

= Voalavo gymnocaudus =

Voalavo gymnocaudus , also known as the northern voalavo , naked @-@ tailed voalavo , or just voalavo , is a rodent in the family Nesomyidae found in the highlands of northern Madagascar . Discovered in 1994 and formally described in 1998 , it is the type species of genus Voalavo ; its closest relative is Voalavo antsahabensis of the Central Highlands . DNA sequence data suggests it may be more closely related to Eliurus grandidieri than to other species of the closely related genus Eliurus . V. gymnocaudus is found at 1 @, @ 250 to 1 @, @ 950 m ( 4 @, @ 100 to 6 @, @ 400 ft ) above sea level in montane wet and dry forest in the Marojejy and Anjanaharibe @-@ Sud massifs . Nocturnal and solitary , it lives mainly on the ground , but can climb , and probably eats plant matter . Despite a small range , it is classified as " Least Concern " because it lacks obvious threats and much of its range is within protected areas .

Voalavo gymnocaudus is a small , mouse @-@ like rodent with soft , gray fur which is only slightly darker above than below . The ears are short and rounded . The long tail appears mostly naked and lacks a distinct tuft , which is present in Eliurus . It differs from V. antsahabensis mainly in the values of some measurements . The skull is delicate , with a long , narrow rostrum ( front part ) , narrow interorbital region ( between the eyes ) , and no development of ridges on the braincase . The molars are relatively high @-@ crowned ( hypsodont ) . Body mass is 17 to 25 @. @ 5 g ( 0 @. @ 60 to 0 @. @ 90 oz ) .

= = Taxonomy = =

The rodent fauna of the Northern Highlands of Madagascar remained almost totally unstudied until the 1990s . A 1994 survey of the Anjanaharibe @-@ Sud Reserve partially filled this gap and led to the discovery of two new species : Eliurus grandidieri ( genus Eliurus ) and Voalavo gymnocaudus , the first known and type species of the genus Voalavo . Both species were formally described in 1998 by Michael Carleton and Steven Goodman . The generic name , Voalavo , is a general Malagasy word for rodent , and the specific name , gymnocaudus , refers to the naked tail , which distinguishes V. gymnocaudus from the related tufted @-@ tailed rats ( Eliurus ) . In 2000 , the species was also recorded from the nearby Marojejy National Park .

Meanwhile , in 1999 , Sharon Jansa and colleagues published a molecular phylogenetic study of the Nesomyinae , the native Malagasy rodents , using the mitochondrial gene cytochrome b . Their results suggested that the current definitions of Eliurus and Voalavo may not be correct , because they found that V. gymnocaudus and E. grandidieri are more closely related to each other than to the remaining species of Eliurus . However , the DNA of Eliurus petteri , a possible close relative of E. grandidieri , could not be sampled , so Jansa and colleagues recommended further evaluation of the problem . According to a 2003 report , data from nuclear genes also support the relationship between V. gymnocaudus and E. grandidieri , but E. petteri remains genetically unstudied and the taxonomic issue has not been resolved .

A second species of Voalavo , Voalavo antsahabensis , was named in 2005 from central Madagascar . Morphological differences between the two are subtle but consistent , and the cytochrome b sequences of the two species differ by about 10 % . In mammals , closely related species regularly differ by less than 5 % in their cytochrome b sequences , and a divergence of more than 5 % within a single species suggests the presence of cryptic species .

= = Description = =

= = = External morphology = = =

Voalavo gymnocaudus is a small , mouse @-@ like rodent . It differs from the very similar V. antsahabensis mainly in some measurements , such as a greater tail length . It also resembles small species of Eliurus , but the fur is darker and there is no tail tuft . The fur is soft , short , and thick ,

and appears dark gray on most of the upperparts , but more brownish on the sides . On the back , the cover hairs , which form the main part of the fur , are three @-@ colored : most of the hair is gray , followed by a narrow light buff band and a black tip . The longer guard hairs are black . The fur of the underparts is not different in overall color , but the individual hairs are gray for about three quarters of their length and white at the tips , except for those at the chin , which are white throughout .

The mystacial vibrissae ( whiskers on the upper lips ) reach the tips of the ears when pressed against the head . The short , rounded ears themselves are naked on the inside , but covered with short brown hairs on the outer surface . Females have three pairs of mammae . The digits and metapodials are mostly covered by white hairs . Short ungual tufts of hairs surrounding the bases of the claws are present . There are five pads on the forefeet and six on the hindfeet . On the hindfeet , the fifth digit is nearly as long as the middle three and the first ( the hallux ) is much shorter . The tail is longer than the head and body and appears naked for most of its length , but fine hairs are visible near the tip . Although the lower side is slightly lighter , there is no clear difference in coloration between the upper and lower sides . The skin of the tail is gray , and it is covered lightly by fine hairs that are dark brown over most of the length of the tail , but white near the tip .

#### = = = Skeleton = = =

The skull is delicate and lightly built . The rostrum , the front part of the skull , is narrow and fairly long ; it is shorter in *V. antsahabensis* . The narrow zygomatic plate ( a plate on the side of the skull ) extends back to about the front of the first upper molar ( M1 ) . The zygomatic notch , a notch in the upper part of the zygomatic plate , is small . The zygomatic arches ( cheekbones ) are narrow , but as usual in nesomyines contain a relatively long jugal bone . The interorbital region ( between the eyes ) is narrow and short and lacks accessory shelves and ridges . The braincase also lacks such ridges .

The incisive foramina ( openings in the front part of the palate ) are medium in length , and do not reach the first molars . Their back margin is angular , not rounded as in *V. antsahabensis* . The diastema ( the gap between the upper incisors and molars ) is shorter than in *V. antsahabensis* . The bony palate is broad and lacks notable ridges and other features , except for a pair of foramina ( openings ) near the place where the first and second molars ( M1 and M2 ) meet . The back border of the palate is at the level of the middle of the third molars ( M3 ) . In the bony roof of the mesopterygoid fossa , the opening behind the palate , wide sphenopalatine vacuities ( openings ) are present . A thin alisphenoid strut ( a piece of bone on the lower side of the skull separating two foramina ) is present in specimens from Marojejy , but not in those from Anjanaharibe @-@ Sud . The tegmen tympani , the roof of the tympanic cavity , is reduced .

The root of the lower incisor is visible at the back of the mandible ( lower jaw ) as a slight protrusion ; a true capsular process is absent . There are 13 thoracic ( chest ) , 7 lumbar , 4 sacral , and 38 or 39 caudal ( tail ) vertebrae . The humerus ( upper arm bone ) lacks an entepicondylar foramen .

#### = = = Dentition = = =

The upper incisors are orthodont ( with their cutting edge perpendicular to the plane formed by the molars ) and have yellow to light orange enamel . On the lower incisor , the enamel contains series of fine ridges . The toothrows are longer than in *V. antsahabensis* . As in *Eliurus* , the molars are incipiently hypsodont ( high @-@ crowned ) and the individual cusps have lost their identities , having merged into transverse laminae that are not connected longitudinally . There are three laminae on each first and second molar , two on the third lower molar , and the laminae cannot be differentiated on the third upper molar . Although the first and second molars are similar to each other in size , the third ( upper and lower ) molars are conspicuously smaller . There are three roots below each upper and two below each lower molar .

#### = = Distribution and ecology = =

*Voalavo gymnocaudus* has been found only in two massifs of the Northern Highlands , Anjanaharibe @-@ Sud and Marojejy , but may range more widely . At Anjanaharibe @-@ Sud , the species has been found in wet mountain forest at 1 @,@ 950 m ( 6 @,@ 400 ft ) , where it occurred with the indigenous rodents *Eliurus majori* and *Nesomys rufus* as well as the introduced black rat ( *Rattus rattus* ) , and in drier forest at about 1 @,@ 300 m ( 4 @,@ 300 ft ) , where it may live alongside other species of *Eliurus* and *Gymnuromys roberti* . The Marojejy records come from similar habitats at 1 @,@ 250 to 1 @,@ 875 m ( 4 @,@ 101 to 6 @,@ 152 ft ) above sea level . *V. gymnocaudus* probably largely lives on the ground , but is able to climb in vegetation . It likes areas with dense networks of roots , among which it moves using runways and natural tunnels . The species is nocturnal ( active during the night ) , is solitary , probably eats fruits and seeds , and bears up to three young per litter . A variety of parasitic arthropods have been recorded on *V. gymnocaudus* : mites from the families Laelapidae and Trombiculidae ( both Marojejy and Anjanaharibe @-@ Sud ) , the demodicid mite *Demodex* ( Marojejy only ) , the atopomelid mite *Listrophoroides* ( both Marojejy and Anjanaharibe @-@ Sud ) , and unidentified sucking lice ( Anjanaharibe @-@ Sud only ) . In 2007 , a laelapid mite found on *V. gymnocaudus* in Anjanaharibe @-@ Sud was described as a new species , *Andreacarus voalavo* . The apicomplexan parasite *Eimeria* has also been recorded in Anjanaharibe @-@ Sud *V. gymnocaudus* .

= = Conservation status = =

Although *Voalavo gymnocaudus* has a small range and is uncommon even within that range , no major threats are known and virtually all of its distribution is within protected areas . The species is therefore classified as " Least Concern " on the IUCN Red List .