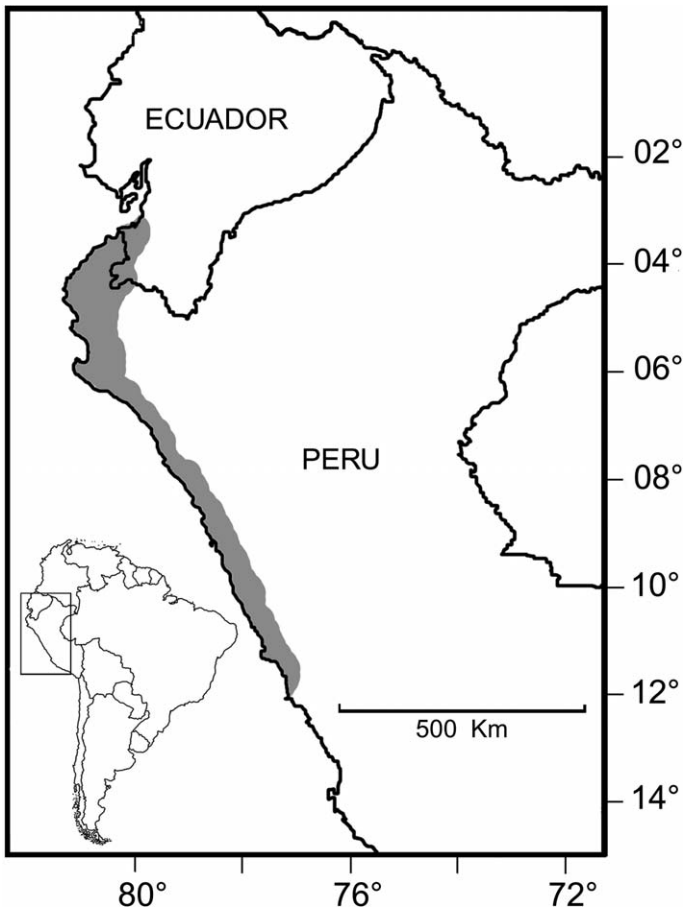

Fig. 3.—South American distribution of *Lycalopex sechurae* modified from Asa and Cossíos (2004).

FORM AND FUNCTION

Lycalopex sechurae has a dental formula of i 3/3, c 1/1, p 4/4, m 2/3, total 42 (Asa and Cossíos 2004); deciduous dental formula is unknown. The p3 and p4 present a posterior accessory cusp (Beebe 1976). The P4, M1, and M2 (Hoffstetter 1952) and m1 and m2 (Beebe 1976) are shorter in length in recent individuals than in fossils. Those differences may represent an evolutionary trend to a less-carnivorous diet (Beebe 1976).

Longer hairs on the back of *L. sechurae* are about 30 mm long, and they are light colored for the proximal one-third and black for the middle one-third; the terminal one-third is white or fulvous white proximally and black terminally. Underfur is scant, dull grayish proximally, and dull fulvous terminally (Thomas 1900).

Forty cranial dimensions of males were 3.0% larger, in average, than those of females (Beebe 1976). The external brain presents a parenthesislike pattern formed by the coronal and ansate sulci bordering the sigmoig gyri, a characteristic that *L. sechurae* has in common with other members of the genus except for *L. culpaeus* (Lyras and Van

Der Geer 2003). The posterior face of the cerebellar vermis is slightly twisted, and the prorean gyrus is relatively short (Radinsky 1973).

Lack of standing water in inland desert habitats suggests that *L. sechurae* can survive without drinking. Its mainly nocturnal activity, largely vegetarian diet, small size, and somewhat large ears also may be adaptations to desert life (Asa and Cossíos 2004).

ECOLOGY

Lycalopex sechurae has been reported from desert environments and adjacent beaches, cultivated areas, dry forests, foothills, sea cliffs, and the western slopes of the Andes (Aguilar 1985; Birdseye 1956; Brack 1974; Grimwood 1969; Huey 1969; Koepcke and Koepcke 1952). *L. sechurae* is an opportunistic omnivore, capable of being strictly vegetarian when necessary. Its diet varies depending on habitat, season and, in general, abundance of dietary items (Asa and Cossíos 2004; Huey 1969; Landeo 1992). In deserts and dry forests, diets contained fruits, rodents, birds, reptiles, insects, and scorpions (Asa and Wallace 1990; Cossíos 2005; Huey 1969; Landeo 1992). In the Peruvian Sechura Desert, >100 fecal samples collected in the dry season contained seeds of *Prosopis juliflora* (91% by weight), *Capparis scabrida* (5%), and *C. avicennifolia* (3%), and <1% insects, lizards (*Dicrodon* and *Tropidurus*), and unidentified birds. In contrast, 136 feces collected during the rainy season contained grasshoppers (42%), *P. juliflora* seeds (35%), mice (*Paralomys gerbillus,* reported as *Phyllotis gerbillus*—20%), and seeds from other plant species (3%—Asa and Wallace 1990).

Annually, the main foods of *L. sechurae* in dry forest of the Bosque de Pomac National Sanctuary, Peru, were fruits of *Prosopis pallida* (in 91.4% of 326 scats), *C. scabrida* (8.6%), *Mutingia calabura* (2.8%), *Heliotropium ferreyrae* (2.2%), and *C. avicennifolia* (1.8%), as well as rodents (10.4%) and insects (5.5%—Cossíos 2005). In the dry forest of El Angolo, Peru, fruits of *Cordia lutea* were the most important dietary component (Landeo 1992).

Along coastal beaches, crabs, carrion, and sea birds and their eggs are eaten (Asa and Wallace 1990; Birdseye 1956; Koepcke and Koepcke 1952). Sea birds present in the diet of *L. sechurae* along the coast were probably obtained as carrion and include brown pelican (*Pelecanus occidentalis*), blue-footed booby (*Sula nebouxii*), Peruvian booby (*Sula variegata*), Neotropic cormorant (*Phalacrocorax brasilianus*), guanay cormorant (*Phalacrocorax bougainvillii*), red-legged cormorant (*Phalacrocorax gaimardi*), gulls (*Larus*), and Humboldt penguin (*Spheniscus humboldti*—Asa and Wallace 1990; Huey 1969). In foothills of central Peru, I observed that fruit of *Carica candicans*, mice, insects, and scorpions were principal dietary items of *L. sechurae*. In cultivated areas and near human populations, diets of *L. sechurae* include eggs, poultry, guinea pigs, and cultivated vegetables (Aguilar et al. 1977; Cossíos 2004; Landeo 1992). Preying on poultry is more common between November and January, probably during the birth period and the 1st months of pups' life (Cossíos 2004). Other prey include squirrels (e.g., *Sciurus stramineus*), geckos (*Phyllodactyllus*), and snakes (Huey 1969; Landeo 1992).

Seeds eaten by *L. sechurae* in the dry forest of the Bosque de Pomac can be dispersed ≥809 m; most are dispersed 20–80 m (37.2% of the feces of *L. sechurae* with dispersed seeds) and 160–220 m (32.8%). Of 8 fruits eaten by *L. sechurae*, germination rates significantly diminished for 1 species (*Heliotropium ferreyrae*) and increased for 3 species (*P. pallida*, *Acacia macracantha*, and *Mutingia calabura*) after their passage in the fox's digestive system. Germination time also was diminished for *P. pallida* (Cossíos 2005).

BEHAVIOR

Lycalopex sechurae is mostly solitary and seldom found in groups of ≥3 individuals. Larger groups are usually only observed where food is concentrated (Asa and Cossíos 2004). Births were reported for October and November (Birdseye 1956). The abdominal distension of an adult female suggested that it was pregnant in August (Asa and Wallace 1990). *L. sechurae* is largely nocturnal (Asa and Wallace 1990; Birdseye 1956). In the Peruvian Sechura Desert during austral winter, foxes emerged from dens and began to forage before sunset and returned to dens before dawn, where they remained all day. Between December and March, *L. sechurae* occasionally was seen foraging during daylight in the same area. The pattern of nocturnal activity does not change with lunar phases during dry seasons, when rodent prey are not abundant (Asa and Wallace 1990).

Four calls or sounds were recorded from a captive juvenile female. A loud high-pitched chatter was the only call used up to 2 months of age, apparently to call for attention. After that age, the female stopped using this chatter and developed a puppylike whine to protest against the approach of its owners when she was eating, a doglike growl used in the presence of strangers, and a loud, 2-syllabled call, followed by a whine, to demand food or attention (Birdseye 1956).

GENETICS

Chromosome number is unknown. Metachromatic analyses indicate that *Lycalopex sechurae* and *L. fulvipes* are more closely related than they are to *L. griseus*, *L. gymnocercus*, and *L. culpaeus* (Yahnke 1995).

CONSERVATION

Lycalopex sechurae is classified as a Near Threatened species by the World Conservation Union (International

Union for Conservation of Nature and Natural Resources 2009). In Ecuador, *L. sechurae* is not common but is considered at Low Risk (Tirira 2001). In Peru, *L. sechurae* is considered a common species, mainly in the northern coastal region (Grimwood 1969), but its status on the central coast is unknown (Asa and Cossíos 2004). It is not included in the list of endangered species of the Peruvian government, but hunting and commercialization are not permitted without authorization. Main threats are habitat reduction and illegal hunting. Deforestation of western Ecuador has been extensive, and <8% of forest cover remains (Best and Kessler 1995; Dodson and Gentry 1991). Forest loss in northern Peru also is considered to be detrimental to *L. sechurae* (Best and Kessler 1995).

In many areas of Peru, *L. sechurae* is persecuted because of real or perceived depredation of farm animals and agricultural goods. It is hunted for use in magic–religious rituals and fabrication of amulets and handicrafts. Of 120 rural Peruvians living throughout the range of *L. sechurae*, 68.3% persecute *L. sechurae*. Use of *L. sechurae* in folkloric medicine and the sale of pups are less common threats (Cossíos 2004). Limited information is available on *L. sechurae* and research on its distribution and natural history is considered a priority for its conservation (Sillero-Zubiri et al. 2004). *L. sechurae* seems to have had an important influence on the ancient cultures of northern Peru and southern Ecuador, as suggested by the artistic representations of Mochica and Chimu cultures (Donnan 1976), as well as by bones of *L. sechurae* found in ancient tombs (Wing 1988, 1989). The current perception of the fox by the locals can be influenced by these old beliefs (Cossíos 2004).

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