Palaeobiogeography and evolution of insular bovids: ecogeographic patterns of body mass variation and morphological changes

Roberto Rozzi

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by

Roberto Rozzi

Tutor

Prof. Maria Rita Palombo

Co-tutor

Prof. Mark V. Lomolino

Except where cited in the text, this work is the result of research carried out by the author.

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Roberto Rozzi

本綱羆似熊而大色黄白其頭長脚高猛憨多力能拔樹木虎亦畏之遇人則人立而攫之故俗呼爲人熊蓋熊羆壯毅之物屬陽故書以不二心之臣譬之

魋 音頽

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リンヤン

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An entry on the Japanese serow (*Capricornis crispus*) in the 1712 Illustrated Sino-Japanese Encyclopedia Wakan Sansai Zue.

Abstract

The study of the plants and animals that live on island has been a frequent key to understanding the processes of evolution that determine biotic diversity globally. Insular endemic mammals represent a special ground for the study of evolutionary mechanisms and speciation processes in response to the special characteristics of island environments. Endemic bovids are intriguing elements of insular faunas and offer an extensive and diversified sample for exploring patterns of insular evolution of large-sized mammals. This thesis provides the first comprehensive study on the evolution of extinct and living insular bovids, exploring the selective biotic and abiotic factors that influenced ecogeographic patterns of body mass variation and peculiar morphological changes (e.g., hypsodonty and low-gear locomotion) of these taxa.

I show that the majority of island bovids, as large mammals, do follow the main prediction of the island rule, showing a body size reduction, and that ecological release and resource limitation are the main factors influencing body size evolution of these taxa.

My results indicate that hypsodonty (increase in molar crown height), a quite common morphological trend in insular artiodactyls, is shared by the majority of insular bovids independently from the abrasiveness of the current diet. The evolution of this feature appear to result from an expansion of the dietary niche under resource limitation, although alternative, but complementary, hypotheses (e.g., increase in reproductive lifespan/longevity and changes in eating methods) cannot be excluded.

The acquisition of a low-gear locomotion or the maintaining of a cursorial aptitude in insular bovids can be explained in the light of habitat selection (niche availability) and predatory pressure (ecological release) operating on each island.

Finally, my results confirm the crucial role of time in isolation, with each of the above evolutionary phenomena becoming more developed for bovid populations with longer residence times on the islands. Another factor that needs to be mentioned is original bauplan, working as a constraint in the evolution of all the species in the study.

By integrating research into the evolution of body mass variation and peculiar morphological changes exhibited by both extinct and extant bovids, this thesis documents patterns that have often been only hinted at previously, and identifies some that appear to be entirely new, providing new insights into the phenomena of the island syndrome and bovid evolution.

To Adalgisa, Patrizia and Elide

For giving me courage, strength and hope

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« Natural history, taken in all its extent, is an immense history, it embraces all the objects with which the universe presents us. This prodigious multitude of quadrupeds... offers to the curiosity of the human spirit a vast spectacle in which the whole is so large, as it seems and as it is, so as to be inexhaustible in its details.»

Comte de Buffon, Histoire Naturelle, I, 1749

1. Introduction

Islands are renowned for their extraordinary biota and have long been recognized as laboratories for the study of evolution.

Insular endemic mammals represent a special ground for the study of evolutionary mechanisms and speciation processes in response to the special characteristics of island environments. Although pathways of island colonization and evolutionary processes undergone by endemic settlers have greatly interested evolutionary biologists, ecologists and biogeographers, we are far from reaching a general consensus on both the generality of patterns and the causal mechanisms driving the evolution of island biotas. Some patterns have been claimed to be shared across space and time by a number of insular, not closely phylogenetically related mammals (e.g., Sondaar, 1977; Van der Geer et al., 2010; Lomolino et al., 2012, 2013), but a number of exceptions can be found when comparing different mammals on different islands. Two main issues need to be considered in the study of these insular biotas: the community structure and the loss of biodiversity of insular faunas, which affects available niches and speciation processes, and the peculiar changes undergone by island settlers.

Changes in bauplan and body size are the most spectacular of these changes, but they are not trivial to explain in the light of evolutionary processes on islands. For instance, they make it difficult to discriminate between ecomorphological, apomorphic and plesiomorphic features, perhaps inherited by unknown ancestors living in different habitats. One crucial aspect of the island syndrome is body size variation. This pattern was first described in insular mammals by Foster (1964) and then labeled the island rule by Van Valen (1973), who postulated gigantism in smaller and dwarfism in larger species of insular mammals. Over time, many hypotheses have been formulated to explain the causal mechanisms of body size modification on islands, with a diversity of alternative explanations, either confirming or rejecting the island rule, which is now described as a graded trend from gigantism in small species to dwarfism in large species of mammals (e.g., Van Valen, 1973; Heaney, 1978; Lomolino, 1985, 2005; Lomolino et al., 2006, 2012, 2013; Köhler et al., 2008; Meiri et al., 2008; Palombo, 2009a; Benton et al., 2010). Furthermore, several authors described other peculiar morphological traits acquired by insular mammalian species, in a few cases highlighting pervasive patterns that affected most of the representatives of particular lineages, such as proboscideans and ruminants (see e.g., De Vos, 2000; Van der Geer, 2005, in press; De Vos et al., 2007; Palombo, 2007; Palombo et al., 2013; Rozzi & Palombo, in press).

The ultimate objective of this research project is to explore the selective biotic and abiotic factors (e.g., time in isolation, island area, distance to mainland, latitude, longitude, and number of predators and competitors) that influenced ecogeographic patterns of body mass variation and peculiar morphological changes (i.e., increased molar crown height and transition toward low-gear locomotion) in insular mammals, and to build an evolutionary model which explain these processes. To achieve this end, this project concentrates on Bovidae, not only because of its complex evolutionary history (it includes more species than any other extant family of large mammals; Hernández Fernández & Vrba, 2005; Bibi et al., 2009), but also because it includes a large number of insular species that inhabited or are still living on islands located in different regions and characterized by different features and palaeogeographic histories. In particular, I focused on extant and Quaternary fossil bovids in order to verify the following hypotheses put forth to explain the following three types of insular phenomena:

1) Insular body size of bovids results from a combination of selective forces whose influence varies with characteristics of the focal islands and the focal species, and with interactions among species (Lomolino et al., 2012). Thus, the key factors influencing body size and their associated predictions include:

    - Ecological release: predicting that body size divergence (in this case the degree of dwarfism exhibited by these large mammals) should be most pronounced on islands with the fewest competitors and predators;
    - Resource limitation: predicting that body size divergence should be most pronounced for the larger mammals on smaller islands.

2) Increase in molar crown height is a quite common morphological trend in insular artiodactyls. Hypsodonty is generally found to be related to increased dental wear rate because of feeding habits (see Jordana et al., 2012 and references therein). Therefore, it has been suggested that hypsodonty results from the expansion of the dietary niche under resource limitation, and an adaptation for eating more abrasive plant material, assuming arid soil particles when foraging (van der Geer et al., 2010; Damuth & Janis, 2011). A recent work on the endemic bovid

Myotragus suggests that this genus evolved a hypsodont dentition independent from its current diet, enabling the species to cope with harsh conditions by extending its dietary range when needed (Winkler et al., 2013, in press). However, some recent work on herbivores suggests that increased tooth height may also evolve in response to shifts in life-history traits, specifically to an increase in reproductive lifespan/longevity (e.g., Jordana et al., 2012). Here I test the following predictions:

- Hypsodonty is shared by the majority of insular bovids independently from the abrasiveness of the current diet.
- Hypsodonty is significantly correlated with resource limitation (island area) and number of competitors and predators.

3) Morphological traits related to the so-called ‘‘low-gear’’ locomotion (Sondaar, 1977) have been regarded by several authors as typical adaptations acquired by insular artiodactyls (e.g., Sondaar, 1977, Van der Geer, 2005, in press). Actually, some insular bovids acquired a peculiar structure of the shortening long bones, increasing the robustness of metapodials (e.g., *Bubalus mindorensis*; Custodio et al., 1996) and occasionally developing bone fusions (e.g., *Myotragus*; Bover et al., 2010) which increase their stability, especially on rocky and/or uneven grounds in a carnivore-free environment. The significance of the variation of the pattern in both extant and fossil bovids can be investigated by examining the influence of habitat selection and predatory pressure had on the acquisition of a low-gear locomotion or in maintaining or increasing a cursorial aptitude (see Rozzi & Palombo, in press). I predict that the morphological characters associated with low-gear locomotion (i.e., shortening of limb length and metapodials) should be most pronounced for bovids living on:

- islands with fewer predators and competitors;
- islands of greater topographic complexity;

In addition to testing the predictions listed above, I also assessed whether the above evolutionary phenomena are influenced by bauplan and time in isolation, becoming more developed for bovid populations with longer residence times on the islands.

As my results reveal, although island bovids are not as famous as dwarf proboscideans or giant mice, they offer an extensive and diversified sample for exploring patterns of insular evolution of large-sized mammals.

A comprehensive overview of the main features and evolutionary patterns exhibited by both extant and fossil insular bovids is given in the following pages, integrating information from the literature with personal observations.

Overview of extant insular bovids: systematics, ecology and conservation

2. Overview of extant insular bovids: systematics, ecology and conservation

Living insular bovids include the Greenland muskox (*Ovibos moschatus wardi*), the Japanese serow (*Capricornis crispus*), the Formosan serow (*Capricornis swinhoei*), the tamaraw from Mindoro, Philippines (*Bubalus mindorensis*), and the anoas (*Bubalus depressicornis* and *B. quarlesi*), two species of dwarf buffalos endemic to Sulawesi, Indonesia (Fig. 1). In addition to these native species, many introduction 'experiments' performed by human civilizations during their advances across the globe provide an opportunity to investigate the initial phases of development of peculiar features and evolutionary trends in insular bovids (see below).

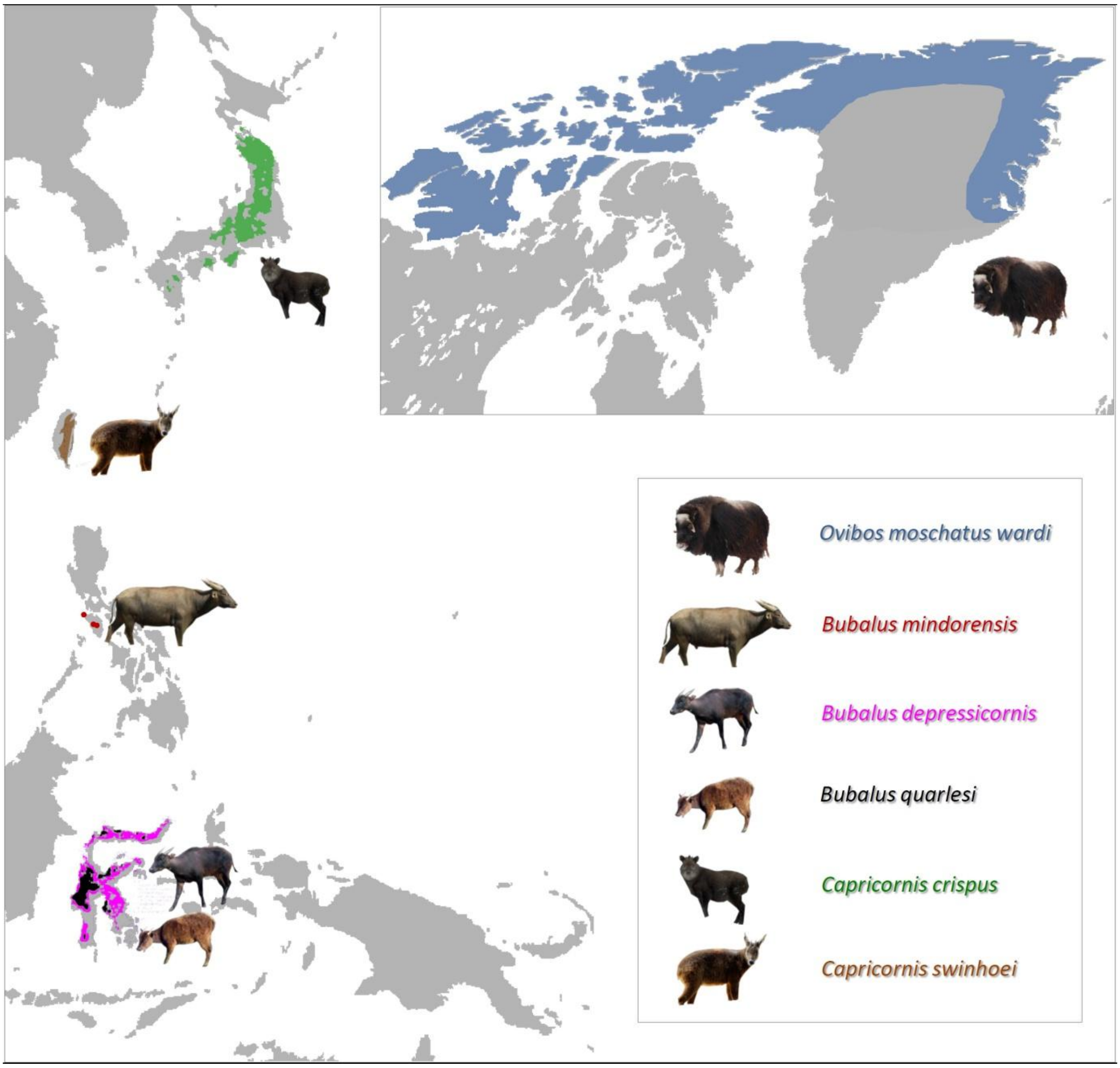


Fig. 1. Distribution map of living insular bovids (redrawn from www.ultimateungulate.com).

2.1. Dwarf buffalos from Sulawesi and Mindoro

Two closely related, extant dwarf buffalos are the anoa species - the lowland anoa *Bubalus* (*Anoa*) *depressicornis* and the mountain anoa *B.* (*A.*) *quarlesi* (Fig. 2 a,b) - that are endemic to the Indonesian island of Sulawesi (and offshore islands). Remains of fossil anoa testify the occurrence of this species on Sulawesi at least since the Late Pleistocene (Hooijer, 1948, 1950, 1972; Clason, 1976; Groves, 1980; Van den Bergh et al., 2001). There is still much debate over the distribution and taxonomic status of the two species of anoa (Mohr, 1921; Bohlken, 1958; Dolan, 1965; Groves, 1969; Weise, 1979; Corbet & Hill, 1992; Wilson & Reeder, 1993; Kakoi et al., 1994; Schreiber & Nötzhold, 1995; Kikkawa et al., 1997; Pitra et al., 1997; Nowak, 1997; Schreiber et al., 1999; Burton et al., 2005; Groves & Grubb, 2011). The classification of the subgenus *Anoa* within *Bubalus* is widely accepted and supported by recent morphological and genetic studies, although some authors (see e.g., Groves & Grubb, 2011) suggest that there could well be more taxonomic variation than hitherto recognized. The classification of the anoas into two species, accepted by the majority of the specialists, is adopted here.

Fig. 2. Lowland anoa (*Bubalus depressicornis*) (a) and mountain anoa (*Bubalus quarlesi*) (b) (from www.tumblr.com and www.ds-lands.com).

B. depressicornis and *B. quarlesi* are the smallest known extant Bovini, standing about 1 m tall at the shoulder and weighing up to 300 and 150 kg respectively (see Burton et al,. 2005). The discrepancy in reported adult weights of these species (average body mass of *B. depressicornis* is 135 kg according to Croft et al., 2006) is possibly due to the scantiness of published data and/or to the inclusion of zoo and/or misidentified specimens in the measured samples. My body mass estimates, based on measurements of occipital and limb bones of adult specimens (see Appendix III), suggest that the data published thus far would slighlty overestimate the body mass of these species.

The lowland and mountain anoas inhabit many types of forest, from lowland forest to montane forest at up to 2300 m above sea level (Burton et al., 2005), but, despite their common names, it is still uncertain whether the two species are sympatric or parapatric in their distribution. These species have no natural predators despite being frequently hunted by humans, while competitors include the endemic suids *Babyrousa celebensis* and *Sus celebensis*.

Both anoas are classified as Endangered by International Union for the Conservation of Nature (IUCN, 2012), are included in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (UNEP-WCMC, 2011) and are legally protected under Indonesian law (Jahja, 1987). According to Burton et al. (2005), conservation efforts should focus on protecting anoas from hunting, preventing habitat loss in key sites, determining the status of the remaining anoa populations, and completing genetic studies to better define the number of anoa taxa and assess their distribution.

Another living dwarf species of buffalo is the tamaraw, *Bubalus* (*Bubalus*) *mindorensis* (average body mass: 225 kg; see Talbot & Talbot, 1966; Popenoe, 1983; Custodio et al., 1996; Croft et al., 2006; Fig. 3), restricted to Mindoro Island, Philippines.

Fig. 3. Tamaraw (*Bubalus mindorensis*) from Mindoro (from www.archive.com).

Custodio et al. (1996) gave a full account of this species, which is characterized by a dark brown to grayish black pelage and short, stocky limbs. Beyer (1957) identified several fossil teeth retrieved from surface accumulations on Luzon as *B. mindorensis*, suggesting that the tamaraw occurred on Luzon as well as Mindoro during the Pleistocene (see Croft et al. 2006; Fig. 1 and Tab. 1). The species, widespread in historical time on the entire Mindoro island, is now restricted to only three protected areas with a total estimated population of about 250 individuals (Custodio et al. 1996; Ishihara & Kanai 2010). *B. mindorensis* has no natural predators, while major competitors are the endemic suid *Sus oliveri* and the Philippine brown deer *Cervus mariannus*. One of the main reasons for its population decline has been unrelenting habitat destruction. The original lowland dipterocarp forest vegetation has largely been cleared by fire and logging, and grasslands now cover 90% of the Mt. Iglit reserve area, where current populations are primarily confined (Custodio et al., 1996). The tamaraw is classified as Critically Endangered by International Union for the Conservation of Nature (IUCN, 2012), is listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (UNEP-WCMC, 2011) and legally protected under Philippine law since 1936 (Ishihara & Kanai, 2010). Nevertheless, current evidence indicates that the tamaraw population continues to decline (Custodio et al., 1996) because of relentless habitat destruction and poaching.

2.2. The Japanese and Formosan serows

The Japanese serow, *Capricornis crispus* (Fig. 4a), is a goat-sized representative of Caprini (average body mass: 38 kg; Miura & Maruyama, 1986; Silva & Downing, 1995; Ochiai & Susaki, 2002; Natori & Porter, 2007), characterized by sturdy legs and a short bushy tail (Ohdachi et al., 2009; Groves & Grubb, 2011). It is a monogamous bovid inhabiting forested areas - from low mountains to the subalpine zone – in the three main islands of Japan, Honshu, Shikoku and Kyushu (Okumura, 2004). This species is a browser, selectively feeding on digestible plants such as the dwarf bamboo *Sasa nipponica* and dicotyledonous plants (Kobayashi & Takatsuki, 2012; Yamada, 2013). Japanese serows have no or very few predators other than humans. However, potential predators include Asiatic black bear (*Ursus thibetanus*) and wolf (*Canis lupus*). Main competitors are sika deer (*Cervus nippon*) and wild boar (*Sus scrofa*). Several genetic studies were conducted in order to investigate the intrageneric relationships among the *Capricornis* species and the intraspecific genetic diversity and structure of the Japanese and Formosan serows (e.g., Soma et al., 1987; Min et al., 2004; Okumura, 2004; Ohdachi et al., 2009; Chang et al., 2012; Yang et al., 2012; Liu et al., in press). Nevertheless, the taxonomic status of the *Capricornis* species and their phylogenetic relationships are still debated. Jass & Mead (2004) gave a full account of the Japanese serow but informed that, according to Soma et al. (1994), no fossil record of *Capricornis* is known from Japan. Conversely, fossils of *Capricornis crispus* and/or *Capricornis* sp. are actually recorded in the late Pleistocene of Tochigi, Aomori, Iwate and Ehime Prefectures and in several Holocene sites (from early Holocene to historical times) of Honshu, Shikoku and Kyushu (Kawamura, 2003; Ohdachi et al., 2009). A well studied locality bearing remains of *Capricornis* sp., slightly larger than extant *Capricornis crispus*, is Apache cave at Kitakamisanchi (Iwate Prefecture; Kawamura, 2003). In particular, Kawamura (2003) reports specimens coming from a layer of Apache cave dated at ca. 18000 yBP. Furthermore, Shikama (1949) erected the species *Naemorhedus nikitini* on the basis of few remains recovered in Late Pleistocene deposits of the Kuzu area (Tochigi Prefecture). Pending a revision of this species and of fossil material from Japan ascribed to *Capricornis*, phylogenetic relationships between fossil and living Japanese serows remain uncertain.

The Japanese serow was designed as a “Natural Monument of Japan” by the Japanese Government in 1934, and in 1955 its status was raised to a “Special Natural Monument” because of continuing poaching. Consequently, due to strict protection, the Japanese serow has rapidly recovered its numbers in most of Honshu. Since 1978, controlled hunting has been permitted in Gifu and Nagano Prefectures (Honshu), and 1979 policy allows hunting of Japanese serows outside of protected reserves in Japan (Jass & Mead, 2004). At present, the Japanese serow population is not threatened in Honshu, whereas in Shikoku and Kyushu most of the local populations are still small and isolated. The Japanese serow is considered a low risk, conservation dependent species by the IUCN (2012).

The Formosan serow, *Capricornis swinhoei* (Fig. 4b), is smaller and more goral-like than mainland and Japanese serows (average body mass: 24 kg; Wang & Chen 1981; Smith & Xie, 2008). This generally solitary species is endemic to Taiwan and inhabits rugged forest and rocky slopes along the main mountain chain on the island between 1,000 and 3,000 m (Smith & Xie, 2008). The Formosan serow is a mixed-feeder, feeding on juvenile parts of conifers, grasses and shrubs (Lue, 1987). No native predators of *C. swinhoei* remain on Taiwan, although the clouded leopard (*Neofelis nebulosa*) may have been a prime predator in forests prior to its extinction (Lue, 1987). Potential competitors include Formosan sambar (*Cervus unicolor swinhoei*), Formosan muntjac (*Muntiacus reevesi micrurus*), Formosan sika deer (*Cervus nippon taioanus*) and wild boar (*Sus* *scrofa*. According to Lue (1987), *C. swinhoei* originated from the Japanese serow, *C. crispus*, which likely reached Taiwan from the eastern part of mainland China prior to its isolation due to the sea level rising after the Last Glacial Maximum. Nevertheless, because the taxonomic status of this taxon is still problematic (see Jass & Mead, 2004; Groves & Grubb, 2011), hypotheses regarding the biogeographic and evolutionary history of Formosan serow are purely speculative. The conservation status of *C. swinhoei* is considered to be of least concern by the IUCN (IUCN, 2012) and the species is not listed by CITES (UNEP-WCMC, 2011). Populations have always been small, but, in the late 1970s, increased habitat exploitation and high levels of hunting seemed to cause a rapid drop in numbers (Wang & Chen, 1981; Lue, 1987). Current hunting pressure is less than in previous decades, now that this taxon is legally protected under Taiwanese local regulation since 1989, and it is listed as a "Precious and Rare species" under the Wildlife Protection Act (Chiang & Pei 2008). Nevertheless, an estimate of total population size is still missing, and population trends need further research in order to organize effective conservation strategies.

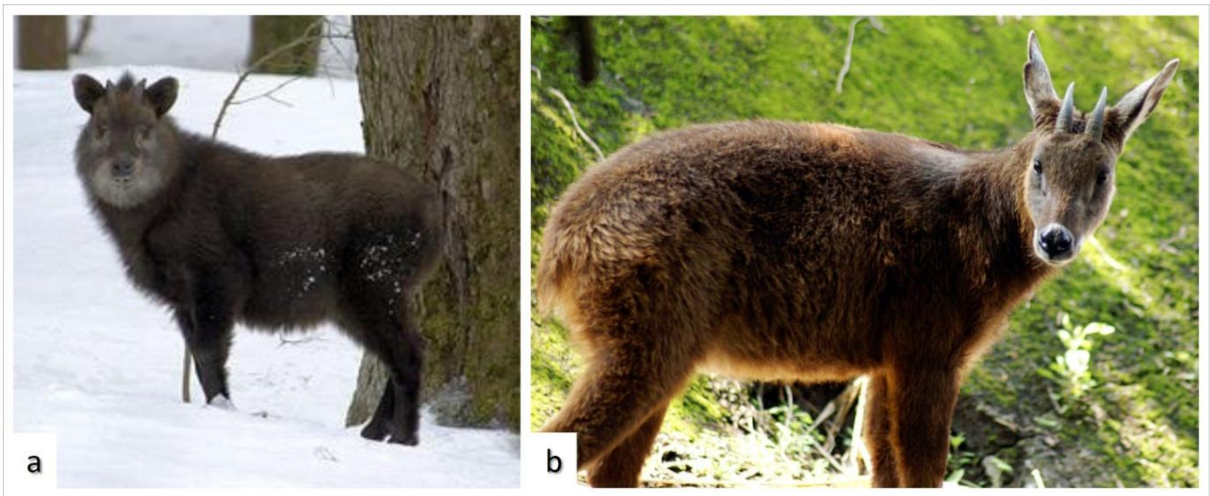


Fig. 4. Japanese serow (*Capricornis crispus*) (a) and Formosan serow (*Capricornis swinhoei*) (b) (from www.flickr.com and commons.wikimedia.com).

2.3. The white-faced muskox

Another bovid characterized by a natural insular distribution is *Ovibos moschatus wardi* (= *Ovibos wardi* in Groves & Grubb, 2011; Fig. 5). This subspecies of muskox, including several relatively isolated populations distributed in Greenland and in the Arctic Archipelago, tends to be slightly smaller than *O. moschatus moschatus* from the Canadian mainland (Lent, 1988; Forchhammer &

Boertmann, 1993; Nowak, 1997). Tener (1965) gives average body sizes for bulls of *O. moschatus moschatus* from the Arctic mainland and *O. moschatus wardi* from Melville Island of about 340,2 kg and 324,3 kg, respectively. Although several taxonomic studies of muskoxen indicate differences in body measurements between the two subspecies (Lent, 1988; Forchhammer & Boertmann, 1993; Nowak, 1997; Groves & Grubb, 2011), this separation is not accepted by all the authors. For example, Tener (1965) performed an analysis of variance in seven skull measurements of the insular (*O. m. wardi*) and mainland (*O. m. moschatus*) populations revealing that the little difference between the two does not meet the conventional level of accepted subspecific difference of 90 %. In Tener's opinion, muskox would be a monotypic species showing remarkable geographic variability in absolute skull size, skull proportions, horn colour, coat colour and other features. However, for the purpose of this research, mainly focused on evaluating the body size reduction of the insular subspecies (see Appendix III), taxonomic issues can be left aside and the separation between *O. m. wardi* and *O. m. moschatus* is adopted here (in agreement with Groves & Grubb, 2011). The Greenland muskox, as well as its mainland counterpart, is a seasonal mixed-feeder living north of the tree line on the arctic tundra. It is characterized by adaptations to the arctic environment, protecting it from wind and water and minimizing heat loss, such as a barrel-shaped body with short legs and long hair covering the entire body except for the small area between the nostrils and lips (Myers et al., 2006). Predators of this species (other than humans) include brown bear (*Ursus arctos*), polar bear (*Ursus maritimus*) and wolf (*Canis lupus*). The white-faced muskox mainly compete with the reindeer (*Rangifer tarandus*) and roe deer (*Capreolus capreolus*).

The genus *Ovibos* appears to have evolved on the prairies, steppes and tundra of north central Asia in the Early Pleistocene (Tener, 1965). Fossil evidence suggests that *Ovibos* crossed to North America along the land bridge connecting Asia and Alaska in the late Middle Pleistocene (late Nebraskan or early Kansan Age), with the major crossing taking place at the end of the Middle Pleistocene (late Illinoian Age). The origin of the present species is difficult to determine because of the absence of a fossil record in central and northern Canada. Current hypotheses suggest that *Ovibos* moved northward to occupy northern Canada and Alaska as the last glacial ice sheets melted, while an isolated population in the Greenland refugium moved southward to occupy part of that country and the Canadian Arctic islands (Harington, 1970, 1977).

Although herds of *O. moschatus* native to Alaska and parts of Europe were driven to extinction through hunting pressures and climate fluctuations in the late 1800's, the species has been successfully reintroduced from surviving populations in Canada and Greenland, and is currently not listed as a threatened species. (e.g., Gray, 1990; Groves, 1997; Reynolds, et al., 2001; Rowell, 1990).

Fig. 5. White-faced muskox (*Ovibos moschatus wardi*) from Greenland (from www.flickr.com).

2.4. Introduced species and the spectacular case of the feral cattle from Amsterdam Island

Biological invasions are amongst the most significant threats to biodiversity, threatening individual species and producing major changes to ecosystem structure and functioning (see e.g., Frenot et al., 2005 and references therein). On the other hand, these unplanned experiments provide a unique opportunity to investigate the processes that lead to ecogeographical patterns in body size and morphological changes across latitudinal gradients and on islands. A number of intriguing studies have demonstrated that ecogeographical patterns can evolve in surprisingly short periods of time as an invasive species experiences repeated founder events and novel selection regimes (e.g., Sax, 2001; Campbell & Echternacht, 2003; Fridley et al., 2006; Patterson et al., 2006).

Bovids, and especially goats, are among the most destructive introduced herbivores in island ecosystems, causing direct and indirect impacts through overgrazing and trampling (Campbell &

Donlan, 2005). For this reason many populations have been removed and further eradication programes are under consideration.

Populations of goats, sheep and cattle have been introduced onto hundreds of islands all over the world, following the massive human expansion occurred during the Holocene/Anthropocene time (see e.g., Campbell & Donlan, 2005; Dilks & Wilson, 1979; Keegan et al., 1994; Frenot et al., 2005; Berteaux & Micol, 1992; Hall & Moore, 1986). Especially during European exploration and colonization before and throughout the eighteenth and nineteenth centuries, these animals were introduced onto many islands by sailors on long sea voyages. Some of these populations, despite the little time of isolation, developed peculiar features often shown by island endemic taxa, such as body size reduction - e.g., the feral cattle from Swona Island (Hall & Moore, 1986), Socotra Island (Damme & Banfield, 2011) and Amsterdam Island (see below), and the Soay sheep of St Kilda (Ozgul et al., 2009). In the majority of cases, scanty data on these populations are available and the body size reduction can only be inferred from indirect estimates or anecdotal reports. However, a more detailed scenario can be depicted in the case of feral cattle from Amsterdam Island (Fig. 6) which offers a very rare opportunity to assess the rapidity of demographic, life history and evolutionary (body size and bau-plan) responses of large mammals to the ecological simplicity of a very isolated, insular environment.

Fig. 6. Feral cattle from Amsterdam Island (from www.static.panoramio.com).

Amsterdam Island (37"40'S, 77"35'E) is a 55 km^2 volcanic dome in the Southern Indian Ocean, alfway between South Africa and Australia, that mainly arose during the period 400-200 kyr BP (Lebouvier & Frenot, 2007) (Fig. 7). The population of feral cattle of Amsterdam Island initially numbered five individuals which were imported in 1871 from La Réunion Island (west Indian Ocean) by a settler (Heurtin), who released them after a few months (Lesel, 1969). They are descendants of French stocks present on La Réunion Island which at that time included the following breeds: Jersey, Tarentaise, Grey Alpine and Breton Black Pied. The hypothesis that some individuals of the species *Bos indicus* may also have been introduced on the island was rejected on the basis of an accurate zootechnic analysis (Lesel, 1969). In 1988, the feral herd numbered about 2000 individuals and this introduced mammal directly threatened the endemic albatross, *Diomedea amsterdamensis*, and the autochtonous tree, *Phylica nitida* (Lebouvier & Frenot, 2007). As part of a conservation project, a first fence was erected across the island (Fig. 7) and all the cattle located south of the fence (n = 1059) were culled at the beginning of 1988 and 1989 in order to preserve the ecosystem of the island from cattle grazing and trampling (Micol & Jouventin, 1995).

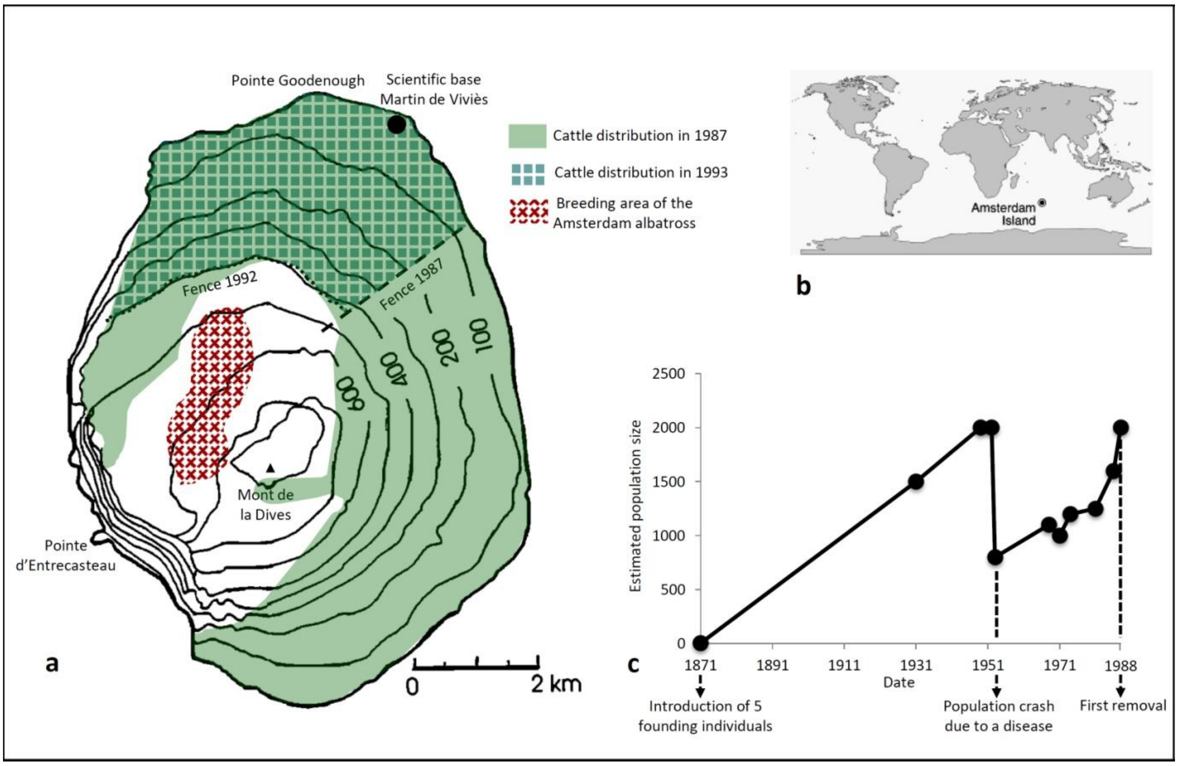


Fig. 7. Map of Amsterdam Island and general information about the feral cattle population: a) feral cattle distribution and breeding area of the Amsterdam albatross (map modified after Micol & Jouventin, 1995); b) location map of Amsterdam Island; c)feral cattle population size from introduction to first removal (data from Micol & Jouventin, 1995).

A small herd was left in the northern part and harvesting by monthly culling was used to stabilize the herd size, preventing the extension of the cattle range to the central plateau, including the breeding area of the Amsterdam albatross (Micol & Jouventin, 1995). Nevertheless, in the following years there was renewed colonization of this key area and further protection measures were undertaken. In February-March 1992, 327 individuals were culled and a second fence was erected, enclosing the residual herd within a 1225-ha area (Micol & Jouventin, 1995) (Fig. 7). Finally, in agreement with conservation policies, the last individuals of the population were eradicated in 2010. The first removal (1988-1989) offered a unique opportunity to collect information on the original feral population (Berteaux, 1993; Berteaux & Micol, 1992; Berteaux & Guintard, 1995) that had lived in the wild and had been free from artificial selection since 1871.

The descendant individuals of this population have been regarded as small-bodied by most authors (Lesel, 1969; Berteaux & Micol, 1992; Berteaux & Guintard, 1995) and estimates of body size reductions in adult Amsterdam Island cattle ranged from 45% to 68% of the mass of the ancestral breeds (see Appendix III).

Amsterdam cattle also exhibited marked shifts in life history traits including a variety of those associated with so-called fast life (formerly “r-selected”) strategies (Palombo, 2007; Van Heteren & De Vos, 2008; Meiri & Raia, 2010) including earlier age at first reproduction, expanded season of breeding, and female-biased mortality in comparison to continental populations (Berteaux & Micol, 1992; Hall & Hall, 1988; Halle & Moore, 1986; Lazo, 1994). Likely closely associated with the habitat shifts referred to above, shortening of metapodials in these cattle (Berteaux & Guintard, 1995) indicates a marked shift toward low-gear locomotion (Sondaar, 1977; see above).

Overview of fossil insular bovids: systematics, biochronology and palaeoecology

3. Overview of fossil insular bovids: systematics, biochronology and palaeoecology

Extinct insular endemic bovids, ranging in age from the latest Miocene to the early Holocene, are mostly recorded from some Asian and Western Mediterranean islands (Van der Geer et al., 2010; Palombo et al., 2013; Rozzi & Palombo, 2013, in press; Fig. 8).

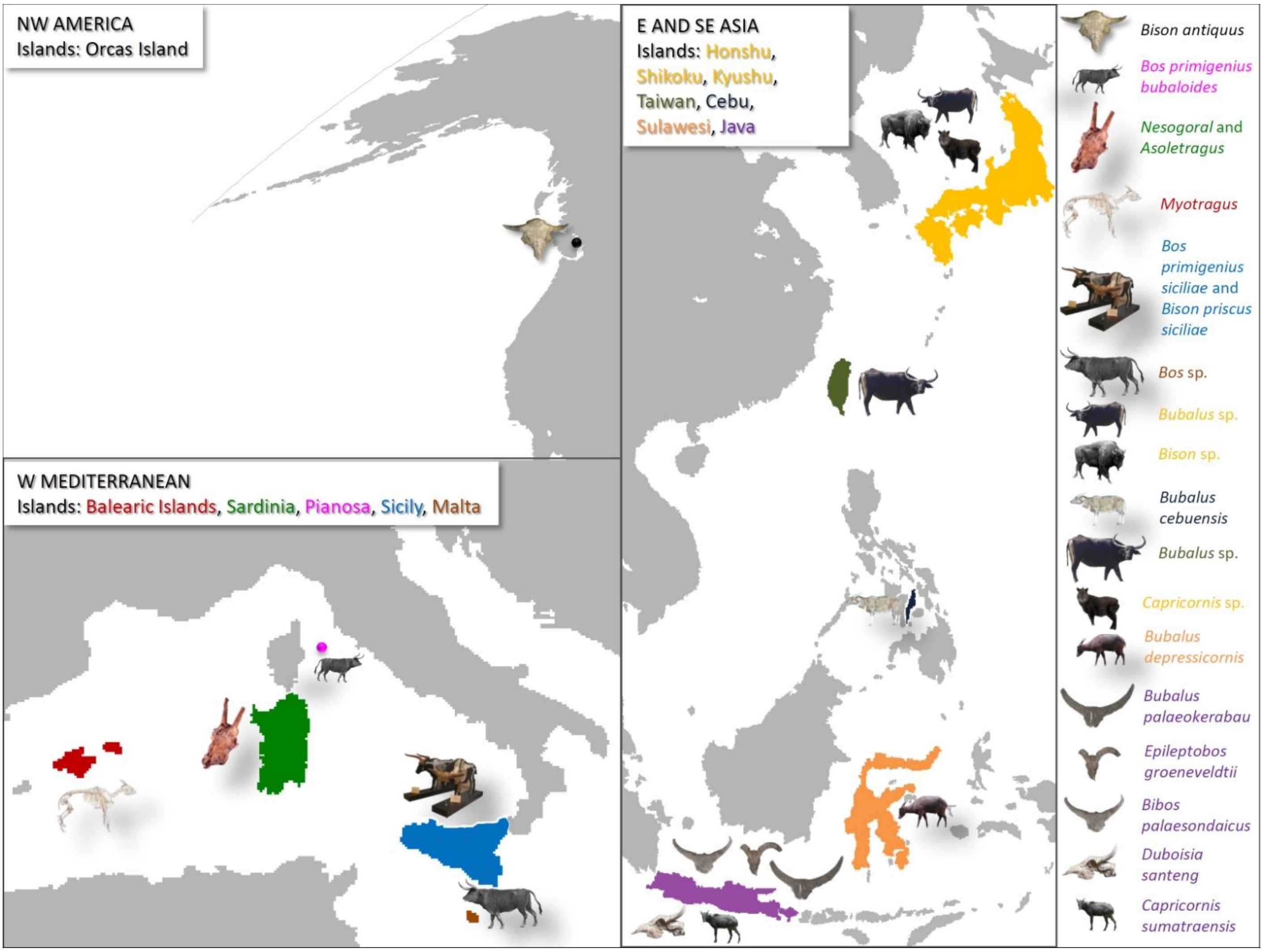


Fig. 8. Distribution map of Quaternary fossil insular bovids.

The only fossil insular population reported thus far from the Americas is that of the wild bison *Bison antiquus* from Orcas Island, Washington (skull from Ayer Pond radiocarbon dated to 11,990 ^{14}C yr BP; Kenady et al., 2011 ; Fig. 9), which was slightly reduced in size with respect to coeval Great Plains *B. antiquus* populations (Wilson et al., 2009; Kenady et al., 2011 ; see Appendix III).

Several bison finds in similar contexts on Orcas and Vancouver Islands dating between ~ 12,000 and 10,800 ^{14}C yr BP indicate an early postglacial land mammal dispersal corridor with reduced water barriers between mainland and islands (Wilson et al., 2009). In fact, shortly after recession of last Glacial Maximum ice, an evolving postglacial landscape nearly connected the San Juan Islands to both mainland Washington and Vancouver Island (Kenady et al., 2011).

Fig.9. Cranial (above) and frontal (below) views of adult male *Bison antiquus* cranium from Ayer Pond on Orcas Island (modified from Kenady et al., 2011).

A putative fossil insular bovid from Africa is the alcelaphine *Rusingoryx atopocranion*, documented in Kenya in Pleistocene deposits from which Mesolithic artifacts are reported (see Tyler Faith et al., 2010). Pickford & Thomas (1984) raised the hypothesis that this species was an insular taxon restricted to Rusinga Island but geological evidence does not support this scenario (Tyler Faith et al., 2010).

3.1. West Mediterranean islands

3.1.1. The middle-sized bovids from the Balearic Islands and Sardinia

The Balearic Islands is an archipelago located in the western part of the Mediterranean sea, composed by two different groups of islands: the Pityusic Islands (Eivissa [''Ibiza''] and Formentera) and the Gymnesic Islands (Mallorca [''Majorca''] and Menorca [''Minorca'']). Scanty remains of two bovids have been reported from an Early Pliocene deposit at Ses Fontanelles, Eivissa: a small-sized bovid identified as perhaps a new species of the genus *Tyrrhenotragus* and another bovid cited as Caprinae indet. (see Van der Made, 2005; Abbazzi et al., 2008; Palombo et al., 2013). The only large mammals recorded from the Gymnesic Islands belong to six chronospecies of the genus *Myotragus* (Mallorca), which evolved in isolation for more than 5 Ma (Early Pliocene-early Holocene) before becoming extinct somewhere between 3700 and 2040 years BC (Bover et al., 2010). Evolutionary patterns within *Myotragus* include body size reduction, reduction in number of incisors and premolars, and changes in skull and postcranial morphology (Bover, 2004). The most advanced species, *Myotragus balearicus* (Fig. 10) was no more than 50 cm tall at the shoulder, weighting about 26 kg (see references in Appendix III); its eye sockets almost faced forward, enabling stereoscopic vision; there was a single, ever-growing incisor in its mandible and its lower limb bones were dramatically shortened (Bover, 2004).

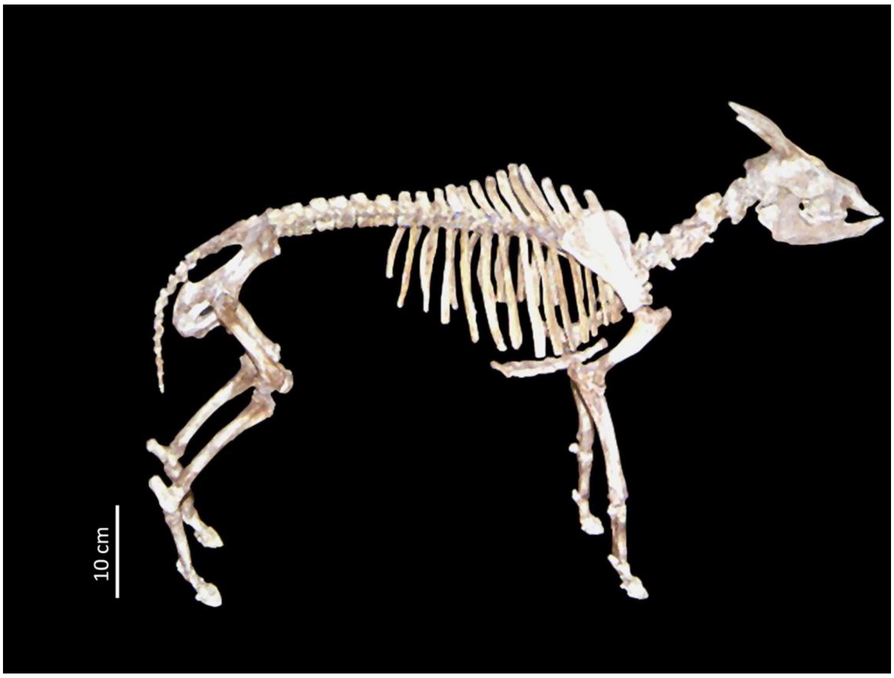


Fig. 10. Mounted skeleton of *Myotragus balearicus* from Majorca (courtesy of Pere Bover).

Indeed, Balearic bovids acquired a slow, powerful walking gait by reducing limb length in a carnivore-free environment. Since no bovid remains are known from the Middle Miocene of the Balearic Islands, the ancestor of *Myotragus* presumably reached Mallorca sometime during the Messinian Salinity Crisis (MSC) by a temporarily emerged filter route (Palombo et al., 2013). Some remarkable similarities can be traced between *Myotragus* and both Miocene archaic 'goats' *Aragoral* (late Vallesian, MN10) and *Norbertia* (Turolian–Ruscinian boundary, MN13/14), which had robust metapodials, weak upper premolar styles and reduced second lower premolar, and therefore, eligible as ancestors of the Balearic genus (Palombo et al., 2013).

For decades it was believed that only one bovid occurred during the Early Pleistocene in Sardinia: the middle-sized *Nesogoral melonii* (Fig. 11a), known from a few remains retrieved from bone-breccias filling the karstic fissures of the Capo Figari promontory (north-eastern Sardinia). New findings allowed the identification of a new genus and species, *Asoletragus gentryi* (Fig. 11b,c; Monte Tuttavista; Palombo et al., 2006a), a strange small bovid "with straight, almost conical horn cores slightly divergent from the sagittal plane, very close to each other at their bases and strongly inclined backwards" (Palombo et al., 2006a).

The majority of remains of bovids of the so-called '*Nesogoral* group' come from Monte Tuttavista (Orosei, western Sardinia) (morphotype A *Nesogoral* sp. 1 aff. *N. melonii* and morphotype B *Nesogoral* sp. 2), from a few sites ranging in age from the Late Pliocene (Mandriola, *Nesogoral* sp.) to Early Pleistocene (Capo Mannu, *Nesogoral* sp.), and from an uncertain locality in the Campidano area (*Nesogoral cenisae*) (Abbazzi et al., 2004; Van der Made, 2005; Palombo, 2009b; Palombo et al., 2006b, 2013). *Asoletragus* and *Nesogoral* show a combination of apomorphic and plesiomorphic features that make their origin and evolutionary relationships difficult to ascertain, although Palombo et al. (2013) suggest that the ancestor of *Nesogoral* should be searched among the primitive Caprini/Hippotragini stock widespread in Europe during the Late Miocene. In contrast to *Myotragus*, the Sardinian bovids likely retained the characteristics of long leg bones and the ability to run, due to the presence of a top predator, the running hyaena *Chasmaporthetes melei*. Neither hyaenids nor bovids can easily swim or float, so it is rational to suppose that their ancestors did not cross water to reach Sardinia. Most likely, they reached the island by a selective path (maybe a landbridge) sometime during the MSC (Palombo et al., 2013).

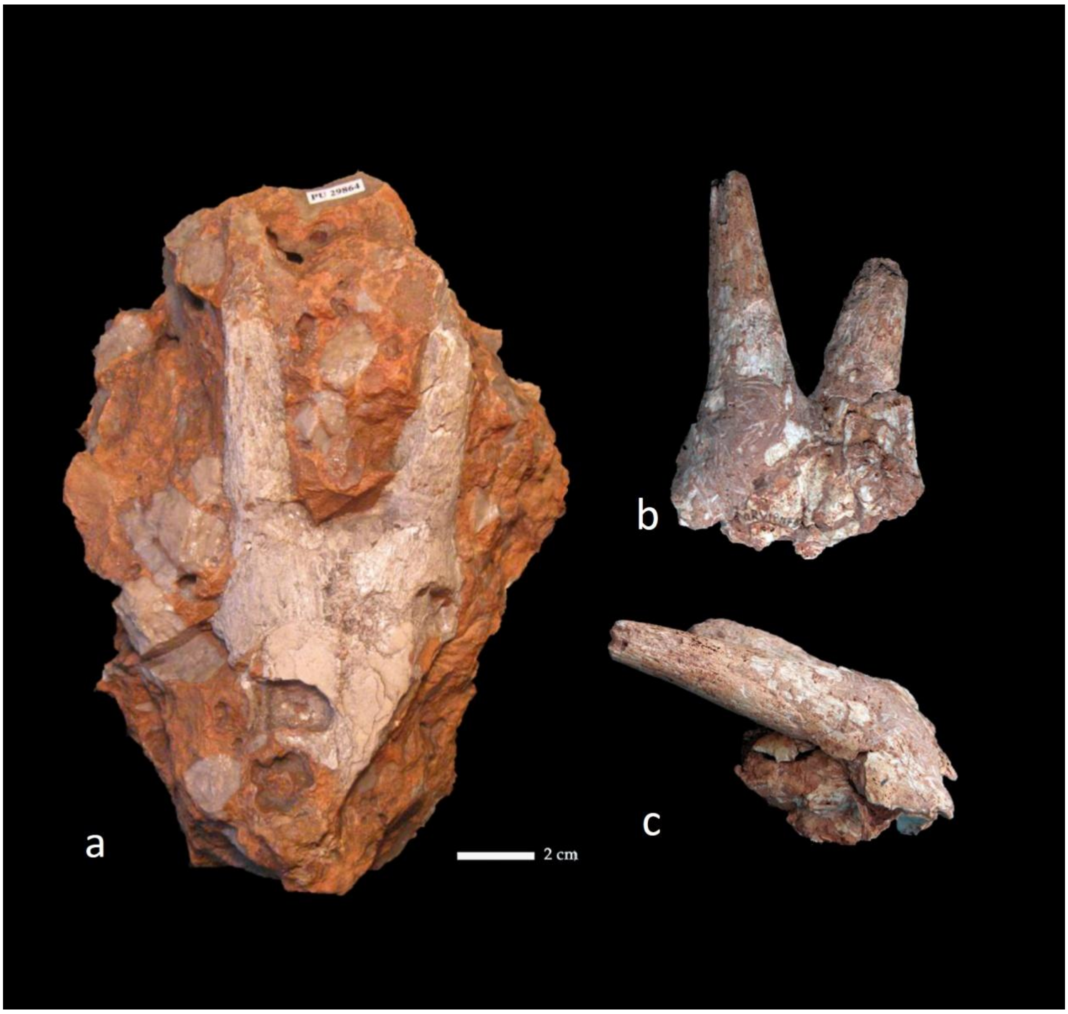


Fig. 11. *Nesogoral melonii*, (Dehaut, 1911) holotype (a) from Capo Figari (North-Eastern Sardinia). "Museo di Geologia e Paleontologia". Turin University (photo by Roberto Rozzi). *Asoletragus gentryi*, from fossiliferous pocket "VI 3", Monte Tuttavista: incomplete skull (ORVI1179) in dorsal (b) and lateral (c) view. Scale bar: 2 cm (modified from Palombo et al., 2013).

3.1.2. The large Bovini from Sicily, Malta and Pianosa

Bovids slightly reduced in size have been recorded in late Middle Pleistocene to Late Pleistocene (about 32ka) deposits of Sicily (*Bos primigenius siciliae* and *Bison priscus siciliae*; Brugal, 1987; Bonfiglio et al., 2008; Masini et al., 2008) and have been claimed to be present on Malta (*Bos*. sp.; Hunt & Schembri, 1999) and Pianosa (*Bos primigenius bubaloides*; Azzaroli, 1978).

Sicily

Bos primigenius siciliae (Fig. 12b) reduced its size of about 20% with respect to *Bos primigenius,* and also *Bison priscus siciliae* (Fig. 12a) slightly reduced its size (Brugal, 1987). Both taxa closely resemble the respective continental ancestors in morphology. The Sicilian endemic bovids were found in local faunal assemblages (LFAs) referred to the late Middle-Late Pleistocene "*Elephas mnaidriensis*" (such as Puntali Cave, Carini, PA, Sicily; Burgio et al., 1983) and San Teodoro-Pianetti Sicilian faunal complexes (FCs). In particular, they are still documented at San Teodoro Cave (Acquedolci, North-Eastern Sicily) in a fossiliferous layer overlaying a flowstone for which a radiometric 230Th/234U date of 32±4 ka is available (Bonfiglio et al., 2008). These large Bovini shared several predators (e.g., *Panthera leo spelaea*, *Crocuta crocuta spelaea*, *Ursus arctos*, *Canis lupus*) and competitors (e.g., *Hippopotamus pentlandi*, *Palaeoloxodon mnaidriensis*, *Cervus elaphus siciliae*, *Dama carburangelensis*). The composition of the "*Elephas mnaidriensis*" FC suggest that large mammals, including the ancestors of the Sicilian aurochs and bison, dispersed from the Italian Peninsula through a filtering barrier, such as a partially emerged sea floor or a swampy lagoon system (Masini et al., 2008). Following the emersion of the Sill in the Messina Strait during the Last Glacial Maximum (Antonioli et al., 2012), new mainland species entered Sicily (including, among others, *Homo sapiens* and *Bos primigenius*) replacing the last endemic Sicilian large mammals as documented in the completely renewed continental fauna of the Castello FC (Masini et al., 2008).

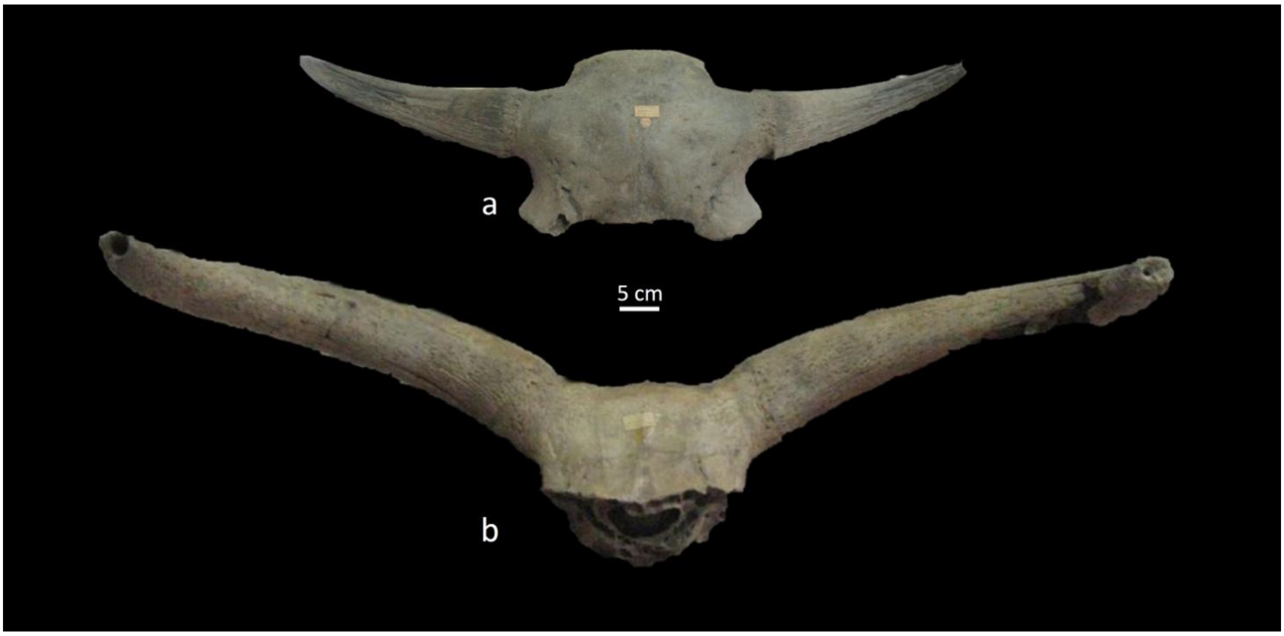


Fig. 12. Incomplete skulls of *Bison priscus siciliae* (a) and *Bos primigenius siciliae* (b) from Puntali Cave (Carini, PA, Sicily) in frontal view. Specimens 566 and 569 stored at Museo Gemmellaro dell'Università di Palermo (photograph by Roberto Rozzi).

Malta

It is worth noting that, during the last Glacial, when the sea level dropped about 130 m, the south-western corner of Sicily and the Malta-Gozo insular system were connected by a land bridge (Furlani et al., 2012). Accordingly, some Sicilian large and small mammals, including *Bos primigenius*, possibly dispersed to Malta, where similar taxa have been retrieved from the "Red earth layers" of Ghar Dalam cave, which date back to about 18 ka (Zammit-Maemple, 1989; Hunt & Schembri, 1999). Among these species, the only bovid is an aurochs (*Bos* sp., likely *Bos primigenius*), slightly reduced in size with respect to *Bos primigenius siciliae*.

Pianosa

Another small endemic ox, *Bos primigenius bubaloides* (Fig. 13) has been reported from Pianosa (Azzaroli, 1978), a small island of the Tuscan Archipelago (northern Tyrrhenian Sea), where fossil vertebrates were found in bone-breccias and caves eroded by the sea in the coastal cliffs. According to Azzaroli (1978), the ancestors of the most archaic fauna (including remains of the aurochs, together with *Ursus arctos*, *Equus hydruntinus*, *Equus* sp., *Capreolus capreolus*, *Cervus elaphus*) would have dispersed to Pianosa during the Last Glacial Maximum, but this hypothesis needs to be supported by additional evidence.

Fig. 13. Left metacarpal (a) and distal fragment of left humerus (b) of *Bos primigenius bubaloides* from Pianosa in dorsal view. Specimens 8529 and 8526 stored at Museo di geologia e paleontologia dell'Università di Torino (photograph by Roberto Rozzi).

3.2. East and Southeast Asia

3.2.1. Java, Sumatra and Sulawesi

The fossil record of Java, one of the largest Indonesian islands, is undoubtedly intriguing (Van den Bergh et al., 1996; Widianto et al., 2001, Hertler & Volmer, 2008). During the Pleistocene, the Sunda Islands, including Java, were frequently connected with the Southeast Asian mainland and with each other. During glacial phases, the Sunda Shelf was periodically exposed because sea level dropped between about 50 and 200 m (Voris, 2000). These temporary paths between the Sunda Islands and the Southeast Asian mainland allowed a few faunal elements of Siva-Malayan origin, including bovids, to colonize Java.

Fossil bovids from Java, commonly found in the "*Stegodon-Homo erectus* fauna" (Early-Middle Pleistocene) include at least four species: *Bubalus palaeokerabau* (Fig. 14a), *Bibos palaesondaicus* (Fig. 14b), *Epileptobos groeneveldtii* (Fig. 14c) and *Duboisia santeng* (Fig. 15). *Duboisia santeng*, possibly the only true insular endemic bovid of the fauna, was a small boselaphine (Hooijer, 1958; average body mass 54 Kg; Rozzi et al., 2013) with short and keeled horn cores, whose remains are typical of the Trinil H.K. and Kedung Brubus Faunal units (Van den Bergh et al., 2001). According to Rozzi et al. (2013), this species, which was about 70 % reduced in size with respect to its putative ancestor *Boselaphus namadicus* of the Siwaliks, was a forest-dweller and a browser, only occasionally feeding on harder vegetation. *Bubalus palaeokerabau* was a large water buffalo, with extremely long horn cores (longer than the ones of the extant *Bubalus arnee;* see Groves & Grubb, 2011 for taxonomic notes) characterized by a triangular cross section. This would suggest that the Javanese extinct buffalo could had been slightly larger than the extant species, taking into account the similar bauplan shared by these taxa. *Bibos palaesondaicus*, perhaps the ancestor of the extant *Bos javanicus* (Hooijer, 1958), had horn cores characterized by an oval cross-section and curving backwards. *Epileptobos groeneveldtii*, was a leptobovine with large horn cores, rising far behind the orbits, and a triangular occiput, with the upper angle outlined by the parieto-occipital eminence.

Fossil bovids of the "*Stegodon-Homo erectus* fauna" coexisted with various predators and competitors (see Appendix IV for a complete list). In fact, at the time of the Trinil HK faunal unit, the Javanese carnivore guild included a tiger – *Panthera tigris* – and a canid – *Cuon* (*Mececyon*) *trinilensis*. In the subsequent Kedung Brubus faunal level, despite the disappearance of *C.*

trinilensis, a marked increase of the predatory pressure was produced by the occurrence of the large hyena *Pachycrocuta brevirostris* (Hertler & Volmer, 2008). Moreover, not only carnivores fed on bovids, but also reptiles and possibly *H. erectus*, as testified by cut marks observed on long bones of *D. santeng* recovered in Sangiran (Bouteaux & Moigne, 2010).

Several teeth of the serow *Capricornis sumatraensis* were recovered by Dubois from Goea (= cave) Djimbe, central Java (see Hooijer, 1958). This species, together with *Bubalus arnee* and *Bibos* sp., characterizes the Late Pleistocene Javanese Punung bovid fauna (80-60 ka; Van den Bergh et al., 2001). At that time, the Sunda Islands were part of the mainland. In fact, fossil remains of *C. sumatraensis* were also retrieved from several caves of Central Sumatra, together with scanty remains of *Bos javanicus*, which is now extinct in Sumatra, and *Bubalus arnee* (Holocene; Hooijer, 1958).

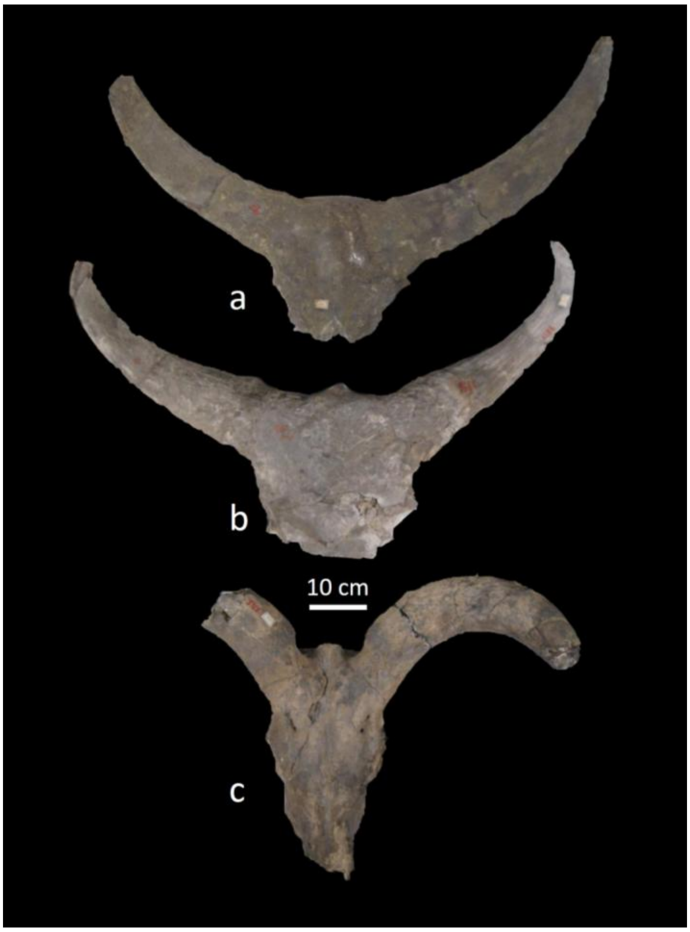


Fig. 14. Incomplete skulls of *Bubalus palaeokerabau* (a) and *Bibos palaesondaicus* (b) from Trinil (Java); incomplete skull of *Epileptobos groeneveldtii* (c) from Kedung Nojo (Java). Specimens 58, 2798+8839 and 514+537+2765a stored at Naturalis Biodiversity Center (Leiden, The Netherlands) (photographs by Roberto Rozzi).

Fossil bovids from Sulawesi includes, in addition to the already mentioned remains of fossil anoa (see above), few remains of *Bubalus arnee*.

Fig. 15. Incomplete skull of the endemic bovid *Duboisia santeng* from Java, lectotype of the species in frontal (on the left) and lateral view (on the right) (Trinil, Java). Naturalis Biodiversity Center (Leiden, The Netherlands) (photograph by Roberto Rozzi).

3.2.2. Philippines, Taiwan and Japan

A dwarf fossil buffalo, *Bubalus cebuensis* (Fig. 16), was described by Croft et al. (2006) on the basis of a partial skeleton found in soft karst deposits near Balamban, Cebu Island, Philippines. This species, likely Late Pleistocene or Holocene in age, is characterized by a more robust skeleton compared to that of the extant anoas and displays a mixture of characters shared with *B. arnee* and extant *B. mindorensis* (Croft et al., 2006). *B. cebuensis*, weighing about 160 kg, is smaller than *B. mindorensis* and larger than *B. depressicornis*. The small size of this species relative to other *B.* (*Bubalus*) should be attributed to island dwarfing, and the long fossil record of *Bubalus* in Asia would suggests that both *B. mindorensis* and *B. cebuensis* might be dwarf forms of *B. arnee* that arose after dispersal to and within the Philippines (Croft et al., 2006). Details of such a scenario, i.e. whether *B. cebuensis* would have evolved during the Holocene after Cebu's isolation or during the Late Pleistocene in the larger Negros–Panay Faunal Region, remain hypothetical.

Fig. 16. Artistic reconstruction of the dwarf fossil buffalo *Bubalus cebuensis* from Cebu Island, the Philippines. This drawing shows the extinct dwarf water buffalo in proportion to the extant *Bubalus mindorensis* from Mindoro and a full-sized extant water buffalo (source: John Weinstein and Velizar Simeonovski; courtesy of Lawrence Heaney).

Fossil bovids have been claimed to be present on Taiwan by several authors (e.g., Hayasaka, 1942; Otsuka, 1984; Otsuka & Shikama, 1978; Van den Bergh, 2001). Scanty remains of a buffalo slightly reduced in size, *Bubalus* sp., were retrieved from Middle Pleistocene deposits in the Chochen district and Tainan prefecture (= *Bibos* sp. in Hayasaka, 1942; = *Bison* in Otsuka, 1984). This large buffalo had various predators (*Panthera* sp. and maybe *Tomistoma taiwanicus*) and competitors (e.g., *Cervus sintikuensis*, *Cervus* (*Rusa*) sp., *Cervus* (*Sika*) sp., *Mammuthus armeniacus taiwanicus*, *Rhinoceros sinensis hayasakai*). Furthermore, specimens ascribed to *B. arnee* have been reported by Yuzhu & Xingren (1995) from the Late Pleistocene Local Faunal Assemblage (LFA) of the Western Taiwan Strait, a local branch of the *Ailuropoda-Stegodon* fauna occurring along the Southeastern coast of China.

Several remains of Bovini slightly or not reduced in size have been reported from the Quaternary of Japan (see Appendix IV for a complete list of predators and competitors). One of the first representatives of the genus *Bison*, the gaur-like bison *Bison* (= *Leptobison) hanaizumiensis*

Matsumoto & Mori (1956, 1968), was erected on the basis of remains found at Kanamori (Iwate prefecture; Fig. 17; Matsumoto et al., 1959). The occurrence of *Bubalus* sp. in the early Middle Pleistocene of Honshu-Shikoku-Kyushu and Bisan-Seto Straits (West Japan) (Taruno & Yamamoto, 1978; Kawamura, 1991; Van den Bergh et al. 2001) mirrors that of the same (or a similar) taxon on Taiwan. The similarity of the faunal turnover in these regions during the Pleistocene, possibly related to the same Chinese mainland faunal source, was noticed by Van den Bergh et al. (2001). According to these authors, the increased mammalian diversity recorded from Japan at the Early/Middle Pleistocene transition would suggest a replacement of the original insular fauna by a more continental fauna, as in Java and, possibly, Taiwan as well.

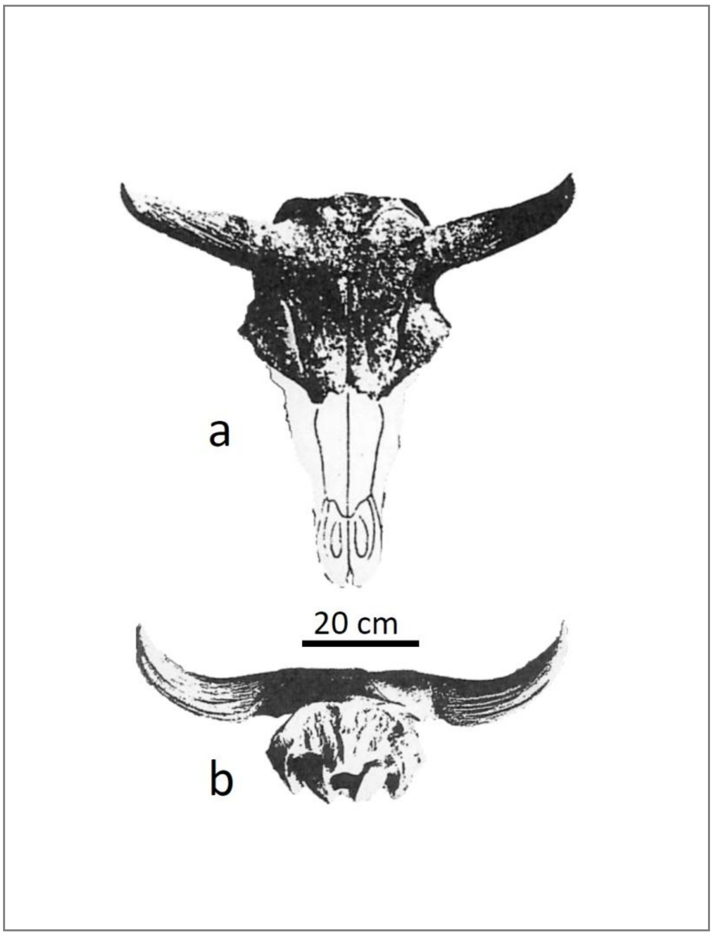


Fig. 17. Incomplete skull of *Bison* (= *Leptobison*) *hanaizumiensis* from Kanamori (Hanaizumi, Iwate prefecture) in frontal (a) and occipital (b) view (modified from Matsumoto et al., 1959).

The latest Pleistocene fauna of Japan includes the serow (see above) and large bovids (*Bison priscus*, *Bos primigenius*, *Bison* sp.) (see Hasegawa et al., 2009 and references therein) that colonized Honshu, Shikoku and Kyushu from the north, likely via a land bridge connection between the Japanese archipelago and the Asiatic mainland during the sea-lowering of the late Pleistocene (around 20,000 years BP; see Millien-Parra & Jaeger, 1999). These Bovini were claimed to be present at Kanamori (Iwate prefecture; see Hasegawa et al., 2009 and references therein), while other remains ascribed to the genus *Bison* have been reported from Kuzuu (Tochigi prefecture; Hasegawa et al., 2009), Shoudo Island (Kagawa prefecture; Matsumoto, 1918) and Urakawa (Hokkaido; Hasegawa, 1972). The majority of these new immigrants went extinct between 20,000 and 10,000 years BP, possibly in connection with human hunting activities (see e.g., Kawamura, 1991), and were replaced by the modern Holocene fauna, almost identical to that of the present day.

Materials and Methodology

«The first was to never accept anything as true which I could not accept as obviously true; that is to say, to carefully avoid impulsiveness and prejudice, and to include nothing in my conclusions but whatever was so clearly presented to my mind that I could have no reason to doubt it.»

René Descartes, Discourse on the Method, 1637

4. Materials and Methodology

4.1. Database

The database includes linear measurements (recorded to the tenth of a millimeter) of 6 extant and 27 extinct insular bovid species. These measurements were used for estimating body mass and evaluating morphological changes (see Appendix III for body mass estimates and Appendix V for data on hypsodonty and low-gear locomotion). The sources for these data and a complete list of specimens, stored in 14 European and American museums, are reported in Appendix I. In addition to these measurements, I have added 10 predictor variables (described-below) describing geographic, ecological and climatic conditions of the species or the 15 focal islands (see Appendix II for characterization of focal islands).

4.2. Body mass estimate

Body size may be regarded as a central aspect of mammal adaptive strategy, since it is strictly related to animal architecture and physiology, ecology and ethology (e.g. Hutchinson & MacArthur, 1959; McNab, 1971, 1990; Van Valen, 1973; Schmidt-Nielsen, 1975; Eisenberg, 1981; Janis, 1982; Robinson & Redford, 1986; Alexander et al., 1988; Palombo, 2009a; Lomolino et al., 2012). Body mass has been considered the best proxy of body size (Gingerich et al., 1982) and different allometric equations (based on cranial, teeth or long bones dimensions) have been proposed to estimate the body mass of fossil species (see inter alios Anderson et al., 1985; Van Valkenburgh, 1990; Damuth & MacFadden, 1990; Janis, 1990; Alberdi et al., 1995; Martinez & Sudre, 1995; Delson et al., 2000; Palmqvist et al., 2002; Giovinazzo, 2003; Christiansen, 2004; Palombo & Giovinazzo, 2005; Mendoza et al., 2006; De Esteban-Trivigno & Köhler, 2011). The body mass of the focal species were estimated by using the predictive equations with the lowest predictive errors among those based on dimensions measurable on the available specimens (Appendix III), then averaging all the obtained body masses for each species. In a few cases, body mass estimates were based on data given in publications or directly taken from published sources (see Appendix III for details and references).

4.3. Description of variables

In order to investigate the island rule pattern and the key factors influencing body size divergence, I calculated the first response variable as the mass of the insular population divided by that of its putative mainland relative, the latter based on geographic proximity and taxonomic designation (S_i = body size divergence, *sensu* Lomolino, 2005).

Predictor variables included body mass of mainland relatives M (which serves to investigate the island rule pattern) and variables most closely associated with alternative hypothesis for body size evolution in large mammals (see above).

Island area (in km^2) and isolation (in km) were estimated by integrating the present-day scenario of each focal island (as taken from databases of islands of the world, including the UN Island database - http://islands.unep.ch/Iindex.htm) with palaeogeographic data, sea level changes, extension of tectonically undisturbed marine deposits, and offshore bathymetry (see Appendix II for details and sources). Island isolation was measured as the straight-line distance to the nearest mainland area with the reference mainland population. Although more complex measures of isolation exist, I chose this one because it is widely used in biogeographic studies (see e.g., Lomolino et al., 2012, 2013; Van der Geer et al., 2013) and for its simplicity and comparability.

I calculated maximum elevation using Google Earth's 3-D terrain function and I expressed topographic complexity with an index calculated as maximum elevation divided by island area.

I used two variables to describe the trophic characteristics and habitat of the focal species, including whether they were browsers, grazers or mixed feeders, and whether they inhabit Forest, Heavy Cover, Light Cover and Open habitats (based on descriptions provided by the University of Michigan's Animal Diversity Web, http://animaldiversity.ummz.umich.edu/site/index.html and several publications - see Appendix IV). These four general categories of habitat are widely used in palaeoecology: the 'Forest' category includes, naturally, forest dwelling taxa (scrub-forest, forest, rainforest); 'Heavy Cover' category includes taxa which live in bush, woodland, swamp, and near-water habitats; 'Light Cover'category gathers taxa that inhabit light bush, tall grass, and hilly areas and 'Open' category is that of taxa living in edge or ecotone, open country, and arid country (Kappelman et al., 1997; DeGusta & Vrba, 2003, 2005a, b; Rozzi & Palombo, 2013; Rozzi et al., 2013).

Variables describing ecological conditions of the focal insular communities included large mammal species richness and number of predators or competitors most likely to directly interact with the focal insular taxon. Since body size evolution may also be influenced by ecological interactions with non-mammalian predators and competitors (e.g., large reptiles, raptors and avian competitors), I decided to include them in the analyses. Although high dispersal abilities of these species relative to non-volant mammals suggests that ecological pressures from these taxa are less variable and, therefore, less likely to account for inferred evolutionary changes in body size of the focal, mammalian populations (see e.g., Lomolino et al., 2012), they should be taken into account when analyzing body size variation of island bovids, being in some cases their only predators or competitors. Modern humans were included among predators only in cases when interaction with the focal species has been well documented since the early Holocene or at least in historical times. The number of predators and competitors were estimated by first developing a list of all other mammals co-occurring on the focal island, and then consulting general references on the diet and habitats of those species to determine which ones were likely to be significant predators or competitors of the focal insular taxon (see Appendix IV for sources and details).

Time in isolation TI (in years) is an estimate of the duration of isolation of the focal species (time of extinction or the present in the case of living species - time of colonization) and it is a crucial variable for evaluating temporal variation of body size divergence. In the majority of cases only rough estimates were available (especially as regards fossil species) so I decided to use an order of magnitude (100 for hundreds of years, 1000 for thousands of years, etc.). This approach was followed in order to avoid too imprecise and uncertain estimates. Time in isolation was also expressed in generations. The number of generations or biological time (I) experienced by the population is equal to the chronological time experienced (TI) divided by generation time (G). I estimated the generation time from my body mass estimates using the following allometric scaling function developed for placental mammals (see Gingerich, 1993; Hamilton et al., 2011; Evans et al., 2012):

$$G_{plac} = 0{,}175M^{0{,}259}$$

G_{plac} is generation time in years for placentals and M is body mass in grams. 95% confidence interval for the slope of the placental regression is 0.247-0.272. This regression does not incorporate the effects on generation time of varying r- and K-selection strategies, but such detailed life history information is difficult to extract from the fossil record (see Evans et al., 2012). For estimates of time in isolation and number of generations see Appendix IV.

4.4. Evolutionary rates of body size divergence

We calculated evolutionary rates of body size divergence of insular bovids in order to assess whether this phenomenon is influenced time in isolation, becoming more developed for bovid populations with longer residence times on the islands. Evolutionary rates were expressed in darwins (Haldane, 1949; Millien, 2006), (d), as (Log x2-Log x1)/Dt, where a trait evolved from x1 to x2 over a time Dt in millions of years (= TI expressed in millions of years). Log is the natural logarithm, and the variable x is, in this case, body mass. Rates in darwins are inversely related to the time interval over which they are calculated (see Gingerich, 2001; Millien, 2006).

We also expressed evolutionary rates in haldanes (Gingerich, 2001; Evans et al., 2012), (H), as D/I, where D = d/s_p. The proportional difference between the sample means (d = $\bar{y}_2$-$\bar{y}_1$) is, in this case, the difference between the insular body mass and the ancestral body mass; s_p is the pooled standard deviation of the samples; I is the time interval between the samples, I = $t_2 - t_1$, estimated in generations. All the measurements of the samples were logged (logs to the base *e*) because of the geometric normality of biological variation (Gingerich, 2001). Body mass standard deviation (s_p) was estimated as (ln(maximum) – ln(minimum))/4, based on an estimate that 95% of normally-distributed observations are within two standard deviations of the mean (see Evans et al., 2012). The number of generations or biological time (I) experienced by the population was calculated as above. Estimates of evolutionary rates of body mass divergence of focal insular bovids are included in Appendix IV.

4.5. Hypsodonty

Variations in molar crown height, or hypsodonty, is one of the best documented among various dental adaptations that especially herbivorous mammals are known for (see e.g., Van Valen, 1960; Fortelius, 1985; Janis, 1988; Janis & Fortelius, 1988; Mendoza & Palmqvist, 2007; Damuth & Janis, 2011; Kaiser et al., 2013). Hypsodonty has been extensively used in palaeontology as an indicator of the feeding preferences and/or habitat selection of extinct ungulates (see e.g., Mendoza & Palmqvist, 2007 and references therein). As a quantitative measure of hypsodonty, I used the hypsodonty index (HI), defined by Janis (1988) as the height of the unworn M3 crown divided by the occlusal width of the same tooth. Examples of teeth varying in their hypsodonty are depicted in Fig. 18. Hypsodont teeth have a very high tooth crown, mesodont teeth have an intermediate tooth crown, and brachydont teeth have a comparatively low crown height. Janis (1988) defined ‘‘degrees of hypsodonty’’ based on the hypsodonty index (HI): brachydont HI < 1.5; mesodont HI > 1.5 < 3.0; hypsodont HI > 3.0 < 4.5; highly hypsodont HI > 4.5.

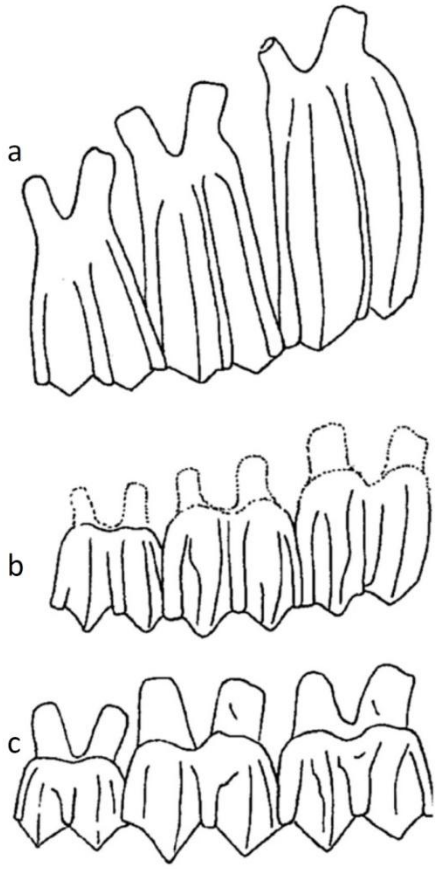


Fig. 18. Examples of hypsodont, mesodont and brachyodont molars, from a goat (a) *Capra hircus* (hypsodont); (b) *Cervus duvaucellii* (mesodont); and (c) white-tailed deer *Odocoileus virginianus* (brachyodont) (from Fortelius & Solounias, 2000).

In order to assess whether hypsodonty is shared by the majority of insular bovids independently from the abrasiveness of the current diet, I compared HI values with two cranial measurements showing a significant correlation with diet and habitat (see Fig. 19; Mendoza & Palmqvist, 2007):

- JLB (the anterior jaw length, measured from the base of the first incisor to the premolar/molar boundary) which allows characterization of the craniodental morphology of those species from an open habitat, a mixed habitat and a closed habitat;

- MZW (muzzle width, measured at the outer junction of the boundary between the maxilla and the premaxilla), which allows characterizing aspects of the craniodental morphology of grazers compared with non-grazing species, including mixed feeders and browsers.

HI is a size-independent variable, but the other measurements were size-adjusted by dividing each of them by the lower molar tooth row length, measured along the base of the teeth (Mendoza & Palmqvist, 2006).

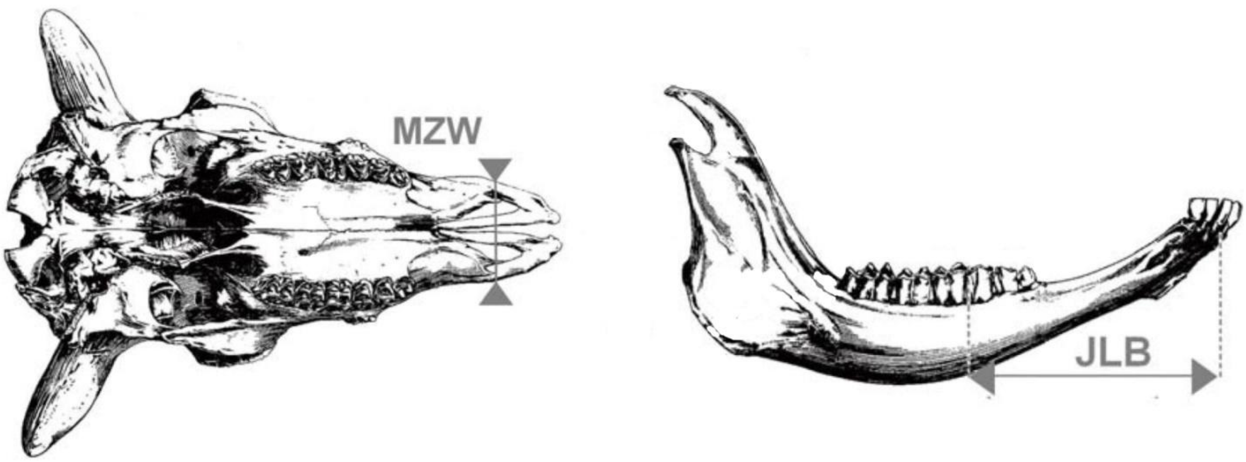


Fig. 19. Description of measurements showing a significant correlation with diet (MZW) and habitat (JLB) (modified from Mendoza & Palmqvist, 2006).

In order to increase the accuracy of this analysis I mainly used species whose diet and habitat were known from direct observation or from other studies (see e.g., Rozzi et al., 2013 as for *Duboisia santeng*).

To further test my hypotheses, I also verified whether hypsodonty (in this case, the response variable) is significantly correlated with resource limitation (island area) and number of competitors and predators (predictor variables), by using different statistical approaches (see below).

4.6. Low-gear locomotion

The significance of the variation of this pattern in both extant and fossil bovids can be investigated by examining the role that habitat selection and predatory pressure had on each island either in driving the acquisition of a low-gear locomotion or in maintaining/increasing a cursorial aptitude.

Evaluating the change in relative proportions of limb elements of fossil insular bovids is extremely difficult not only because of the doubtful phylogenetic relationships of some taxa, but also because remains belonging to a single individual are extremely rare.

Limb bone shortening cannot be explained by a simple allometric downscaling of the animal, because the relative proportions of limb elements are drastically changed, as is evident when comparing their lengths. I defined a hindlimb shortening index (HSI) and forelimb shortening index (FSI) as the ratio of length of metacarpal/length of radius (LMc/LR) and length of metatarsal/length of tibia (LMt/LT) (normalized with respect to the total length of the forelimb and hindlimb long bones, respectively; see Fig. 20) and I compared values obtained for extant insular species with that of their ancestors and with the data available for the fossil species. Since long metapodials are not necessarily slender and vice versa, I also calculated the robusticity index RI (transverse diameter at the diaphysis/total length*100) of metapodials of both extant and fossil species (see Fig. 20).

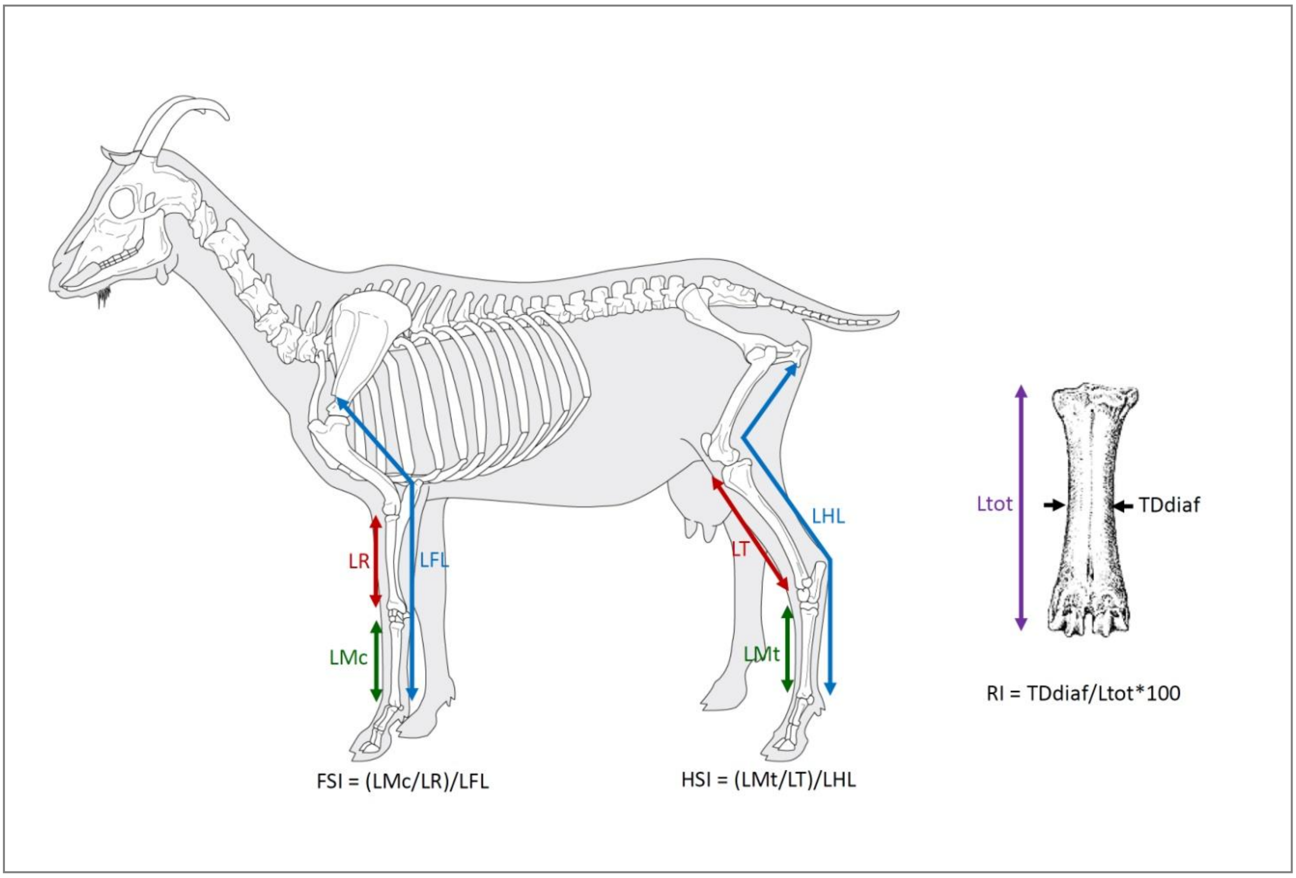


Fig. 20. Definition of hindlimb shortening index (HSI), forelimb shortening index (FSI) and robusticity index (RI) on a skeleton of a goat and on a metapodial of a cattle. See text for description of measurements.

In order to test whether the morphological characters associated with low-gear locomotion (i.e., shortening of limb length and metapodials) should be most pronounced for bovids living on islands of greater topographic complexity and with fewer predators and competitors, I investigated the relationship between these variables by means of different statistical approaches.

4.7. Statistical analyses

All the following analyses were performed with JMP 10, a software for statistics developed by the JMP business unit of SAS Institute.

4.7.1. Regression analysis

Simple linear regression is an approach to modeling the relationship between a scalar dependent variable *y* and one explanatory variables denoted *x* (see Fig. 21). Given a data set $\{y_i, x_{i1}, \ldots, x_{ip}\}^n_{i=1}$ of *n* statistical units, a linear regression model assumes that the relationship between the dependent variable y_i and the *p*-vector of regressors x_i is linear. This relationship is modelled through a disturbance term or error variable ε_i — an unobserved random variable that adds noise to the linear relationship between the dependent variable and regressors. Thus the model takes the form

$$y_i = \beta_1 x_{i1} + \ldots + \beta_p x_{ip} + \varepsilon_i = x_i^{\mathrm{T}}\beta + \varepsilon_i, \qquad i = 1, \ldots, n$$

where $^{\mathrm{T}}$ denotes the transpose, so that $x_i^{\mathrm{T}}\beta$ is the inner product between vectors x_i and β (for a complete dissertation on regression methods see Kenney & Keeping, 1962).

Simple linear regression fits a straight line through the set of n points in such a way that makes the sum of squared residuals of the model (that is, vertical distances between the points of the data set and the fitted line) as small as possible. This is known as ordinary least squares estimation method and it is the simplest and thus most common estimator (see e.g., Lomolino et al., 2013).

I adopted several regression models, using ordinary least square method, to investigate the relationship between focal response variables (S_i, Hi, RI, FSI and HIS, evolutionary rates) and

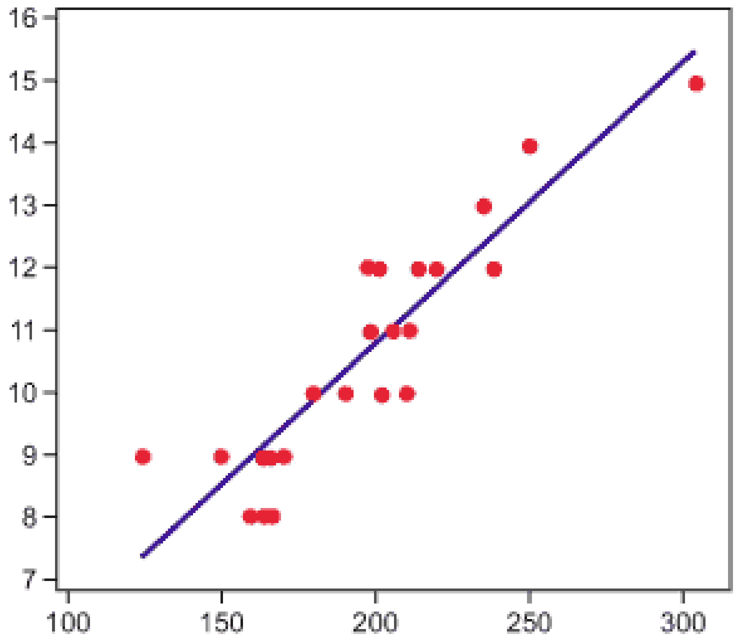


Fig. 21. Example of simple linear regression, which has one independent variable.

predictor variables describing geographic, ecological and climatic conditions of the focal species and islands. In addition to using the simple linear regression model (i.e., RI Mc as a function of the number of predators) and the semi-log regression model [i.e., HI as a function of log (Island area)], which is the approach utilized in most earlier studies of the island rule pattern, I also used a log–log model [i.e., log (S_i) as a function of log (M)]. The latter in retrospect seems more appropriate for analyzing the island rule pattern, given that the semi-log model can generate predicted S_i values below 0 (i.e., a negative body size) when very large mammals are considered. In agreement with these different regression models, in some cases not only linear regressions, but also exponential functions were used to fit the data.

I first conducted preliminary regressions of all data for populations of extant and fossil bovids to identify and remove those points that were identified as having undue influence on the results (i.e., I deleted observations if exceeded the 95% confidence limits of regression trends). Nevertheless, in the cases when the sample size was rather small (e.g., HI and other variables), records of undue influence were not excluded from the analyses.

I chose not to use multiple linear regressions because, while they can be highly informative in the proper applications, they do not immediately highlight relationships between couples of variables.

In presenting the results of regression analyses, I adopted the following convention: a) no line if the trend was not significant (P>0,1); b) a dashed line if the trend was of marginal significance

(0,1>P>0,05); c) a solid line if the slope was significantly different from 0. Since I tested for negative or positive slopes, and not just slopes that were different from zero, the P values for slopes not equal to zero were halved in applying the graphic convention. In a few cases, although the correlation was not significant on the basis of the obtained P values, I decided to preserve a dashed line in the graph since a vague trend was however emerging from the observed distribution (see e.g., Figs. 27, 56).

4.7.2. T-tests

A *t*-test is any statistical hypothesis test in which the test statistic follows a Student's *t* distribution if the null hypothesis is supported. It can be used to determine if two sets of data are significantly different from each other, and is most commonly applied when the test statistic would follow a normal distribution if the value of a scaling term in the test statistic were known. The formula for the t-test is a ratio. The top part of the ratio is just the difference between the two means or averages. The bottom part is a measure of the variability or dispersion of the scores.

I used t-tests to test the prediction that the slopes of the relationship between S_i and M differed between bovids with different bauplan (Bovinae and Antilopinae) and between populations of extant and palaeo-insular mammals, where t = (difference in slopes) / $(s1^2 + s2^2)^{0.5}$, and s1 and s2 are the standard errors of the slopes being compared.

4.7.3. Regression Tree Analysis (RTA)

Regression tree analysis (RTA) is a recursive, binary machine learning method that has some advantages over traditional regression methods. As Olden et al. (2008) summarize, these include that RTA is nonparametric, distribution free and thus does not require transformations. RTA is capable of handling categorical, interval and continuous variables, it is able to efficiently deal with missing variables and with high dimensionality, and it is not affected by outliers, but it is capable of providing readily interpretable descriptions of the relationships between predictor and response variables even when complex, contextual relationships exist (i.e., when the relationships between these variables varies among subgroups of the data). In contrast, traditional linear methods can only uncover relationships that are globally significant (i.e., consistent across the entire data set). As Davidson et al. (2009) also point out, one especially important advantage of machine learning methods in ecological and evolutionary applications is that they do not assume data independence, thus alleviating the need for phylogenetic controls of such data (see also Westoby et al., 1995; Melo et al., 2009).

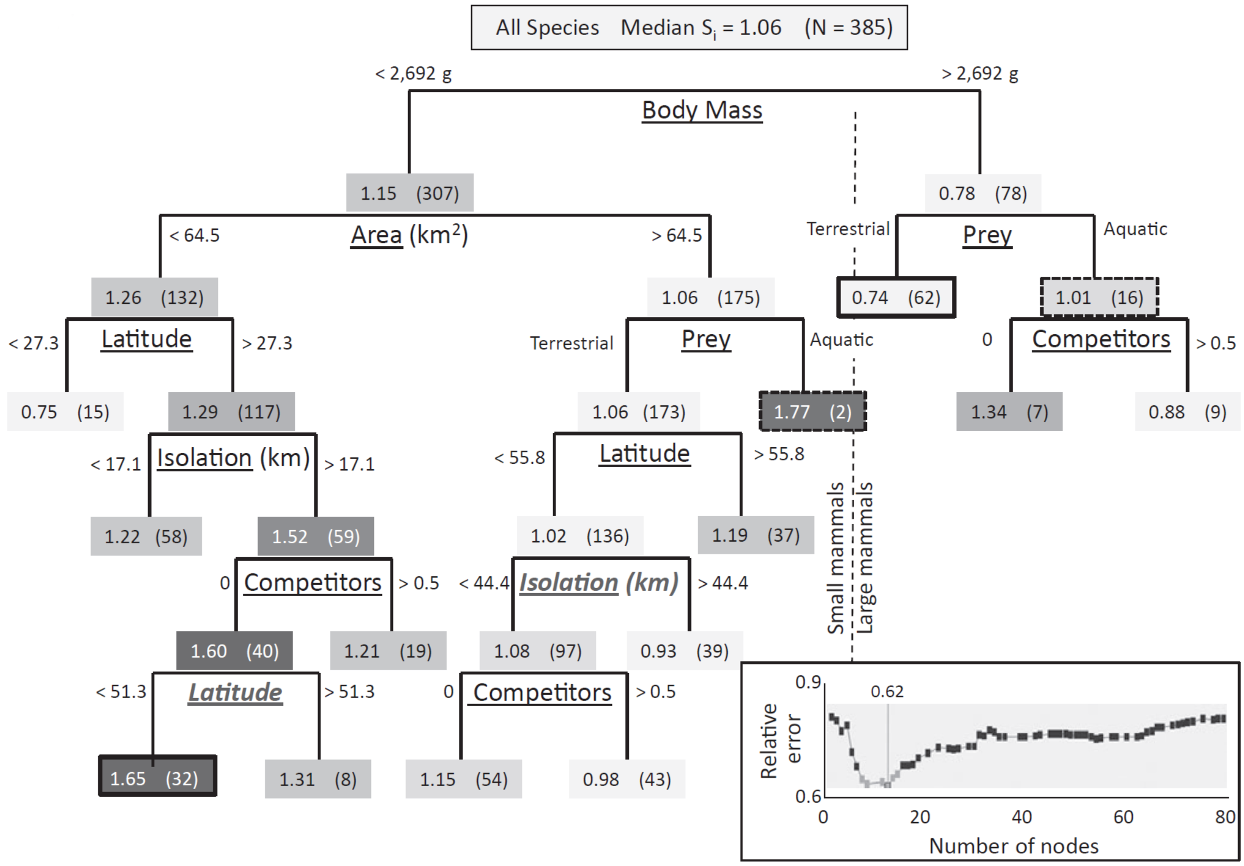


Fig. 22. Example of regression tree generated from analysis of all the factors (except for climatic variables) influencing evolution of body mass of all non-volant mammals (included in Lomolino et al., 2012).

The principal product of RTA is a recursively branching tree that describes the direct, interactive and contextual relationships between the response variable (here S_i, Hi, RI, FSI and HIS) and a subset of the predictor variables (geographic and ecological variables) (see Fig. 22 for an example of regression tree). The first split, or branch is determined by first sorting the entire data set by the values of each predictor variable and then determining which of those variables is best at splitting the data into two subgroups that are most homogeneous with respect to values of the response variable. The process is then repeated for each of the subsequent branches of subgroups until a stopping rule is satisfied (either by reaching an a priori limit to the minimal number of observations in terminal branches, a maximum number of terminal nodes, or allowable error or heterogeneity in the subgroups). To prevent over-fitting, these “maximal trees” are then pruned (using cross-validation of learning and test data sets; see Bell, 1999) until an optimal tree is selected. Here, I consider the best tree as that having the smallest relative error rate for predicting test data based on models developed from independent training data (see Olden et al., 2008). For further descriptions and application of classification and regression tree analyses to this and similar topics see Lomolino et al., 2012, 2013.

I used regression tree analysis (RTA) to investigate the factors influencing evolution of body size, hypsodonty and low-gear locomotion in insular bovids. I also used RTA as a means of verifying that our results were not the spurious outcome of non-independence among replicates (populations). I ran separate analyses of the dataset – one for all bovids, and two for the extant and fossil species considered separately.

Results

« κόσμον (τόνδε), τὸν αὐτὸν ἁπάντων, οὔτε τις θεῶν, οὔτε ἀνθρώπων ἐποίησεν, ἀλλ' ἦν ἀεὶ καὶ ἔστιν καὶ ἔσται πῦρ ἀειζωον, ἁπτόμενον μέτρα καὶ ἀποσβεννύμενον μέτρα. »

« *This world, which is the same for all, no one of gods or men has made; but it was ever, is now and ever shall be an ever-living fire, with measures kindling and measures going out*.»

Heraclitus of Ephesus, Fragment 29 (30 DK; 51 Marc.)

5. Results

5.1. Insular body size of bovids

Results obtained by plotting logs of S_i values against M values for all the species in the database indicate that the majority of insular bovids are reduced in size – i.e., most of the S_i values are less than 1.0 (Log S_i less than 0; Fig. 23). This is in agreement with the general island rule prediction for large mammals. Nevertheless, the island rule pattern (negative relationship between S_i and M) is not significant across all species of insular bovids combined (Fig. 23).

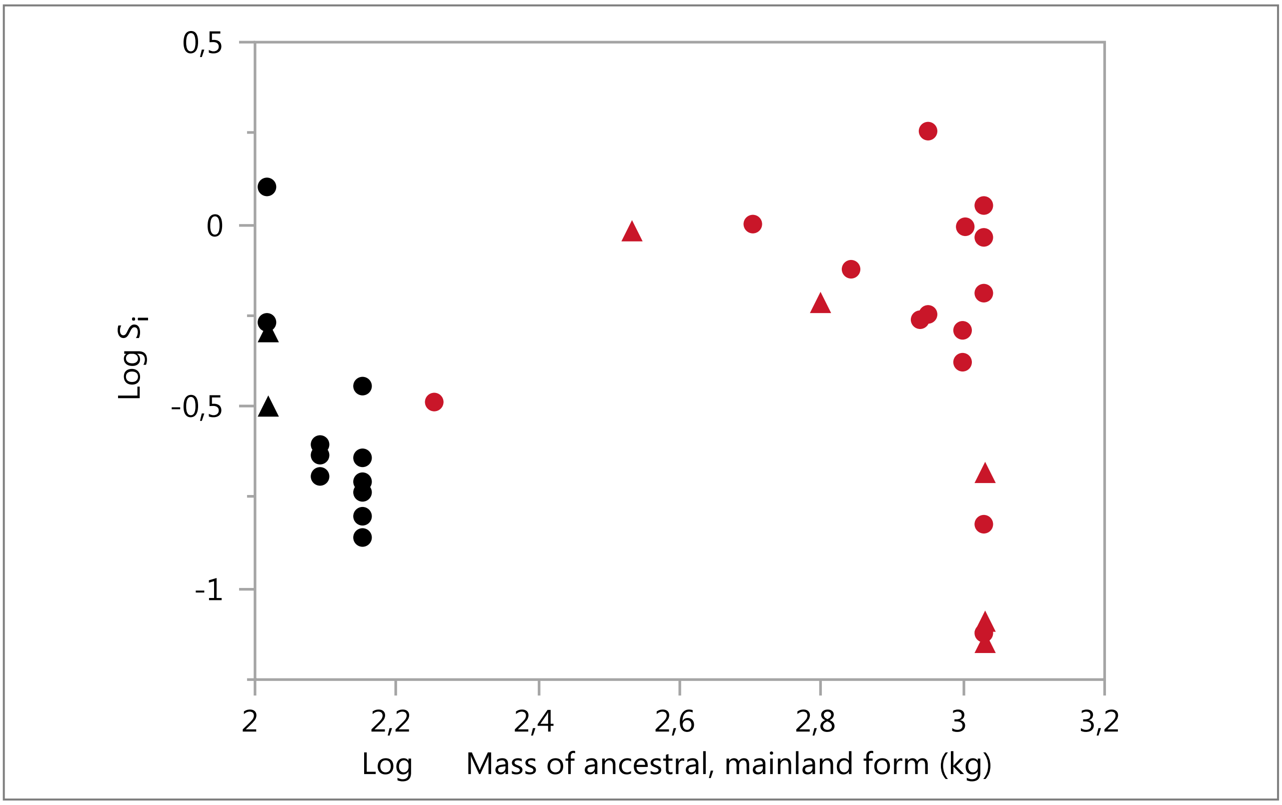
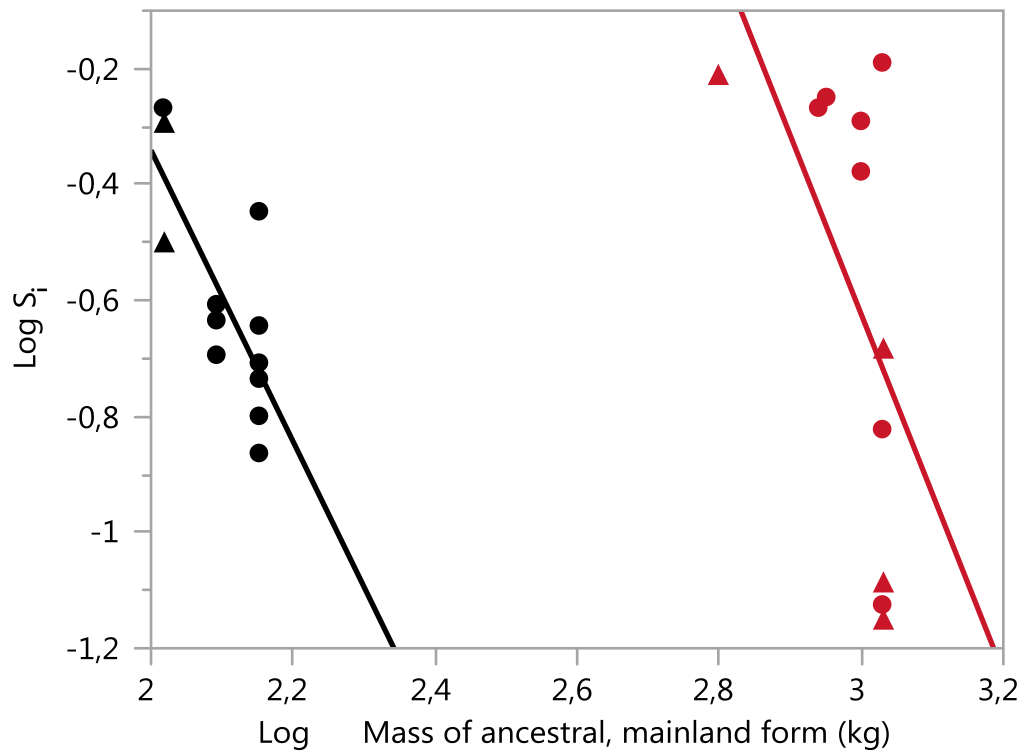


Fig. 23. The island rule pattern across extant (triangles) and fossil (circles) species of insular bovids (N=33). Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.

A significant negative relationship between S_i and M can be observed within the two subfamilies Bovinae and Antilopinae (Fig. 24), after excluding records of undue influence (see methodology). Although the two slopes of the island rule pattern are different, this difference is not statistically significant (t = 1,5770, alfa=0,05, df=22). In fact, the slope is only slightly more shallow (more positive: +0,5785344) for Antilopinae than that for Bovinae (Fig. 24).



Linear Fit Subfamily=="Antilopinae"

Log Si = 4,6823842 - 2,5116419*Log 10 Mass of ancestral, mainland form (kg)

Summary of Fit

RSquare	0,600775
RSquare Adj	0,564481
Root Mean Square Error	0,121714
Mean of Response	-0,61122
Observations (or Sum Wgts	13

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,24522679	0,245227	16,5534
Error	11	0,16295753	0,014814	**Prob > F**
C. Tota	12	0,40818432		0,0019 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4,6823842	1,30153	3,60	0,0042 *
Log 10 Mass of ancestral, mainland form (k	-2,511642	0,617326	-4,07	0,0019 *

Linear Fit Subfamily=="Bovinae"

Log Si = 8,6464245 - 3,0901763*Log 10 Mass of ancestral, mainland form (kg)

Summary of Fit

RSquare	0,311224
RSquare Adj	0,234694
Root Mean Square Error	0,346077
Mean of Response	-0,58825
Observations (or Sum Wgts	11

Analysis of Variance

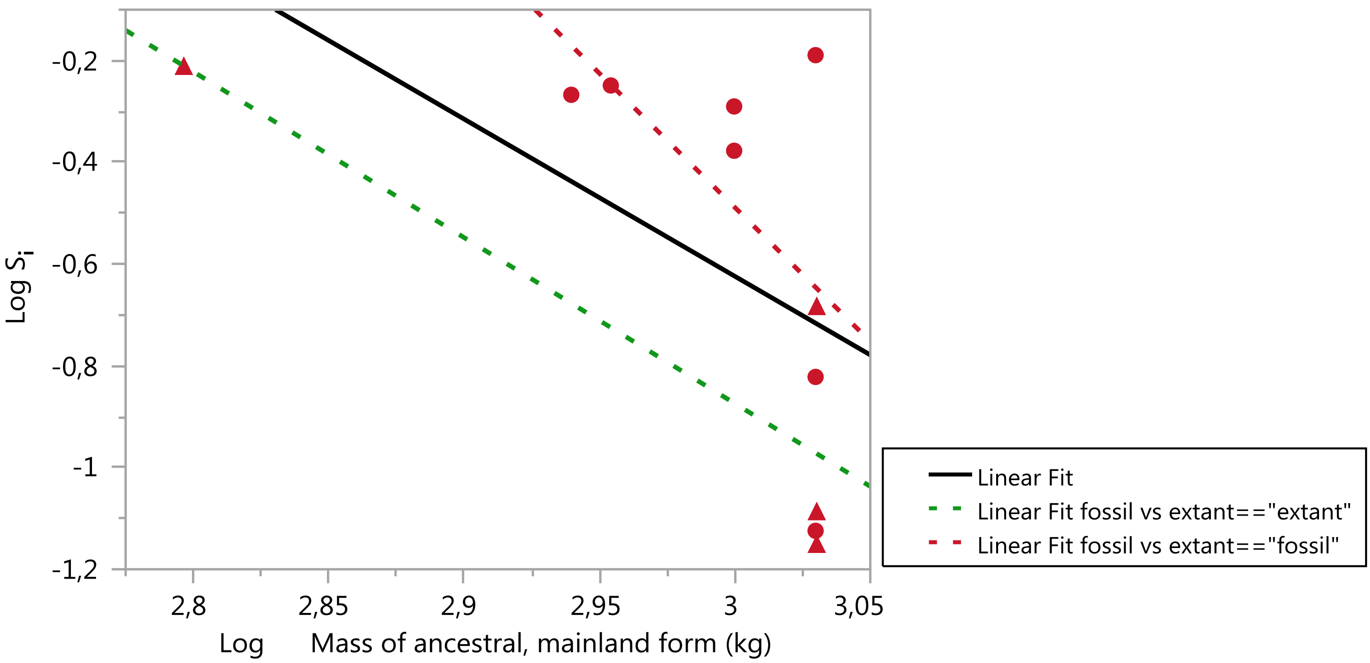
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,4870622	0,487062	4,0667
Error	9	1,0779255	0,119770	**Prob > F**
C. Tota	10	1,5649877		0,0745

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	8,6464245	4,580525	1,89	0,0917
Log 10 Mass of ancestral, mainland form (k	-3,090176	1,532372	-2,02	0,0745

Fig. 24. The island rule pattern within the two subfamilies Bovinae (in red; N=11) and Antilopinae (in black; N=13). Living species are depicted by triangles, while palaeo-species are depicted by circles.

The slope of the island rule pattern is significantly steeper (more negative) for palaeo-insular species in comparison to extant species within Bovinae (t = 4,853648, alfa=0,05, df=9) (Fig. 25).



Linear Fit

Log Si = 8,6464245 - 3,0901763*Log 10 Mass of ancestral, mainland form (kg)

Summary of Fit

RSquare	0,311224
RSquare Adj	0,234694
Root Mean Square Error	0,346077
Mean of Response	-0,58825
Observations (or Sum Wgts	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,4870622	0,487062	4,0667
Error	9	1,0779255	0,119770	Prob > F
C. Tota	10	1,5649877		0,0745

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	8,6464245	4,580525	1,89	0,0917
Log 10 Mass of ancestral, mainland form (k	-3,090176	1,532372	-2,02	0,0745

Linear Fit fossil vs extant=="extant"

Log Si = 8,9087056 - 3,2609532*Log 10 Mass of ancestral, mainland form (kg)

Summary of Fit

RSquare	0,76868
RSquare Adj	0,65302
Root Mean Square Error	0,25564
Mean of Response	-0,78262
Observations (or Sum Wgts	4

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,43433147	0,434331	6,6460
Error	2	0,13070404	0,065352	Prob > F
C. Tota	3	0,56503551		0,1233

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	8,9087056	3,761428	2,37	0,1414
Log 10 Mass of ancestral, mainland form (k	-3,260953	1,264921	-2,58	0,1233

Linear Fit fossil vs extant=="fossil"

Log Si = 15,314011 - 5,2675805*Log 10 Mass of ancestral, mainland form (kg)

Summary of Fit

RSquare	0,307732
RSquare Adj	0,169278
Root Mean Square Error	0,324915
Mean of Response	-0,47719
Observations (or Sum Wgts	7

Analysis of Variance

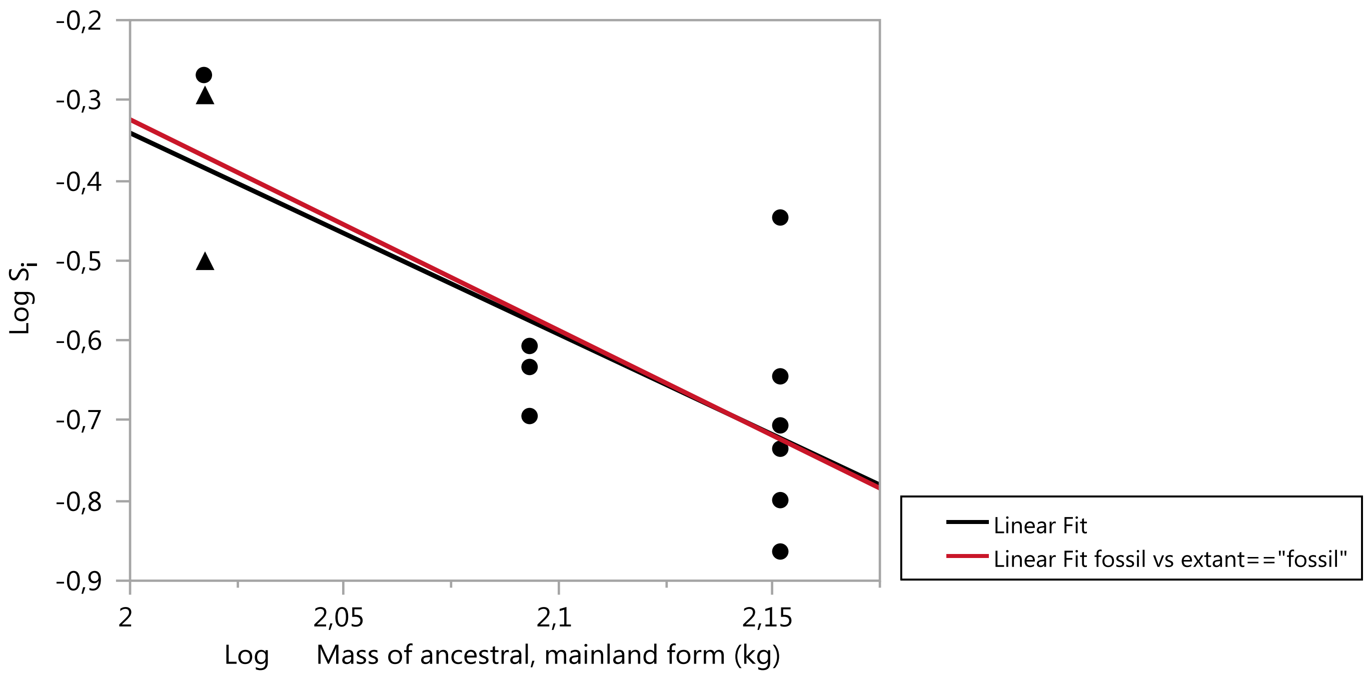
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,23464389	0,234644	2,2226
Error	5	0,52785027	0,105570	Prob > F
C. Tota	6	0,76249416		0,1962

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	15,314011	10,59278	1,45	0,2079
Log 10 Mass of ancestral, mainland form (k	-5,267581	3,533271	-1,49	0,1962

Fig. 25. The island rule pattern within Bovinae (N=11). Living species are depicted by triangles, while palaeo-species are depicted by circles.

A similar pattern can also be observed between the slopes of palaeo-insular species and of all the species (fossil + extant) within Antilopinae (Fig. 26). In this case, the slope of the island rule trend is slightly more shallow (more positive: +0,1189547) for the complete sample than that for palaeo-species.



Linear Fit

Log Si = 4,6823842 - 2,5116419*Log 10 Mass of ancestral, mainland form (kg)

Summary of Fit

RSquare	0,600775
RSquare Adj	0,564481
Root Mean Square Error	0,121714
Mean of Response	-0,61122
Observations (or Sum Wgts	13

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,24522679	0,245227	16,5534
Error	11	0,16295753	0,014814	Prob > F
C. Tota	12	0,40818432		0,0019 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4,6823842	1,30153	3,60	0,0042 *
Log 10 Mass of ancestral, mainland form (k	-2,511642	0,617326	-4,07	0,0019 *

Linear Fit fossil vs extant=="fossil"

Log Si = 4,937048 - 2,6305966*Log 10 Mass of ancestral, mainland form (kg)

Summary of Fit

RSquare	0,491753
RSquare Adj	0,435281
Root Mean Square Error	0,125198
Mean of Response	-0,65032
Observations (or Sum Wgts	11

Analysis of Variance

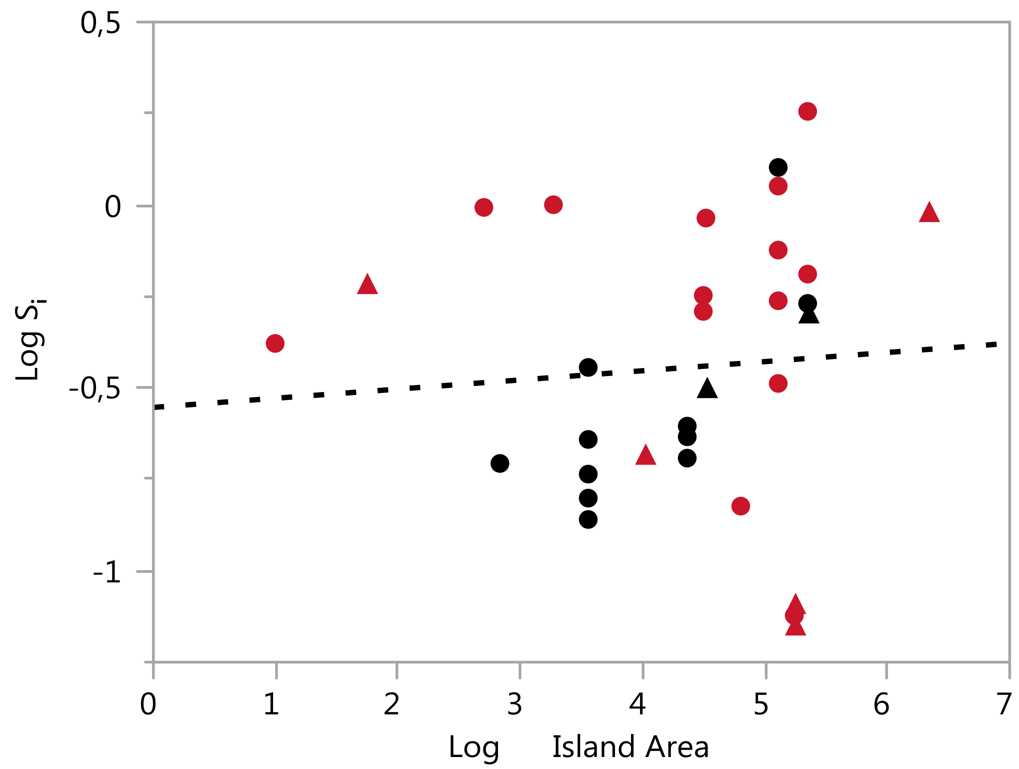
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,13649169	0,136492	8,7079
Error	9	0,14106996	0,015674	Prob > F
C. Tota	10	0,27756164		0,0162 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4,937048	1,893809	2,61	0,0284 *
Log 10 Mass of ancestral, mainland form (k	-2,630597	0,89145	-2,95	0,0162 *

Fig. 26. The island rule pattern within Antilopinae (N=13). Living species are depicted by triangles, while palaeo-species are depicted by circles.

Regression analyses and RTA results show significant relationships between body size divergence and number of predators and/or competitors and large mammal richness. The relationship between S_i and island area is undoubtedly less significant, although a general positive trend can be observed (Fig. 27). Main results are summarized in the following graphs:



Linear Fit

Log Si = -0,553527 + 0,0250356*Log 10 Island Area

Summary of Fit

RSquare	0,005896
RSquare Adj	-0,02617
Root Mean Square Error	0,376204
Mean of Response	-0,44572
Observations (or Sum Wgts	33

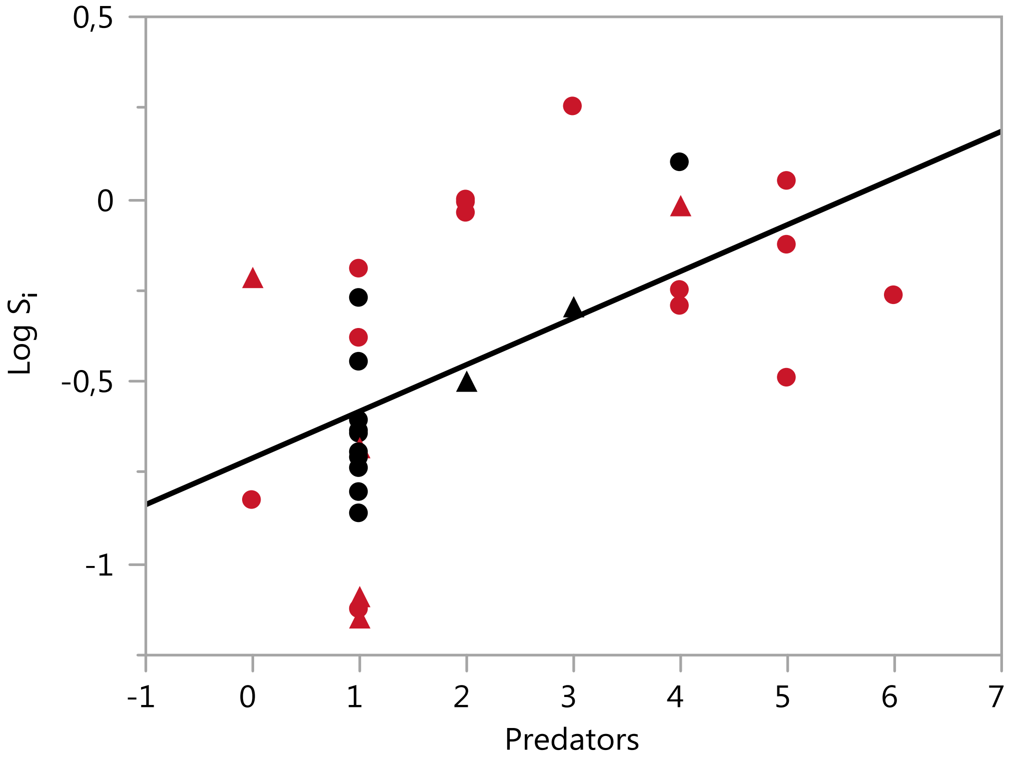
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,0260222	0,026022	0,1839
Error	31	4,3874046	0,141529	Prob > F
C. Tota	32	4,4134268		0,6710

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-0,553527	0,259818	-2,13	0,0412 *
Log 10 Island Are	0,0250356	0,058386	0,43	0,6710

Fig. 27. Result of regression analysis between S_i and island area across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

Log Si = -0,709368 + 0,1279484*Predators

Summary of Fit

RSquare	0,318552
RSquare Adj	0,29657
Root Mean Square Error	0,311475
Mean of Response	-0,44572
Observations (or Sum Wgts	33

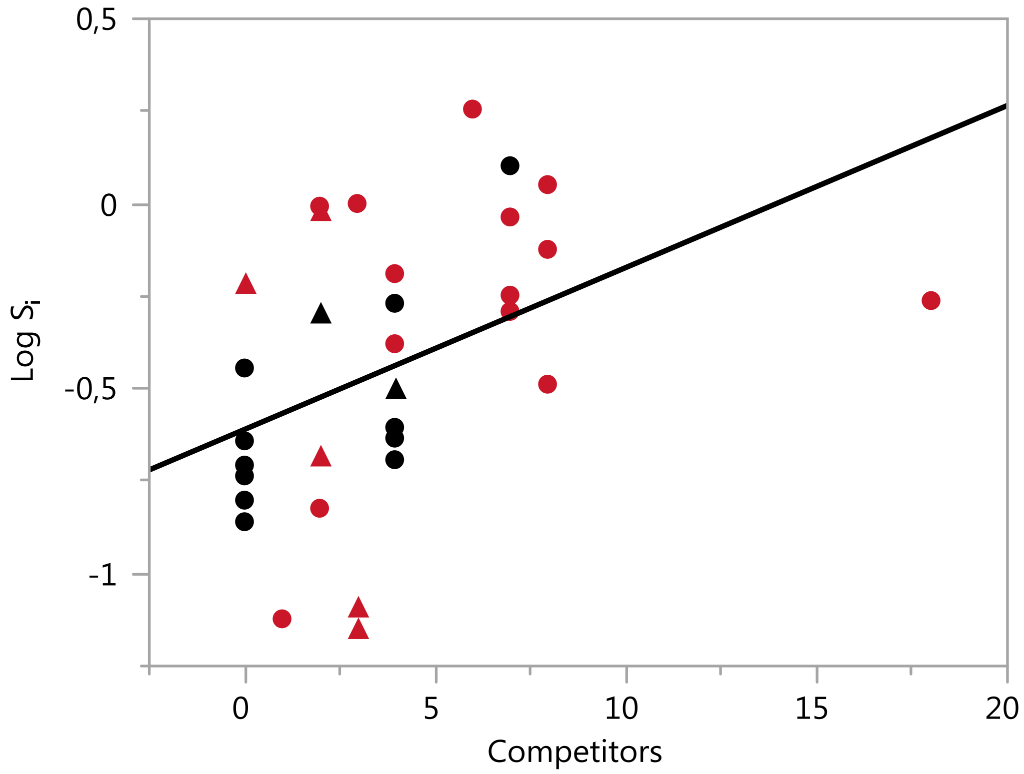
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1,4059048	1,40590	14,4913
Error	31	3,0075219	0,09702	**Prob > F**
C. Tota	32	4,4134268		0,0006 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercep	-0,709368	0,087959	-8,06	<,0001 *
Predator	0,1279484	0,033611	3,81	0,0006 *

Fig. 28. Result of regression analysis between S_i and number of predators across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

Log Si = -0,610267 + 0,0437918*Competitors

Summary of Fit

RSquare	0,192084
RSquare Adj	0,166023
Root Mean Square Error	0,339149
Mean of Response	-0,44572
Observations (or Sum Wgts	33

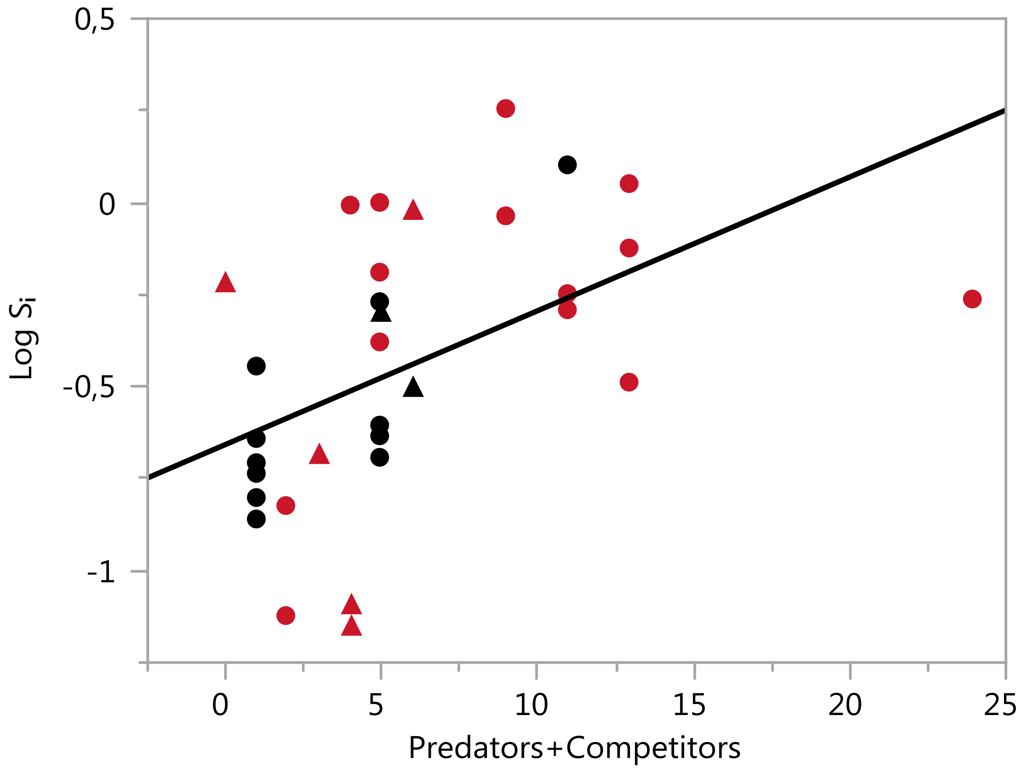
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,8477502	0,847750	7,3703
Error	31	3,5656766	0,115022	Prob > F
C. Tota	32	4,4134268		0,0107 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-0,610267	0,084613	-7,21	<,0001 *
Competitor	0,0437918	0,016131	2,71	0,0107 *

Fig. 29. Result of regression analysis between S_i and number of competitors across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

Log Si = -0,657191 + 0,0363473*Predators+Competitors

Summary of Fit

RSquare	0,249924
RSquare Adj	0,225728
Root Mean Square Error	0,326783
Mean of Response	-0,44572
Observations (or Sum Wgts	33

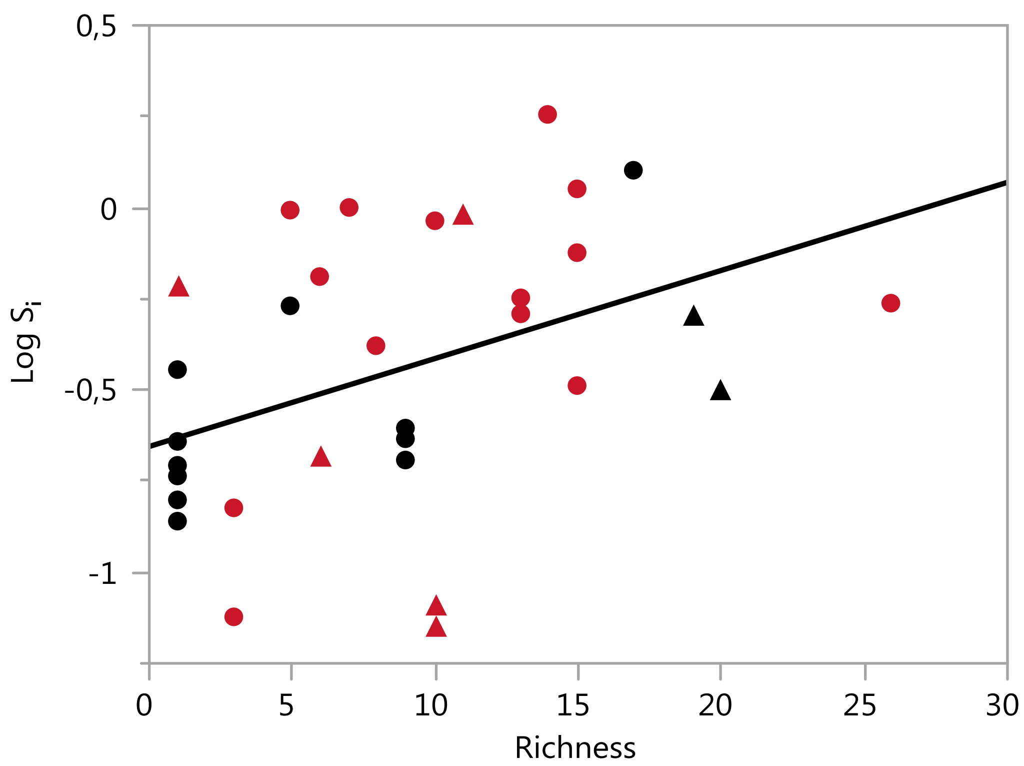
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1,1030207	1,10302	10,3291
Error	31	3,3104060	0,10679	**Prob > F**
C. Tota	32	4,4134268		0,0031 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-0,657191	0,086981	-7,56	<,0001 *
Predators+Competitor	0,0363473	0,011309	3,21	0,0031 *

Fig. 30. Result of regression analysis between S_i and number of predators + competitors across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

Log Si = -0,655022 + 0,0241507*Richness

Summary of Fit

RSquare	0,18255
RSquare Adj	0,15618
Root Mean Square Error	0,341144
Mean of Response	-0,44572
Observations (or Sum Wgts	33

Analysis of Variance

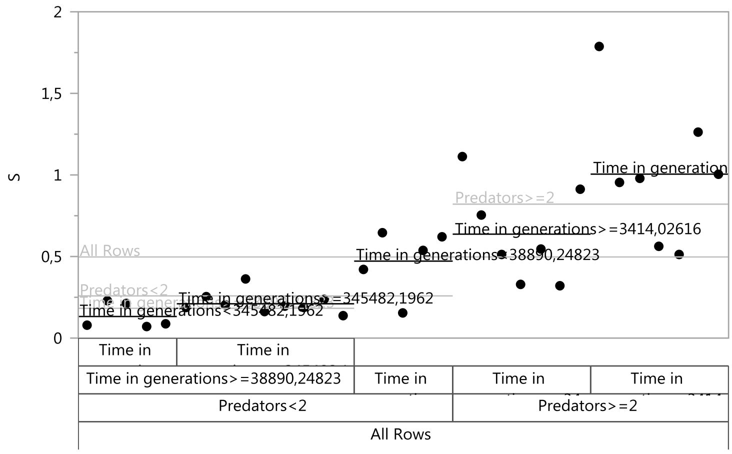
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,8056695	0,805669	6,9228
Error	31	3,6077573	0,116379	**Prob > F**
C. Tota	32	4,4134268		0,0131 *

Parameter Estimates

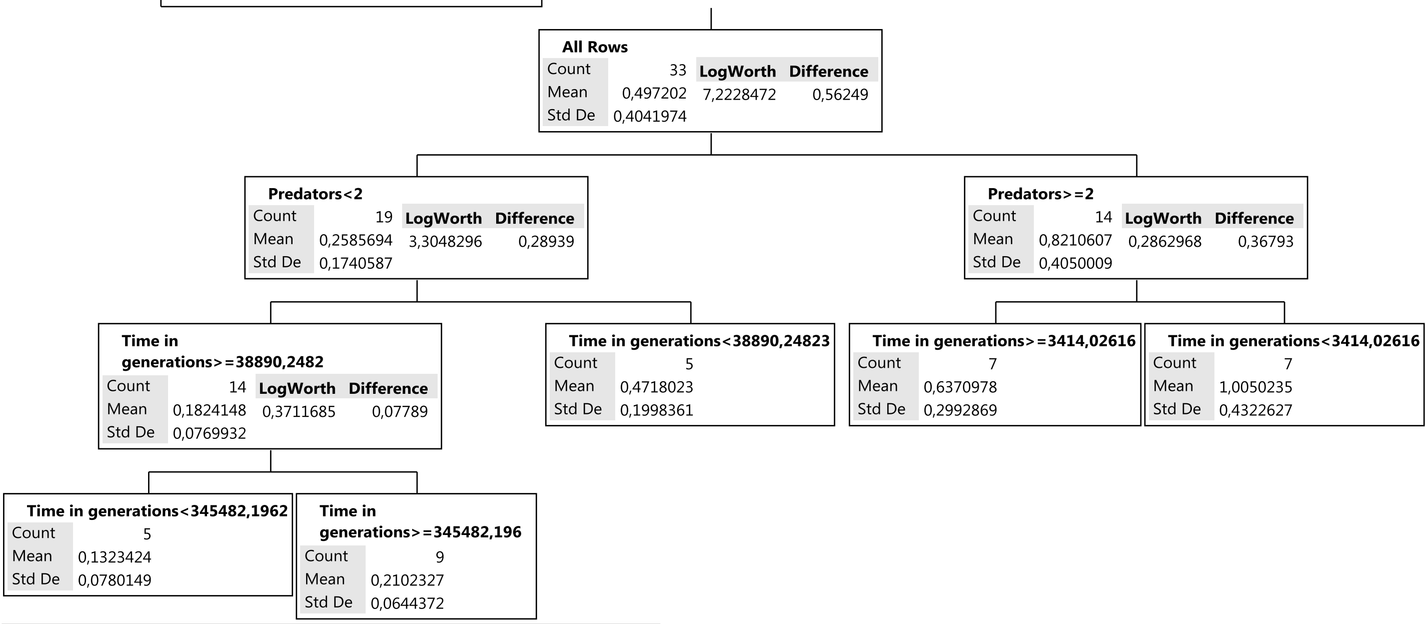
Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercep	-0,655022	0,099272	-6,60	<,0001 *
Richnes	0,0241507	0,009179	2,63	0,0131 *

Fig. 31. Result of regression analysis between S_i and large mammal richness across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.

Partition for Si



RSquare	RMSE	N	Number of Splits	AICc
0,641	0,2384192	33	4	14,2549



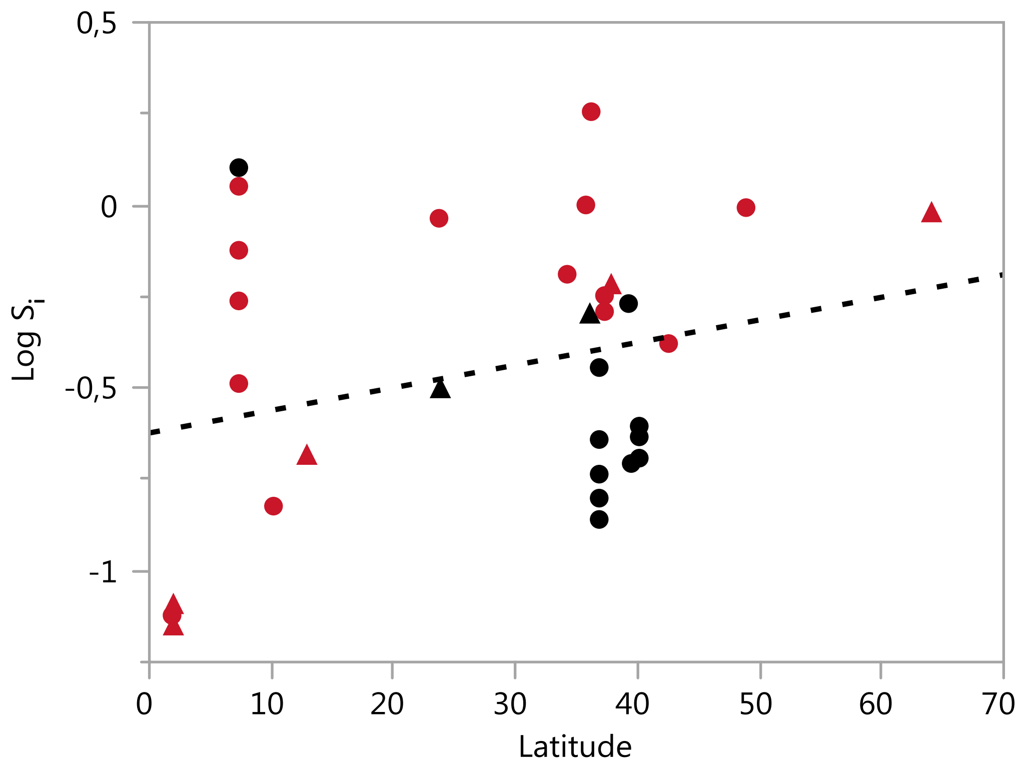
Column Contributions

Term	Number of Splits	SS	Portion
Predators	1	2,55034712	0,7608
Time in generations	3	0,8018283	0,2392
Body mass ancestor	0	0	0,0000
Time in isolation	0	0	0,0000
Latitude	0	0	0,0000
Isolation to mainland (km	0	0	0,0000
Area	0	0	0,0000
Topographic complexity	0	0	0,0000
Richness	0	0	0,0000
Competitors	0	0	0,0000
Predators+Competitors	0	0	0,0000

Fig. 32. Regression tree generated from analysis of all insular bovids and including all predictor variables. Variables used for each split and their critical values are in the first row of each box. Means and Standard deviations of insular body size (*Si*) and number of insular species included in each split are also reported. Column contributions displays a report showing each input column's contribution to the fit. The report also shows how many times it defined a split and the total Sum of Squares (SS) attributed to that column.

Other supporting results include regression analyses between S_i and other predictor variables (Fig. 33, 34, 35), a correlation matrix of all the variables in the study (Fig. 36) and two RTAs for the extant and fossil species considered separately (Fig. 37, 38).

Results of regression analyses show a strong correlation between S_i and Isolation to mainland (Fig. 33) and a less significant positive trend between S_i and latitude (Fig. 34). No correlation can be observed between S_i and topographic complexity (Fig. 35).



Linear Fit

Log Si = -0,62316 + 0,0061847*Latitude

Summary of Fit

RSquare	0,072455
RSquare Adj	0,042535
Root Mean Square Error	0,363391
Mean of Response	-0,44572
Observations (or Sum Wgts	33

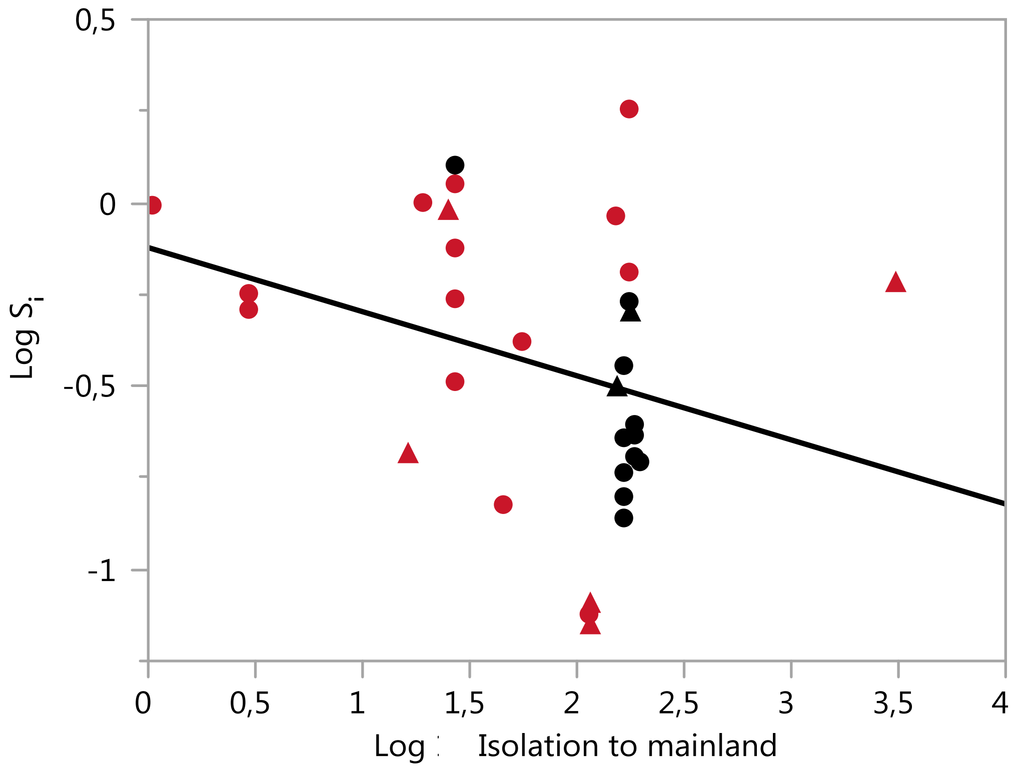
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,3197767	0,319777	2,4216
Error	31	4,0936501	0,132053	**Prob > F**
C. Tota	32	4,4134268		0,1298

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercep	-0,62316	0,130399	-4,78	<,0001 *
Latitude	0,0061847	0,003974	1,56	0,1298

Fig. 33. Result of regression analysis between S_i and latitude across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

Log Si = -0,122291 - 0,1748732*Log 10 Isolation to mainland

Summary of Fit

RSquare	0,09875
RSquare Adj	0,069677
Root Mean Square Error	0,358203
Mean of Response	-0,44572
Observations (or Sum Wgts	33

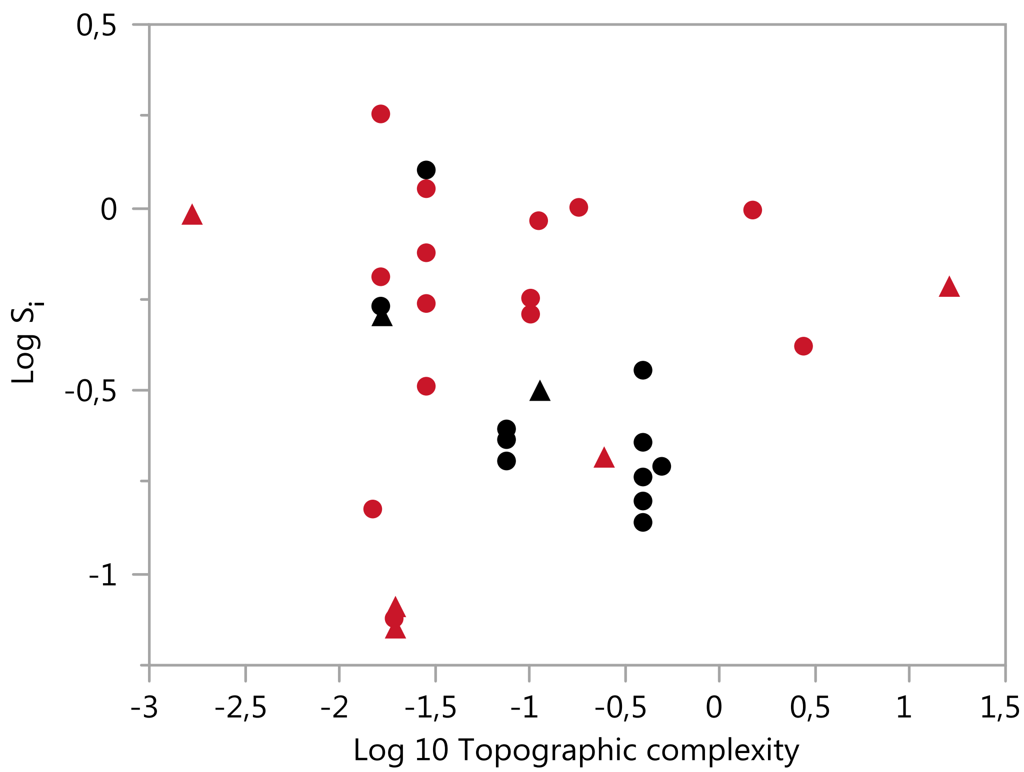
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,4358248	0,435825	3,3967
Error	31	3,9776019	0,128310	**Prob > F**
C. Tota	32	4,4134268		0,0749

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-0,122291	0,186237	-0,66	0,5163
Log 10 Isolation to mainlan	-0,174873	0,094885	-1,84	0,0749

Fig. 34. Result of regression analysis between S_i and isolation to mainland across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

Log Si = -0,480102 - 0,0333727*Log 10 Topographic complexity

Summary of Fit

RSquare	0,005162
RSquare Adj	-0,02693
Root Mean Square Error	0,376343
Mean of Response	-0,44572
Observations (or Sum Wgts	33

Analysis of Variance

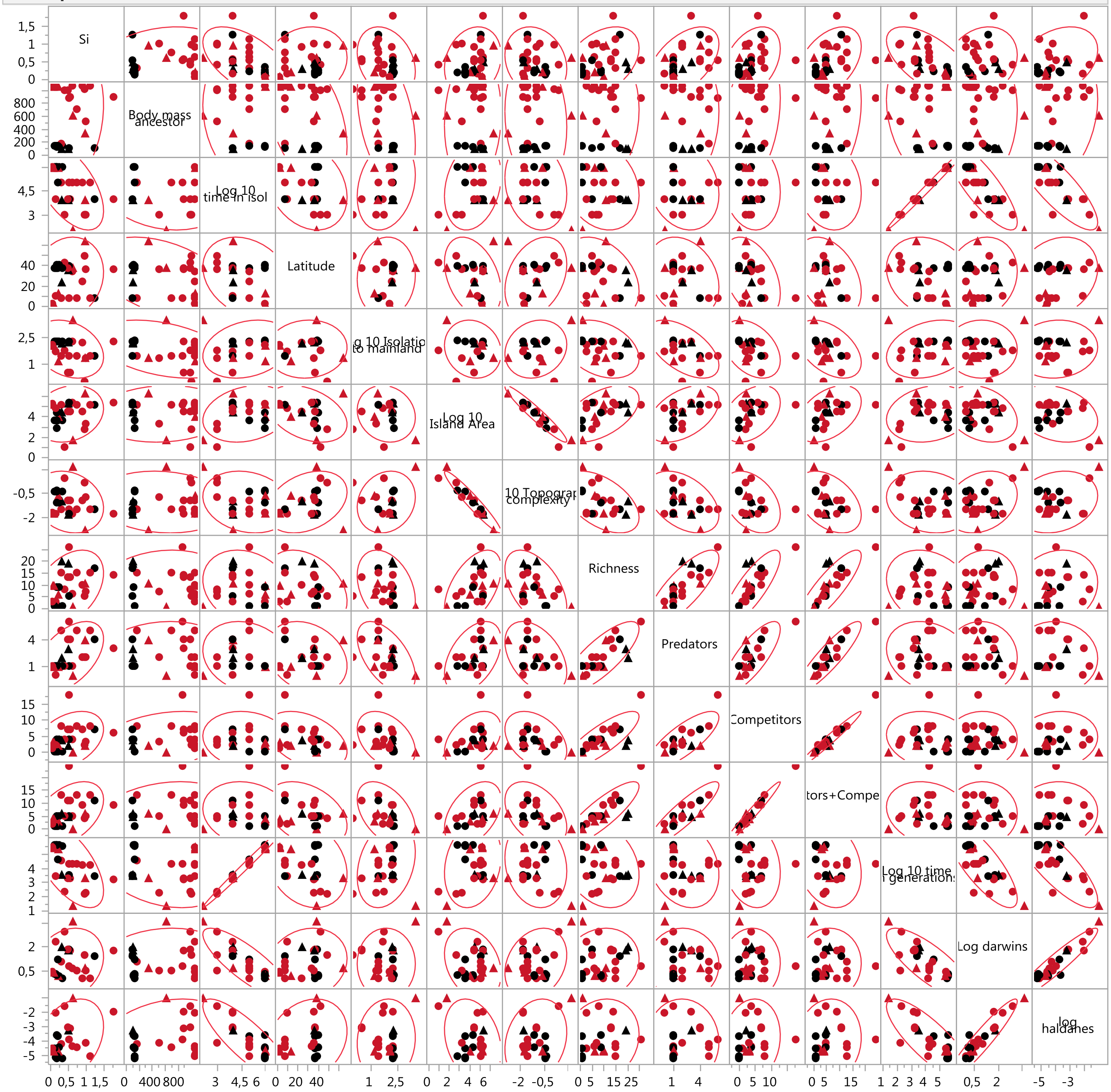
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,0227803	0,022780	0,1608
Error	31	4,3906465	0,141634	**Prob > F**
C. Tota	32	4,4134268		0,6911

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-0,480102	0,107905	-4,45	0,0001 *
Log 10 Topographic complexit	-0,033373	0,083214	-0,40	0,6911

Fig. 35. Log-log correlation between S_i and topographic complexity across extant (triangles) and fossil (circles) species of insular bovids (N=33). Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.

Scatterplot Matrix



Correlations

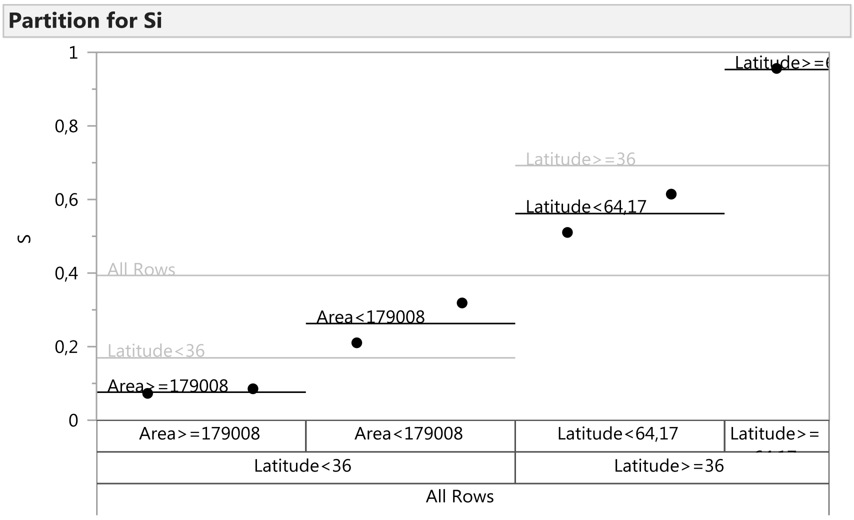
	Si	Body mass ancestor	Log 10 time in isol	Latitude	Log 10 Isolation to mainland	Log 10 Island Area	Log 10 Topographic complexity
Si	1,0000	0,2136	-0,5660	0,1241	-0,2735	0,1919	-0,1950
Body mass ancestor	0,2136	1,0000	-0,2074	-0,4055	-0,3875	0,0915	-0,1162
Log 10 time in isol	-0,5660	-0,2074	1,0000	-0,2582	0,2466	0,2356	-0,1841
Latitude	0,1241	-0,4055	-0,2582	1,0000	0,0579	-0,3708	0,3265
Log 10 Isolation to mainland	-0,2735	-0,3875	0,2466	0,0579	1,0000	-0,1317	0,1633
Log 10 Island Area	0,1919	0,0915	0,2356	-0,3708	-0,1317	1,0000	-0,9569
Log 10 Topographic complexity	-0,1950	-0,1162	-0,1841	0,3265	0,1633	-0,9569	1,0000
Richness	0,3980	0,1433	-0,2212	-0,3464	-0,3304	0,5224	-0,5044
Predators	0,5146	0,1197	-0,1974	-0,2453	-0,5553	0,4601	-0,4295
Competitors	0,3824	0,3127	-0,1431	-0,4008	-0,3893	0,3998	-0,3831
Predators+Competitors	0,4433	0,2659	-0,1675	-0,3703	-0,4613	0,4385	-0,4165
Log 10 time in generations	-0,6150	-0,2875	0,9946	-0,2262	0,2872	0,2054	-0,1557
Log darwins	0,2030	0,1418	-0,8258	0,1520	-0,0014	-0,2834	0,2537
log haldanes	0,3491	0,2983	-0,8321	0,2316	0,0736	-0,2679	0,2108

Correlations

	Richness	Predators	Competitors	Predators+Competitors	Log 10 time in generations	Log darwins	log haldanes
Si	0,3980	0,5146	0,3824	0,4433	-0,6150	0,2030	0,3491
Body mass ancestor	0,1433	0,1197	0,3127	0,2659	-0,2875	0,1418	0,2983
Log 10 time in isol	-0,2212	-0,1974	-0,1431	-0,1675	0,9946	-0,8258	-0,8321
Latitude	-0,3464	-0,2453	-0,4008	-0,3703	-0,2262	0,1520	0,2316
Log 10 Isolation to mainland	-0,3304	-0,5553	-0,3893	-0,4613	0,2872	-0,0014	0,0736
Log 10 Island Area	0,5224	0,4601	0,3998	0,4385	0,2054	-0,2834	-0,2679
Log 10 Topographic complexity	-0,5044	-0,4295	-0,3831	-0,4165	-0,1557	0,2537	0,2108
Richness	1,0000	0,7917	0,8246	0,8539	-0,2486	0,1360	0,1579
Predators	0,7917	1,0000	0,7877	0,8939	-0,2404	-0,0170	-0,0393
Competitors	0,8246	0,7877	1,0000	0,9803	-0,1945	0,0322	0,1178
Predators+Competitors	0,8539	0,8939	0,9803	1,0000	-0,2187	0,0180	0,0730
Log 10 time in generations	-0,2486	-0,2404	-0,1945	-0,2187	1,0000	-0,7959	-0,8192
Log darwins	0,1360	-0,0170	0,0322	0,0180	-0,7959	1,0000	0,9442
log haldanes	0,1579	-0,0393	0,1178	0,0730	-0,8192	0,9442	1,0000

Fig. 36. Correlation matrix showing the relationships among all variables in the study. The correlations are estimated by Pairwise method.

Results of RTAs (Figs. 37, 38) highlight a significant relationship between Si and latitude in the living species, and between Si and number of predators in the palaeo-species. In fact, these two predictor variables are responsible of the first split in the respective regression trees.



RSquare	RMSE	N	Number of Splits	AICc
0,982	0,0402216	7	3	44,8782

All Rows

		LogWorth	Difference
Count	7		
Mean	0,39352	1,6853015	0,52274
Std De	0,3206356		

Latitude<36

		LogWorth	Difference
Count	4		
Mean	0,1694891	1,1132652	0,18662
Std De	0,1164572		

Latitude>=36

		LogWorth	Difference
Count	3		
Mean	0,692228	1,0938844	0,39164
Std De	0,2320749		

Area>=179008

Count	2
Mean	0,0761816
Std De	0,0078707

Area<179008

Count	2
Mean	0,2627966
Std De	0,0761561

Latitude<64,17

Count	2
Mean	0,5616812
Std De	0,0739104

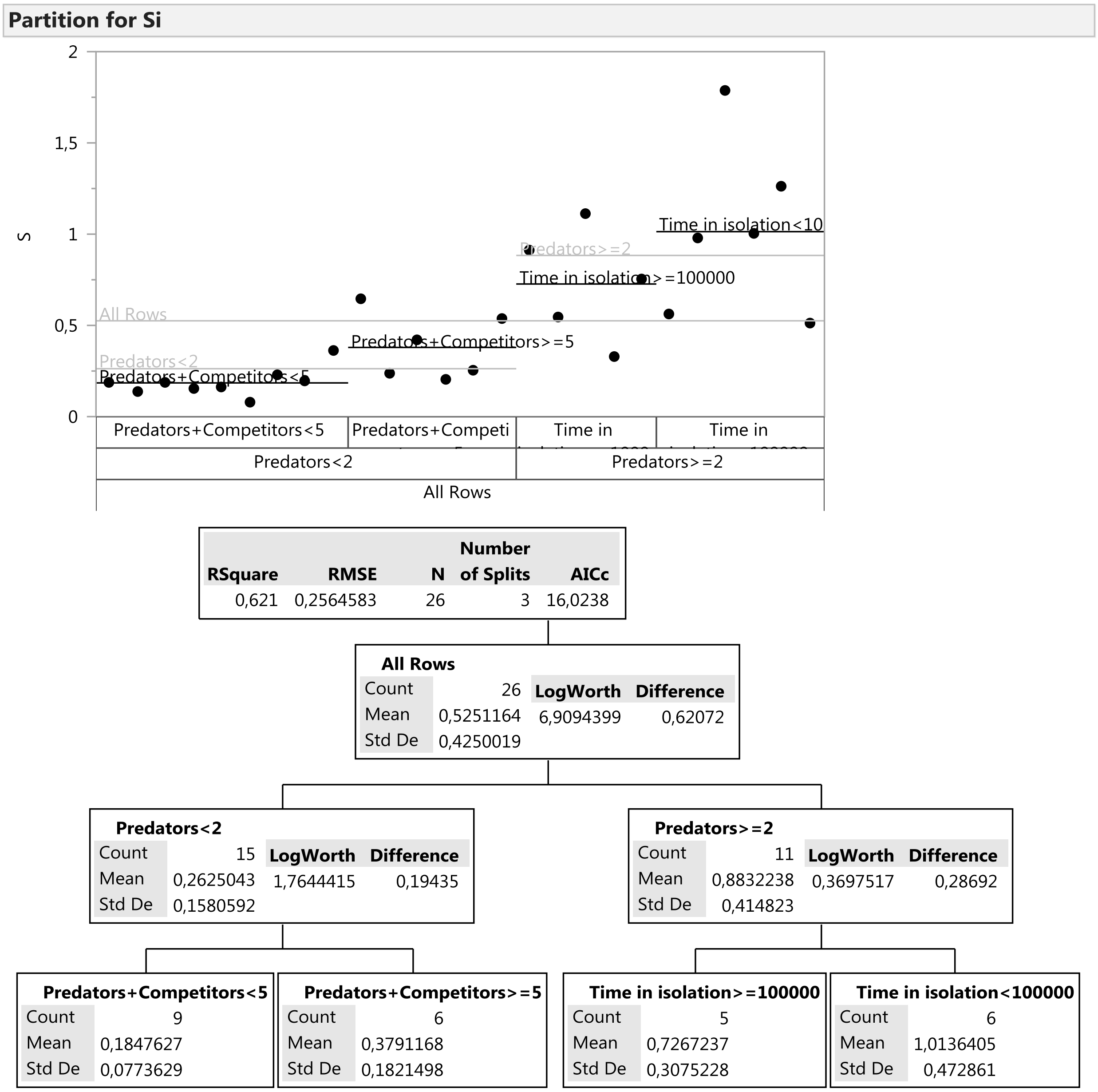
Latitude>=64,17

Count	1
Mean	0,9533216
Std De	.

Column Contributions

Term	Number of Splits	SS	Portion
Latitude	2	0,57069357	0,9425
Area	1	0,03482518	0,0575
Body mass ancestor	0	0	0,0000
Time in isolation	0	0	0,0000
Isolation to mainland (km	0	0	0,0000
Topographic complexity	0	0	0,0000
Richness	0	0	0,0000
Predators	0	0	0,0000
Competitors	0	0	0,0000
Predators+Competitors	0	0	0,0000
Time in generations	0	0	0,0000
darwins	0	0	0,0000
haldanes	0	0	0,0000

Fig. 37. Regression tree generated from analysis of extant insular bovids and including all predictor variables. Due to the small number of extant species (N=7) the minimum dimension of partitioning was changed from default (5) to 1. Variables used for each split and their critical values are in the first row of each box. Means and Standard deviations of insular body size (*Si*) and number of insular species included in each split are also reported. Column contributions displays a report showing each input column’s contribution to the fit. The report also shows how many times it defined a split and the total Sum of Squares (SS) attributed to that column.



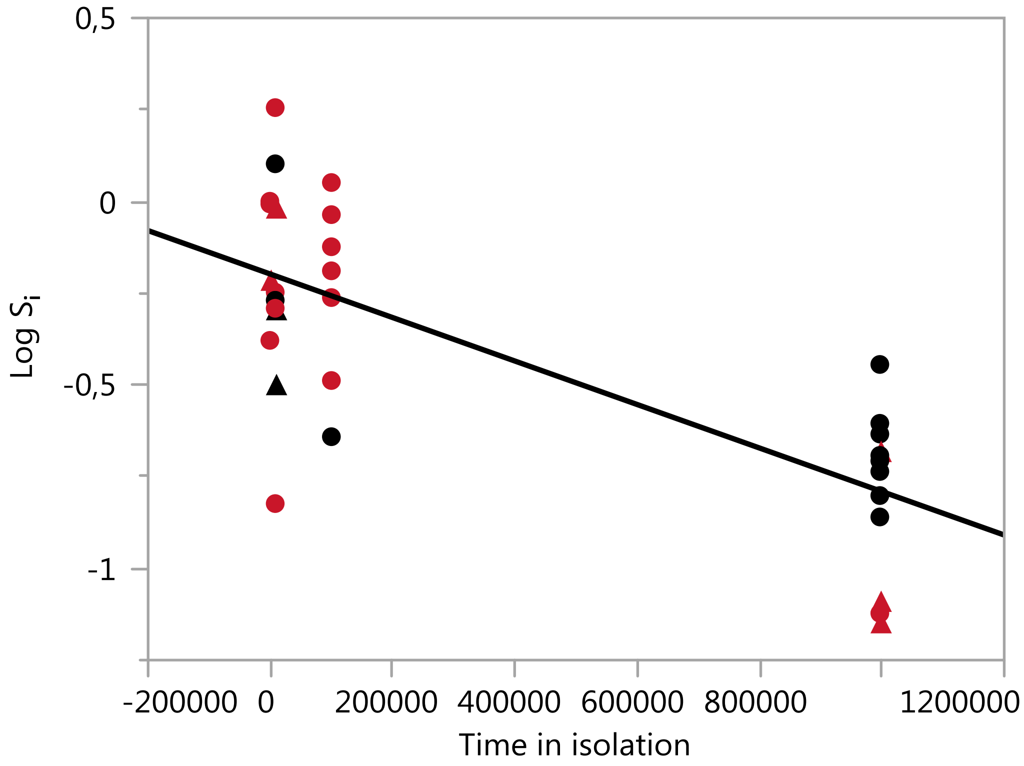
Column Contributions

Term	Number of Splits	SS	Portion
Predators	1	2,44512648	0,8715
Time in isolation	1	0,22451248	0,0800
Predators+Competitors	1	0,13598475	0,0485
Body mass ancestor	0	0	0,0000
Latitude	0	0	0,0000
Isolation to mainland (km	0	0	0,0000
Area	0	0	0,0000
Topographic complexity	0	0	0,0000
Richness	0	0	0,0000
Competitors	0	0	0,0000
Time in generations	0	0	0,0000
darwins	0	0	0,0000
haldanes	0	0	0,0000

Fig. 38. Regression tree generated from analysis of fossil insular bovids and including all predictor variables. Variables used for each split and their critical values are in the first row of each box. Means and Standard deviations of insular body size (Si) and number of insular species included in each split are also reported. Column contributions displays a report showing each input column's contribution to the fit. The report also shows how many times it defined a split and the total Sum of Squares (SS) attributed to that column.

5.1.1. Time in isolation and evolutionary rates

Regression analyses results highlight significant relationships between body size divergence and time in isolation, becoming more developed for bovid populations with longer residence times on the islands (Fig. 39, 40).



Linear Fit

Log Si = -0,198014 - 5,9263e-7*Time in isolation

Summary of Fit

RSquare	0,58137
RSquare Adj	0,567866
Root Mean Square Error	0,244131
Mean of Response	-0,44572
Observations (or Sum Wgts	33

Analysis of Variance

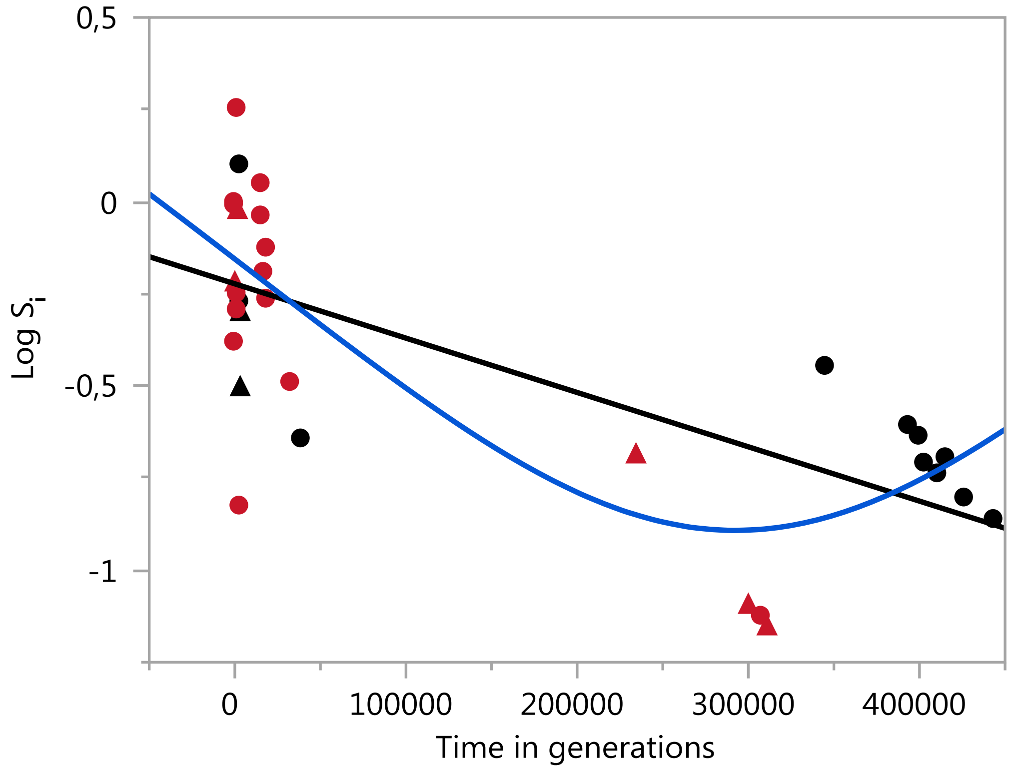
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2,5658337	2,56583	43,0511
Error	31	1,8475931	0,05960	Prob > F
C. Tota	32	4,4134268		<,0001 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-0,198014	0,056844	-3,48	0,0015 *
Time in isolatio	-5,926e-7	9,032e-8	-6,56	<,0001 *

Fig. 39. Result of regression analysis between S_i and time in isolation (years) across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.

In particular, results obtained show two main stages of body size divergence (Fig. 40), with a steep slope at first (for times in isolation < 50,000 generations), followed by a more shallow slope (for times in isolation > 50,000 generations) – as highlighted by the exponential model. Among the bovids with longer residence times, two main groups, related to the two subfamilies Antilopinae and Bovinae (and, accordingly, to different bauplan), can be observed.



Transformed Fit Exp

Exp(Log Si) = 0,7368616 - 1,4745e-6*Time in generations + 5,213e -12*(Time in generations-151094)^2

Summary of Fit

RSquare	0,565418
RSquare Adj	0,536446
Root Mean Square Error	0,16892
Mean of Response	0,683548
Observations (or Sum Wgts	33

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	2	1,1137316	0,556866	19,5159
Error	30	0,8560181	0,028534	Prob > F
C. Tota	32	1,9697497		<,0001 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0,7368616	0,058076	12,69	<,0001 *
Time in generations	-1,475e-6	2,943e-7	-5,01	<,0001 *
(Time in generations-151094)^	5,213e-12	2,48e-12	2,10	0,0441 *

Fit Measured on Original Scale

Sum of Squared Error	1,7005307
Root Mean Square Erro	0,2342132
RSquare	0,6146915
Sum of Residuals	-0,797048

Linear Fit

Log Si = -0,222963 - 1,4743e-6*Time in generations

Summary of Fit

RSquare	0,52839
RSquare Adj	0,513176
Root Mean Square Error	0,259119
Mean of Response	-0,44572
Observations (or Sum Wgts	33

Analysis of Variance

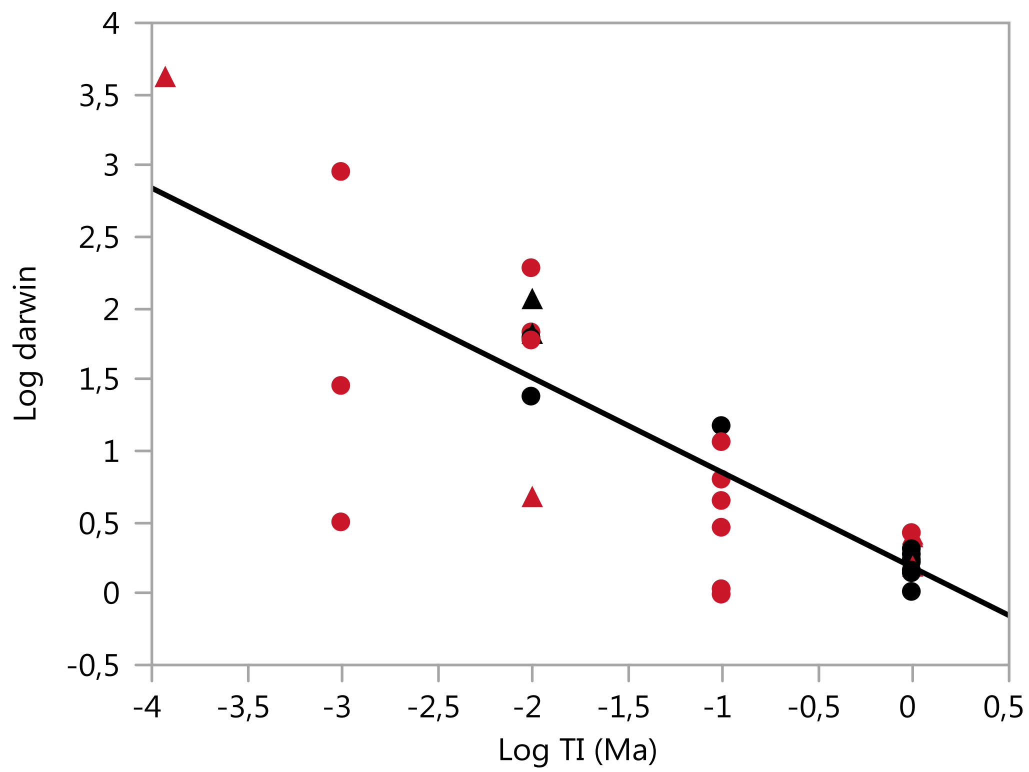
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2,3320087	2,33201	34,7322
Error	31	2,0814181	0,06714	Prob > F
C. Tota	32	4,4134268		<,0001 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-0,222963	0,058849	-3,79	0,0007 *
Time in generation	-1,474e-6	2,502e-7	-5,89	<,0001 *

Fig. 40. Result of regression analysis between S_i and time in isolation (generations) across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red. In addition to the general linear fit for all the species, I fitted the data with an exponential quadratic model. Among the bovids with longer residence times, two main groups (anoas + tamaraw and *Myotragus* + *Nesogoral*) be observed.

Significant regressions were also obtained when rates in darwins and haldanes were plotted against time intervals in million years, and evolutionary rates decreased with the time interval over which they were calculated (Fig. 41, 42).



Linear Fit

Log darwins = 0,1798224 - 0,6656403*Log TI (Ma)

Summary of Fit

RSquare	0,682013
RSquare Adj	0,671756
Root Mean Square Error	0,528152
Mean of Response	0,944942
Observations (or Sum Wgts	33

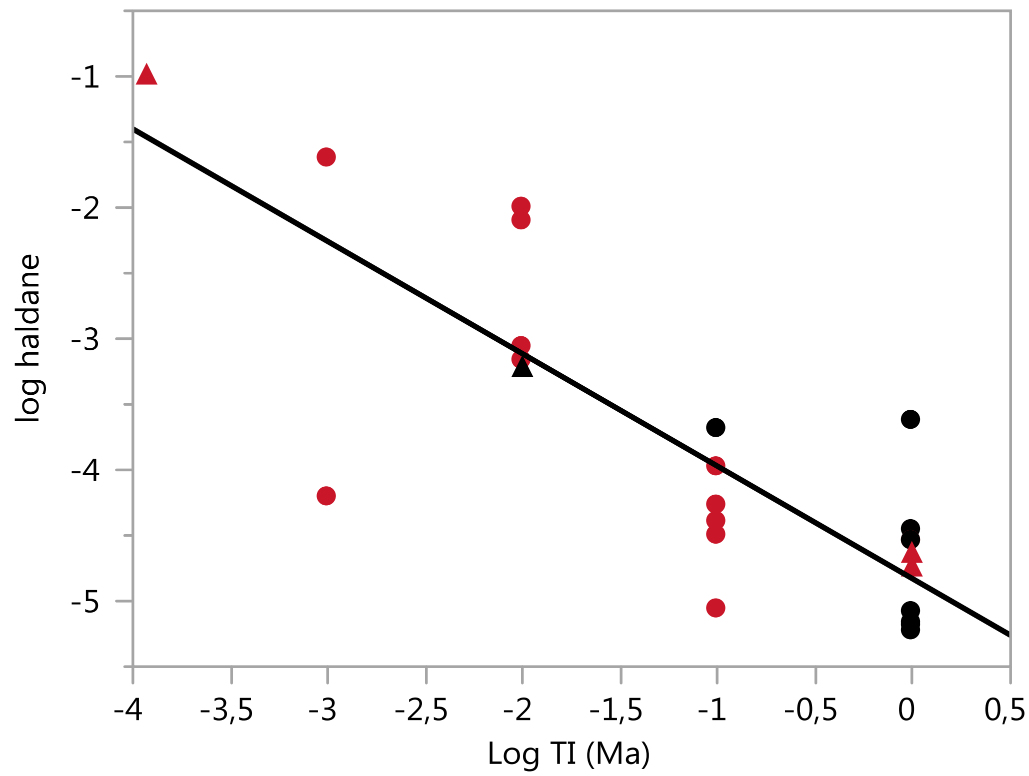
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	18,546527	18,5465	66,4883
Error	31	8,647265	0,2789	**Prob > F**
C. Tota	32	27,193792		<,0001 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0,1798224	0,131368	1,37	0,1809
Log TI (M	-0,66564	0,081633	-8,15	<,0001 *

Fig. 41. Result of regression analysis between evolutionary rates (darwins) and time in isolation (millions of years) across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

log haldanes = -4,831925 - 0,8577464*Log TI (Ma)

Summary of Fit

RSquare	0,692365
RSquare Adj	0,679547
Root Mean Square Error	0,676462
Mean of Response	-3,97643
Observations (or Sum Wgts	26

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	24,717071	24,7171	54,0145
Error	24	10,982413	0,4576	**Prob > F**
C. Tota	25	35,699483		<,0001 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-4,831925	0,176493	-27,38	<,0001 *
Log TI (M	-0,857746	0,116709	-7,35	<,0001 *

Fig. 42. Result of regression analysis between evolutionary rates (haldanes) and time in isolation (millions of years) across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.

5.2. Hypsodonty

Results obtained by plotting HI values with two cranial measurements strongly correlated with diet and habitat (MZW and JLB) show that hypsodonty is shared by the majority of insular bovids independently from their habitat and the abrasiveness of the current diet (Fig. 43, 44). In fact, island species (coloured symbols in the graphs), while scanty, are widely dispersed in both graphs, falling into different dietary and habitat morphospaces. In particular, species that are known to live or have lived in different types of habitat (e.g., *Duboisia santeng*, *Bubalus depressicornis* – forest; *Bison priscus siciliae* – open) are characterized by similar degrees of hypsodonty and vice versa (Fig. 43).

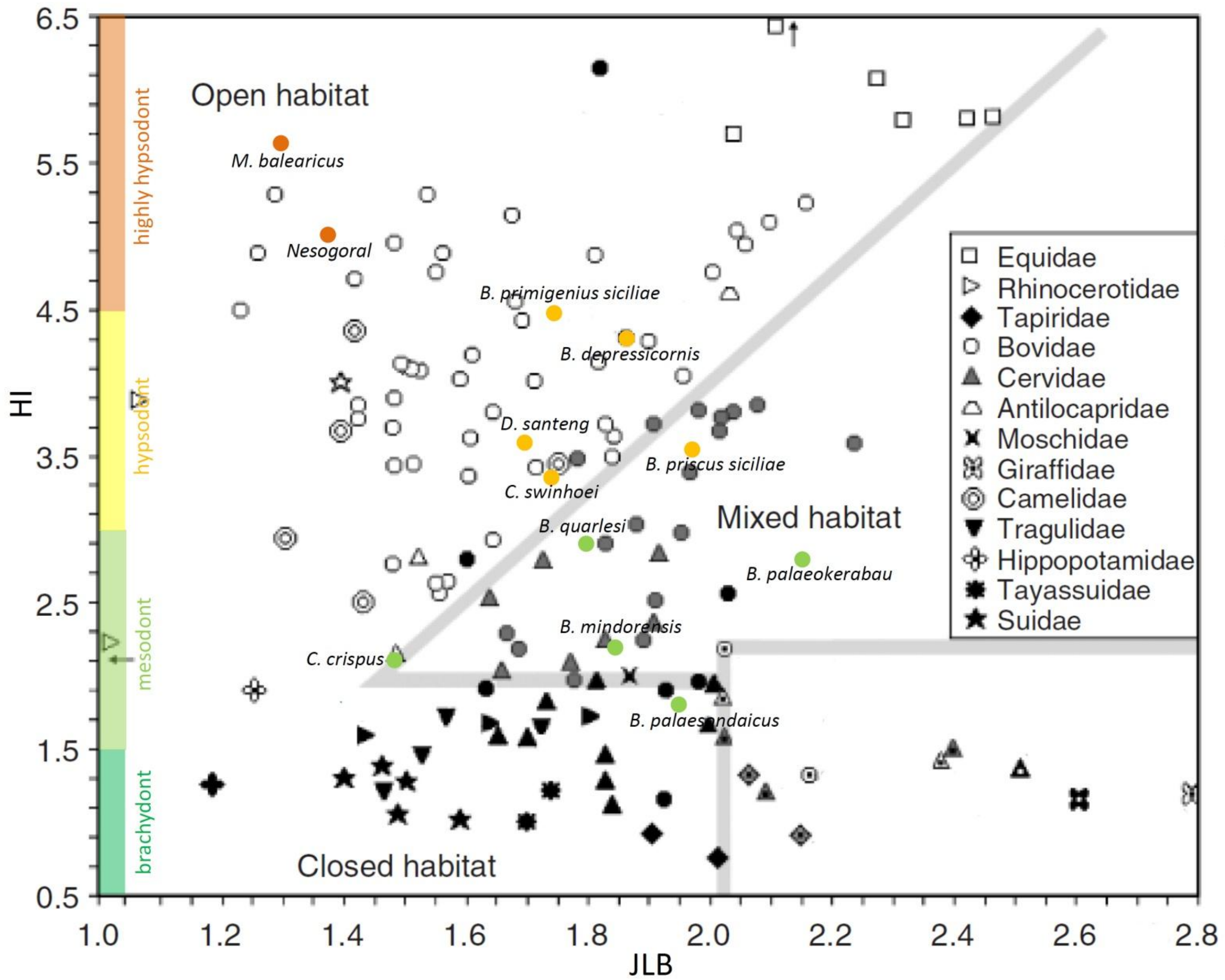


Fig. 43. Distribution of insular bovids (in different colours according to their degree of hypsodonty) and a reference sample of 134 extant mainland ungulate species in the morphospace depicted by the hypsodonty index (HI) and the relative length of the anterior part of the jaw (JLB). JLB allows characterization of the craniodental morphology of species from an open habitat (white symbols), a mixed habitat (grey symbols) and a closed habitat (black symbols). Dotted symbols: species with special adaptations (high-level browsers, riparian and extremely adaptable species). For a description of the morphological variables, see above. Reference sample from Mendoza & Palmqvist, 2007.

A similar scenario characterizes the distribution of insular bovids in the morphospace defined by HI and MZW. In fact, species with different dietary strategies (e.g., *Capricornis crispus* – browser; *Bubalus palaeokerabau* – grazer) show similar values of HI and vice versa (Fig. 44).

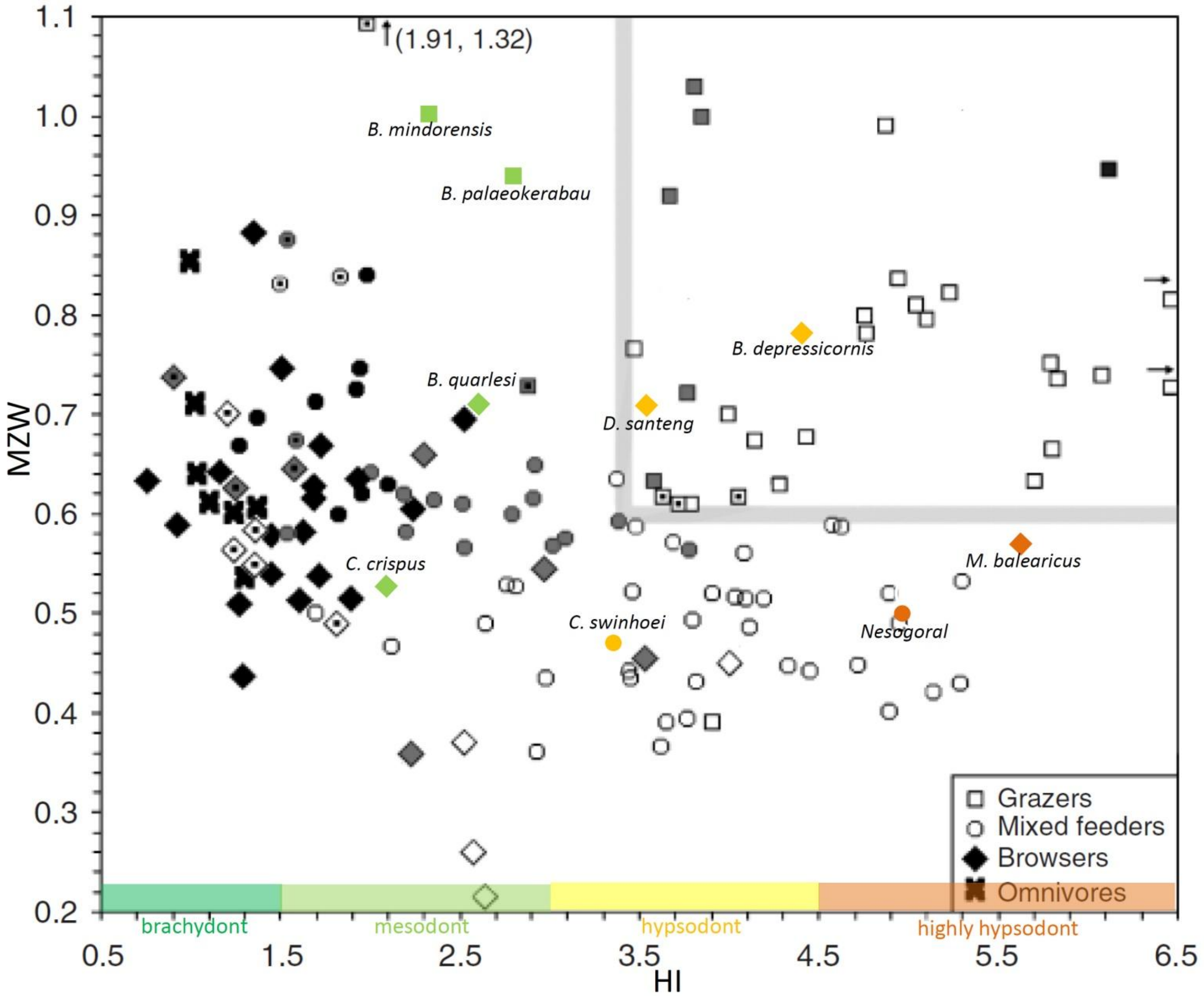
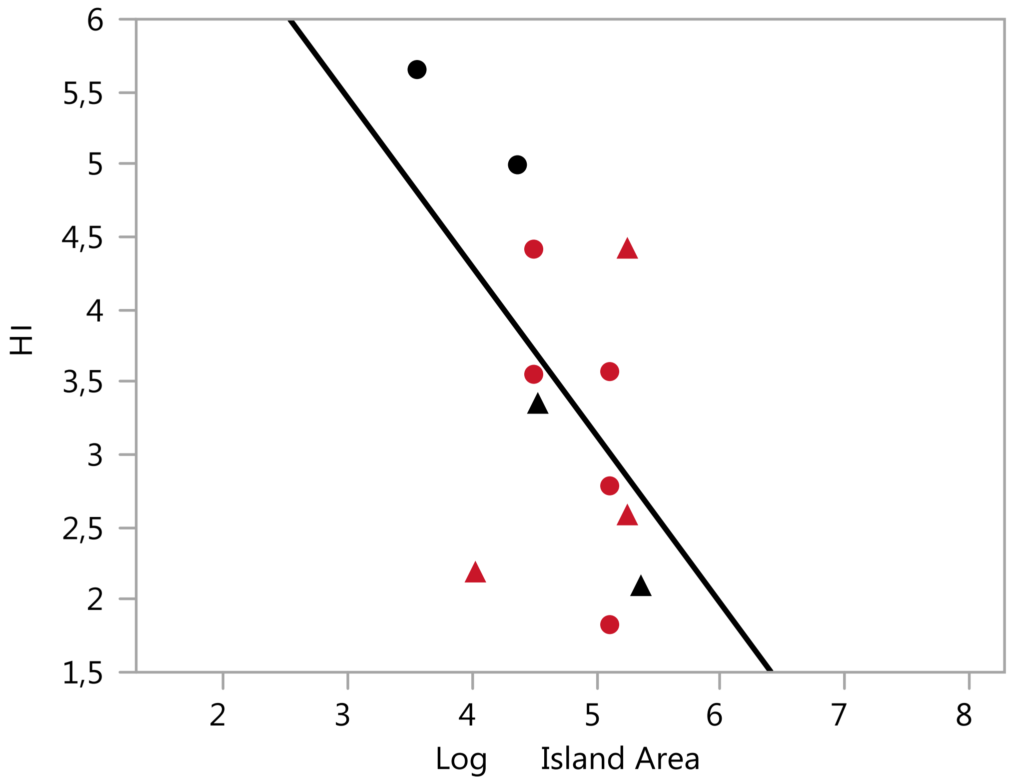


Fig. 44. Distribution of insular bovids (in different colours according to their degree of hypsodonty) and a reference sample of 134 extant mainland ungulate species in the morphospace defined by the hypsodonty index (HI) and the relative width of the muzzle (MZW), which allows characterizing aspects of the craniodental morphology of grazers compared with non-grazing species, including mixed feeders, browsers and omnivores. White symbols: species from an open habitat; grey symbols: species from a mixed habitat; black symbols: species from a closed habitat; dotted symbols: species with special adaptations (high-level browsers, riparian and extremely adaptable species). For a description of the morphological variables, see above. Reference sample from Mendoza & Palmqvist, 2007.

Moreover, regression analyses and RTAs results (Fig. 45, 46, 47) highlight relationships between hypsodonty, island area and number of predators and/or competitors. Main results are summarized in the following graphs:



Linear Fit

HI = 8,931811 - 1,1594685*Log 10 Island Area

Summary of Fit

RSquare	0,286027
RSquare Adj	0,21463
Root Mean Square Error	1,081515
Mean of Response	3,45117
Observations (or Sum Wgts	12

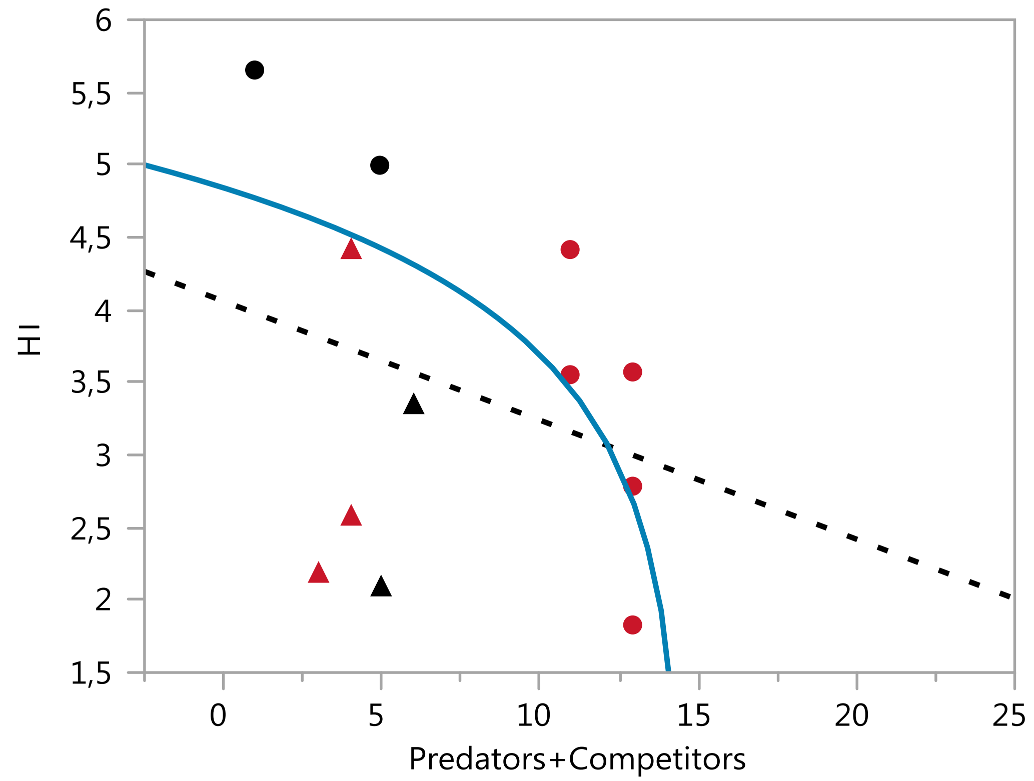
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	4,685868	4,68587	4,0061
Error	10	11,696749	1,16967	Prob > F
C. Tota	11	16,382617		0,0732

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	8,931811	2,755965	3,24	0,0089 *
Log 10 Island Are	-1,159468	0,579291	-2,00	0,0732

Fig. 45. Result of regression analysis between HI and island area (square kilometers) across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Transformed Fit Exp

Exp(HI) = 126,6097 - 8,6598165*Predators+Competitors

Summary of Fit

RSquare	0,221243
RSquare Adj	0,143367
Root Mean Square Error	75,66965
Mean of Response	62,38272
Observations (or Sum Wgts	12

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	16267,106	16267,1	2,8410
Error	10	57258,957	5725,9	Prob > F
C. Tota	11	73526,063		0,1228

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	126,6097	43,92223	2,88	0,0163 *
Predators+Competitor	-8,659816	5,137777	-1,69	0,1228

Fit Measured on Original Scale

Sum of Squared Error	19,475914
Root Mean Square Erro	1,3955613
RSquare	-0,188816
Sum of Residuals	-4,983157

Linear Fit

HI = 4,0594195 - 0,0820112*Predators+Competitors

Summary of Fit

RSquare	0,089054
RSquare Adj	-0,00204
Root Mean Square Error	1,221625
Mean of Response	3,45117
Observations (or Sum Wgts	12

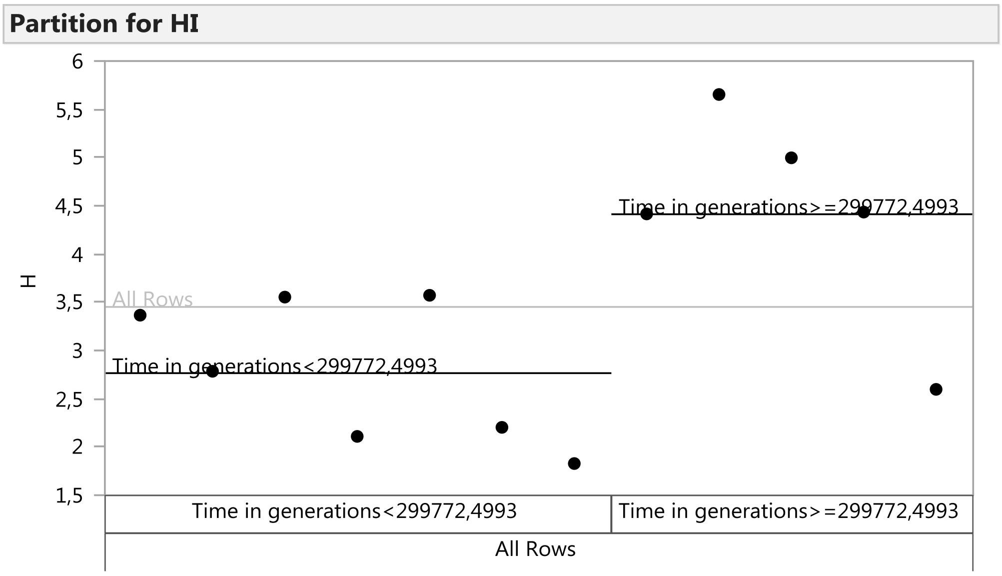
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1,458945	1,45894	0,9776
Error	10	14,923672	1,49237	Prob > F
C. Tota	11	16,382617		0,3461

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4,0594195	0,709089	5,72	0,0002 *
Predators+Competitor	-0,082011	0,082945	-0,99	0,3461

Fig. 46. Result of regression analysis between HI and number of predators+competitors across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red. In addition to the general linear fit for all the species, I fitted the data with an exponential model.



RSquare	RMSE	N	Number of Splits	AICc
0,483	0,8401342	12	1	38,8739

All Rows

		LogWorth	Difference
Count	12		
Mean	3,45117	1,0962276	1,6471
Std De	1,2203806		

Time in generations<299772,4993

Count	7
Mean	2,7648795
Std De	0,7371758

Time in generations>=299772,499

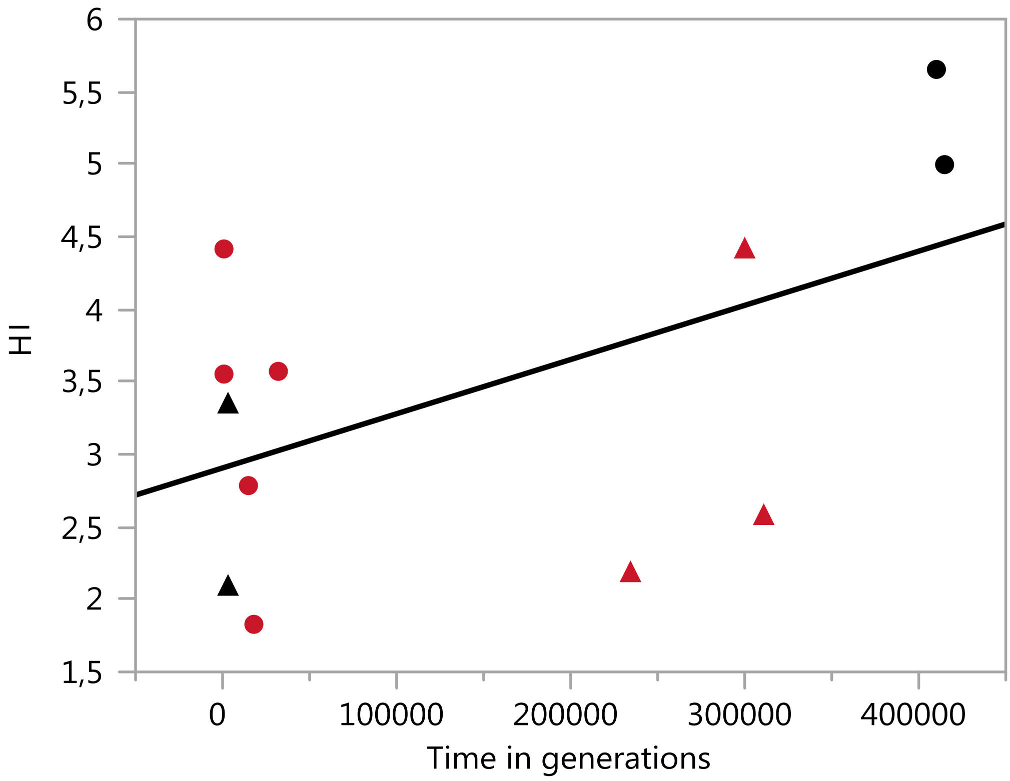
Count	5
Mean	4,4119769
Std De	1,1411986

Column Contributions

Term	Number of Splits	SS	Portion
Time in generations	1	7,91271201	1,0000
Si	0	0	0,0000
Body mass ancestor	0	0	0,0000
Time in isolation	0	0	0,0000
Latitude	0	0	0,0000
Isolation to mainland (km	0	0	0,0000
Area	0	0	0,0000
Topographic complexity	0	0	0,0000
Richness	0	0	0,0000
Predators	0	0	0,0000
Competitors	0	0	0,0000
Predators+Competitors	0	0	0,0000
darwins	0	0	0,0000
haldanes	0	0	0,0000

Fig. 47. Regression tree generated from analysis of all insular bovids and including all predictor variables. Variables used for each split and their critical values are in the first row of each box. Means and Standard deviations of hypsodonty index (HI) and number of insular species included in each split are also reported. Column contributions displays a report showing each input column's contribution to the fit. The report also shows how many times it defined a split and the total Sum of Squares (SS) attributed to that column.

Other supporting results include a linear regression analysis (Fig. 48) showing a significant positive relationship between HI and time in isolation (in generations).



Linear Fit

HI = 2,9061499 + 3,7362e-6*Time in generations

Summary of Fit

RSquare	0,280694
RSquare Adj	0,208763
Root Mean Square Error	1,085547
Mean of Response	3,45117
Observations (or Sum Wgts	12

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	4,598498	4,59850	3,9023
Error	10	11,784120	1,17841	**Prob > F**
C. Tota	11	16,382617		0,0765

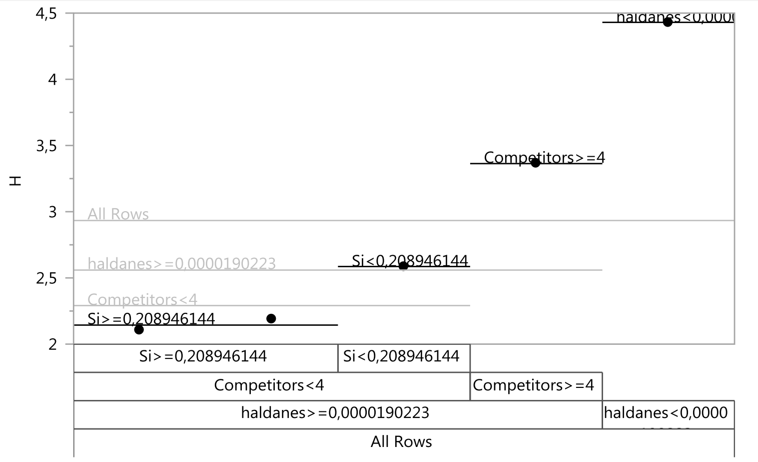
Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	2,9061499	0,417519	6,96	<,0001 *
Time in generation	3,7362e-6	1,891e-6	1,98	0,0765

Fig. 48. Result of regression analysis between HI and time in isolation (generations) across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.

Two RTAs were also performed for the extant and fossil species considered separately (Fig. 49, 50). Regression trees obtained highlight the importance of evolutionary rates and time in isolation, respectively, in splitting living and extinct taxa characterized by different HI values.

Partition for HI



RSquare	RMSE	N	Number of Splits	AICc
0,999	0,0268849	5	3	-71,973

All Rows

		LogWorth	Difference
Count	5		
Mean	2,9333491	0,7701372	1,87081
Std De	0,974184		

haldanes>=0,0000190223

		LogWorth	Difference
Count	4		
Mean	2,5591864	1,1782277	1,07218
Std De	0,5762472		

haldanes<0,0000190223

Count	1
Mean	4,43
Std De	.

Competitors<4

		LogWorth	Difference
Count	3		
Mean	2,2911426	2,1557126	0,44227
Std De	0,2588561		

Competitors>=4

Count	1
Mean	3,3633177
Std De	.

Si>=0,208946144

Count	2
Mean	2,1437209
Std De	0,0601165

Si<0,208946144

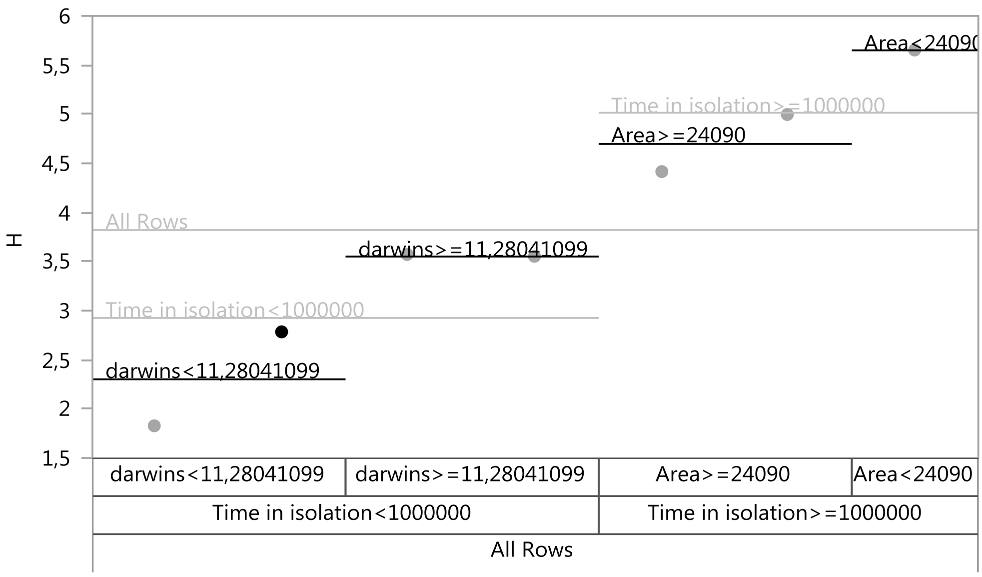
Count	1
Mean	2,585986
Std De	.

Column Contributions

Term	Number of Splits	SS	Portion
haldanes	1	2,7999549	0,7383
Competitors	1	0,86216966	0,2273
Si	1	0,13039894	0,0344
Body mass ancestor	0	0	0,0000
Time in isolation	0	0	0,0000
Latitude	0	0	0,0000
Isolation to mainland (km	0	0	0,0000
Area	0	0	0,0000
Topographic complexity	0	0	0,0000
Richness	0	0	0,0000
Predators	0	0	0,0000
Predators+Competitors	0	0	0,0000
Time in generations	0	0	0,0000
darwins	0	0	0,0000

Fig. 49. Regression tree generated from analysis of extant insular bovids and including all predictor variables. Due to the small sample (N=5) the minimum dimension of partitioning was changed from default (5) to 1. Variables used for each split and their critical values are in the first row of each box. Means and Standard deviations of hypsodonty index (HI) and number of insular species included in each split are also reported. Column contributions displays a report showing each input column's contribution to the fit. The report also shows how many times it defined a split and the total Sum of Squares (SS) attributed to that column.

Partition for HI



RSquare	RMSE	N	Number of Splits	AICc
0,937	0,3031108	7	3	73,1539

All Rows

		LogWorth	Difference
Count	7		
Mean	3,8210421	1,8682123	2,08878
Std De	1,3094623		

Time in isolation<1000000

		LogWorth	Difference
Count	4		
Mean	2,9258492	0,5822144	1,24901
Std De	0,8212805		

Time in isolation>=1000000

		LogWorth	Difference
Count	3		
Mean	5,0146328	0,290789	0,95305
Std De	0,6265727		

darwins<11,28041099

Count	2
Mean	2,3013451
Std De	0,6807629

darwins>=11,28041099

Count	2
Mean	3,5503533
Std De	0,0067555

Area>=24090

Count	2
Mean	4,6969492
Std De	0,4238507

Area<24090

Count	1
Mean	5,65
Std De	.

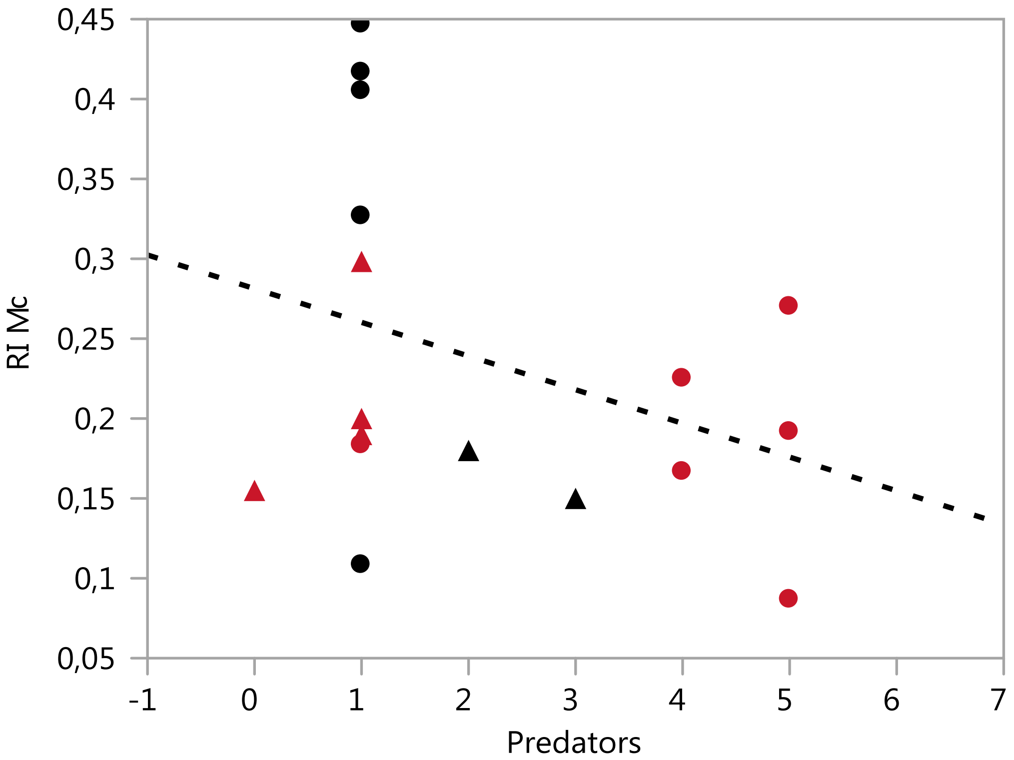
Column Contributions

Term	Number of Splits	SS	Portion
Time in isolation	1	7,47945753	0,7755
darwins	1	1,56002152	0,1617
Area	1	0,60553727	0,0628
Si	0	0	0,0000
Body mass ancestor	0	0	0,0000
Latitude	0	0	0,0000
Isolation to mainland (km	0	0	0,0000
Topographic complexity	0	0	0,0000
Richness	0	0	0,0000
Predators	0	0	0,0000
Competitors	0	0	0,0000
Predators+Competitors	0	0	0,0000
Time in generations	0	0	0,0000
haldanes	0	0	0,0000

Fig. 50. Regression tree generated from analysis of fossil insular bovids and including all predictor variables. Due to the small sample (N=7) the minimum dimension of partitioning was changed from default (5) to 1. Variables used for each split and their critical values are in the first row of each box. Means and Standard deviations of hypsodonty index (HI) and number of insular species included in each split are also reported. Column contributions displays a report showing each input column's contribution to the fit. The report also shows how many times it defined a split and the total Sum of Squares (SS) attributed to that column.

5.3. Low-gear locomotion

Regression analyses (Figs. 51-58) and RTAs (Figs. 59-62) results show a significant relationship between most of the morphological characters associated with low-gear locomotion (i.e., shortening of limb length and metapodials), number of predators and/or competitors and topographic complexity. Nevertheless, in some cases less significant relationships (e.g., between FSI and predators) or no correlation (e.g., between FSI and topographic complexity) can be observed. Main results are summarized in the following graphs:



Linear Fit

RI Mc = 0,2812972 - 0,0210865*Predators

Summary of Fit

RSquare	0,114334
RSquare Adj	0,05529
Root Mean Square Error	0,105498
Mean of Response	0,235403
Observations (or Sum Wgts	17

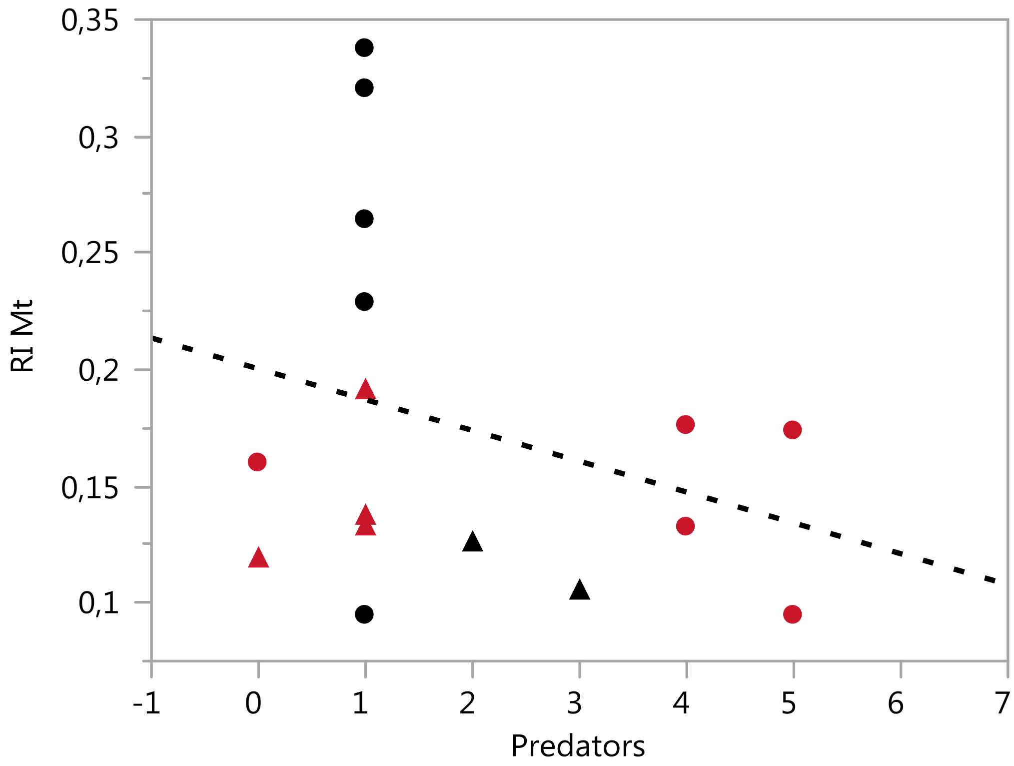
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,02155194	0,021552	1,9364
Error	15	0,16694713	0,011130	Prob > F
C. Tota	16	0,18849908		0,1844

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercep	0,2812972	0,041742	6,74	<,0001 *
Predator	-0,021086	0,015153	-1,39	0,1844

Fig. 51. Result of regression analysis between robusticity index of metacarpals (RIMc) and number of predators across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

RI Mt = 0,2002829 - 0,0132129*Predators

Summary of Fit

RSquare	0,086545
RSquare Adj	0,021298
Root Mean Square Error	0,075175
Mean of Response	0,174683
Observations (or Sum Wgts	16

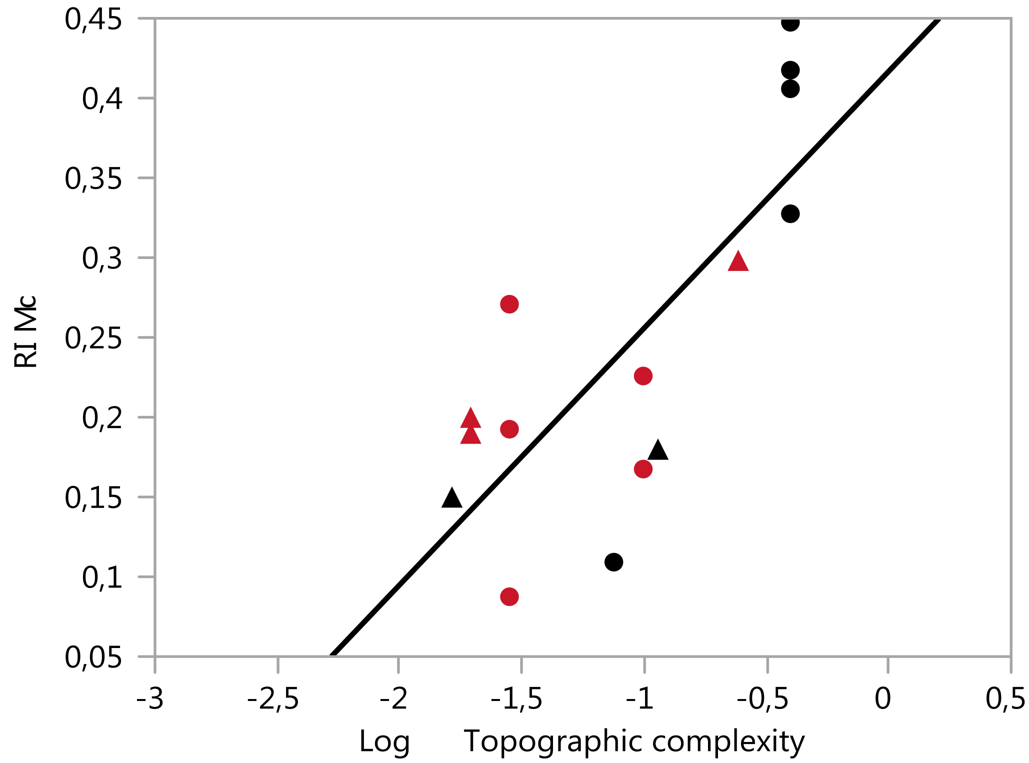
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,00749605	0,007496	1,3264
Error	14	0,07911865	0,005651	**Prob > F**
C. Tota	15	0,08661470		0,2687

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercep	0,2002829	0,029108	6,88	<,0001 *
Predator	-0,013213	0,011472	-1,15	0,2687

Fig. 52. Result of regression analysis between robusticity index of metatarsals (RIMt) and number of predators across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

RI Mc = 0,4168688 + 0,1609678*Log 10 Topographic complexity

Summary of Fit

RSquare	0,585169
RSquare Adj	0,553259
Root Mean Square Error	0,075444
Mean of Response	0,244141
Observations (or Sum Wgts	15

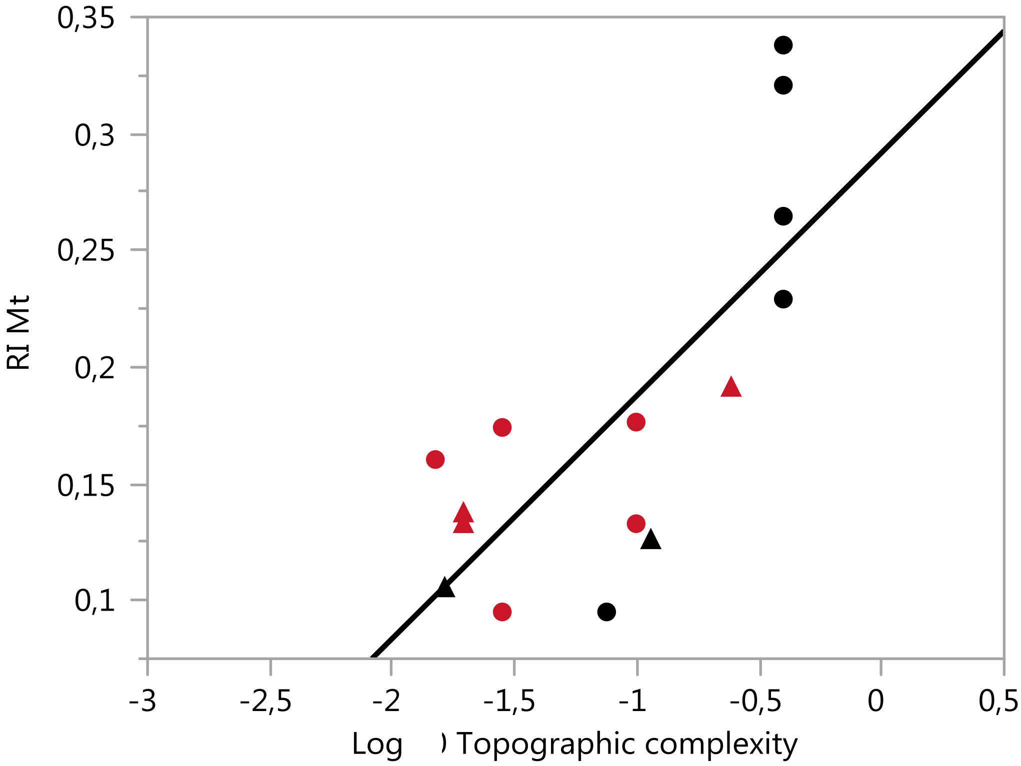
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,10437615	0,104376	18,3381
Error	13	0,07399297	0,005692	Prob > F
C. Tota	14	0,17836911		0,0009 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0,4168688	0,044793	9,31	<,0001 *
Log 10 Topographic complexit	0,1609678	0,037589	4,28	0,0009 *

Fig. 53. Result of regression analysis between robusticity index of metacarpals (RIMc) and topographic complexity across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red. Records of undue influence (N=2) were excluded after a preliminary run of the analysis (see methodology).



Linear Fit

RI Mt = 0,2919862 + 0,1041448*Log 10 Topographic complexity

Summary of Fit

RSquare	0,566473
RSquare Adj	0,533125
Root Mean Square Error	0,052749
Mean of Response	0,178321
Observations (or Sum Wgts	15

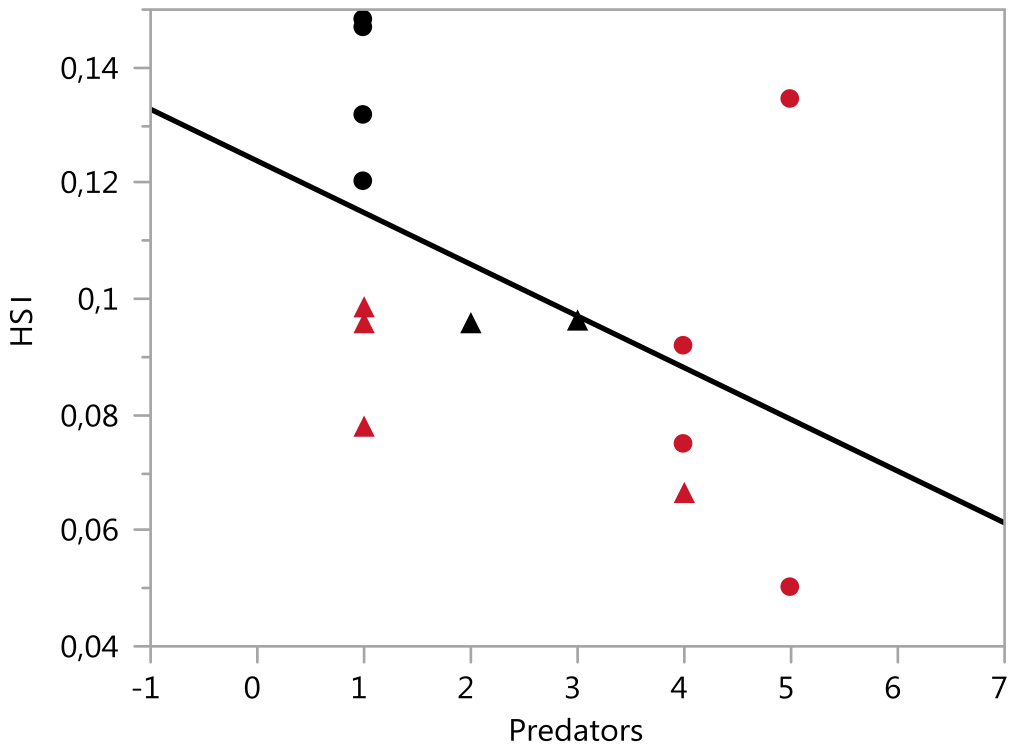
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,04726519	0,047265	16,9866
Error	13	0,03617248	0,002782	**Prob > F**
C. Tota	14	0,08343766		0,0012 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0,2919862	0,030758	9,49	<,0001 *
Log 10 Topographic complexit	0,1041448	0,025269	4,12	0,0012 *

Fig. 54. Result of regression analysis between robusticity index of metatarsals (RIMt) and topographic complexity across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red. Records of undue influence (N=1) were excluded after a preliminary run of the analysis (see methodology).



Linear Fit

HSI = 0,1238476 - 0,0089311*Predators

Summary of Fit

RSquare	0,236849
RSquare Adj	0,173253
Root Mean Square Error	0,027546
Mean of Response	0,102158
Observations (or Sum Wgts	14

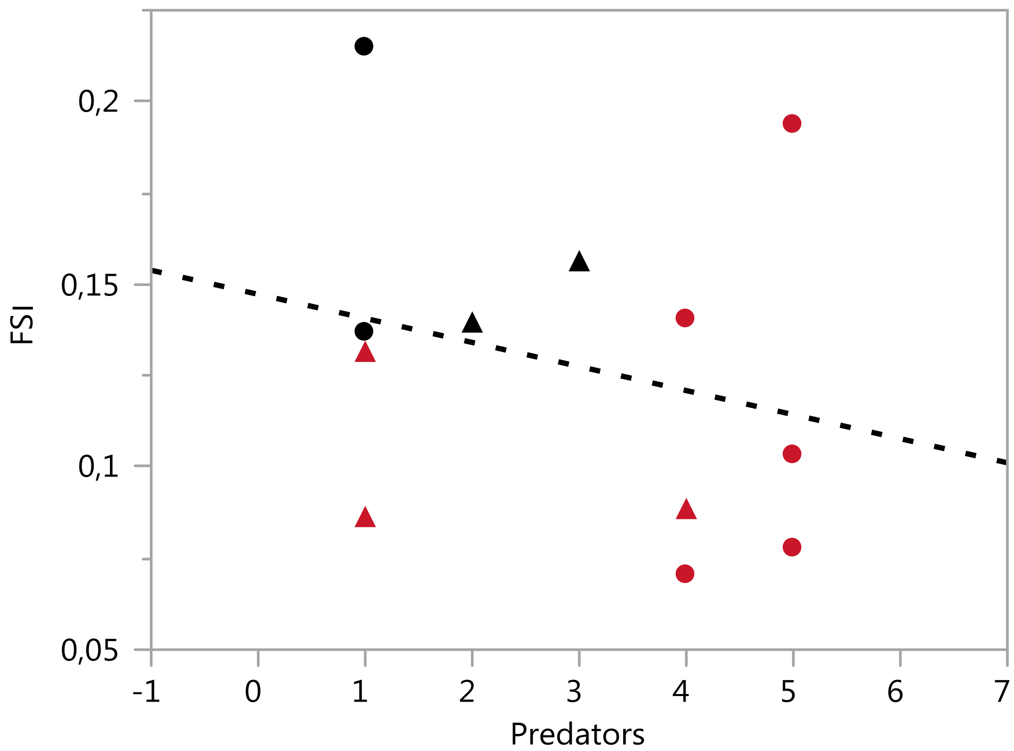
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,00282592	0,002826	3,7243
Error	12	0,00910540	0,000759	**Prob > F**
C. Tota	13	0,01193132		0,0776

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercep	0,1238476	0,013436	9,22	<,0001 *
Predator	-0,008931	0,004628	-1,93	0,0776

Fig. 55. Result of regression analysis between HIS (hindlimb shortening index) and number of predators across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

FSI = 0,1472526 - 0,006586*Predators

Summary of Fit

RSquare	0,067891
RSquare Adj	-0,01685
Root Mean Square Error	0,043958
Mean of Response	0,128508
Observations (or Sum Wgts	13

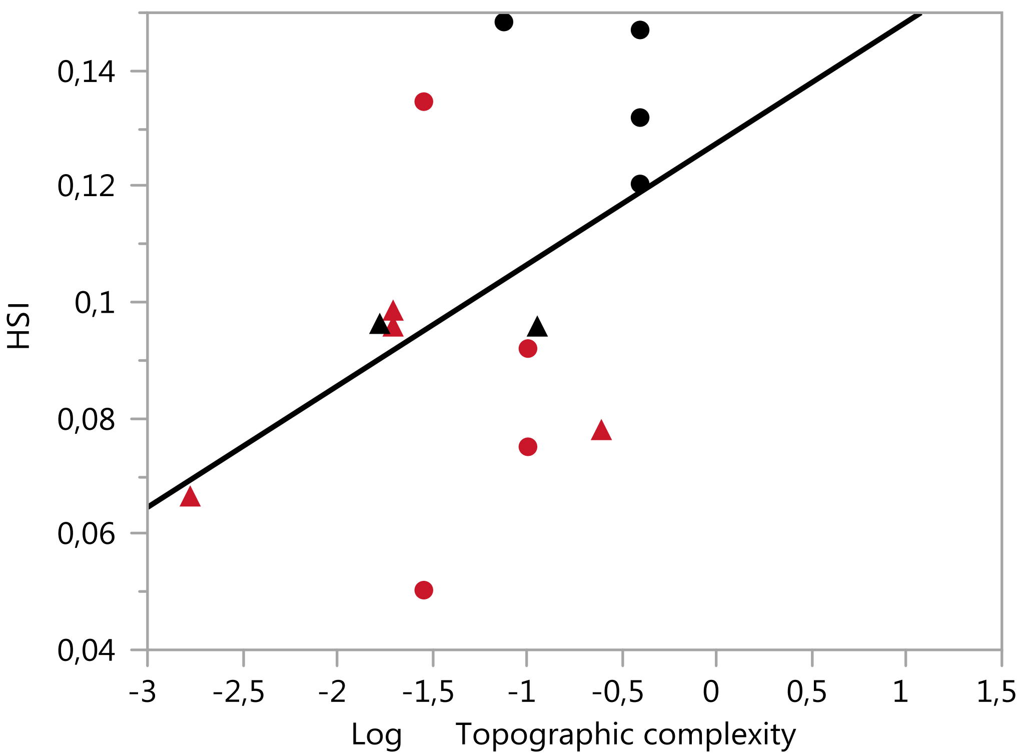
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,00154817	0,001548	0,8012
Error	11	0,02125547	0,001932	**Prob > F**
C. Tota	12	0,02280364		0,3899

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercep	0,1472526	0,024232	6,08	<,0001 *
Predator	-0,006586	0,007358	-0,90	0,3899

Fig. 56. Result of linear regression between FSI (forelimb shortening index) and number of predators across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

HSI = 0,1274918 + 0,020962*Log 10 Topographic complexity

Summary of Fit

RSquare	0,219958
RSquare Adj	0,154955
Root Mean Square Error	0,027849
Mean of Response	0,102158
Observations (or Sum Wgts	14

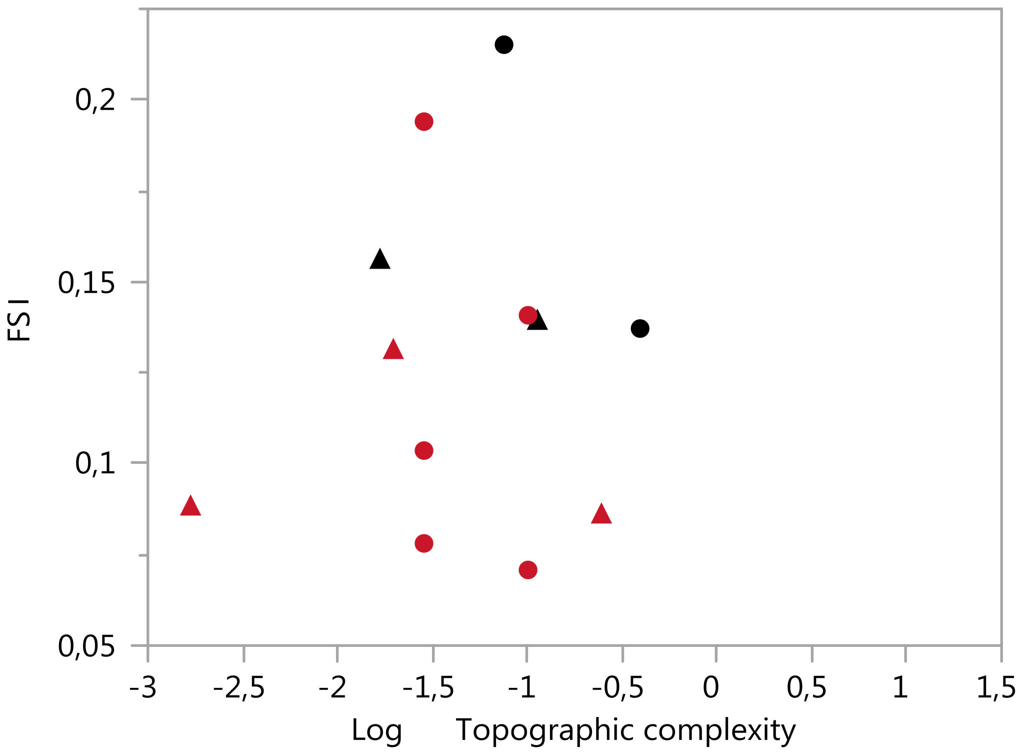
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,00262439	0,002624	3,3838
Error	12	0,00930693	0,000776	**Prob > F**
C. Tota	13	0,01193132		0,0907

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0,1274918	0,015655	8,14	<,0001 *
Log 10 Topographic complexit	0,020962	0,011395	1,84	0,0907

Fig. 57. Result of regression analysis between HIS (hindlimb shortening index) and topographic complexity across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

FSI = 0,1373666 + 0,0065211*Log 10 Topographic complexity

Summary of Fit

RSquare	0,00837
RSquare Adj	-0,08178
Root Mean Square Error	0,04534
Mean of Response	0,128508
Observations (or Sum Wgts	13

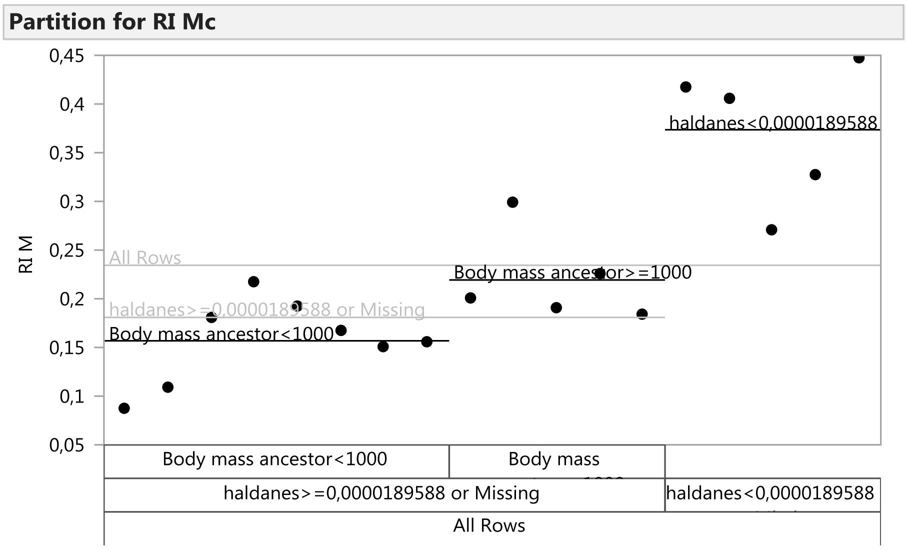
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,00019088	0,000191	0,0929
Error	11	0,02261276	0,002056	**Prob > F**
C. Tota	12	0,02280364		0,7663

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0,1373666	0,031675	4,34	0,0012 *
Log 10 Topographic complexit	0,0065211	0,021401	0,30	0,7663

Fig. 58. Correlation between FSI (forelimb shortening index) and topographic complexity across extant (triangles) and fossil (circles) species of insular bovids (N=12). Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



RSquare	RMSE	N	Number of Splits	AICc
0,774	0,0487106	18	2	-46,628

All Rows

		LogWorth	Difference
Count	18	5,9453271	0,19271
Mean	0,2343706		
Std De	0,1053915		

haldanes>=0,0000189588 or Missing

		LogWorth	Difference
Count	13	0,7642562	0,06248
Mean	0,1808406		
Std De	0,0529431		

haldanes<0,0000189588 not Missing

Count	5
Mean	0,3735486
Std De	0,0726052

Body mass ancestor<1000

Count	8
Mean	0,1568086
Std De	0,0428036

Body mass ancestor>=1000

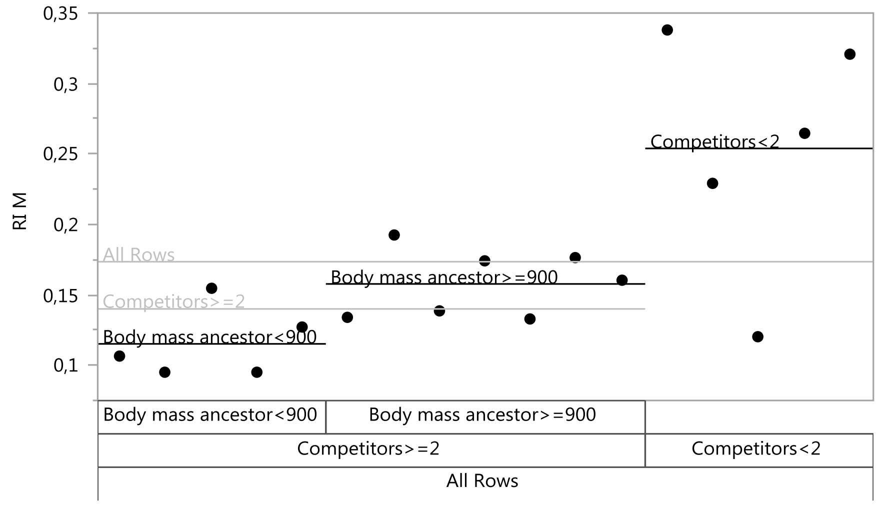
Count	5
Mean	0,2192919
Std De	0,0468984

Column Contributions

Term	Number of Splits	SS	Portion
haldanes	1	0,13410352	0,9178
Body mass ancestor	1	0,01201281	0,0822
Si	0	0	0,0000
Time in isolation	0	0	0,0000
Latitude	0	0	0,0000
Isolation to mainland (km	0	0	0,0000
Area	0	0	0,0000
Topographic complexity	0	0	0,0000
Richness	0	0	0,0000
Predators	0	0	0,0000
Competitors	0	0	0,0000
Predators+Competitors	0	0	0,0000
Time in generations	0	0	0,0000
darwins	0	0	0,0000

Fig. 59. Regression tree generated from analysis of all insular bovids and including all predictor variables. Variables used for each split and their critical values are in the first row of each box. Means and Standard deviations of robusticity index of metacarpals (RIMc) and number of insular species included in each split are also reported. Column contributions displays a report showing each input column's contribution to the fit. The report also shows how many times it defined a split and the total Sum of Squares (SS) attributed to that column.

Partition for RI Mt



RSquare	RMSE	N	Number of Splits	AICc
0,587	0,0459755	17	2	-45,131

All Rows

		LogWorth	Difference
Count	17		
Mean	0,1734881	2,7608417	0,1139
Std De	0,0737407		

Competitors>=2

		LogWorth	Difference
Count	12		
Mean	0,139987	1,2349621	0,04254
Std De	0,0319836		

Competitors<2

Count	5
Mean	0,2538907
Std De	0,0865445

Body mass ancestor<900

Count	5
Mean	0,115171
Std De	0,025551

Body mass ancestor>=900

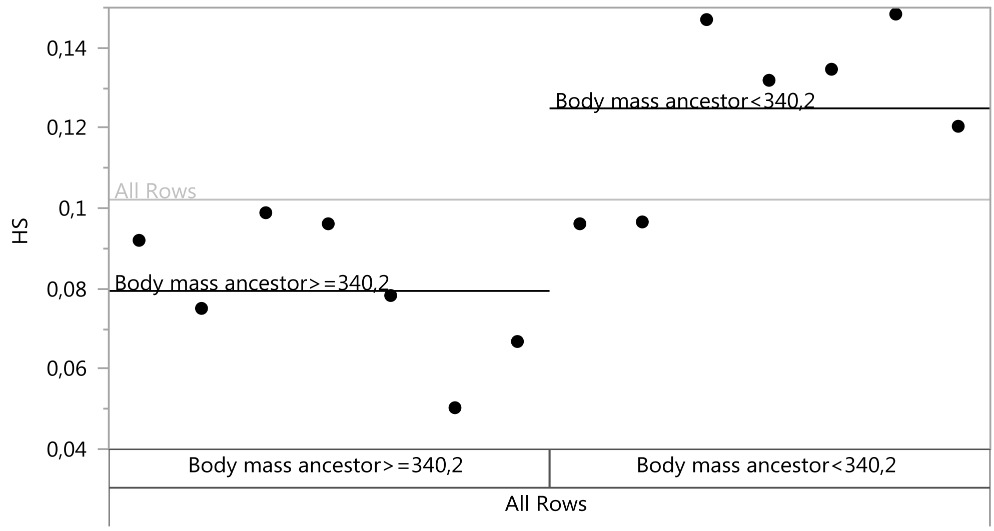
Count	7
Mean	0,1577127
Std De	0,0236729

Column Contributions

Term	Number of Splits	SS	Portion
Competitors	1	0,04579075	0,8966
Body mass ancestor	1	0,00527856	0,1034
Si	0	0	0,0000
Time in isolation	0	0	0,0000
Latitude	0	0	0,0000
Isolation to mainland (km	0	0	0,0000
Area	0	0	0,0000
Topographic complexity	0	0	0,0000
Richness	0	0	0,0000
Predators	0	0	0,0000
Predators+Competitors	0	0	0,0000
Time in generations	0	0	0,0000
darwins	0	0	0,0000
haldanes	0	0	0,0000

Fig. 60. Regression tree generated from analysis of all insular bovids and including all predictor variables. Variables used for each split and their critical values are in the first row of each box. Means and Standard deviations of robusticity index of metatarsals (RIMt) and number of insular species included in each split are also reported. Column contributions displays a report showing each input column's contribution to the fit. The report also shows how many times it defined a split and the total Sum of Squares (SS) attributed to that column.

Partition for HSI



RSquare	RMSE	N	Number of Splits	AICc
0,607	0,018296	14	1	-63,9

All Rows

		LogWorth	Difference
Count	14		
Mean	0,1021578	2,6731143	0,0455
Std De	0,0302951		

Body mass ancestor>=340,2

Count	7
Mean	0,0794094
Std De	0,017598

Body mass ancestor<340,2

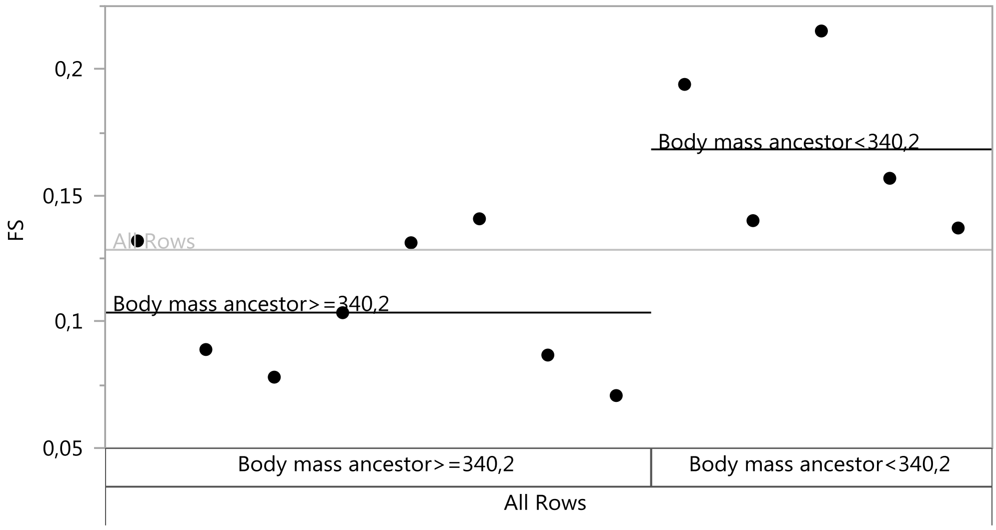
Count	7
Mean	0,1249063
Std De	0,0217114

Column Contributions

Term	Number of Splits	SS	Portion
Body mass ancestor	1	0,00724489	1,0000
Si	0	0	0,0000
Time in isolation	0	0	0,0000
Latitude	0	0	0,0000
Isolation to mainland (km	0	0	0,0000
Area	0	0	0,0000
Topographic complexity	0	0	0,0000
Richness	0	0	0,0000
Predators	0	0	0,0000
Competitors	0	0	0,0000
Predators+Competitors	0	0	0,0000
Time in generations	0	0	0,0000
darwins	0	0	0,0000
haldanes	0	0	0,0000

Fig. 61. Regression tree generated from analysis of all insular bovids and including all predictor variables. Variables used for each split and their critical values are in the first row of each box. Means and Standard deviations of hindlimb shortening index (HSI) and number of insular species included in each split are also reported. Column contributions displays a report showing each input column's contribution to the fit. The report also shows how many times it defined a split and the total Sum of Squares (SS) attributed to that column.

Partition for FSI



RSquare	RMSE	N	Number of Splits	AICc
0,564	0,0276633	13	1	-47,72

All Rows

		LogWorth	Difference
Count	13		
Mean	0,1285078	1,9363395	0,06464
Std De	0,0435925		

Body mass ancestor>=340,2

Count	8
Mean	0,1036473
Std De	0,0271294

Body mass ancestor<340,2

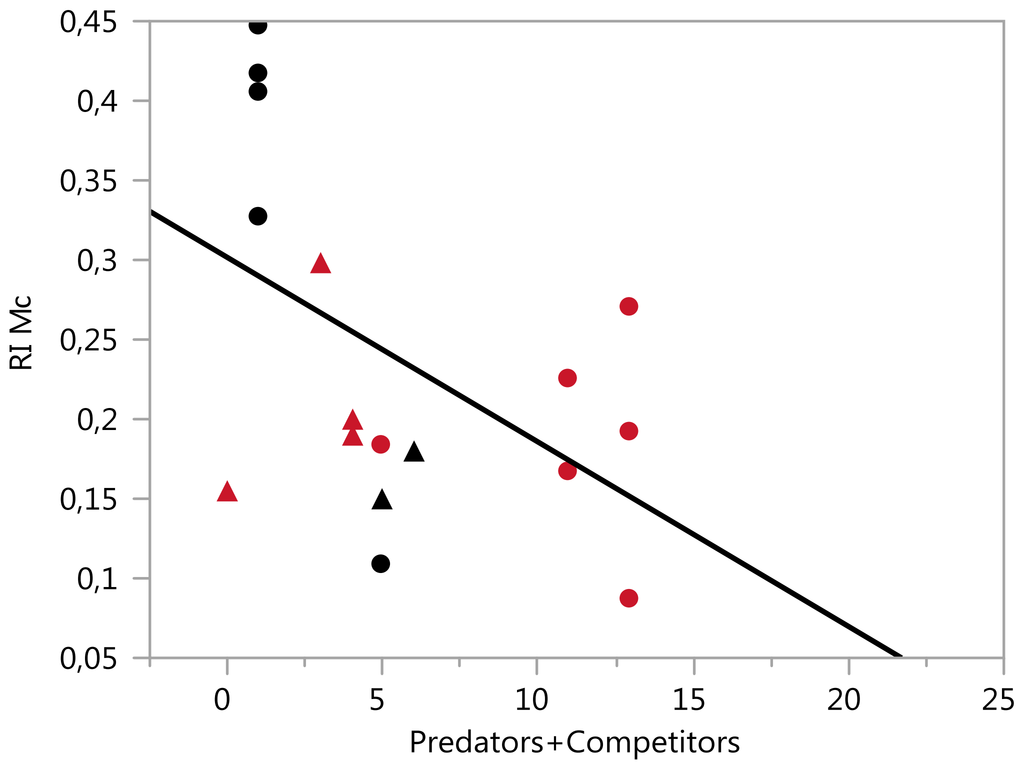
Count	5
Mean	0,1682845
Std De	0,0346277

Column Contributions

Term	Number of Splits	SS	Portion
Body mass ancestor	1	0,01285528	1,0000
Si	0	0	0,0000
Time in isolation	0	0	0,0000
Latitude	0	0	0,0000
Isolation to mainland (km	0	0	0,0000
Area	0	0	0,0000
Topographic complexity	0	0	0,0000
Richness	0	0	0,0000
Predators	0	0	0,0000
Competitors	0	0	0,0000
Predators+Competitors	0	0	0,0000
Time in generations	0	0	0,0000
darwins	0	0	0,0000
haldanes	0	0	0,0000

Fig. 62. Regression tree generated from analysis of all insular bovids and including all predictor variables. Variables used for each split and their critical values are in the first row of each box. Means and Standard deviations of forelimb shortening index (FSI) and number of insular species included in each split are also reported. Column contributions displays a report showing each input column's contribution to the fit. The report also shows how many times it defined a split and the total Sum of Squares (SS) attributed to that column.

Other supporting results (Fig. 63, 64, 65, 66) show a significant relationship between RI Mc, RI Mt and number of predators and competitors.



Linear Fit

RI Mc = 0,301528 - 0,0115889*Predators+Competitors

Summary of Fit

RSquare	0,250459
RSquare Adj	0,20049
Root Mean Square Error	0,097052
Mean of Response	0,235403
Observations (or Sum Wgts	17

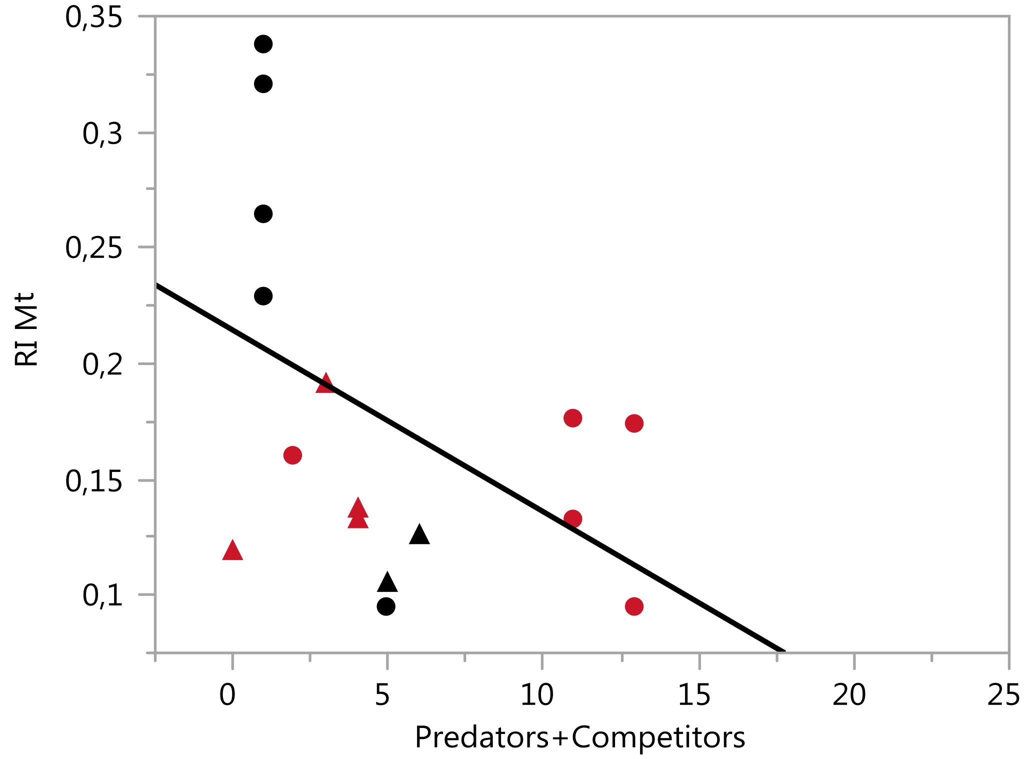
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,04721130	0,047211	5,0122
Error	15	0,14128778	0,009419	**Prob > F**
C. Tota	16	0,18849908		0,0408 *

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0,301528	0,037768	7,98	<,0001 *
Predators+Competitor	-0,011589	0,005176	-2,24	0,0408 *

Fig. 63. Result of regression analysis between RIMc (robusticity index of metacarpals) and number of predators+competitors across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.



Linear Fit

RI Mt = 0,2143971 - 0,0078448*Predators+Competitors

Summary of Fit

RSquare	0,216661
RSquare Adj	0,160708
Root Mean Square Error	0,069616
Mean of Response	0,174683
Observations (or Sum Wgts	16

Analysis of Variance

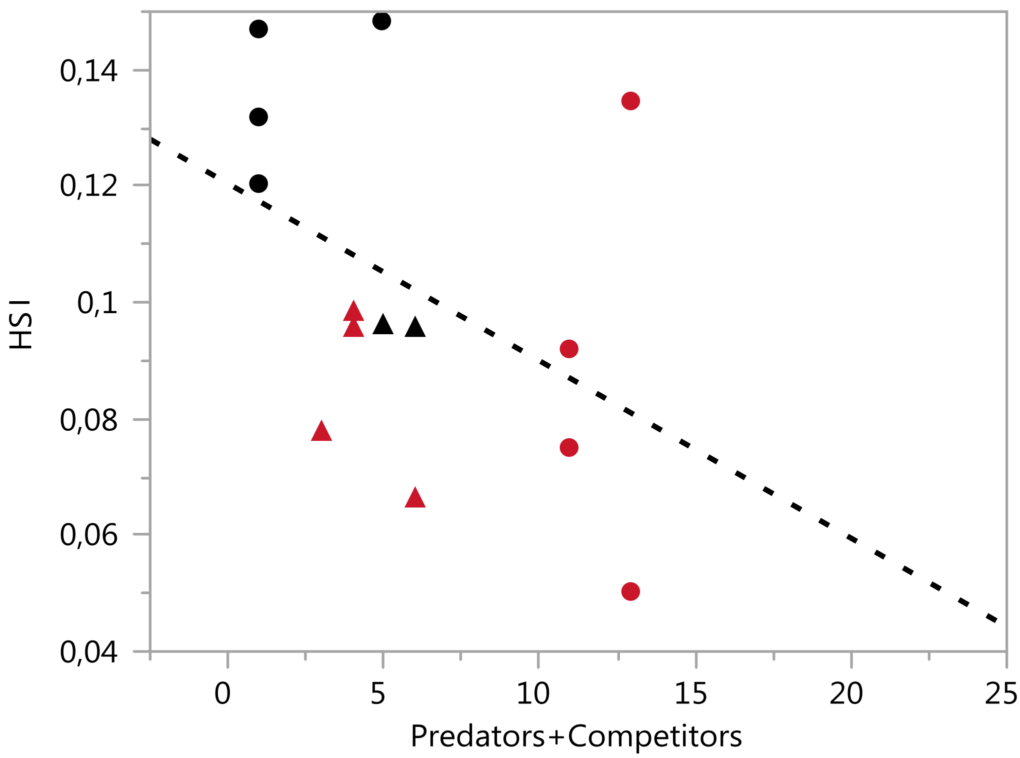
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,01876603	0,018766	3,8722
Error	14	0,06784867	0,004846	**Prob > F**
C. Tota	15	0,08661470		0,0692

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0,2143971	0,02665	8,04	<,0001 *
Predators+Competitor	-0,007845	0,003987	-1,97	0,0692

Fig. 64. Result of regression analysis between RIMt (robusticity index of metatarsals) and number of predators+competitors across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.

The correlation between HSI and number of predators + competitors is undoubtedly less significant, although a general negative trend can be observed (Fig. 65). No sound relationship exists between FSI and number of predators + competitors (Fig. 66).



Linear Fit

HSI = 0,120444 - 0,0030477*Predators+Competitors

Summary of Fit

RSquare	0,188396
RSquare Adj	0,120762
Root Mean Square Error	0,028407
Mean of Response	0,102158
Observations (or Sum Wgts	14

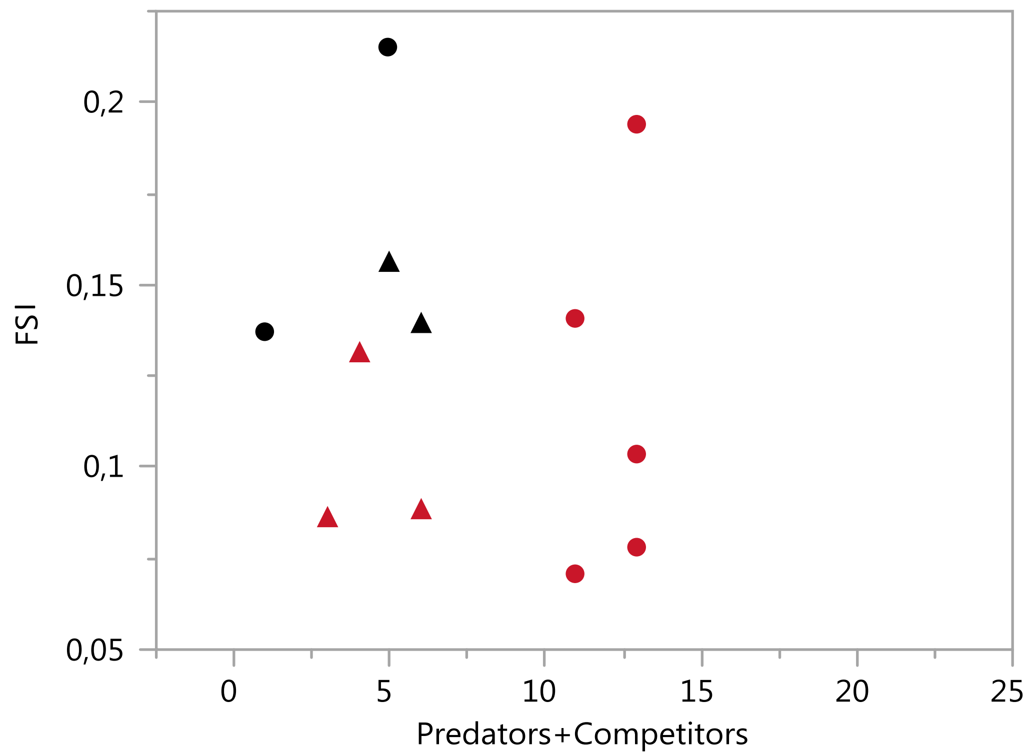
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,00224781	0,002248	2,7855
Error	12	0,00968351	0,000807	**Prob > F**
C. Tota	13	0,01193132		0,1210

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0,120444	0,01333	9,04	<,0001 *
Predators+Competitor	-0,003048	0,001826	-1,67	0,1210

Fig. 65. Result of regression analysis between HSI (hindlimb shortening index) and number of predators+competitors across extant (triangles) and fossil (circles) species of insular bovids. Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in re.d



Linear Fit

FSI = 0,1401121 - 0,001588*Predators+Competitors

Summary of Fit

RSquare	0,024192
RSquare Adj	-0,06452
Root Mean Square Error	0,044977
Mean of Response	0,128508
Observations (or Sum Wgts	13

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0,00055166	0,000552	0,2727
Error	11	0,02225198	0,002023	**Prob > F**
C. Tota	12	0,02280364		0,6119

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0,1401121	0,025483	5,50	0,0002 *
Predators+Competitor	-0,001588	0,003041	-0,52	0,6119

Fig. 66. Correlation between FSI (forelimb shortening index) and predators+competitors across extant (triangles) and fossil (circles) species of insular bovids (N=12). Representatives of Antilopinae are depicted in black, while representatives of Bovinae are depicted in red.

Discussion

«We have now not only traversed the region of the pure understanding and carefully surveyed every part of it, but we have also measured it, and assigned to everything therein its proper place. But this land is an island, and enclosed by nature herself within unchangeable limits. It is the land of truth (an attractive word), surrounded by a wide and stormy ocean, the region of illusion, where many a fog-bank, many an iceberg, seems to the mariner, on his voyage of discovery, a new country, and, while constantly deluding him with vain hopes, engages him in dangerous adventures, from which he never can desist, and which yet he never can bring to a termination.»

Immanuel Kant, The Critique of Pure Reason, 1781

6. Discussion

6.1. Generality and antiquity of the island rule pattern in insular bovids

One of the most recurring patterns in insular mammals is the island rule, describing a graded trend from gigantism in small species to dwarfism in large species (see Introduction).

This research, including the most comprehensive analysis of body size evolution in insular bovids (extant and as well as fossil) to date, reveals that the majority of island bovids, as large mammals, do follow the main prediction of the island rule, showing a body size reduction (Fig. 23). However, the island rule pattern is not clearly exhibited across all species of insular bovids combined, while it is a pervasive pattern within the two subfamilies Bovinae and Antilopinae (Fig. 24). In fact, when regression analyses are used to investigate this relationship within the two subfamilies of insular bovids (Fig. 24), a significant linear fitting can be observed, especially in the case of Antilopinae ($P < 0,05$). Much variation about the analysed island rule trends (r^2 values ranging from less than 0,60 to 0,31) is to be expected given that the current study include species and islands with different characteristics known to influence evolution of body size of insular mammals (see Lomolino et al., 2013). Furthermore, it is worth noting the presence on different islands (e.g., *Bubalus mindorensis* and *B. depressicornis*) and even on the same island (*B. depressicornis* and *B. quarlesi*) of species showing different body size reductions even if originating from the same continental ancestor.

In addition to the analysis of the general trend, I decided to test the differences between the island rule trends shown by the representatives of the two subfamilies Bovinae and Antilopinae, clearly separated in Fig. 24. Insular bovids are characterized by two main types of bauplan. Island Bovinae mainly include species with a bovine/bubaline-like bauplan (i.e., large sized bovids, with a robust chest), while island Antilopinae only include species with a caprine-like bauplan (i.e., small sized bovids, with a slight chest). Results obtained suggest some difference between the island rule trends of these two groups, although not statistically significant (Fig 24). This slight difference could be explained, at a first glance, by the influence of variables of interests correlated with phylogeny and, accordingly, bauplan (e.g., two main body size classes of the mainland, ancestral species). However, I cannot rule out the hypothesis that some characteristics of the sample (e.g., the small number of insular Antilopinae with respect to Bovinae) and/or the so-called Narcissus effect (*sensu* Colwell & Winkler, 1984) could have added a certain amount of uncertainty to the results. Nevertheless, results obtained highlight the importance of the original bauplan of insular species as an initial constraint on body size divergence, although further evidence needs to be gathered.

A significantly steeper (more negative) slope of the island rule relationship was observed for palaeo-insular bovids in comparison to living species within Bovinae (see results of t-test and Fig. 25), and for palaeo-insular species in comparison to the complete sample, including both fossil and extant species, within Antilopinae (Fig. 26). I could not use of a t-test to directly compare the slopes of fossil and extant species within Antilopinae because of the few insular representatives of this subfamily living today, but an even more marked difference in the slopes should be expected in that case. These results are overall in agreement with the prediction that body size evolution was more pronounced in palaeo-insular mammals in comparison to extant species (Fig. 67; see Lomolino et al., 2013).

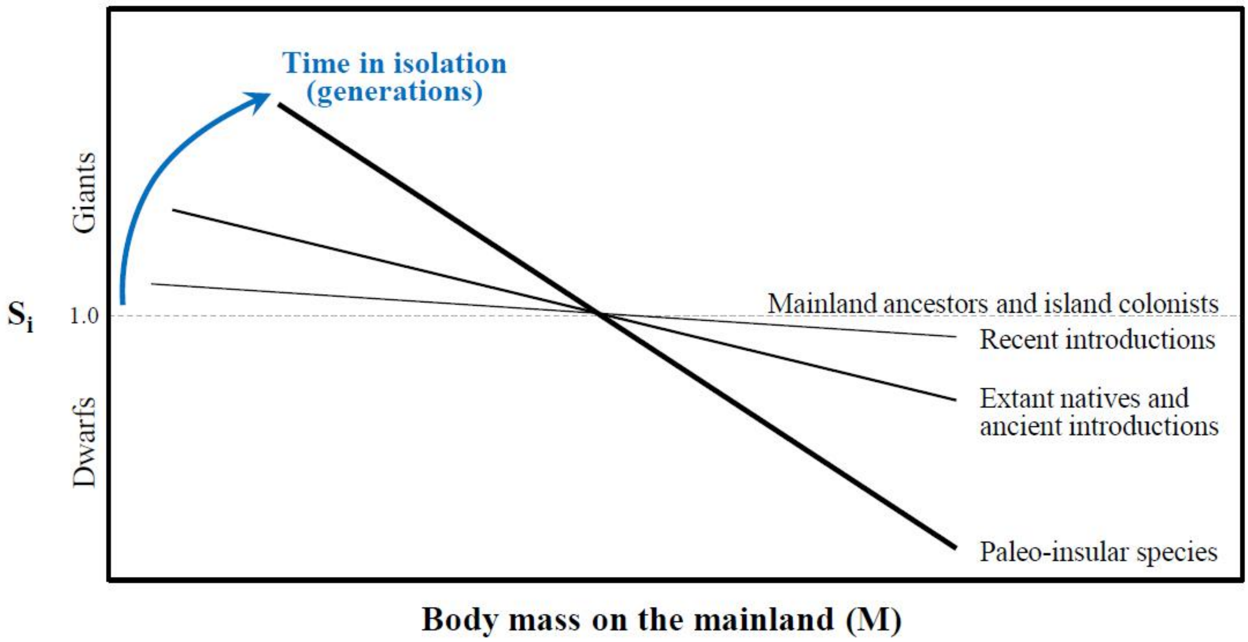


Fig. 67. The Island rule describes a graded trend from gigantism in small mammals to dwarfism in large mammals. Because body size evolution of insular mammals should develop with time in isolation, the slope of the line describing the relation between relative body size of insular mammals (Si) and mass of mainland or ancestral forms (M) should decrease (become steeper) with age of insular populations. This scheme is included in Lomolino et al. (2013).

6.2. Causal explanations for body size evolution in insular mammals

Following the comprehensive investigation of causality of the island rule in extant mammals by Lomolino et al. (2012), I explored the combination of selective forces that have influenced body size evolution of insular bovids in order to clarify which factors played a major role in this process. In particular, results obtained confirm the central role of ecological release and, secondly, of resource limitation. Thus, body size divergence (in this case the degree of dwarfism exhibited by these large mammals) would be most pronounced on smaller islands and on islands with the fewest competitors and predators.

Even the area *per se* version of the resource limitation hypothesis (see Lomolino et al., 2012), suggesting that insular species would be directly affected by the total space available, garnered some support from results of linear regressions, showing a significant relation between S_i and richness (usually correlated with island area; see e.g., Lomolino, 2000). Nevertheless, S_i and island area were only slightly correlated, while a stronger relationship (higher r^2 values and RTA results; see e.g., Figs. 30, 32) between S_i and number of predators and/or competitors was found.

From this I infer that evolution of island bovids is more strongly influenced by ecological interactions than by island area *per se*. This is in agreement with the so-called ecological hypothesis for body size evolution: the direction and magnitude of body size evolution, and the underlying selection forces should be contextual – i.e., dependent on the size and trophic strategies of both the focal species and those species with which they interact (see Palombo 2009; Lomolino et al., 2012).

Relationships between S_i and other predictor variables were also tested. Although no variable was as strongly correlated with S_i as the number of predators and/or competitors, results of linear regressions and RTA highlighted a negative relation with isolation to mainland and a positive relation with latitude. In particular, results obtained suggest that body size divergence of extant bovids exhibited a latitudinal gradient (see e.g., RTA in Fig. 37). However, this gradient could also be a byproduct of other constrains such as the original bauplan of these species, being all living insular Bovinae (except for *Ovibos*) occur on tropical islands and all living insular Antilopinae occur on islands of the middle latitudes. Accordingly, relationship between S_i and isolation to mainland could also be explained in the light of other related variables influencing body size evolution. In fact, isolation to mainland generally affects the number of competitors and/or predators that can be found on an island, clearly driving their biogeographic history. Although isolation to mainland and topographic complexity are correlated with each other, as illustrated by the correlation matrix in Fig. 36 (in fact, oceanic islands, mainly of volcanic origin - e.g., Amsterdam Island -, are usually characterized by complex topographies and rather high elevations), only a vague negative trend between S_i and the latter variable was observed (Fig. 35). This could reflect the weak correlation between S_i and island area, the latter being the denominator in the calculation of topographic complexity.

All in all, most of the analysed variables seem to combine to influence ecological release, clearly one of the crucial forces in guiding body size evolution of insular bovids.

6.2.1. Time in isolation and evolutionary rates

As suggested by results obtained for all insular mammals by Lomolino et al. (2012, 2013), I not only analysed physiographic, climatic and ecological characteristics of the islands among the factors driving body size evolution, but I also considered time in isolation and evolutionary rates of the insular species as well.

The significant relationship between S_i and time in isolation (Figs. 39, 40) – expressed in years and generations – is in agreement with the prediction that body size divergence is more pronounced in species characterized by longer times in isolation (see Lomolino et al. 2013). In addition, a reduction of the variance of S_i values for residence times longer than 200000 years (Figs. 39, 40) would suggest a stabilization of body size evolution through time.

Lister (1989, 1996) hypothesized that body size evolution in insular mammals may take place in two stages: an initial stage of very rapid change (that lasts for a few thousand years) followed by a second stage of slower, but ultimately much more prolonged and pronounced change (for reports on relatively rapid change in body size in the initial stages of island evolution see e.g., Millien, 2006 and other references in Lomolino et al., 2012).

Results of regression analyses are in agreement with this hypothesis, showing two main stages of body size divergence (Fig. 40). Additional evidence supporting Lister's model is provided by the negative relation between evolutionary rates (darwins and haldanes) and the time intervals (millions of years and generations) over which they were calculated (Figs. 41, 42). This negative relation was also found in other analysis of insular mammals (see e.g., Millien, 2006). Unfortunately, most of extant bovids are characterized by long residence times on islands. Thus, typical patterns of the initial stages of body size change can be observed only in some cases (e.g., *Bos primigenius taurus* from Amsterdam Island). In fact, S_i ranges from 0,07 to 0,95 for extant species in my database (time in isolation can even reach an order of magnitude of millions of years as in the case of *Bubalus mindorensis*), while S_i ranges from 0,14 to 1,78 for fossil species. These results highlight the crucial role of time in isolation in body size divergence (see e.g., results of RTA in Figs. 32, 38), for both extant and now extinct forms. In fact, time in isolation as defined in my analysis (time of extinction or the present in the case of living species - time of colonization) does not correspond to the age of insular species *per se*, but essentially reflects their time in ecological isolation from mammalian predators and competitors (including humans and their commensals), in agreement with the already mentioned ecological hypothesis for body size evolution. According to this hypothesis, ecological displacement on the mainland and other high diversity communities drives diversification in body size, while release in ecologically simple and unbalanced, insular communities (in particular, those lacking humans and other ecologically dominant mammals) results in convergence on that of intermediate but absent species (see Lomolino et al., 2012, 2013).

One alternative, but complementary, explanation for more pronounced changes in body size of many insular mammals is that their residence predates the arrival of humans. This hypothesis, proposed by Sondaar (1987, 1991), assumes that island species could not have evolved and coexisted with humans because they are particularly susceptible to the direct actions of humans, as well as the indirect but equally devastating effects of introduced species (commensals that become predators or competitors, or transmit disease). This hypothesis was verified only in some cases among insular bovids (e.g., *Myotragus* and *Nesogoral*), while many other species (e.g., *Bubalus depressicornis*, *Bubalus quarlesi*, *Bubalus mindorensis*, *Capricornis swinhoei*) are still coexisting with humans, albeit most of them are endangered.

6.3. Hypsodonty: resource limitation and increase in reproductive lifespan/longevity

Results obtained (Figs. 43, 44) show that hypsodonty is a common morphological trait shared by the majority of insular bovids (no brachyodont molars were present in the sample) and that this feature evolved independently from their habitat and the abrasiveness of the current diet. In fact, for many browsers (e.g., *Duboisia santeng*, *Bubalus depressicornis*) and mixed feeders (e.g., *Capricornis swinhoei*, *Nesogoral*), both living in closed or more open habitats, I obtained HI values higher than 3 (Figs. 43, 44). This would support the hypothesis, proposed by Winkler et al. (2013, in press), that hypsodonty is one of several adaptations to dietary variability instead of an immediate adaptation to abrasive foods in general and it would reflect an expansion of dietary niche, resulting in a generalistic feeding strategy. The extreme hypsodonty of *Myotragus* *balearicus* thus does not need to be directly related to a specific diet and its abrasiveness, but could well represent a maintained pre-adaptation to energy-limited insular environments, that enabled the species to be flexible in terms of forage selection when needed, and maintain functional durability of teeth throughout the lifespan (see Winkler et al., 2013). Accordingly, hypsodonty should evolve in energetically limited environments as a response to resource limitation, even if browse makes up most of the predominating source of forage. This is also confirmed by the negative relation between HI and island area (Fig. 45). In fact, island area is generally used as a measure of resource limitation, though other forces (e.g., climate) are known to affect the total amount of resources available on an island and other variables (e.g., predators and competitors). Even the negative relation between HI and number or predators and competitors (Fig. 46) could be explained in the light of an energetically limited environment, simply reflecting the well known species-area relation (see e.g., Heaney, 1984; Lomolino, 2000).

However, one alternative, but complementary, hypothesis needs to be taken into account. Some recent studies on herbivores suggest that hypsodonty would increase in response to an increase in reproductive lifespan/longevity. In particular, in *M. balearicus* "the acquisition of a more durable permanent dentition through selection on increased hypsodonty allowed the species to delay senescence and to extend their reproductive lifespan" (Jordana & Köhler 2011, p. 3344). Accordingly, the association between hypsodonty and longevity may be totally independent from diet. Living lowland anoa (*Bubalus depressicornis*) provides another valuable example of an island bovid characterized by a surprisingly high longevity and extremely long gestation time for its body size, likely reflecting those of its larger relatives (see Clauss et al., in press and references therein). Results obtained – e.g., the negative relation between HI, island area and number of predators and competitors (Figs. 45, 46) – do not contradict this evolution towards a slow life history that has been suggested to result from changes in energy allocation from reproduction to growth and maintenance that facilitated survival in a resource-limited environment without predators (see Jordana et al., 2012).

Results of RTAs (see first nodes in Figs. 47, 49, 50) suggest that, together with island area and number of predators and/or competitors, other factors influencing the evolution of hypsodonty in insular bovids are time in isolation (in millions of years and in generations) and evolutionary rates (in darwins and haldanes). This can be verified, for example, in the case of the *Myotragus* endemic anagenetic lineage, spreading in age from the Early Pliocene to the Holocene (e.g., Bover et al., 2010; Palombo et al., 2013). From the oldest to youngest *Myotragus* species, an increase in the degree of hypsodonty is observed in all tooth positions (Alcover et al., 1981), together with the evolution from a grazing feeding strategy towards a more generalistic browse dominated intermediate strategy (see above and Winkler et al., in press).

Another hypothesis, proposed by Damuth & Janis, 2011, suggests that it would be ungulate feeding behaviour, rather than the diet *per se*, that determine the levels of hypsodonty. Accordingly, different levels of hypsodonty would reflect changes in eating methods, including rooting, overgrazing and near-surface browsing, all resulting in a significant soil particle intake.

Since my results strongly suggested that hypsodonty evolved in insular bovids independently from their current diet, the influence of changes in feeding behaviour, although difficult to test in the case of extinct species, should not be underestimated.

6.4. Low-gear locomotion: ecological release and niche partitioning

Factors driving the acquisition of a low-gear locomotion or the maintaining of a cursorial aptitude in insular bovids were explored in this study. The crucial role of predators in affecting the evolution of different types of locomotion was already recognized in the case of some extinct taxa (e.g., *Nesogoral*, *Myotragus*, *Duboisia*; see Palombo et al., 2006b, 2013; Bover 2004; Bover et al., 2010 and references therein; Rozzi et al., 2013; Rozzi & Palombo, in press). However, this is the first study that explored the causal mechanisms behind the acquisition of low-gear locomotion among all the species of insular bovids. Morphological features associated with this type of locomotion include robusticity of metapodials, mainly reflecting an increase in stability especially on rocky and/or uneven grounds, and shortening of limb length, related to the loss of cursorial aptitude (see above). Results obtained by Rozzi & Palombo (in press) indicate that all the extant species of bovids exhibit a shortening of limb length and metapodials, although to a different extent in different species. In fact, each taxon shows peculiar relative proportions of limb elements and different combinations of features. One of the most extreme cases is *Bubalus mindorensis*, which strongly shortened the metapodials with respect to its ancestor *Bubalus arnee* (length of metapodials is less than 20% of the total length of the other limb elements), but only slightly reduced the lengths of radius and tibia (Fig, 68; see Rozzi & Palombo, in press). It is worth noting that in some species the autopodium is strongly shortened with respect to that of their ancestors (e.g., *Myotragus balearicus* and *Bubalus cebuensis*), while other species show quite long and slender metapodials (e.g., *Nesogoral* and *Duboisia santeng*) (Fig. 68; see Rozzi & Palombo, in press).

Results of regression analyses, highlighting a negative relation between these features, the number of predators (Figs. 51, 52, 55, 56) and the number of predators + competitors (Figs. 63, 64, 65), confirmed that ecological release is one of the most important factors in influencing the evolution of low-gear locomotion. Accordingly, the acquisition of characters associated with this type of locomotion or the maintaining of a cursorial aptitude can be explained in light of the predatory pressure that each focal species had/have to face in each insular community.

Fig. 68. Selection of metapodials of extant and fossil insular bovids arranged in order of decreasing robusticity index (RI values at the bottom of each bone). All the specimens are figured with the same total length in order to highlight their different RI values. First row: *Bubalus mindorensis* (SNMNH 219049), *Bubalus depressicornis* (SNMNH 219297), *Bubalus quarlesi* (ANSP 19186), *Capricornis swinhoei* (SNMNH 311229), *Capricornis crispus* (SNMNH 013829/A20934). Second row: *Myotragus balearicus* (IMEDEA 85651), *Bison priscus siciliae* (MGUP fuori collez.), *Bubalus palaeokerabau* (NKM 23303), *Bubalus cebuensis* (FMNH PNM), *Bos primigenius siciliae* (MGUP ST 164), *Nesogoral* sp. (SI Nuoro ORXB 1064), *Duboisia santeng* (Naturalis Coll. Von Koenigswald). Photographs by Roberto Rozzi.

Another factor that could play a significant role is niche partitioning, as shown by the importance of competitors in the evolution of some features associated with low-gear locomotion (see e.g., results of RTA for RI of metatarsals in Fig. 60). Additional evidence is provided by results of linear regressions, highlighting a positive relation between low-gear locomotion proxies and topographic complexity (Figs. 53, 54, 57, 58).

In fact, topographic complexity is a well known measure of habitat fragmentation and available niches (see e.g., Hutchinson, 1959; Owen, 1990) and, accordingly, might reflect the number of competitors occurring on the islands as well. In other words, available niches affecting the assemblage of island communities, their structure and, consequently, inter-specific relations would strongly influence the type of locomotion and cursorial adaptations exhibited by large herbivores.

Results of RTAs (Figs. 59, 60, 61, 62) suggest that the role of evolutionary rates (haldanes) and of ancestral body mass in explaining differences in degree of evolution of morphological features associated with low-gear locomotion in insular bovids should not be underestimated. In particular, the body mass of the continental ancestors might reflect their original bauplan (see discussion about the generality and antiquity of the island rule pattern above) and might work as initial constraint in the evolution of those features. Additional evidence supporting the importance of bauplan constraint is provided by results of regression analyses, highlighting weaker correlations between FSI and predictor variables than the ones observed for HSI (Figs. 56, 58, 66). In fact, forelimb morphology should be more influenced by the ancestral bauplan, being correlated with the original weight and features of the horn-cores (see Rozzi & Palombo, in press).

Conclusion

« And what man withal his witte, can sufficiently declare and proclaime the wonderful industrious minds of the little Emmets and Bees,… being silly things, and yet in(b)ued with noble and commendable qualities...»

Edward Topsell, The Historie of Foure-footed Beastes, 1607

7. Conclusion

This thesis investigated the evolution of extinct and living insular bovids, exploring the selective biotic and abiotic factors that influenced ecogeographic patterns of body mass variation and peculiar morphological changes (e.g., hypsodonty and low-gear locomotion) of these taxa. Through this I hoped to shed new light on the phenomenon of the island syndrome and wider issues in bovid evolution. The preceding chapters have involved extensive review of peculiar features characterizing insular bovids and discussion of causal explanations driving their evolution. In this chapter I summarized my main results in order to build an evolutionary model to explain how selective forces worked together in triggering focal insular phenomena.

Results obtained confirmed hypotheses and predictions associated with the following three types of phenomena:

1) Body size evolution:

- The majority of island bovids, as large mammals, show a body size reduction in agreement with the main prediction of the island rule.
- The island rule is a pervasive pattern within the two subfamilies Bovinae and Antilopinae, although it is not clearly exhibited across all species of insular bovids combined.
- Ecological release and resource limitation are the main factors influencing body size evolution of insular bovids and, thus, body size divergence would be most pronounced on smaller islands and on islands with the fewest competitors and predators.
- Body size divergence is more pronounced in species of bovids characterized by longer times in isolation. In addition, results obtained suggest a stabilization of body size evolution through time.
- Lister's hypothesis (1989, 1996) of body size evolution in two stages was confirmed by the results of regression analysis between S_i and time in isolation and by the negative relation between evolutionary rates and the time intervals over which they were calculated.

2) Hypsodonty:

- Hypsodonty is shared by the majority of insular bovids independently from the abrasiveness of the current diet.
- Hypsodonty is related to expansion of the dietary niche under resource limitation.
- Alternative, but complementary, hypotheses explaining the evolution of this feature (e.g., increase in reproductive lifespan/longevity and changes in eating methods) cannot be excluded.

3) Low-gear locomotion

- The acquisition of a low-gear locomotion or the maintaining of a cursorial aptitude in insular bovids can be explained in the light of habitat selection (niche availability) and predatory pressure (ecological release) operating on each island.

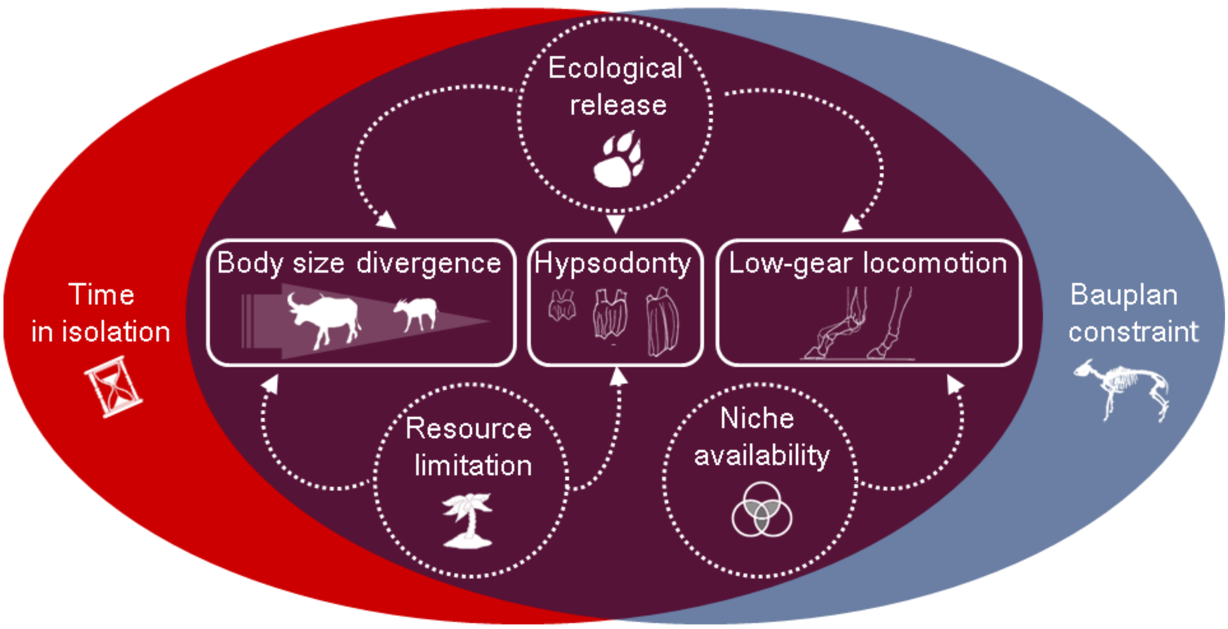


Fig. 69. Conceptual evolutionary model summarizing main factors (in coloured and dotted circles) driving the evolution of body size, hypsodonty and low-gear locomotion in insular bovids. Only the main relations are represented, while more complex relationships obviously exist among predictor variables.

In addition to these predictions, results obtained confirmed the crucial role of time in isolation, with each of the above evolutionary phenomena becoming more developed for bovid populations with longer residence times on the islands. Another factor that needs to be mentioned is original bauplan, working as a constraint in the evolution of all the species in the study. This, which may largely reflect the demands for functional integration of all features of particular bauplan and trophic strategies, may explain the stabilization of evolutionary rates referred to above.

All things considered, available evidence suggests that a major role in the evolution of insular bovids is played by the structure of the insular community, the nature of available niches and by the dynamics of ecological interactions. Accordingly, the ecological hypothesis should be invoked not only in explaining body size evolution but also the other peculiar features exhibited by insular bovids, features that under natural selection of the whole individual must evolve in concert with body size.

Proposals for future work

«…Sed perge in tenebris radiorum quaerere lucem:
nonnisi ab obscura sidera nocte micant.»

D. O. M. ordinis S. Benedicti Occidentalium Monachorum
Patriarchae cunabula

8. Proposals for future work

Following the results obtained in this thesis I outline here some suggestions for the extension and improvement of my research findings.

As regards island bovids, one direction of future research is a detailed analysis of body size patterns exhibited by feral populations of introduced taxa, which would substantially improve our knowledge of Lister's initial stage of body size evolution. Other studies that would shed light on the evolution of these taxa include those focusing on changes in brain morphology and brain volume versus body mass (Rozzi et al., in prep.), and those focusing on body size patterns in species of montane islands (e.g., *Pseudois schaeferi* vs *Pseudois nayaur*; see Groves, 1978; Zeng et al., 2008). Furthermore, targeted studies delving into the taxonomy of some poorly known species (e.g., fossil bovids from Japan) would substantially increase the diversity of focal species well beyond that studied here.

Another area of critical research is that devoted toward developing developing a robust geochronology for the focal islands and the improving of the already existing biochronological schemes. In particular, a good chronological framework is needed to improve and provide vital information about the timing of colonization of insular taxa and, accordingly, island area and distance from the mainland during evolution, the latter two factors being related to sea-level changes (see Introduction). Improving our knowledge of the tempo and nature of long-distance dispersal would also enable us to assess the possible role of climate change as a driver of island evolution.

Finally, my thesis supports the inclusion of time in isolation in comprehensive investigations of causal factors influencing the evolution of island mammals. By applying a similar approach to other island taxa, as already suggested by Lomolino et al. (2013), we might shed considerable new light on the understanding of the island syndrome and evolution of body size, bauplan, and related traits in mainland lineages as well.

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9. References

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Appendix I

10. Appendix I

Abbreviations	Museum
FMNH	The Field Museum, Chicago
SNMNH	Smithsonian National Museum of Natural History, Washington DC
ANSP	Academy of Natural Sciences, Philadelphia
AMNH	American Museum of Natural History, New York
Naturalis	Naturalis Biodiversity Center, Leiden
NMB	Naturhistorisches Museum Basel, Basel
NHM	Natual History Museum, London
IMEDEA	Mediterranean Institute for Advanced Studies (IMEDEA), Esporles, Majorca
NKM	Museum für Naturkunde, Berlin
MGUP	Museo Gemmellaro - Università di Palermo, Palermo
MGPUT	Museo Regionale di Scienze Naturali, Torino
MArc Nuoro	Museo Nazionale Archeologico di Nuoro, Nuoro
SI Nuoro	Soprintendenza per i Beni Archeologici per le province di Sassari e Nuoro, Nuoro

10.1. List of specimens of living bovids

Taxon	Specimen	Museum of Reference	Type of specimen	Sex	Locality
Bubalus arnee	1846.12.15.6	NHM	skeleton	male	Java
Bubalus arnee	not registered	NHM	skull, mandible	?	?
Bubalus arnee	604.b	NHM	skull	?	?
Bubalus arnee	26.9.5.2	NHM	skull	?	Pegu, Burma
Bubalus arnee	41.172	NHM	skull	?	India
Bubalus arnee	41.173	NHM	skull	?	Assam
Bubalus arnee	30.12.22.1	NHM	skull	?	N Bihar
Bubalus arnee	31.10.2.1	NHM	skull	?	Ceylon

Taxon	Specimen	Museum of Reference	Type of specimen	Sex	Locality
Bubalus arnee	30.12.22.2	NHM	skull	?	N Bihar
Bubalus arnee	604.d	NHM	skull	?	?
Bubalus arnee	5.7.29.1	NHM	skull, mandible	female	Assam
Bubalus arnee	604.e	NHM	skull	?	India
Bubalus arnee	604.w	NHM	skull, mandible	?	India
Bubalus arnee	45.1.8.142	NHM	skull	?	N India
Bubalus arnee	12.10.31.84	NHM	skull	male	?
Bubalus arnee	44.130	NHM	skull	female	Dhansiri huke, Gola Ghat, Assam
Bubalus arnee	20.5.14.1	NHM	skull	male	Rangamatti, Bhubri disctrict, Assam
Bubalus arnee	59.471	NHM	skull	?	Nepal
Bubalus arnee	46.210	NHM	skull, mandible	male	Yula disctrict, S Province, Ceylon
Bubalus arnee	55.1.10.1	NHM	skull	?	?
Bubalus arnee	67.4.12	NHM	skull	?	?
Bubalus arnee	12.10.31.83	NHM	skull	female	Gowhatti
Bubalus arnee	92912	FMNH	skull, mandible, skeleton	male	Ahwaz, Kuzistan, Iran
Bubalus arnee	31710	FMNH	skull, mandible	male	Liagna River, Cochin China, Vietnam
Bubalus arnee	31711	FMNH	skull, mandible	female	Cochin China, Vietnam
Bubalus arnee	31711bis	FMNH	skull, mandible	female	Liagna River, Cochin China, Vietnam
Bubalus arnee	SN	FMNH	skull, mandible	?	?
Bubalus arnee	31709	FMNH	skull	?	?
Bubalus arnee	238045	SNMNH	skull	?	British India
Bubalus arnee	238046	SNMNH	skull	male	British India
Bubalus arnee	396881	SNMNH	skull, mandible	male	SE of Darwin, Northern territory, Australia
Bubalus arnee	A 15782/012532	SNMNH	skull, mandible, skeleton	male	India
Bubalus arnee	357402	SNMNH	skull, mandible	male	Vietnam
Bubalus arnee	125189	SNMNH	skull	male	Mindanao, Philippines
Bubalus arnee	151603	SNMNH	skull, mandible	male	Luzon, Philippines
Bubalus arnee	241359	SNMNH	skull, mandible	male	Philippines

Taxon	Specimen	Museum of Reference	Type of specimen	Sex	Locality
Bubalus arnee	268349	SNMNH	skull	?	Mindanao, Philippines
Bubalus arnee	112986	SNMNH	skull, mandible	?	Luzon, Philippines
Bubalus arnee	114144	SNMNH	skull	?	Philippines
Bubalus arnee	267876	SNMNH	skull	?	?
Bubalus arnee	152159	SNMNH	skeleton	male	?
Bubalus depressicornis	42.100	NHM	skull	male	Sulawesi
Bubalus depressicornis	1.10.2.2	NHM	skull	male	N Sulawesi
Bubalus depressicornis	46.5.11.1	NHM	skull	?	?
Bubalus depressicornis	40.691	NHM	skull, mandible	?	Sulawesi
Bubalus depressicornis	1983.2	NHM	skull, mandible, skeleton	male	?
Bubalus depressicornis	1.10.3.3	NHM	skull	female	Uonano, Uinahassa, N Sulawesi
Bubalus depressicornis	1860.8.26.20	NHM	skull, mandible	?	Sulawesi
Bubalus depressicornis	607.b	NHM	skull, mandible	?	? Possibly Mauritius
Bubalus depressicornis	8.12.23.1	NHM	skull	?	Zoological gardens, Trivandrum
Bubalus depressicornis	54.9.8.7	NHM	skull	female	Sulawesi
Bubalus depressicornis	98791	FMNH	skull, mandible, skeleton	female	Indonesia
Bubalus depressicornis	65633	FMNH	skull, mandible, skeleton	female	Sulawesi
Bubalus depressicornis	31748	FMNH	skull	male	Limbe I, N Sulawesi
Bubalus depressicornis	31728	FMNH	skull	male	Limbe I, N Sulawesi
Bubalus depressicornis	219297	SNMNH	skull, mandible, skeleton	male	?
Bubalus depressicornis	281735	SNMNH	skull, mandible	female	?
Bubalus depressicornis	283150	SNMNH	skull, mandible	male	?
Bubalus depressicornis	267369	SNMNH	skull, mandible, skeleton	female	?
Bubalus depressicornis	361484	SNMNH	skull, mandible	female	?
Bubalus depressicornis	5358	ANSP	skull, mandible, skeleton	?	?
Bubalus depressicornis	12142	ANSP	skull, mandible, skeleton	male	Sulawesi
Bubalus depressicornis	14241	ANSP	skull, mandible	male	?
Bubalus mindorensis	92.10.8.1	NHM	skull, mandible	?	Mindoro

Taxon	Specimen	Museum of Reference	Type of specimen	Sex	Locality
Bubalus mindorensis	18817	FMNH	skull, mandible, skeleton	male	Mindoro
Bubalus mindorensis	43301	FMNH	skull, mandible, skeleton	male	Mindoro
Bubalus mindorensis	43302	FMNH	skull, mandible, skeleton	female	Mindoro
Bubalus mindorensis	43303	FMNH	skull, mandible, skeleton	female	Mindoro
Bubalus mindorensis	217	FMNH	skull	female	Mindoro
Bubalus mindorensis	218	FMNH	skull	female	Mindoro
Bubalus mindorensis	18979	FMNH	skull, mandible	male	Mindoro
Bubalus mindorensis	43300	FMNH	skull, mandible	male	Mindoro
Bubalus mindorensis	144461	SNMNH	skull, mandible	?	Mindoro
Bubalus mindorensis	144462	SNMNH	skull	?	Mindoro
Bubalus mindorensis	199703	SNMNH	skull, mandible	male	Mindoro
Bubalus mindorensis	219049	SNMNH	skull, mandible, skeleton	?	Lumanta River, Mindoro
Bubalus mindorensis	144554	SNMNH	skull	?	Lumanta River, Mindoro
Bubalus mindorensis	2415	ANSP	skull, mandible	?	Mindoro
Bubalus quarlesi	219763	SNMNH	skull, mandible	male	Besoa, Sulawesi
Bubalus quarlesi	219760	SNMNH	skull, mandible	male	Besoa, Sulawesi
Bubalus quarlesi	218584	SNMNH	skull, mandible	male	Kulawi, Sulawesi
Bubalus quarlesi	219764	SNMNH	skull, mandible	female	Besoa, Sulawesi
Bubalus quarlesi	199857	SNMNH	skull, mandible	female	Kwandang Molengkapoti, Sulawesi
Bubalus quarlesi	219761	SNMNH	skull, mandible	male	Besoa, Sulawesi
Bubalus quarlesi	219762	SNMNH	skull, mandible	female	Besoa, Sulawesi
Bubalus quarlesi	218587	SNMNH	mandible	?	Gunung Lehio, Sungai Supol, Sulawesi
Bubalus quarlesi	218589	SNMNH	mandible	?	Tuwulu, Sulawesi
Bubalus quarlesi	218588	SNMNH	mandible	?	Tuwulu, Sulawesi
Bubalus quarlesi	218586	SNMNH	skull	male	Tuwulu, Sulawesi
Bubalus quarlesi	218582	SNMNH	skull	female	Tuwulu, Sulawesi
Bubalus quarlesi	218583	SNMNH	skull	female	Lindu, Sulawesi
Bubalus quarlesi	218579	SNMNH	skull	?	Lindu, Sulawesi

Taxon	Specimen	Museum of Reference	Type of specimen	Sex	Locality
Bubalus quarlesi	218580	SNMNH	skull	?	Lindu, Sulawesi
Bubalus quarlesi	218581	SNMNH	skull	?	Lindu, Sulawesi
Bubalus quarlesi	218585	SNMNH	skull	male	Lindu, Sulawesi
Bubalus quarlesi	19186	ANSP	skull, mandible, skeleton	female	Toratja, Sulawesi
Capricornis crispus	5.5.30.31	NHM	skull	female	Washikaguchi, Southern Central Hondo, Japan
Capricornis crispus	1666.a	NHM	skull, mandible	female	Japan
Capricornis crispus	1666.b	NHM	incomplete skull, mandible	male	Japan
Capricornis crispus	A20945	SNMNH	skull	?	Japan
Capricornis crispus	14237	SNMNH	skull	?	Japan
Capricornis crispus	013829/A20934	SNMNH	skull, mandible, skeleton	male	Tateyama, Japan
Capricornis sumatraensis	1965.3.25.2	NHM	mandible, skeleton	?	?
Capricornis sumatraensis	26922	FMNH	skull, mandible, skeleton	?	Kaj-I-Nag Mountains, N Bank Jhelum, Kashmir, India
Capricornis sumatraensis	26921	FMNH	skeleton	?	Kaj-I-Nag Mountains, N Bank Jhelum, Kashmir, India
Capricornis sumatraensis	33.2.4.9	NHM	skull, mandible	?	Katnauli, E Kuman
Capricornis sumatraensis	34.11.3.4.	NHM	skull, mandible	female	Katnauli, E Kuman, Burma
Capricornis sumatraensis	55.604a	NHM	skeleton	male	Sze-chwan, NW China
Capricornis sumatraensis annectens	253534	SNMNH	skull, mandible	female	Ta Chang Tai, Thailand
Capricornis sumatraensis annectens	140836	SNMNH	skull, mandible	?	Thailand
Capricornis sumatraensis argyrochaetes	8.10.9.10	NHM	skull, mandible	?	W China
Capricornis sumatraensis argyrochaetes	1896.11.4.6	NHM	skeleton	female	?
Capricornis sumatraensis argyrochaetes	1965.3.25.1	NHM	skeleton	?	Sze-chwan, NW China
Capricornis sumatraensis argyrochaetes	26672	FMNH	skull	male	Tum Liu, Zhejiang, China

Taxon	Specimen	Museum of Reference	Type of specimen	Sex	Locality
Capricornis sumatraensis argyrochaetes	152165	SNMNH	skull, mandible, skeleton	female	Tao River Valley, Gansu, China
Capricornis sumatraensis argyrochaetes	152164	SNMNH	skull, mandible	male	Tao River Valley, Gansu, China
Capricornis sumatraensis humei	24.5.29.1	NHM	skull, mandible	male	Kashmir
Capricornis sumatraensis jamrachi	88.3.20.15	NHM	skull, mandible	?	Kunsiong, W Darjilong
Capricornis sumatraensis maritimus	39184	FMNH	skeleton	male	Ninh Binh, Tonkin, Vietnam
Capricornis sumatraensis milnedwardsi	8.10.9.12	NHM	skull	female	W China
Capricornis sumatraensis milnedwardsi	36782	FMNH	skull, mandible, skeleton	male	Gang Yang Go, Yaan prefecture, Sichuan, China
Capricornis sumatraensis milnedwardsi	36783	FMNH	skull, mandible, skeleton	male	Dun Shih Goh, Yaan prefecture, Sichuan, China
Capricornis sumatraensis milnedwardsi	39515	FMNH	skeleton	?	Kuan Hsien, Wenjiang prefecture, Sichuan, China
Capricornis sumatraensis milnedwardsi	36783	FMNH	skeleton	?	Dun Shih Goh, Yaan prefecture, Sichuan, China
Capricornis sumatraensis milnedwardsi	258670	SNMNH	skull, mandible, skeleton	male	Wen Chuan, Sichuan, China
Capricornis sumatraensis milnedwardsi	258671	SNMNH	skull, mandible, skeleton	?	Wen Chuan, Sichuan, China
Capricornis sumatraensis milnedwardsi	258831	SNMNH	skull, mandible, skeleton	male	Wen Chuan, Sichuan, China
Capricornis sumatraensis milnedwardsi	258832	SNMNH	skull, mandible, skeleton	male	Wen Chuan, Sichuan, China
Capricornis sumatraensis milnedwardsi	258833	SNMNH	skull, mandible, skeleton	male	Wen Chuan, Sichuan, China
Capricornis sumatraensis milnedwardsi	259025	SNMNH	skull, mandible, skeleton	female	Mupin, Sichuan, China
Capricornis sumatraensis milnedwardsi	259404	SNMNH	skull, mandible, skeleton	male	Wen Chuan, Sichuan, China

Taxon	Specimen	Museum of Reference	Type of specimen	Sex	Locality
Capricornis sumatraensis milnedwardsi	258653	SNMNH	skeleton	female	Wen Chuan, Sichuan, China
Capricornis sumatraensis robinsoni	13.8.9.1	NHM	skull	male	Malay peninsula
Capricornis sumatraensis sumatraensis	1938.11.30.71	NHM	skull, mandible	female	Korinchi Peak, Barasan Range, W Sumatra
Capricornis sumatraensis sumatraensis	1965.3.25.2	NHM	skull, skeleton	?	Sumatra
Capricornis sumatraensis sumatraensis	267332	SNMNH	skull, mandible	male	W Sumatra
Capricornis swinhoei	70.2.10.33	NHM	skull, mandible	?	Taiwan
Capricornis swinhoei	358655	SNMNH	skull	?	Nan Tou, Taiwan
Capricornis swinhoei	308872	SNMNH	skull, mandible, skeleton	male	Wu Lai, Taiwan
Capricornis swinhoei	311229	SNMNH	skull, mandible, skeleton	female	Nan Tou, Taiwan
Capricornis swinhoei	330798	SNMNH	skull, mandible	?	I Lan, Taiwan
Capricornis swinhoei	330800	SNMNH	skull, mandible	?	I Lan, Taiwan
Capricornis swinhoei	330801	SNMNH	skull, mandible	?	I Lan, Taiwan
Capricornis swinhoei	330802	SNMNH	skull, mandible, skeleton	?	I Lan, Taiwan
Capricornis swinhoei	330803	SNMNH	skull, mandible	male	I Lan, Taiwan
Capricornis swinhoei	358656	SNMNH	skull, mandible	?	Nan Tou, Taiwan
Capricornis swinhoei	330804	SNMNH	skull, mandible, skeleton	female	I Lan, Taiwan
Capricornis swinhoei	330799	SNMNH	skull, mandible	?	I Lan, Taiwan
Capricornis swinhoei	308881	SNMNH	skull, mandible, skeleton	female	Pu Li, Taiwan
Capricornis swinhoei	330797	SNMNH	skull, mandible, skeleton	?	Nan Tou, Pu Li, Taiwan
Capricornis swinhoei	330796	SNMNH	skull, mandible	?	Nan Tou, Pu Li, Taiwan
Ovibos moschatus wardi	20.28.66	AMNH	skull, mandible, skeleton	?	Greenland

10.2. List of specimens of fossil bovids

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Asoletragus gentryi	1179	SI Nuoro	skull	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Bibos palaesondaicus	DUB 2826	Naturalis	skull	?	Bangle, Java
Bibos palaesondaicus	DUB 2823	Naturalis	skull	?	Bangle, Java
Bibos palaesondaicus	DUB 2802	Naturalis	skull	?	Kedung Brubus, Java
Bibos palaesondaicus	DUB 2817	Naturalis	skull	?	Kedung Brubus, Java
Bibos palaesondaicus	DUB 2809	Naturalis	skull	?	Kedung Brubus, Java
Bibos palaesondaicus	DUB 2810	Naturalis	skull	?	Kedung Brubus, Java
Bibos palaesondaicus	DUB 1703	Naturalis	skull	?	Sumber Kepuh, Java
Bibos palaesondaicus	DUB 2825	Naturalis	skull	?	Sumber Kepuh, Java
Bibos palaesondaicus	DUB 2801	Naturalis	skull	?	Teguan, Java
Bibos palaesondaicus	DUB 2831	Naturalis	skull	?	Pati Ayam, Java
Bibos palaesondaicus	DUB 2812	Naturalis	skull	?	Trinil, Java
Bibos palaesondaicus	DUB 2771	Naturalis	skull	?	Trinil, Java
Bibos palaesondaicus	DUB 2778	Naturalis	skull	?	Trinil, Java
Bibos palaesondaicus	DUB 2772	Naturalis	skull	?	Trinil, Java
Bibos palaesondaicus	DUB 2774	Naturalis	skull	?	Trinil, Java
Bibos palaesondaicus	MBMa 23251	NKM	M3	?	Trinil, Java
Bibos palaesondaicus	MBMa 23252	NKM	M3	?	Trinil, Java
Bibos palaesondaicus	MBMa 23228	NKM	M2	?	Trinil, Java
Bibos palaesondaicus	MBMa 23227	NKM	M2	?	Trinil, Java
Bibos palaesondaicus	MBMa 23161	NKM	M1	?	Trinil, Java
Bibos palaesondaicus	MBMa 23143	NKM	M3	?	Trinil, Java
Bibos palaesondaicus	MBMa 23253	NKM	M3	?	Trinil, Java
Bibos palaesondaicus	DUB 2639	Naturalis	hemimandible	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bibos palaesondaicus	DUB 336	Naturalis	hemimandible	?	Trinil, Java
Bibos palaesondaicus	DUB 4361	Naturalis	hemimandible	?	Trinil, Java
Bibos palaesondaicus	DUB 336	Naturalis	hemimandible	?	Trinil, Java
Bibos palaesondaicus	DUB 345	Naturalis	hemimandible	?	Trinil, Java
Bibos palaesondaicus	DUB 4361	Naturalis	hemimandible	?	Trinil, Java
Bibos palaesondaicus	MBMa 23176	NKM	hemimandible	?	Trinil, Java
Bibos palaesondaicus	MBMa 23142	NKM	hemimandible	?	Trinil, Java
Bibos palaesondaicus	MBMa 23262	NKM	hemimandible	?	Trinil, Java
Bibos palaesondaicus	MBMa 23255	NKM	hemimandible	?	Trinil, Java
Bibos palaesondaicus	MBMa 23257	NKM	hemimandible	?	Trinil, Java
Bibos palaesondaicus	MBMa 23177	NKM	hemimandible	?	Trinil, Java
Bibos palaesondaicus	MBMa 23141	NKM	maxilla with teeth	?	Trinil, Java
Bibos palaesondaicus	DUB 8487	Naturalis	hemimandible	?	Trinil, Java
Bibos palaesondaicus	MBMa 23301	NKM	metacarpal	?	Trinil, Java
Bibos palaesondaicus	MBMa 23337	NKM	metacarpal	?	Trinil, Java
Bibos palaesondaicus	MBMa 23349	NKM	metatarsal	?	Trinil, Java
Bibos palaesondaicus	MBMa 23348	NKM	metatarsal	?	Trinil, Java
Bibos palaesondaicus	DUB 6789	Naturalis	radius	?	Trinil, Java
Bibos palaesondaicus	DUB 8836	Naturalis	tibia	?	Trinil, Java
Bibos palaesondaicus	DUB 6746	Naturalis	tibia	?	Trinil, Java
Bibos palaesondaicus	MBMa 23297	NKM	radius	?	Trinil, Java
Bibos palaesondaicus	MBMa 23296	NKM	radius	?	Trinil, Java
Bibos palaesondaicus	MBMa 23286	NKM	radius	?	Trinil, Java
Bibos palaesondaicus	MBMa 23341	NKM	tibia	?	Trinil, Java
Bibos palaesondaicus	MBMa 23306	NKM	astragalus	?	Trinil, Java
Bibos palaesondaicus	MBMa 42747	NKM	astragalus	?	Trinil, Java
Bibos palaesondaicus	MBMa 23507	NKM	femur	?	Trinil, Java
Bibos palaesondaicus	MBMa 23517	NKM	humerus	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bibos palaesondaicus	MBMa 23519	NKM	humerus	?	Trinil, Java
Bibos palaesondaicus	MBMa 23527	NKM	humerus	?	Trinil, Java
Bibos palaesondaicus	MBMa 23518	NKM	humerus	?	Trinil, Java
Bison priscus siciliae	252	MGUP	femur	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	253	MGUP	scapula	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	235	MGUP	radius, ulna	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	247	MGUP	tibia	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	249	MGUP	tibia	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	248	MGUP	tibia	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	Puntali 14	MGUP	femur	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	251	MGUP	femur	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	241	MGUP	teeth	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	244	MGUP	metacarpal	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	243	MGUP	metacarpal	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	233	MGUP	radius	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	232	MGUP	radius	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	Puntali 2	MGUP	metacarpal	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	242	MGUP	metacarpal	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	Fuori collezione	MGUP	metacarpal	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	Fuori collezione	MGUP	metatarsal	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	282	MGUP	hemimandible	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	221	MGUP	skull	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	220	MGUP	skull	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	255	MGUP	humerus	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	234	MGUP	radius, ulna	?	Puntali Cave, Carini (Palermo), Italy
Bison priscus siciliae	219	MGUP	vertebra	?	Puntali Cave, Carini (Palermo), Italy
Bos primigenius bubaloides	8531	MGPUT	astragalus	?	Pianosa, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bos primigenius bubaloides	8532	MGPUT	naviculo cuboid	?	Pianosa, Italy
Bos primigenius bubaloides	8532 bis	MGPUT	naviculo cuboid	?	Pianosa, Italy
Bos primigenius bubaloides	8533	MGPUT	intermediate phalanx	?	Pianosa, Italy
Bos primigenius bubaloides	8533 bis	MGPUT	intermediate phalanx	?	Pianosa, Italy
Bos primigenius bubaloides	8535	MGPUT	capitato trapezoid	?	Pianosa, Italy
Bos primigenius bubaloides	8535 bis	MGPUT	capitato trapezoid	?	Pianosa, Italy
Bos primigenius bubaloides	8537	MGPUT	terminal phalanx	?	Pianosa, Italy
Bos primigenius bubaloides	8536	MGPUT	terminal phalanx	?	Pianosa, Italy
Bos primigenius bubaloides	8534/4	MGPUT	terminal phalanx	?	Pianosa, Italy
Bos primigenius bubaloides	8534/3	MGPUT	terminal phalanx	?	Pianosa, Italy
Bos primigenius bubaloides	8534/2	MGPUT	terminal phalanx	?	Pianosa, Italy
Bos primigenius bubaloides	8534/1	MGPUT	terminal phalanx	?	Pianosa, Italy
Bos primigenius bubaloides	8526	MGPUT	humerus	?	Pianosa, Italy
Bos primigenius bubaloides	8524	MGPUT	atlas	?	Pianosa, Italy
Bos primigenius bubaloides	8525	MGPUT	axis	?	Pianosa, Italy
Bos primigenius bubaloides	8530	MGPUT	femur	?	Pianosa, Italy
Bos primigenius bubaloides	8527/1	MGPUT	ulna	?	Pianosa, Italy
Bos primigenius bubaloides	8527/2	MGPUT	ulna	?	Pianosa, Italy
Bos primigenius bubaloides	8522	MGPUT	hemimandible	?	Pianosa, Italy
Bos primigenius bubaloides	8523	MGPUT	P3	?	Pianosa, Italy
Bos primigenius bubaloides	8529	MGPUT	metacarpal	?	Pianosa, Italy
Bos primigenius bubaloides	8528	MGPUT	metacarpal	?	Pianosa, Italy
Bos primigenius siciliae	230	MGUP	horncore, fragment of skull	?	Puntali Cave, Carini (Palermo), Italy
Bos primigenius siciliae	231	MGUP	horncore, fragment of skull	?	Puntali Cave, Carini (Palermo), Italy
Bos primigenius siciliae	229	MGUP	fragment of skull	?	Puntali Cave, Carini (Palermo), Italy
Bos primigenius siciliae	241	MGUP	teeth	?	Puntali Cave, Carini (Palermo), Italy
Bos primigenius siciliae	283	MGUP	hemimandible	?	Puntali Cave, Carini (Palermo), Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bos primigenius siciliae	279	MGUP	hemimandible	?	Puntali Cave, Carini (Palermo), Italy
Bos primigenius siciliae	228	MGUP	skull	?	Puntali Cave, Carini (Palermo), Italy
Bos primigenius siciliae	225	MGUP	skull	?	Puntali Cave, Carini (Palermo), Italy
Bos primigenius siciliae	226	MGUP	skull	?	Puntali Cave, Carini (Palermo), Italy
Bos primigenius siciliae	ST 145	MGUP	hemimandible	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 153	MGUP	M1	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 163	MGUP	tibia	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 165	MGUP	tibia	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 155	MGUP	horncores	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 151	MGUP	Pm3	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 158	MGUP	radius	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 179	MGUP	radius	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 159	MGUP	radius	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 164	MGUP	tibia	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 166	MGUP	tibia	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 154	MGUP	metatarsal	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 168	MGUP	metatarsal	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 161	MGUP	metatarsal	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 160	MGUP	metacarpal	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 167	MGUP	metacarpal	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 170	MGUP	metacarpal	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 169	MGUP	metacarpal	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 178	MGUP	metatarsal	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 157	MGUP	humerus	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 172	MGUP	astragalus	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 171	MGUP	astragalus	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 162	MGUP	proximal phalanx	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 177	MGUP	intermediate phalanx	?	San Teodoro Cave, Acquedolci (Messina), Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bos primigenius siciliae	ST 173	MGUP	calcaneus	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 174	MGUP	calcaneus	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 183	MGUP	scapula	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 156	MGUP	scapula	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 175	MGUP	naviculo cuboid	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 176	MGUP	naviculo cuboid	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 149	MGUP	m3	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 148	MGUP	M2	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 152	MGUP	M2	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 146	MGUP	hemimandible	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 147	MGUP	hemimandible	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	ST 150	MGUP	Pm2	?	San Teodoro Cave, Acquedolci (Messina), Italy
Bos primigenius siciliae	224	MGUP	skull	?	Puntali Cave, Carini (Palermo), Italy
Bos sp.	SN	NHM	horncore	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	M2-M3	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	i	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	M2	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	m1-m3	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	M2	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	proximal phalanx	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	astragalus	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	m3	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	terminal phalanx	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	terminal phalanx	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	proximal phalanx	?	Ghar Dalam, Malta
Bos sp.	SN	NHM	intermediate phalanx	?	Ghar Dalam, Malta
Bubalus cebuensis	PNM 2006-A4	FMNH	2 thoracic vertebrae	?	near Balamban, near "K Hill", Cebu, Philippines

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bubalus cebuensis	PNM 2006-A5	FMNH	2 molars	?	near Balamban, near "K Hill", Cebu, Philippines
Bubalus cebuensis	PNM 2006-A	FMNH	2 terminal phalanges, humerus	?	near Balamban, near "K Hill", Cebu, Philippines
Bubalus cebuensis	PNM 2006-A1	FMNH	humerus	?	near Balamban, near "K Hill", Cebu, Philippines
Bubalus cebuensis	PNM 2006-A2	FMNH	radius	?	near Balamban, near "K Hill", Cebu, Philippines
Bubalus cebuensis	PNM	FMNH	metatarsal	?	near Balamban, near "K Hill", Cebu, Philippines
Bubalus depressicornis	SN	Naturalis	hemimandible	?	Sompoh, Tjabenge, Sopeng district, S Sulawesi
Bubalus depressicornis	SN	Naturalis	humerus	?	Taola Caves, Sulawesi
Bubalus depressicornis	S50	Naturalis	humerus	?	Taola Caves, Sulawesi
Bubalus depressicornis	S	Naturalis	radius	?	Taola Caves, Sulawesi
Bubalus depressicornis	1	Naturalis	metacarpal	?	Taola Caves, Sulawesi
Bubalus depressicornis	2 - 247	Naturalis	metacarpal	?	Taola Caves, Sulawesi
Bubalus depressicornis	3 - 242	Naturalis	metacarpal	?	Taola Caves, Sulawesi
Bubalus depressicornis	SN	Naturalis	metacarpal	?	Taola Caves, Sulawesi
Bubalus depressicornis	ii	Naturalis	m3	?	Sulawesi
Bubalus depressicornis	io	Naturalis	m3	?	Sulawesi
Bubalus depressicornis	5.	Naturalis	m3	?	Bola Batu, Sulawesi
Bubalus depressicornis	i.	Naturalis	m3	?	Bola Batu, Sulawesi
Bubalus depressicornis	6.	Naturalis	m3	?	Bola Batu, Sulawesi
Bubalus depressicornis	2.	Naturalis	m3	?	Bola Batu, Sulawesi
Bubalus depressicornis	SN	Naturalis	molars	?	Sompoh or Beru, Sulawesi
Bubalus depressicornis	SN	Naturalis	calcaneus	?	Taola Caves, Sulawesi
Bubalus depressicornis	SN	Naturalis	metapodial	?	Taola Caves, Sulawesi
Bubalus depressicornis	SN	Naturalis	astragalus	?	Taola Caves, Sulawesi
Bubalus depressicornis	SN	Naturalis	intermediate phalanx	?	Taola Caves, Sulawesi
Bubalus depressicornis	SN	Naturalis	molars	?	Taola Caves, Sulawesi

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bubalus depressicornis	S	Naturalis	astragalus	?	Sompoh, Tjabenge, Sopeng district, S Sulawesi
Bubalus depressicornis	SN	Naturalis	astragalus	?	Taola Caves, Sulawesi
Bubalus depressicornis	SN	Naturalis	proximal phalanx	?	Taola Caves, Sulawesi
Bubalus depressicornis	SN	Naturalis	intermediate phalanx	?	Taola Caves, Sulawesi
Bubalus depressicornis	SN	Naturalis	terminal phalanx	?	Taola Caves, Sulawesi
Bubalus depressicornis	SN	Naturalis	terminal phalanx	?	Taola Caves, Sulawesi
Bubalus depressicornis	3.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i3.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	22.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i0.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	7.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i6.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i5.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	6.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i8.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	ii.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	6 bis	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	SN	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	24.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i7.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	2i.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	23.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	8.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	20.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	SN	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	25.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	SN	Naturalis	M1/M2	?	Bola Batu, Sulawesi

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bubalus depressicornis	9.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	2.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i2.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	5.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	27.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	4.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i4.	Naturalis	M1/M2	?	Bola Batu, Sulawesi
Bubalus depressicornis	4.	Naturalis	m3	?	Bola Batu, Sulawesi
Bubalus depressicornis	SN	Naturalis	m3	?	Bola Batu, Sulawesi
Bubalus depressicornis	5.	Naturalis	p3	?	Bola Batu, Sulawesi
Bubalus depressicornis	SN	Naturalis	p3	?	Bola Batu, Sulawesi
Bubalus depressicornis	4.	Naturalis	p3	?	Bola Batu, Sulawesi
Bubalus depressicornis	3.	Naturalis	p3	?	Bola Batu, Sulawesi
Bubalus depressicornis	2.	Naturalis	p3	?	Bola Batu, Sulawesi
Bubalus depressicornis	SN	Naturalis	lower i	?	Bola Batu, Sulawesi
Bubalus depressicornis	6.	Naturalis	P3/P4	?	Bola Batu, Sulawesi
Bubalus depressicornis	2.	Naturalis	P3/P4	?	Bola Batu, Sulawesi
Bubalus depressicornis	8.	Naturalis	P3/P4	?	Bola Batu, Sulawesi
Bubalus depressicornis	7.	Naturalis	P3/P4	?	Bola Batu, Sulawesi
Bubalus depressicornis	ii	Naturalis	P3/P4	?	Bola Batu, Sulawesi
Bubalus depressicornis	5.	Naturalis	P3/P4	?	Bola Batu, Sulawesi
Bubalus depressicornis	4.	Naturalis	P3/P4	?	Bola Batu, Sulawesi
Bubalus depressicornis	3.	Naturalis	P3/P4	?	Bola Batu, Sulawesi
Bubalus depressicornis	i0.	Naturalis	P3/P4	?	Bola Batu, Sulawesi
Bubalus depressicornis	6.	Naturalis	m1/m2	?	Bola Batu, Sulawesi
Bubalus depressicornis	9.	Naturalis	m1/m2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i.	Naturalis	m1/m2	?	Bola Batu, Sulawesi
Bubalus depressicornis	3.	Naturalis	m1/m2	?	Bola Batu, Sulawesi

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bubalus depressicornis	ii.	Naturalis	m1/m2	?	Bola Batu, Sulawesi
Bubalus depressicornis	5.	Naturalis	m1/m2	?	Bola Batu, Sulawesi
Bubalus depressicornis	8.	Naturalis	m1/m2	?	Bola Batu, Sulawesi
Bubalus depressicornis	7.	Naturalis	m1/m2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i2.	Naturalis	m1/m2	?	Bola Batu, Sulawesi
Bubalus depressicornis	4.	Naturalis	m1/m2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i3.	Naturalis	m1/m2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i0.	Naturalis	m1/m2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i3.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	6.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	i0.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	i2.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	ii.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	6 bis	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	i.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	2.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	3.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	7.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	4.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	5.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	8.	Naturalis	M3	?	Bola Batu, Sulawesi
Bubalus depressicornis	SN	Naturalis	deciduous teeth	?	Bola Batu, Sulawesi
Bubalus depressicornis	7.	Naturalis	m3	?	Bola Batu, Sulawesi
Bubalus depressicornis	8.	Naturalis	m3	?	Bola Batu, Sulawesi
Bubalus depressicornis	9.	Naturalis	m3	?	Bola Batu, Sulawesi
Bubalus depressicornis	3.	Naturalis	p4	?	Bola Batu, Sulawesi
Bubalus depressicornis	i.	Naturalis	p4	?	Bola Batu, Sulawesi
Bubalus depressicornis	2.	Naturalis	p4	?	Bola Batu, Sulawesi

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bubalus depressicornis	2.	Naturalis	P2	?	Bola Batu, Sulawesi
Bubalus depressicornis	i.	Naturalis	P2	?	Bola Batu, Sulawesi
Bubalus palaeokerabau	DUB 2818	Naturalis	skull	?	Kedung Brubus, Java
Bubalus palaeokerabau	DUB 12026	Naturalis	skull	?	Kedung Brubus, Java
Bubalus palaeokerabau	DUB 2871	Naturalis	skull	?	Kedung Brubus, Java
Bubalus palaeokerabau	DUB 2872	Naturalis	skull	?	Kedung Brubus, Java
Bubalus palaeokerabau	DUB 2846	Naturalis	skull	?	Teguan, Java
Bubalus palaeokerabau	DUB 2939	Naturalis	skull	?	Tritik, Java
Bubalus palaeokerabau	DUB 12029	Naturalis	skull	?	Dekes / Wadegan
Bubalus palaeokerabau	DUB 2941	Naturalis	skull	?	Kali Gedeh
Bubalus palaeokerabau	DUB 2837	Naturalis	skull	?	Kali Gedeh
Bubalus palaeokerabau	DUB 69	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 2843	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 62	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 72	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 59	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 2886	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 63	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 3805	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 3011	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 2936	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 2870	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 9416	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 60	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 12025	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 2938	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 3806	Naturalis	skull	?	Trinil, Java
Bubalus palaeokerabau	DUB 12028	Naturalis	skull	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bubalus palaeokerabau	MBMa o.Nr.6	NKM	skull, teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa o.Nr.7	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23250	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23200	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23199	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23248	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23249	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23244	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23201	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23204	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23254	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23227	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23228	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23196	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23197	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23198	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23251	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23252	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23253	NKM	teeth	?	Trinil, Java
Bubalus palaeokerabau	DUB 9025	Naturalis	hemimandible	?	Bangle, Java
Bubalus palaeokerabau	DUB 8180a,b	Naturalis	hemimandible	?	Kedung Brubus, Java
Bubalus palaeokerabau	DUB 9000	Naturalis	hemimandible	?	Kali Gedeh, Java
Bubalus palaeokerabau	DUB 8140	Naturalis	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	DUB 357	Naturalis	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	DUB 2598	Naturalis	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	DUB 4459	Naturalis	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	DUB 2596	Naturalis	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	DUB 540	Naturalis	hemimandible	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bubalus palaeokerabau	DUB 536	Naturalis	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	9001-9002	Naturalis	hemimandible	?	Kali Gedeh, Java
Bubalus palaeokerabau	MBMa 23256	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23158	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23175	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23178	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23260	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23258	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23140	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23259	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23174	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23176	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23177	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23255	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23257	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23142	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa o.Nr.8	NKM	hemimandible	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23302	NKM	metacarpal	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23338	NKM	metacarpal	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23335	NKM	metacarpal	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23336	NKM	metacarpal	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23334	NKM	metacarpal	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23350	NKM	metacarpal	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23351	NKM	metacarpal	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23347	NKM	metatarsal	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23346	NKM	metatarsal	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23303	NKM	metatarsal	?	Trinil, Java
Bubalus palaeokerabau	DUB 10515	Naturalis	metacarpal	?	Kedung Brubus, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bubalus palaeokerabau	DUB 10514	Naturalis	metacarpal	?	Kedung Brubus, Java
Bubalus palaeokerabau	DUB 1654	Naturalis	metatarsal	?	Trinil, Java
Bubalus palaeokerabau	DUB 1624	Naturalis	metatarsal	?	Trinil, Java
Bubalus palaeokerabau	DUB 8743	Naturalis	tibia	?	Trinil, Java
Bubalus palaeokerabau	st. 18498	Naturalis	astragalus	?	Trinil, Java
Bubalus palaeokerabau	st. 18497	Naturalis	astragalus	?	Trinil, Java
Bubalus palaeokerabau	11394	Naturalis	humerus	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23333	NKM	radius	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23332	NKM	radius	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23289	NKM	radius	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23291	NKM	radius	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23290	NKM	radius	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23287	NKM	radius	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23298	NKM	radius	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23295	NKM	radius	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23288	NKM	radius	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23294	NKM	radius	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23292	NKM	radius, ulna	?	Trinil, Java
Bubalus palaeokerabau	1834 MB Ma 7412	NKM	tibia	?	Trinil, Java
Bubalus palaeokerabau	1847 MB Ma 7413	NKM	tibia	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23345	NKM	tibia	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23342	NKM	tibia	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23340	NKM	tibia	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23343	NKM	tibia	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23339	NKM	tibia	?	Trinil, Java
Bubalus palaeokerabau	1862 MB Ma 7414	NKM	astragalus	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Bubalus palaeokerabau	864 MB Ma 7415	NKM	astragalus	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23315	NKM	astragalus	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23313	NKM	astragalus	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23314	NKM	astragalus	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23316	NKM	astragalus	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23305	NKM	astragalus	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23304	NKM	astragalus	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23309	NKM	astragalus	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23470	NKM	femur	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23505	NKM	femur	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23508	NKM	femur	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23506	NKM	femur	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23509	NKM	femur	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23512	NKM	femur	?	Trinil, Java
Bubalus palaeokerabau	MB Ma 23510	NKM	femur	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23516	NKM	humerus	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23514	NKM	humerus	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23525	NKM	humerus	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23521	NKM	humerus	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23523	NKM	humerus	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23515	NKM	humerus	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23522	NKM	humerus	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23526	NKM	humerus	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23513	NKM	humerus	?	Trinil, Java
Bubalus palaeokerabau	MBMa 23524	NKM	humerus	?	Trinil, Java
Capricornis sumatraensis	1044	Naturalis	M3	?	Gua Jimbe, near Kates, Java
Duboisia santeng	DUB 2057a	Naturalis	hemimandible	?	Kedung Brubus, Java
Duboisia santeng	DUB 2519	Naturalis	hemimandible	?	Kedung Brubus, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Duboisia santeng	DUB 2036a	Naturalis	hemimandible	?	Kedung Brubus, Java
Duboisia santeng	DUB 8167e4	Naturalis	hemimandible	?	Kedung Brubus, Java
Duboisia santeng	DUB 2576	Naturalis	hemimandible	?	Teguan, Java
Duboisia santeng	DUB 8167e1	Naturalis	maxilla with teeth	?	Kedung Brubus, Java
Duboisia santeng	DUB 8167a	Naturalis	maxilla with teeth	?	Kedung Brubus, Java
Duboisia santeng	DUB 8167e3	Naturalis	M1	?	Kedung Brubus, Java
Duboisia santeng	DUB 8167e2	Naturalis	M3	?	Kedung Brubus, Java
Duboisia santeng	DUB 8167c	Naturalis	M3	?	Kedung Brubus, Java
Duboisia santeng	DUB 8167d	Naturalis	M3	?	Kedung Brubus, Java
Duboisia santeng	DUB 8167b	Naturalis	M3	?	Kedung Brubus, Java
Duboisia santeng	ST. 18513	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	MBMa 39271	NKM	maxilla with teeth	?	Trinil, Java
Duboisia santeng	MBMa o.Nr.1	NKM	skull	?	Trinil, Java
Duboisia santeng	DUB 2041	Naturalis	skull	?	Ngancar, Java
Duboisia santeng	DUB 2039	Naturalis	skull	?	Trinil, Java
Duboisia santeng	DUB 2073	Naturalis	skull	?	Trinil, Java
Duboisia santeng	DUB 2072	Naturalis	skull	?	Trinil, Java
Duboisia santeng	DUB 2045	Naturalis	skull	?	Trinil, Java
Duboisia santeng	MBMa 22134	NKM	M3	?	Trinil, Java
Duboisia santeng	MBMa o.Nr.2	NKM	maxilla with teeth	?	Trinil, Java
Duboisia santeng	MBMa o.Nr.3	NKM	maxilla with teeth	?	Trinil, Java
Duboisia santeng	MBMa 39275	NKM	maxilla with teeth	?	Trinil, Java
Duboisia santeng	MBMa 39284	NKM	M2	?	Trinil, Java
Duboisia santeng	MBMa 39392	NKM	M3	?	Trinil, Java
Duboisia santeng	MBMa 39313	NKM	M3	?	Trinil, Java
Duboisia santeng	MBMa 22183	NKM	m2	?	Trinil, Java
Duboisia santeng	MBMa 22138	NKM	m2	?	Trinil, Java
Duboisia santeng	MBMa 39309	NKM	M1	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Duboisia santeng	MBMa 39296	NKM	M3	?	Trinil, Java
Duboisia santeng	MBMa 39283	NKM	M3	?	Trinil, Java
Duboisia santeng	MBMa 39300	NKM	M3	?	Trinil, Java
Duboisia santeng	MBMa 39308	NKM	M3	?	Trinil, Java
Duboisia santeng	MBMa 39310	NKM	upper molar	?	Trinil, Java
Duboisia santeng	MBMa 39279	NKM	M2	?	Trinil, Java
Duboisia santeng	MBMa 39280	NKM	M2	?	Trinil, Java
Duboisia santeng	MBMa 39293	NKM	M2	?	Trinil, Java
Duboisia santeng	MBMa 39295	NKM	M2	?	Trinil, Java
Duboisia santeng	MBMa 39294	NKM	M1	?	Trinil, Java
Duboisia santeng	MBMa 39278	NKM	M1	?	Trinil, Java
Duboisia santeng	MBMa 39298	NKM	M1, M2	?	Trinil, Java
Duboisia santeng	MBMa 39269	NKM	M1	?	Trinil, Java
Duboisia santeng	MBMa 39311	NKM	upper molar	?	Trinil, Java
Duboisia santeng	MBMa 39299	NKM	M3	?	Trinil, Java
Duboisia santeng	DUB 2063c	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2057b	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2065b	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2063e	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2053	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 8433c	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2068a	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2062e	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2068c	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2512a	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2063a	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2068b	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2068d	Naturalis	hemimandible	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Duboisia santeng	DUB 2067a	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2067b	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2536	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2517	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2056c	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2065a	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 2056b	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 1824f	Naturalis	hemimandible	?	Trinil, Java
Duboisia santeng	MBMa 39264	NKM	hemimandible	?	Trinil, Java
Duboisia santeng	MBMa 39265	NKM	hemimandible	?	Trinil, Java
Duboisia santeng	MBMa 39276	NKM	hemimandible	?	Trinil, Java
Duboisia santeng	MBMa 39268	NKM	hemimandible	?	Trinil, Java
Duboisia santeng	MBMa 39267	NKM	hemimandible	?	Trinil, Java
Duboisia santeng	MBMa 39266	NKM	hemimandible	?	Trinil, Java
Duboisia santeng	MBMa 39277	NKM	hemimandible	?	Trinil, Java
Duboisia santeng	MBMa o.Nr.5	NKM	hemimandible	?	Trinil, Java
Duboisia santeng	MBMa o.Nr.4	NKM	hemimandible	?	Trinil, Java
Duboisia santeng	MBMa 39274	NKM	hemimandible	?	Trinil, Java
Duboisia santeng	DUB 1824o	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2063b	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2511	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2062a	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2520a	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 1824n	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2520b	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2062b	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2062d	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2056	Naturalis	maxilla with teeth	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Duboisia santeng	DUB 1824p	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2055	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2066	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2062g	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2062c	Naturalis	maxilla with teeth	?	Trinil, Java
Duboisia santeng	MBMa 39270	NKM	maxilla with teeth	?	Trinil, Java
Duboisia santeng	DUB 2515a	Naturalis	M3	?	Pati Ayam, Java
Duboisia santeng	DUB 1661	Naturalis	molar	?	Pati Ayam, Java
Duboisia santeng	DUB 2509h	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2062f-3	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 2062f-5	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 13014-4	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 13014-8	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 2062f-4	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 13014-5	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 13014-6	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 2509f	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2062f-2	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 2063d	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 1824l	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 1824d	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2062f-6	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 2062f-1	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 13014-7	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 2520e	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 13014-1	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 2062f-7	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 2510c	Naturalis	M3	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Duboisia santeng	DUB 1824k	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 1824a	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2509a	Naturalis	M1	?	Trinil, Java
Duboisia santeng	DUB 13014-3	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 1824e	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2509e	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 1824h	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2509d	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2509b	Naturalis	P4, M3	?	Trinil, Java
Duboisia santeng	DUB 2520d	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2509c	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 1824b	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2510a	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 1824i	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2510d	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 13014-2	Naturalis	molar	?	Trinil, Java
Duboisia santeng	DUB 2520g	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 1824j	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2520c	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2520f	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2510b	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 1824g	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 1824c	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2509g	Naturalis	M3	?	Trinil, Java
Duboisia santeng	DUB 2515b	Naturalis	4 molars	?	Pati Ayam, Java
Duboisia santeng	DUB 2509i-5	Naturalis	molars	?	Trinil, Java
Duboisia santeng	DUB 2510e	Naturalis	2 molars	?	Trinil, Java
Duboisia santeng	DUB 2509i-3	Naturalis	molars	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Duboisia santeng	DUB 2509i-4	Naturalis	molars	?	Trinil, Java
Duboisia santeng	DUB 2509i-2	Naturalis	molars	?	Trinil, Java
Duboisia santeng	DUB 2509i-1	Naturalis	molars	?	Trinil, Java
Duboisia santeng	DUB 1579	Naturalis	premolars, molars	?	Trinil, Java
Duboisia santeng	DUB 1580	Naturalis	premolars, molars	?	Trinil, Java
Duboisia santeng	DUB 6742	Naturalis	radius	?	Bangle, Java
Duboisia santeng	DUB 6351	Naturalis	radius	?	Kedung Brubus, Java
Duboisia santeng	DUB 6743	Naturalis	tibia	?	Kedung Brubus, Java, Java
Duboisia santeng	DUB 6981	Naturalis	tibia	?	Bangle, Java
Duboisia santeng	DUB 5866	Naturalis	tibia	?	Kedung Brubus, Java, Java
Duboisia santeng	DUB 5159	Naturalis	tibia	?	Bogo, Java
Duboisia santeng	DUB 5478	Naturalis	tibia	?	Bangle, Java
Duboisia santeng	DUB 5166	Naturalis	tibia	?	Teguan, Java
Duboisia santeng	DUB 6355	Naturalis	tibia	?	Kedung Brubus, Java, Java
Duboisia santeng	DUB 6405	Naturalis	tibia	?	Kedung Brubus, Java, Java
Duboisia santeng	DUB 6354	Naturalis	tibia	?	Kedung Brubus, Java, Java
Duboisia santeng	DUB 5472	Naturalis	tibia	?	Kedung Brubus, Java, Java
Duboisia santeng	DUB 6261	Naturalis	metacarpal	?	Bangle, Java
Duboisia santeng	DUB 6412	Naturalis	metacarpal	?	Kedung Brubus, Java
Duboisia santeng	DUB 6932	Naturalis	metacarpal	?	Tritik, Java
Duboisia santeng	DUB 6988	Naturalis	metatarsal	?	Bangle, Java
Duboisia santeng	DUB 6922	Naturalis	metatarsal	?	Kedung Brubus, Java
Duboisia santeng	DUB 5607	Naturalis	metatarsal	?	Kedung Brubus, Java
Duboisia santeng	DUB 5608	Naturalis	metatarsal	?	Kedung Brubus, Java
Duboisia santeng	DUB 5606	Naturalis	metatarsal	?	Kedung Brubus, Java
Duboisia santeng	DUB 5605	Naturalis	metatarsal	?	Kedung Brubus, Java
Duboisia santeng	DUB 6930	Naturalis	metatarsal	?	Tritik, Java
Duboisia santeng	Coll Von Koenigswald	Naturalis	metatarsal	?	Sangiran, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Duboisia santeng	DUB 5177	Naturalis	radius	?	Trinil, Java
Duboisia santeng	DUB 5931	Naturalis	radius	?	Trinil, Java
Duboisia santeng	DUB 5574	Naturalis	radius	?	Trinil, Java
Duboisia santeng	DUB 5162	Naturalis	radius	?	Trinil, Java
Duboisia santeng	DUB 6409	Naturalis	radius	?	Trinil, Java
Duboisia santeng	DUB 6403	Naturalis	radius	?	Trinil, Java
Duboisia santeng	DUB 9855	Naturalis	radius	?	Trinil, Java
Duboisia santeng	MBMa 39317	NKM	radius	?	Trinil, Java
Duboisia santeng	DUB 13366	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 5598	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 3238A	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 5887	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 6342	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 5936	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 7230	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 9249	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 7231	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 7235	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 7232	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 5930	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 217	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	DUB 5101	Naturalis	tibia	?	Trinil, Java
Duboisia santeng	MBMa 39322	NKM	tibia	?	Trinil, Java
Duboisia santeng	MBMa 39321	NKM	tibia	?	Trinil, Java
Duboisia santeng	MBMa 39323	NKM	tibia	?	Trinil, Java
Duboisia santeng	DUB 5895	Naturalis	ulna	?	Trinil, Java
Duboisia santeng	DUB 6806	Naturalis	ulna	?	Trinil, Java
Duboisia santeng	DUB 3238B	Naturalis	astragalus	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Duboisia santeng	DUB 6925A	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 264A	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 264B	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 2178A	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 2178B	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 5797A	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 5797H	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 5797G	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 5797C	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 5797B	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 5797i	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 5797E	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	DUB 5797D	Naturalis	astragalus	?	Trinil, Java
Duboisia santeng	MBMa 39329	NKM	astragalus	?	Trinil, Java
Duboisia santeng	DUB 10629	Naturalis	femur	?	Trinil, Java
Duboisia santeng	DUB 5668	Naturalis	femur	?	Trinil, Java
Duboisia santeng	DUB 10365	Naturalis	femur	?	Trinil, Java
Duboisia santeng	DUB 7260	Naturalis	femur	?	Trinil, Java
Duboisia santeng	DUB 5263	Naturalis	femur	?	Trinil, Java
Duboisia santeng	st. 27941a	Naturalis	femur	?	Trinil, Java
Duboisia santeng	DUB 5427	Naturalis	femur	?	Trinil, Java
Duboisia santeng	DUB 5903	Naturalis	femur	?	Trinil, Java
Duboisia santeng	DUB 9389	Naturalis	femur	?	Trinil, Java
Duboisia santeng	DUB 10640	Naturalis	femur	?	Trinil, Java
Duboisia santeng	MBMa 39318	NKM	femur	?	Trinil, Java
Duboisia santeng	MBMa 39320	NKM	femur	?	Trinil, Java
Duboisia santeng	MBMa 39379	NKM	femur	?	Trinil, Java
Duboisia santeng	DUB 6340	Naturalis	humerus	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Duboisia santeng	DUB 5939	Naturalis	humerus	?	Trinil, Java
Duboisia santeng	DUB 7219	Naturalis	humerus	?	Trinil, Java
Duboisia santeng	DUB 6823	Naturalis	humerus	?	Trinil, Java
Duboisia santeng	DUB 7263	Naturalis	humerus	?	Trinil, Java
Duboisia santeng	DUB 7220	Naturalis	humerus	?	Trinil, Java
Duboisia santeng	DUB 13360	Naturalis	humerus	?	Trinil, Java
Duboisia santeng	DUB 7815	Naturalis	humerus	?	Trinil, Java
Duboisia santeng	DUB 5132	Naturalis	humerus	?	Kali Gedeh, Java
Duboisia santeng	DUB 7224	Naturalis	humerus	?	Trinil, Java
Duboisia santeng	MBMa 39315	NKM	humerus	?	Trinil, Java
Duboisia santeng	DUB 7259	Naturalis	metacarpal	?	Trinil, Java
Duboisia santeng	DUB 6090	Naturalis	metacarpal	?	Trinil, Java
Duboisia santeng	DUB 6321	Naturalis	metacarpal	?	Trinil, Java
Duboisia santeng	DUB 6818	Naturalis	metacarpal	?	Trinil, Java
Duboisia santeng	DUB 5953	Naturalis	metacarpal	?	Trinil, Java
Duboisia santeng	DUB 208	Naturalis	metacarpal	?	Trinil, Java
Duboisia santeng	DUB 5737	Naturalis	metacarpal	?	Trinil, Java
Duboisia santeng	DUB 5553	Naturalis	metacarpal	?	Trinil, Java
Duboisia santeng	DUB 7248	Naturalis	metacarpal	?	Trinil, Java
Duboisia santeng	DUB 5377	Naturalis	metacarpal	?	Trinil, Java
Duboisia santeng	DUB 1678	Naturalis	metacarpal	?	Trinil, Java
Duboisia santeng	DUB 6498	Naturalis	metatarsal	?	Pati Ayam, Java
Duboisia santeng	DUB 7251	Naturalis	metatarsal	?	Trinil, Java
Duboisia santeng	DUB 5374	Naturalis	metatarsal	?	Trinil, Java
Duboisia santeng	DUB 6102	Naturalis	metatarsal	?	Trinil, Java
Duboisia santeng	DUB 8465	Naturalis	metatarsal	?	Trinil, Java
Duboisia santeng	DUB 6829	Naturalis	metatarsal	?	Trinil, Java
Duboisia santeng	DUB 7252	Naturalis	metatarsal	?	Trinil, Java

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Duboisia santeng	MBMa 39324	NKM	metatarsal	?	Trinil, Java
Duboisia santeng	14377	ANSP	m3	?	Bandung, Java
Duboisia santeng	SN	ANSP	m3	?	Bandung, Java
Duboisia santeng	14372	ANSP	m3	?	Bandung, Java
Duboisia santeng	14377	ANSP	m2	?	Bandung, Java
Epileptobos groeneveldtii	DUB 2768b	Naturalis	skull	?	Kedung Brubus, Java
Epileptobos groeneveldtii	DUB 2795	Naturalis	skull	?	Kedung Brubus, Java
Epileptobos groeneveldtii	DUB 2793	Naturalis	skull	?	Kedung Brubus, Java
Epileptobos groeneveldtii	DUB 2789	Naturalis	skull	?	Kedung Brubus, Java
Epileptobos groeneveldtii	DUB 2787	Naturalis	skull	?	Teguan, Java
Epileptobos groeneveldtii	DUB 2770	Naturalis	skull	?	Tritik, Java
Epileptobos groeneveldtii	DUB 2794	Naturalis	skull	?	Tritik, Java
Epileptobos groeneveldtii	DUB 2758	Naturalis	skull	?	Tritik, Java
Epileptobos groeneveldtii	DUB 2824	Naturalis	skull	?	Tritik, Java
Epileptobos groeneveldtii	DUB 514	Naturalis	skull	?	Kedung Nojo, Java
Epileptobos groeneveldtii	DUB 1682	Naturalis	skull	?	Kedung Pingit, Java
Epileptobos groeneveldtii	DUB 2623	Naturalis	skull	?	Wadegan, Java
Epileptobos groeneveldtii	DUB 2765 c	Naturalis	metacarpal	?	Kedung Nojo, Java
Myotragus antiquus	59245	IMEDEA	hemimandible	?	Cap Ferrutx, Majorca, Spain
Myotragus antiquus	59250	IMEDEA	astragalus	?	Cap Ferrutx, Majorca, Spain
Myotragus antiquus	59246	IMEDEA	ulna	?	Cap Ferrutx, Majorca, Spain
Myotragus antiquus	59243	IMEDEA	maxilla with teeth	?	Cap Ferrutx, Majorca, Spain
Myotragus antiquus	59253	IMEDEA	maxilla with teeth	?	Cap Ferrutx, Majorca, Spain
Myotragus antiquus	59257	IMEDEA	m3	?	Cap Ferrutx, Majorca, Spain
Myotragus antiquus	59255	IMEDEA	m1/m2	?	Cap Ferrutx, Majorca, Spain
Myotragus antiquus	59254	IMEDEA	m1/m2	?	Cap Ferrutx, Majorca, Spain
Myotragus antiquus	59242	IMEDEA	skull	?	Cap Ferrutx, Majorca, Spain
Myotragus antiquus	59248	IMEDEA	i	?	Cap Ferrutx, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus antiquus	59252	IMEDEA	horncore	?	Cap Ferrutx, Majorca, Spain
Myotragus antiquus	57958	IMEDEA	hemimandible	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57969	IMEDEA	hemimandible	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57869	IMEDEA	tibia	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57870	IMEDEA	tibia	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57865	IMEDEA	tibia	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57867	IMEDEA	tibia	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57866	IMEDEA	tibia	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57862	IMEDEA	humerus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57863	IMEDEA	femur	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57864	IMEDEA	femur	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57877	IMEDEA	metatarsal	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57811	IMEDEA	metatarsal	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57877	IMEDEA	metatarsal	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57880	IMEDEA	metatarsal	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57878	IMEDEA	metacarpal	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57879	IMEDEA	metacarpal	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57876	IMEDEA	metacarpal	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57875	IMEDEA	metacarpal	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57874	IMEDEA	metacarpal	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57871	IMEDEA	naviculo cuboid	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57889	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57891	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57895	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57888	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57890	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57896	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57894	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus antiquus	57897	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57892	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57893	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57699	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57898	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57900	IMEDEA	astragalus	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58188	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58119	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57956	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57967	IMEDEA	hemimandible	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57957	IMEDEA	hemimandible	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57960	IMEDEA	hemimandible	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57964	IMEDEA	hemimandible	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57963	IMEDEA	hemimandible	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57954	IMEDEA	palate with teeth	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58110	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58113	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58127	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58126	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58166	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58167	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58128	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58108	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58106	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58117	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58109	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58105	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58042	IMEDEA	m3	?	des Fum Cave, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus antiquus	58112	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58111	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58115	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	58046	IMEDEA	m3	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57911	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57909	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57906	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57910	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57912	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57904	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57901	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57905	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57920	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57902	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57907	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57915	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57903	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57916	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57908	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57917	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57918	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57919	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57930	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57926	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57914	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57903	IMEDEA	proximal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57937	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57925	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus antiquus	57927	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57932	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57923	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57935	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57933	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57924	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57922	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57941	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57936	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57928	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57934	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57931	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57938	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57939	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57940	IMEDEA	intermediate phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57946	IMEDEA	terminal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57948	IMEDEA	terminal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57947	IMEDEA	terminal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57953	IMEDEA	terminal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57950	IMEDEA	terminal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57951	IMEDEA	terminal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus antiquus	57949	IMEDEA	terminal phalanx	?	des Fum Cave, Majorca, Spain
Myotragus balearicus	M10962	NHM	skull	?	Minorca, Spain
Myotragus balearicus	M11112	NHM	astragalus	?	Cave near S. Galdano, Barranco, Minorca, Spain
Myotragus balearicus	M11098	NHM	astragalus	?	Cave near S. Galdano, Barranco, Minorca, Spain
Myotragus balearicus	M10942	NHM	skull, mandible	?	Majorca, Spain
Myotragus balearicus	M10953	NHM	hemimandible	?	Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus balearicus	M10948	NHM	skull	?	Majorca, Spain
Myotragus balearicus	M10947	NHM	skull	?	Majorca, Spain
Myotragus balearicus	M10963	NHM	hemimandible	?	Majorca, Spain
Myotragus balearicus	M10964	NHM	hemimandible	?	Majorca, Spain
Myotragus balearicus	M10954	NHM	hemimandible	?	Majorca, Spain
Myotragus balearicus	M10944	NHM	metatarsal	?	Majorca, Spain
Myotragus balearicus	M10943	NHM	metacarpal	?	Majorca, Spain
Myotragus balearicus	M10942	NHM	atlas	?	Majorca, Spain
Myotragus balearicus	M10956	NHM	axis	?	Majorca, Spain
Myotragus balearicus	M10960	NHM	tibia	?	Majorca, Spain
Myotragus balearicus	M10958	NHM	radius	?	Majorca, Spain
Myotragus balearicus	M10955	NHM	i	?	Majorca, Spain
Myotragus balearicus	M10949	NHM	palate with teeth	?	Majorca, Spain
Myotragus balearicus	M10950	NHM	maxilla with teeth	?	Majorca, Spain
Myotragus balearicus	M10951	NHM	maxilla with teeth	?	Majorca, Spain
Myotragus balearicus	M10959	NHM	femur	?	Majorca, Spain
Myotragus balearicus	M10957	NHM	humerus	?	Majorca, Spain
Myotragus balearicus	M10942	NHM	skull, mandible	?	Majorca, Spain
Myotragus balearicus	M10948	NHM	skull	?	Majorca, Spain
Myotragus balearicus	M10952	NHM	hemimandible	?	Majorca, Spain
Myotragus balearicus	38934	IMEDEA	tibia	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	65294	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	81213	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	65285	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	60752	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	65289	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	65295	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	91521	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus balearicus	59755	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	85752	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	97663	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	38702	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	59758	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	5224	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	59601	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	59637	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	81515	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	5220	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	81857	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	67862	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	65286	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	81856	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	81855	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	80684	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	59635	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	60745	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	85783	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	5214	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	140160	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	5216	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	80232	IMEDEA	hemimandible	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	59759	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	5217	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	59757	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	59636	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	59611	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus balearicus	42001	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	39075	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	85781	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	85102	IMEDEA	skull	?	Des Moro Cave, Manacor, Majorca, Spain
Myotragus balearicus	51362	IMEDEA	skull	?	Estreta Cave, Manacor, Majorca, Spain
Myotragus balearicus	51357	IMEDEA	skull	?	Estreta Cave, Manacor, Majorca, Spain
Myotragus balearicus	51356	IMEDEA	skull	?	Estreta Cave, Manacor, Majorca, Spain
Myotragus balearicus	51359	IMEDEA	skull	?	Estreta Cave, Manacor, Majorca, Spain
Myotragus balearicus	51360	IMEDEA	skull	?	Estreta Cave, Manacor, Majorca, Spain
Myotragus balearicus	48147	IMEDEA	skull	?	Estreta Cave, Manacor, Majorca, Spain
Myotragus balearicus	50334	IMEDEA	skull	?	Estreta Cave, Manacor, Majorca, Spain
Myotragus balearicus	51345	IMEDEA	skull	?	Estreta Cave, Manacor, Majorca, Spain
Myotragus balearicus	48136	IMEDEA	skull	?	Estreta Cave, Manacor, Majorca, Spain
Myotragus balearicus	51355	IMEDEA	skull	?	Estreta Cave, Manacor, Majorca, Spain
Myotragus balearicus	48137	IMEDEA	skull	?	Estreta Cave, Manacor, Majorca, Spain
Myotragus balearicus	39728	IMEDEA	skull	?	Son Maiol, Majorca, Spain
Myotragus balearicus	39740	IMEDEA	skull	?	Son Maiol, Majorca, Spain
Myotragus balearicus	39727	IMEDEA	skull	?	Son Maiol, Majorca, Spain
Myotragus balearicus	39734	IMEDEA	skull	?	Son Maiol, Majorca, Spain
Myotragus balearicus	39729	IMEDEA	skull	?	Son Maiol, Majorca, Spain
Myotragus balearicus	39733	IMEDEA	skull	?	Son Maiol, Majorca, Spain
Myotragus balearicus	39731	IMEDEA	skull	?	Son Maiol, Majorca, Spain
Myotragus balearicus	39726	IMEDEA	skull	?	Son Maiol, Majorca, Spain
Myotragus binigausensis	58220	IMEDEA	femur	?	Barranc de Binigaus, Menorca, Spain
Myotragus binigausensis	58283/58233	IMEDEA	palate with teeth	?	Barranc de Binigaus, Menorca, Spain
Myotragus binigausensis	61084	IMEDEA	m3	?	Barranc de Binigaus, Menorca, Spain
Myotragus binigausensis	61085	IMEDEA	hemimandible	?	Barranc de Binigaus, Menorca, Spain
Myotragus binigausensis	58224	IMEDEA	proximal phalanx	?	Barranc de Binigaus, Menorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus binigausensis	58222	IMEDEA	palate with teeth	?	Barranc de Binigaus, Menorca, Spain
Myotragus binigausensis	58225	IMEDEA	femur	?	Barranc de Binigaus, Menorca, Spain
Myotragus binigausensis	58226	IMEDEA	hemimandible	?	Barranc de Binigaus, Menorca, Spain
Myotragus binigausensis	58221	IMEDEA	femur	?	Barranc de Binigaus, Menorca, Spain
Myotragus binigausensis	58228	IMEDEA	skull	?	Barranc de Binigaus, Menorca, Spain
Myotragus kopperi	57320	IMEDEA	hemimandible	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57630	IMEDEA	femur	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57665	IMEDEA	skull	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57659	IMEDEA	maxilla with teeth	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57661	IMEDEA	maxilla with teeth	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57658	IMEDEA	maxilla with teeth	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57666	IMEDEA	maxilla with teeth	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57657	IMEDEA	maxilla with teeth	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57556	IMEDEA	maxilla with teeth	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	M2SN	IMEDEA	maxilla with teeth	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57629	IMEDEA	humerus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57628	IMEDEA	humerus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57776	IMEDEA	humerus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57626	IMEDEA	humerus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7495	IMEDEA	humerus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57627	IMEDEA	humerus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57634	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57635	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57641	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7457	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57772	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57644	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57638	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus kopperi	57636	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57642	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57645	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57637	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7458	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57633	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7486	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57769	IMEDEA	femur	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7484	IMEDEA	femur	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57632	IMEDEA	femur	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57631	IMEDEA	femur	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7485	IMEDEA	naviculo cuboid	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7487	IMEDEA	naviculo cuboid	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57640	IMEDEA	naviculo cuboid	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57639	IMEDEA	naviculo cuboid	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57757	IMEDEA	calcaneus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7497	IMEDEA	calcaneus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57775	IMEDEA	calcaneus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57846	IMEDEA	pelvis	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57763	IMEDEA	sacrum	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57649	IMEDEA	metatarsal	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57647	IMEDEA	metatarsal	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57643	IMEDEA	metatarsal	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57648	IMEDEA	metatarsal	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57652	IMEDEA	metacarpal	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57651	IMEDEA	metacarpal	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57653	IMEDEA	metacarpal	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57650	IMEDEA	metacarpal	?	Pedrera de S'Onix, Manacor, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus kopperi	7454	IMEDEA	metacarpal	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57731	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57729	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57735	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7458	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57724	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57734	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57728	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57723	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57726	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57778	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57730	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57727	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57722	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57732	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57733	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57736	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57738	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57777	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7462	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57834	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57714	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57713	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57716	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57745	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57720	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57780	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57717	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus kopperi	57718	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57779	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57702	IMEDEA	terminal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57703	IMEDEA	terminal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57704	IMEDEA	terminal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57701	IMEDEA	terminal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57706	IMEDEA	terminal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57708	IMEDEA	terminal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57705	IMEDEA	terminal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57742	IMEDEA	terminal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57741	IMEDEA	terminal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57845	IMEDEA	humerus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57746	IMEDEA	astragalus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57748	IMEDEA	astragalus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57751	IMEDEA	astragalus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57745	IMEDEA	astragalus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57743	IMEDEA	astragalus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57747	IMEDEA	astragalus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57744	IMEDEA	astragalus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7496	IMEDEA	astragalus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57749	IMEDEA	astragalus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57750	IMEDEA	astragalus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57753	IMEDEA	astragalus	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57782	IMEDEA	m3	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57781	IMEDEA	m3	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7466	IMEDEA	m3	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57783	IMEDEA	m3	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57784	IMEDEA	m3	?	Pedrera de S'Onix, Manacor, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus kopperi	7463	IMEDEA	m3	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57843	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57842	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	68776	IMEDEA	proximal phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57850	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57844	IMEDEA	intermediate phalanx	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57836	IMEDEA	tibia	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57837	IMEDEA	radius	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57325	IMEDEA	hemimandible	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57665	IMEDEA	hemimandible	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	7452	IMEDEA	hemimandible	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57666	IMEDEA	hemimandible	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57669	IMEDEA	hemimandible	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57668	IMEDEA	hemimandible	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57667	IMEDEA	hemimandible	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus kopperi	57671	IMEDEA	hemimandible	?	Pedrera de S'Onix, Manacor, Majorca, Spain
Myotragus palomboi	90140	IMEDEA	metatarsal	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90131	IMEDEA	astragalus	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90132	IMEDEA	proximal phalanx	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90133	IMEDEA	proximal phalanx	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90274	IMEDEA	proximal phalanx	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90135	IMEDEA	intermediate phalanx	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90134	IMEDEA	intermediate phalanx	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90137	IMEDEA	terminal phalanx	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90136	IMEDEA	terminal phalanx	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90272	IMEDEA	capitato trapezoid	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90273	IMEDEA	capitato trapezoid	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90141	IMEDEA	naviculo cuboid	?	Caló den Rafelino, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus palomboi	90144	IMEDEA	p2	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90143	IMEDEA	p2	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90472	IMEDEA	dp2	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90275	IMEDEA	p3	?	Caló den Rafelino, Majorca, Spain
Myotragus palomboi	90145	IMEDEA	i3	?	Caló den Rafelino, Majorca, Spain
Myotragus pepgonellae	59204	IMEDEA	metatarsal	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59205	IMEDEA	metatarsal	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59206	IMEDEA	metacarpal	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	39207	IMEDEA	astragalus	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59200	IMEDEA	palate with teeth	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59202	IMEDEA	femur	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59212	IMEDEA	m3	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59214	IMEDEA	hemimandible	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59208	IMEDEA	humerus	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59211	IMEDEA	radius, ulna	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59209	IMEDEA	tibia	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59210	IMEDEA	tibia	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59201	IMEDEA	hemimandible	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59199	IMEDEA	maxilla	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59203	IMEDEA	femur	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59197	IMEDEA	skull	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59198	IMEDEA	skull	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59195	IMEDEA	skull	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	holotype	IMEDEA	skull	?	Cala Morlanda C, Majorca, Spain
Myotragus pepgonellae	59216	IMEDEA	femur	?	Cala Morlanda B, Majorca, Spain
Myotragus pepgonellae	59215	IMEDEA	radius	?	Cala Morlanda B, Majorca, Spain
Myotragus pepgonellae	59218	IMEDEA	tibia	?	Cala Morlanda B, Majorca, Spain
Myotragus pepgonellae	59233	IMEDEA	radius	?	Cala Morlanda A, Majorca, Spain

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Myotragus pepgonellae	59232	IMEDEA	m3	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59220	IMEDEA	radius	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59219	IMEDEA	occipital fragment	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59235	IMEDEA	radius	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59236	IMEDEA	ulna, hemimandible	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59225	IMEDEA	terminal phalanx	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59227	IMEDEA	horncore	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59224	IMEDEA	lower molar	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59223	IMEDEA	hemimandible	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59222	IMEDEA	hemimandible	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59221	IMEDEA	hemimandible	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59232	IMEDEA	m3	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59231	IMEDEA	deciduous tooth	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59230	IMEDEA	deciduous tooth	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	57321	IMEDEA	hemimandible	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	59196	IMEDEA	hemimandible	?	Cala Morlanda A, Majorca, Spain
Myotragus pepgonellae	58699	IMEDEA	metacarpal	?	Torrent de Sa Penya Roja, Majorca, Spain
Myotragus pepgonellae	58697	IMEDEA	M3	?	Torrent de Sa Penya Roja, Majorca, Spain
Nesogoral	1003	SI Nuoro	humerus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1010	SI Nuoro	humerus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1008	SI Nuoro	humerus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1080	SI Nuoro	humerus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1079	SI Nuoro	humerus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	MArc Nuoro	ulna	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1094	SI Nuoro	radius	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1031	SI Nuoro	radius	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	MArc Nuoro	radius	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	MArc Nuoro	radius	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1024	SI Nuoro	capitato-trapezoid	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	capitato-trapezoid	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	MArc Nuoro	capitato-trapezoid	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1073	SI Nuoro	metacarpal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1070	SI Nuoro	metacarpal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1067	SI Nuoro	metacarpal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1061	SI Nuoro	metacarpal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1068	SI Nuoro	metacarpal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1071	SI Nuoro	metacarpal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1072	SI Nuoro	metacarpal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	metacarpal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	metacarpal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	SN	MArc Nuoro	metacarpal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	MArc Nuoro	metacarpal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1097	MArc Nuoro	tibia	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1096	MArc Nuoro	tibia	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1002	SI Nuoro	tibia	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1001	SI Nuoro	tibia	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1033	SI Nuoro	tibia	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1034	SI Nuoro	tibia	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1036	SI Nuoro	tibia	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1035	SI Nuoro	tibia	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1032	SI Nuoro	tibia	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	tibia	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	tibia	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1018	SI Nuoro	astragalus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1019	SI Nuoro	astragalus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1020	SI Nuoro	astragalus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1021	SI Nuoro	astragalus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	MArc Nuoro	astragalus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1096	MArc Nuoro	astragalus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1014	SI Nuoro	calcaneus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1015	SI Nuoro	calcaneus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1016	SI Nuoro	calcaneus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1017	SI Nuoro	calcaneus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	calcaneus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	MArc Nuoro	calcaneus	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	MArc Nuoro	naviculo-cuboid	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1022	SI Nuoro	naviculo-cuboid	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1023	SI Nuoro	naviculo-cuboid	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1056	SI Nuoro	naviculo-cuboid	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1026	SI Nuoro	naviculo-cuboid	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	naviculo-cuboid	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1064	SI Nuoro	metatarsal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1065	SI Nuoro	metatarsal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1066	SI Nuoro	metatarsal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1062	SI Nuoro	metatarsal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1063	SI Nuoro	metatarsal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1059	SI Nuoro	metatarsal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	MArc Nuoro	metatarsal	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	9	SI Nuoro	humerus	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	10	SI Nuoro	humerus	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	11	SI Nuoro	humerus	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	34	MArc Nuoro	humerus	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	12	SI Nuoro	humerus	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	13	SI Nuoro	humerus	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	14	SI Nuoro	humerus	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	37	MArc Nuoro	radius	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	15	SI Nuoro	ulna	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	18	SI Nuoro	metacarpal	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	19	SI Nuoro	metacarpal	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	20	SI Nuoro	metacarpal	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	21	SI Nuoro	femur	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	22	SI Nuoro	femur	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	23	SI Nuoro	tibia	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	33	MArc Nuoro	tibia	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	35	MArc Nuoro	tibia	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	36	MArc Nuoro	tibia	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	24	SI Nuoro	tibia	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	25	SI Nuoro	tibia	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	26	SI Nuoro	metatarsal	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	27	SI Nuoro	metatarsal	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	28	SI Nuoro	metatarsal	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	29	SI Nuoro	metatarsal	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	30	SI Nuoro	metatarsal	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	31	SI Nuoro	metatarsal	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	32	SI Nuoro	metatarsal	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	33	SI Nuoro	metatarsal	?	X Mele fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	4	SI Nuoro	humerus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	5	SI Nuoro	humerus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	8	SI Nuoro	radius	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	9	SI Nuoro	ulna	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	10	SI Nuoro	radius	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	11	SI Nuoro	radius	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	20	SI Nuoro	metacarpal	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	49	SI Nuoro	metacarpal	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	humerus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1039	SI Nuoro	humerus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1045	SI Nuoro	humerus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1040	SI Nuoro	humerus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1049	SI Nuoro	humerus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	humerus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	SN	SI Nuoro	humerus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	humerus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1048	SI Nuoro	ulna	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	radius	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1042	SI Nuoro	radius	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1051	SI Nuoro	radius	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1052	SI Nuoro	radius	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1041	SI Nuoro	radius	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1044	SI Nuoro	radius	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	radius	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1047	SI Nuoro	metacarpal	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1043	SI Nuoro	metacarpal	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1046	SI Nuoro	metacarpal	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	metacarpal	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	metacarpal	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1054	SI Nuoro	femur	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	SN	MArc Nuoro	femur	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN2	MArc Nuoro	femur	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1050	SI Nuoro	tibia	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	Blocco1	MArc Nuoro	tibia, metacarpal	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	Blocco2	MArc Nuoro	femur, radius	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1033	SI Nuoro	astragalus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1032	SI Nuoro	astragalus	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1053	SI Nuoro	metatarsal	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	metatarsal	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2	SI Nuoro	radius, ulna	?	X Uccelli fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	3	SI Nuoro	tibia	?	X Uccelli fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	3	SI Nuoro	calcaneus	?	X Uccelli fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1	SI Nuoro	calcaneus	?	X Uccelli fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	3	SI Nuoro	astragalus	?	X Uccelli fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1	SI Nuoro	astragalus	?	X Uccelli fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	3	SI Nuoro	naviculo-cuboid	?	X Uccelli fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1	SI Nuoro	naviculo-cuboid	?	X Uccelli fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	4	SI Nuoro	humerus	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	5	SI Nuoro	humerus	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	6	SI Nuoro	humerus	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	7	SI Nuoro	humerus	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	31	SI Nuoro	humerus	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	32	SI Nuoro	humerus	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	35	SI Nuoro	humerus	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	19	SI Nuoro	ulna	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	16	SI Nuoro	radius	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	17	SI Nuoro	radius	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	33	SI Nuoro	radius	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	40	SI Nuoro	metacarpal	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	11	SI Nuoro	metacarpal	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	12	SI Nuoro	metacarpal	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	8	SI Nuoro	femur	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	9	SI Nuoro	femur	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	10	SI Nuoro	femur	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	42	SI Nuoro	tibia	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	43	SI Nuoro	tibia	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	20	SI Nuoro	astragalus	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	21	SI Nuoro	astragalus	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	44	SI Nuoro	calcaneus	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	45	SI Nuoro	naviculo-cuboid	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	39	SI Nuoro	naviculo-cuboid	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	13	SI Nuoro	metatarsal	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	14	SI Nuoro	metatarsal	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	15	SI Nuoro	metatarsal	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	17	SI Nuoro	humerus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	15	SI Nuoro	humerus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	26	SI Nuoro	humerus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	19	SI Nuoro	humerus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	13	SI Nuoro	humerus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	18	SI Nuoro	humerus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	16	SI Nuoro	humerus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	20	SI Nuoro	humerus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	113*	SI Nuoro	humerus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	132	SI Nuoro	humerus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	7	SI Nuoro	ulna	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	6	SI Nuoro	ulna	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	8	SI Nuoro	ulna	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	10	SI Nuoro	radius	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	12	SI Nuoro	radius	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	11	SI Nuoro	radius	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	107	SI Nuoro	radius	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	9	SI Nuoro	radius	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	129	SI Nuoro	radius	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	133 *	SI Nuoro	radius	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	54	SI Nuoro	capitator-tapezoid	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	45	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	44	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	46	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	104	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	47	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	48	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	38	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	128	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	108	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	109	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	105	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2	SI Nuoro	femur	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	5	SI Nuoro	femur	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	4	SI Nuoro	femur	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	3	SI Nuoro	femur	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	SN	SI Nuoro	femur	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1	SI Nuoro	femur	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	21	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	29	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	22	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	28	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	35	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	23	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	27	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	25	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	24	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	34	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	36	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	37	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	30	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	33	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	14	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	31	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	32	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	114	SI Nuoro	tibia	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	52	SI Nuoro	astragalus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	53	SI Nuoro	astragalus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	50	SI Nuoro	calcaneus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	49	SI Nuoro	calcaneus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	55	SI Nuoro	calcaneus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	51	SI Nuoro	calcaneus	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	121	SI Nuoro	naviculo-cuboid	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	39	SI Nuoro	metatarsal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	43	SI Nuoro	metatarsal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	42	SI Nuoro	metatarsal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	56	SI Nuoro	metacarpal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	40	SI Nuoro	metatarsal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	41	SI Nuoro	metatarsal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	110	SI Nuoro	metatarsal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	131	SI Nuoro	metatarsal	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1049	SI Nuoro	humerus	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1039	SI Nuoro	humerus	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1040	SI Nuoro	humerus	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1045	SI Nuoro	humerus	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	humerus	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1048	SI Nuoro	ulna	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1041	SI Nuoro	radius	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1051	SI Nuoro	radius	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	radius	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1042	SI Nuoro	radius	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1047	SI Nuoro	metacarpal	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1043	SI Nuoro	metacarpal	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1046	SI Nuoro	metacarpal	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	SN	SI Nuoro	metacarpal	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1054	SI Nuoro	femur	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1053	SI Nuoro	metatarsal	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1033	SI Nuoro	astragalus	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1032	SI Nuoro	astragalus	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2020	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2021	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2022	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2023	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2019	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD OO14	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2017	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2016	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2018	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1160	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1162	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1163	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD OO12	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2013	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1138	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1053	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2005	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2024	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2013	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2015	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1037	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	11	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	42	SI Nuoro	humerus, radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1171	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1172	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2012	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	sn	SI Nuoro	humerus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1020	SI Nuoro	radius, ulna	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2025	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2031	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1037	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	34	SI Nuoro	radius, ulna	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2026	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1164	SI Nuoro	ulna	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1006	SI Nuoro	ulna	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1166	SI Nuoro	ulna	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1038	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1102	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1103	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1110	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2024	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2028	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2029	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	2030	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2032	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2033	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2036	SI Nuoro	ulna	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2037	SI Nuoro	ulna	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2048	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2211	SI Nuoro	ulna	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2217	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2230	SI Nuoro	radius	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2108	SI Nuoro	capitato-trapezoid	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1003	SI Nuoro	capitato-trapezoid	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1004	SI Nuoro	capitato-trapezoid	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1023	SI Nuoro	capitato-trapezoid	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1046	SI Nuoro	capitato-trapezoid	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1134	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1120	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1126	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1135	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1127	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1121	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1099	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1119	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1036	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1124	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1012	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1011	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1017	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1101	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1105	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1107	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1108	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1111	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1123	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1125	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1128	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1130	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1137	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2071	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2072	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2074	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2075	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2076	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2077	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2078	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2079	SI Nuoro	metacarpal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	42	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN2	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1149	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1147	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1148	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	35	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN1	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2038	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2040	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	30	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1146	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2039	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2041	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2042	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2043	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2044	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2045	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2046	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2047	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	2231	SI Nuoro	femur	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1143	SI Nuoro	tibia	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1140	SI Nuoro	tibia	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2056	SI Nuoro	tibia	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1444	SI Nuoro	tibia	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2	SI Nuoro	tibia	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1141	SI Nuoro	tibia	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1139	SI Nuoro	tibia	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1030	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1031	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2003	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1029	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1032	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2002	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1036	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	45	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	2001	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	42	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1035	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	Capo Figari Ty5387	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	Capo Figari Ty5472	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	Capo Figari II	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2004	SI Nuoro	astragalus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	4	SI Nuoro	calcaneus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2007	SI Nuoro	calcaneus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1079	SI Nuoro	calcaneus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1080	SI Nuoro	calcaneus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2011	SI Nuoro	calcaneus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2010	SI Nuoro	calcaneus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1075	SI Nuoro	calcaneus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1078	SI Nuoro	calcaneus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1073	SI Nuoro	calcaneus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1076	SI Nuoro	calcaneus	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1150	SI Nuoro	naviculo-cuboid	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1045	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1128	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2067	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2068	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2070	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1122	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1010	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1009	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1106	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1131	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1112	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2073	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2069	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1133	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1118	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1100	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1115	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1117	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1113	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1104	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1233	SI Nuoro	metatarsal	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	21	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	22	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	28	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	20	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	23	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN2	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	26	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	R1	MArcNuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	29	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	43	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	27	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	24	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	25	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	30	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	44	SI Nuoro	humerus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	133	SI Nuoro	ulna	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	131	SI Nuoro	ulna	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	130	SI Nuoro	ulna	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	132	SI Nuoro	ulna	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	129	SI Nuoro	ulna	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	200	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	206	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	202	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	201	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	207	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	198	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN2	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN3	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN4	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	128	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	199	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	203	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	205	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	208	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	209	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	210	SI Nuoro	radius	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	86	SI Nuoro	capitato-trapezoid	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	81	SI Nuoro	capitato-trapezoid	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	82	SI Nuoro	capitato-trapezoid	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	73	SI Nuoro	capitato-trapezoid	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	12	SI Nuoro	metacarpal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	13	SI Nuoro	metacarpal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	14	SI Nuoro	metacarpal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	15	SI Nuoro	metacarpal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	16	SI Nuoro	metacarpal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	17	SI Nuoro	metacarpal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	18	SI Nuoro	metacarpal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	R5	MArcNuoro	metacarpal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	R6	MArcNuoro	metacarpal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	33	SI Nuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	36	SI Nuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	37	SI Nuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	38	SI Nuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	40	SI Nuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	ORX	SI Nuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	45	SI Nuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	41	SI Nuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	35	SI Nuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	34	SI Nuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	BustaX4	SI Nuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	R2	MArcNuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	R3	MArcNuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	R4	MArcNuoro	femur	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	blocco	MArcNuoro	femur, tibia	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	119	SI Nuoro	tibia	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	118	SI Nuoro	tibia	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	116	SI Nuoro	tibia	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	123	MArcNuoro	tibia	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	121	MArcNuoro	tibia	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	120	MArcNuoro	tibia	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	117	MArcNuoro	tibia	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	122	MArcNuoro	tibia	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	124	MArcNuoro	tibia	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	49	SI Nuoro	astragalus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	53	SI Nuoro	astragalus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	52	SI Nuoro	astragalus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	46	SI Nuoro	astragalus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	47	SI Nuoro	astragalus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	50	SI Nuoro	astragalus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	48	SI Nuoro	astragalus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	51	SI Nuoro	astragalus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	57	SI Nuoro	calcaneus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	R7	MArcNuoro	calcaneus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	54	SI Nuoro	calcaneus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	58	SI Nuoro	calcaneus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	calcaneus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN2	SI Nuoro	calcaneus	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	60	SI Nuoro	naviculo-cuboid	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	61	SI Nuoro	naviculo-cuboid	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	62	SI Nuoro	naviculo-cuboid	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	59	SI Nuoro	naviculo-cuboid	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	63	SI Nuoro	naviculo-cuboid	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	64	SI Nuoro	naviculo-cuboid	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	65	SI Nuoro	naviculo-cuboid	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1	SI Nuoro	metatarsal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2	SI Nuoro	metatarsal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	3	SI Nuoro	metatarsal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	4	SI Nuoro	metatarsal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	5	SI Nuoro	metatarsal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	6	SI Nuoro	metatarsal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	8	SI Nuoro	metatarsal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	10	SI Nuoro	metatarsal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	11	SI Nuoro	metatarsal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	SN	SI Nuoro	metatarsal	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1103/1	SI Nuoro	hemimandible	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1103/2	SI Nuoro	hemimandible	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1102	SI Nuoro	hemimandible	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1075d	SI Nuoro	hemimandible	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1075s	SI Nuoro	hemimandible	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2	SI Nuoro	hemimandible	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	6	SI Nuoro	hemimandible	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	69	SI Nuoro	hemimandible	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	70	SI Nuoro	hemimandible	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	71	SI Nuoro	hemimandible	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	73	SI Nuoro	hemimandible	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1000	SI Nuoro	skull	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1007	SI Nuoro	skull	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1076	SI Nuoro	skull	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1180	SI Nuoro	skull	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	0026	SI Nuoro	skull	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1177	SI Nuoro	skull	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	7	SI Nuoro	skull	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1	SI Nuoro	skull	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1075d	SI Nuoro	P2-M1	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1000d	SI Nuoro	P2-M3	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1000s	SI Nuoro	M1-M3	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1006	SI Nuoro	P2-M2	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1005	SI Nuoro	M2	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	sn	SI Nuoro	M3	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	sn	SI Nuoro	M1, M2	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	sn	SI Nuoro	P4	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2	SI Nuoro	M3	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1	SI Nuoro	P3	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	0026d	SI Nuoro	P2-M3	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	0026s	SI Nuoro	P2-M2	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1180d	SI Nuoro	P4-M3	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1180s	SI Nuoro	P2, M2, M3	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1d	SI Nuoro	P3-M1	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1s	SI Nuoro	M2, M3	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1103/1	SI Nuoro	p3-m3	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1103/2	SI Nuoro	p3-m3	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1102/1	SI Nuoro	p2-m3	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1075d	SI Nuoro	p2-m3	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1075s	SI Nuoro	p2-m3	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2	SI Nuoro	p2-m3	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	6	SI Nuoro	p2, p3, m1	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	3	SI Nuoro	m3	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1037	SI Nuoro	p2-m3	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1038	SI Nuoro	p4-m2	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	deciduous teeth	?	Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN	SI Nuoro	deciduous teeth	?	Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1039	SI Nuoro	proximal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1038	SI Nuoro	proximal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1037	SI Nuoro	proximal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1040	SI Nuoro	proximal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1051	SI Nuoro	proximal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN3	SI Nuoro	proximal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2	SI Nuoro	proximal phalanx	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	55	SI Nuoro	proximal phalanx	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	24	SI Nuoro	proximal phalanx	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	25	SI Nuoro	proximal phalanx	?	VII Blocco strada fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1026	SI Nuoro	proximal phalanx	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1022	SI Nuoro	proximal phalanx	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1025	SI Nuoro	proximal phalanx	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1027	SI Nuoro	proximal phalanx	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1030	SI Nuoro	proximal phalanx	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1024	SI Nuoro	proximal phalanx	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1031J	SI Nuoro	proximal phalanx	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	92	SI Nuoro	proximal phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	92	SI Nuoro	proximal phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	92	SI Nuoro	proximal phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	97J	SI Nuoro	proximal phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	96J	SI Nuoro	proximal phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	99	SI Nuoro	proximal phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	98	SI Nuoro	proximal phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1050	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1059	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1049	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1098	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN3	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1046	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1057	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1051	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN2	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1041	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2118/1	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2118/2	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2118/3	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1054	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1056	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1042	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1047	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1058	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1097	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1052	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1043	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1072	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1048	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1045	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1044	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	SD1049	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD1001	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD1002	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD0,022/2	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN1	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD0006/1	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD0006/2	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD0006/3	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD0006/4	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD0006/5	SI Nuoro	proximal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	147	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	149	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN4	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN3	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	136	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	158	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	159J	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	140	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	153	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	145	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	155	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	150	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	142	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	139	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	138	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	143	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	137	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	156	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	141	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	151	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	148	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	144	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	154	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	146	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	157	SI Nuoro	proximal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	21	SI Nuoro	proximal phalanx	?	XI Antilope fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1039	SI Nuoro	proximal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1041	SI Nuoro	intermediate phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1044	SI Nuoro	intermediate phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1042	SI Nuoro	intermediate phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1047	SI Nuoro	intermediate phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1046	SI Nuoro	intermediate phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN1	SI Nuoro	intermediate phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1051	SI Nuoro	intermediate phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1047J	SI Nuoro	intermediate phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1045J	SI Nuoro	intermediate phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	95	SI Nuoro	intermediate phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	102	SI Nuoro	intermediate phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	103	SI Nuoro	intermediate phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	91	SI Nuoro	intermediate phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD1050	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD0006/6	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	0,045	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	0,025/1	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	0,025/2	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SD 1051	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2119/1	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2119/3	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2119/4	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2119/5	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1068	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1064	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1069	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1066	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1065	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1067	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1071J	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1063J	SI Nuoro	intermediate phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	193	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	181	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	178	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	186	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	SN3	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	177	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	184	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	185	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	187	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	190	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	192	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	182	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	176	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	191	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	183	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	179	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	180	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	188	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	189	SI Nuoro	intermediate phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1041	SI Nuoro	intermediate phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1034	SI Nuoro	terminal phalanx	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1035	SI Nuoro	terminal phalanx	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	101	SI Nuoro	terminal phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	100	SI Nuoro	terminal phalanx	?	IV Macaca fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1091	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1095	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1083	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1093	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1084	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1092	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1085	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1027	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1082	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1089	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1052	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	2117/1	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	0,022	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1094	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1088	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1087	SI Nuoro	terminal phalanx	?	VI 3 Antica fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	169	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	172	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	170	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	175	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	160	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	164	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	171	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	162	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	165	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	167	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	163	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	166	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	161	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	174	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	168	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	173	SI Nuoro	terminal phalanx	?	X4 fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1053	SI Nuoro	terminal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1052	SI Nuoro	terminal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1048	SI Nuoro	terminal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1050	SI Nuoro	terminal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral	1058	SI Nuoro	terminal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1057	SI Nuoro	terminal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1060	SI Nuoro	terminal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	49	SI Nuoro	terminal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1054	SI Nuoro	terminal phalanx	?	X Ghiro fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral	1034	SI Nuoro	terminal phalanx	?	VII Mustelide fissure, Monte Tuttavista, Orosei, Sardinia, Italy
Nesogoral melonii	29864	MGPUT	skull	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5386	NMB	skull	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5424	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5383	NMB	palate with teeth	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5437	NMB	lower molar	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5384	NMB	palate with teeth	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5464	NMB	m1, p1	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5463	NMB	P1-P3	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5399	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5392-5393	NMB	occipital fragment	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5454-5456	NMB	P1	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5385	NMB	skull	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5382	NMB	fragment of palate with teeth	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5476	NMB	radius	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5421	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5400	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5423	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral melonii	Ty 5457	NMB	D1-D3	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5465	NMB	m1-d1	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5466-5467	NMB	d3	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5418	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5425-5429	NMB	p2	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5474	NMB	metatarsal	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5420	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5387	NMB	astragalus	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5472	NMB	astragalus	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5473	NMB	calcaneus	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5471	NMB	naviculo cuboid	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5461-5463	NMB	d2	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5437	NMB	upper molars	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5436	NMB	M1-M3	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5434-5435	NMB	i	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5458-5460	NMB	D3	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5430-5433	NMB	p3	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5397	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5419	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5447-5449	NMB	P2	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5422	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5395-5396	NMB	capitato trapezoid	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5394	NMB	horncore	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5391	NMB	humerus	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5388-5390	NMB	humerus	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5479-5482	NMB	humerus	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5486-5488	NMB	tibia	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5483-5485	NMB	femur	?	Capo Figari, Aranci Gulf, Sardinia, Italy

Taxon	Specimen	Museum or Reference	Type of specimen	Sex	Locality
Nesogoral melonii	Ty 5468-5470	NMB	D1-D3	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5417	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5477-5478	NMB	metacarpal	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	SN	NMB	fragment of occipital	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5473	NMB	calcaneus	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5416	NMB	m2-m3	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5398	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	C Figari I	NMB	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Ty 5401-5415	NMB	lower molars	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	SN	NMB	tibia	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	SN	NMB	radius	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	SN	NMB	tibia	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	SN	NMB	femur	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	SN	NMB	intermediate phalanx	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	SN	NMB	intermediate phalanx	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	SN	NHM	horncore	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	SN	NHM	m3	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	M42334	NHM	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	SN	NHM	horncore	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	M10507	NHM	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	M42332	NHM	maxilla and hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	M10508	NHM	endocast	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	M42333	NHM	hemimandible	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	SN	NHM	proximal phalanx	?	Capo Figari, Aranci Gulf, Sardinia, Italy
Nesogoral melonii	Capo Figari II	NMB	astragalus	?	Capo Figari, Aranci Gulf, Sardinia, Italy

Appendix II

11. Appendix II

11.1. List of islands in the study and their main features

Island	Region	Longitude	Latitude	Isolation to mainland (km)	Isolation measured to	Area (km^2)	Max elevation (m)	Topographic complexity	Biome (WWF)
Amsterdam Island	S Indian Ocean	77,554722	-37,825833	3113,962	Réunion Island	55	867	15,76363636	08 - Temperate grasslands, savannas, and shrublands
Cebu (Greater Negros-Panay during the Pleistocene)	Philippines	123,75	10,32	46	Greater Palawan	65795	1000	0,015198723	01 - Tropical and subtropical moist broadleaf forests
Greenland	Artic Ocean	-51,73	64,17	25	Ellesmere Island	2166086	3694	0,00170538	11 - Tundra
Honshu, Shikoku, Kyushu	Japan-Korea	139,604496	36,397592	179,2	Korea	227962,6	3776	0,016564121	01 - Tropical and subtropical moist broadleaf forests; 04 - Temperate broadleaf and mixed forests; 05 - Temperate coniferous forests
Java	Malaysia-Solomons	110,004444	-7,491667	27,2	Sumatra	128297	3676	0,028652268	01 - Tropical and subtropical moist broadleaf forests
Majorca	Mediterranean	2,98	36,92	167,33	Spain	3640	1445	0,396978022	12 - Mediterranean forests, woodlands, and scrub
Malta	Mediterranean	14,5	35,883333	19,57	Sicily	1885	343	0,181962865	12 - Mediterranean forests, woodlands, and scrub
Mindoro	Philippines	121,09	12,93	16,4	Luzon	10572	2582	0,244230042	01 - Tropical and subtropical moist broadleaf forests
Minorca	Mediterranean	2,85771	39,5341	196,97	Spain	702	357	0,508547009	12 - Mediterranean forests, woodlands, and scrub
Orcas Island, Washington	N America	-122,938333	49	1,056	N American mainland	512,756	784,3	1,529577421	04 - Temperate broadleaf and mixed forests

Island	Region	Longitude	Latitude	Isolation to mainland (km)	Isolation measured to	Area (km^2)	Max elevation (m)	Topographic complexity	Biome (WWF)
Pianosa	Mediterranean	10,083333	42,583333	55,67	Tuscany	10,25	29	2,829268293	12 - Mediterranean forests, woodlands, and scrub
Sardinia	Mediterranean	9	40,32	190,86	Tuscany	24090	1834	0,076131175	12 - Mediterranean forests, woodlands, and scrub
Sicily	Mediterranean	14,066667	37,483333	3	Calabria	32697,06	3320	0,101538181	12 - Mediterranean forests, woodlands, and scrub
Sulawesi	Malaysia-Solomons	121	-2	116,5	Borneo	179008	3478	0,019429299	01 - Tropical and subtropical moist broadleaf forests
Taiwan	SE Asia	121	23,77	155,91	SE Asian Mainland	34507	3952	0,114527487	01 - Tropical and subtropical moist broadleaf forests

Appendix III

12. Appendix III

12.1. List or equations used for estimating body mass

Variable	r^2	%SEE	%PE	Reference
Astragalus Area	0,9500	63	44	Martinez & Sudre (1995)
Femur Head Area (FHA)	0,9880	7,6	13,2	Kappelman et al. (1997)
Width of Occipital Condyles (WOC)	0,8300	16,133	?	Palombo et al. (2008)
H4	0,9590	29	18	Scott (1990)
H5	0,9604	28	18	Scott (1990)
U2	0,9436	35	23	Scott (1990)
R2	0,9629	28	17	Scott (1990)
R3	0,9279	39	23	Scott (1990)
R4	0,9543	31	19	Scott (1990)
R5	0,9569	29	18	Scott (1990)
MC2	0,9529	31	20	Scott (1990)
MC3	0,9402	36	22	Scott (1990)
MC4	0,9203	43	25	Scott (1990)
F2	0,9529	31	20	Scott (1990)
F3	0,9420	35	24	Scott (1990)
F4	0,9415	35	24	Scott (1990)
F5	0,9530	31	20	Scott (1990)
T2	0,9567	30	30	Scott (1990)
T3	0,9231	42	42	Scott (1990)
T4	0,9545	31	31	Scott (1990)
T5	0,9464	34	34	Scott (1990)
MT2	0,9405	36	36	Scott (1990)
MT3	0,9307	39	39	Scott (1990)
MT4	0,9418	35	35	Scott (1990)
OCH	0,9440	40,6	26,7	Janis (1990)
M1M3ILU	0,9340	44,5	32,8	Janis (1990)
M2IA	0,9350	44,5	30,8	Janis (1990)
M3IA	0,9430	40,9	29,1	Janis (1990)
M1M3ILU	0,8002	17,7	?	Giovinazzo (2003)
M2SLU	0,8365	12	?	Giovinazzo (2003)
H4	0,9184	11,75	?	Giovinazzo (2003)
R2	0,9144	12,43	?	Giovinazzo (2003)
R5	0,9056	13	?	Giovinazzo (2003)
MC2	0,9105	12,7	?	Giovinazzo (2003)
T4	0,8991	13	?	Giovinazzo (2003)
MT2	0,8965	13,59	?	Giovinazzo (2003)
M2IA	0,7211	20,6	?	Giovinazzo (2003)
M3IA	0,7185	21,23	?	Giovinazzo (2003)

12.2. Body mass estimates and main features of insular bovids

Taxon	Island	Age	Ancestor	S_i	Log (ancestral body mass, g)	Source
Bos primigenius taurus	Amsterdam Island	Extant	*Bos primigenius taurus*	0,613943 684	5,79690527	Lesel (1969), Berteaux & Micol (1992), Berteaux & Guintard (1995)
Bubalus cebuensis	Cebu	Pleistocene-Holocene	*Bubalus arnee*	0,149576 45	6,030270128	Personal observation
Ovibos moschatus wardi	Greenland	Extant	*Ovibos moschatus moschatus*	0,953321 576	5,531734309	Tener, 1965
Capricornis crispus	Honshu, Shikoku, Kyushu	Extant	*Capricornis sumatraensis*	0,509418 66	5,017616682	Personal observation
Bison sp.	Honshu, Shikoku, Kyushu	Late Pleistocene	*Bison priscus*	1,783002 91	5,954242509	Hasegawa et al. (2009)
Bubalus sp.	Honshu, Shikoku, Kyushu	Middle Pleistocene	*Bubalus arnee*	0,640583 017	6,030270128	Taruno & Yamamoto (1978)
Capricornis sp.	Honshu, Shikoku, Kyushu	18000 BP	*Capricornis sumatraensis*	0,537259 651	5,017616682	Kawamura (2003)
Capricornis sumatraensis (Punung fauna)	Java	Late Pleistocene	*Capricornis sumatraensis*	1,262222 09	5,017616682	Personal observation
Duboisia santeng	Java	Middle Pleistocene	*Boselaphus namadicus*	0,323658 142	5,255272505	Personal observation
Bubalus palaeokerabau	Java	Middle Pleistocene	*Bubalus arnee*	1,110800 749	6,030270128	Personal observation
Epileptobos groeneveldtii	Java	Middle Pleistocene	*Leptobos falconeri*	0,539670 42	5,939605804	Personal observation
Bibos palaesondaicus	Java	Middle Pleistocene	*Bos palaeogauro s*	0,752	5,84509804	Personal observation
Myotragus palomboi	Majorca	Earliest Early Pliocene	*Aragoral mudejar*	0,225928 622	5,152288344	Personal observation

Taxon	Island	Age	Ancestor	S_i	Log (ancestral body mass, g)	Source
Myotragus kopperi	Majorca	Early Pleistocene	*Aragoral mudejar*	0,183027399	5,152288344	Personal observation
Myotragus pepgonellae	Majorca	Early/Late Pliocene	*Aragoral mudejar*	0,356849371	5,152288344	Personal observation
Myotragus batei	Majorca	Early/Middle Pleistocene	*Aragoral mudejar*	0,136530993	5,152288344	Adrover, 1967
Myotragus antiquus	Majorca	latest Late Pliocene	*Aragoral mudejar*	0,157878929	5,152288344	Personal observation
Myotragus balearicus	Majorca	Middle Pleistocene-Holocene (survived until 4300-4200 years ago)	*Aragoral mudejar*	0,183098592	5,152288344	Andrews (1915), Bover (2004), Köhler & Moyà-Solà (2004), Palombo et al. (2008), De Esteban-Trivigno & Köhler (2011), personal observation
Bos sp.	Malta	18 ka	*Bos primigenius siciliae*	0,996930505	5,706265334	Personal observation
Bubalus mindorensis	Mindoro	Extant	*Bubalus arnee*	0,208946144	6,030270128	Personal observation
Myotragus binigausensis	Minorca	Early Pleistocene	*Aragoral mudejar*	0,1954996	5,152288344	Personal observation
Bison antiquus	Orcas Island, Washington	11990 BP	*Bison antiquus*	0,972684335	6,006466042	Wilson et al. (2009), Kenady et al. (2011)
Bos primigenius bubaloides	Pianosa	Late Pleistocene	*Bos primigenius*	0,417648676	6	Personal observation
Nesogoral meloni	Sardinia	Early Pleistocene	*Skoufotragus laticeps*	0,201080645	5,093421685	Personal observation
Nesogoral sp	Sardinia	Early Pleistocene	*Skoufotragus laticeps*	0,231709677	5,093421685	Personal observation

Taxon	Island	Age	Ancestor	S_i	Log (ancestral body mass, g)	Source
Nesogoral cenisae	Sardinia	Early Pleistocene	*Skoufotragus laticeps*	0,246419355	5,093421685	Van der Made (2005)
Bison priscus siciliae	Sicily	late Middle Pleistocene	*Bison priscus*	0,558533333	5,954242509	Personal observation
Bos primigenius siciliae	Sicily	late Middle Pleistocene	*Bos primigenius*	0,50847	6	Personal observation
Bubalus depressicornis	Sulawesi	Holocene	*Bubalus arnee*	0,074474094	6,030270128	Personal observation
Bubalus depressicornis	Sulawesi	Extant	*Bubalus arnee*	0,081746998	6,030270128	Personal observation
Bubalus quarlesi	Sulawesi	Extant	*Bubalus arnee*	0,070616115	6,030270128	Personal observation
Capricornis swinhoei	Taiwan	Extant	*Capricornis sumatraensis*	0,316647074	5,017616682	Personal observation
Bubalus sp.	Taiwan	Middle Pleistocene	*Bubalus arnee*	0,907489384	6,030270128	Hayasaka (1942), Otsuka (1984)

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Appendix IV

13. Appendix IV

13.1. List of ecological features of island bovids and their communities

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Bos primigenius taurus	*Bos primigenius taurus*	0	0	Grazer	Open, Light Cover	Lesel, 1969; Bertaux & Micol, 1992
Bison sp.	*Palaeoloxodon* sp., *P. naumanni, Canis lupus, Nyctereutes vivverrinus, Ursus arctos, Meles* sp., *Mustela* sp., *Felis pardus, Macaca* cf. *fuscata, Alces alces, Sinomegaceros yabei, Bison* sp., *Bos primigenius, Equus hemionus*	*Canis lupus, Ursus arctos, Felis pardus*	*Palaeoloxodon* sp., *P. naumanni, Alces alces, Sinomegaceros yabei, Bos primigenius, Equus hemionus*	Grazer	Open, Light Cover	Sondaar & Van der Geer, 2005; Van der Geet et al., 2010
Bubalus sp.	*Bubalus* sp., *P. naumanni, Stegodon orientalis, Rhinoceros sinensis, Nipponicervus* sp., *Panthera youngi*	*Panthera youngi*	*P.naumanni, Stegodon orientalis, Rhinoceros sinensis, Nipponicervus* sp.	Grazer/mixed feeder	Open, Light Cover	Taruno & Yamamoto, 1978; Sondaar & Van der Geer, 2005; Van der Geet et al., 2010

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Capricornis swinhoei	*Macaca cyclopis, Manis pentadactyla, Prionailurus bengalensis, Neofelis nebulosa, Paguma larvata, Viverricula indica, Herpestes urva, Ursus thibetanus, Martes flavigula, Mustela kathiah, Mustela sibirica, Melogale moschata, Lutra lutra, Aonyx cinereus, Sus scrofa, Cervus nippon, Cervus unicolor, Muntiacus reevesi, Capricornis swinhoei, Homo sapiens*	*Neofelis nebulosa, Homo sapiens*	*Cervus unicolor swinhoei, Muntiacus reevesi micrurus, Cervus nippon, Sus scrofa*	Mixed feeder	Forest, Mountain	IUCN (2012); http://animaldiversity.ummz.umich.edu/site/index.html; personal observation

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Capricornis crispus	*Macaca fuscata, Prionailurus bengalensis iriomotensis, Herpestes auropunctatus, Vulpes vulpes, Nyctereutes procyonoides, Canis lupus, Ursus thibetanus, Mustela erminea, Mustela nivalis, Mustela itatsi, Martes melampus, Martes zibellina, Meles anakuma, Lutra lutra, Enhydra lutris, Sus scrofa, Cervus nippon, Capricornis crispus, Homo sapiens*	*Ursus thibetanus, Canis lupus, Homo sapiens*	*Cervus nippon, Sus scrofa*	Browser	Heavy Cover, Forest, Mountain	Jass & Meade, 2004; Ohdachi et al., 2009; IUCN (2012), http://animaldiversity.ummz.umich.edu/site/index.html; personal observation
Bubalus mindorensis	*Macaca fascicularis, Viverra tangalunga, Sus oliveri, Cervus mariannus, Bubalus mindorensis, Homo sapiens*	*Homo sapiens*	*Sus oliveri, Cervus mariannus*	Grazer	Forest, Light Cover	Custodio et al., 1996; Philippines database, Field Museum; personal observation

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Bubalus depressicornis	*Babyrousa celebensis, Sus celebensis, Macaca nigra, Bubalus depressicornis, Bubalus quarlesi, Macrogalidia musschenbroekii, Ailurops ursinus, Strigocuscus celebensis, Macaca ochreata, Homo sapiens*	*Homo sapiens*	*Babyrousa celebensis, Sus celebensis, Bubalus quarlesi*	Browser	Forest, Swamp	Burton et al., 2005; IUCN (2012); http://animaldiversity.ummz.umich.edu/site/index.html; personal observation
Bubalus quarlesi	*Babyrousa celebensis, Sus celebensis, Macaca nigra, Bubalus depressicornis, Bubalus quarlesi, Macrogalidia musschenbroekii, Ailurops ursinus, Strigocuscus celebensis, Macaca ochreata, Homo sapiens*	*Homo sapiens*	*Babyrousa celebensis, Sus celebensis, Bubalus depressicornis*	Browser	Forest, Swamp	Burton et al., 2005; IUCN (2012); http://animaldiversity.ummz.umich.edu/site/index.html; personal observation

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Bison antiquus (Ayer Pond)	*Arctodus simus, Mammut americanum, Bison antiquus, Homo sapiens, Megalonyx jeffersonii*	*Arctodus simus, Homo sapiens*	*Mammut americanum, Megalonyx jeffersonii*	Grazer	Open, Light Cover	Wilson et al., 2009; Kenady et al., 2011
Bos sp.	*Canis lupus, Vulpes vulpes, Ursus* cf. *U. arctos, Sus scrofa, Cervus elaphus, Bos* sp., *Equus hydruntinus*	*Canis lupus, Ursus* cf. *U. arctos*	*Sus scrofa, Cervus elaphus, Equus hydruntinus*	Grazer	Open	Hunt & Schembri, 1999; Furlani et al., 2012; personal observation

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Capricornis sumatraensis (Punung fauna)	*Elephas maximus, Tapirus indicus, Rhinoceros sondaicus, Sus vittatus, Muntiacus muntjak, Cervus* sp., *Bubalus bubalis, Capricornis sumatraensis, Neofelis nebulosa, Panthera tigris, Ursus malayanus, Trachypithecus cristatus, Macaca nemestrina, Hylobates syndactylus, Hylobates* cf. *leuciscus, Pongo pygmaeus, Homo sapiens*	*Neofelis nebulosa, Panthera tigris, Ursus malayanus, Homo sapiens*	*Elephas maximus, Tapirus indicus, Rhinoceros sondaicus, Sus vittatus, Muntiacus muntjak, Cervus* sp., *Bubalus bubalis*	Mixed feeder	Heavy Cover, Forest, Mountain	van den Bergh et al., 2001; Christine Hertler personal communication; personal observation
Myotragus	*Myotragus*	*Aquila* sp.	0	Grazer - browser	Light cover	Alcover et al., 2004; Pere Bover personal communication; personal observation

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Nesogoral melonii	*Sus sondaari, Nesogoral* sp., *Nesogoral melonii, Nesogoral cenisae, Asoletragus gentryi, Chasmaportetes melei, Pannonictis* sp., *Mustela* sp., *Macaca* aff. *M. majori,*	*Chasmaportetes melei*	*Sus sondaari, Nesogoral* sp., *Nesogoral cenisae, Asoletragus gentryi*	Mixed feeder	Open, Light Cover, Forest, Mountain	Palombo, 2009; Rozzi, 2010; personal observation
Nesogoral sp.	*Sus sondaari, Nesogoral* sp., *Nesogoral melonii, Nesogoral cenisae, Asoletragus gentryi, Chasmaportetes melei, Pannonictis* sp., *Mustela* sp., *Macaca* aff. *M. majori,*	*Chasmaportetes melei*	*Sus sondaari, Nesogoral melonii, Nesogoral cenisae, Asoletragus gentryi*	Mixed feeder	Open, Light Cover, Forest, Mountain	Palombo, 2009; Rozzi, 2010; personal observation
Nesogoral cenisae	*Sus sondaari, Nesogoral* sp., *Nesogoral melonii, Nesogoral cenisae, Asoletragus gentryi, Chasmaportetes melei, Pannonictis* sp., *Mustela* sp., *Macaca* aff. *M. majori*	*Chasmaportetes melei*	*Sus sondaari, Nesogoral* sp., *Nesogoral melonii, Asoletragus gentryi*	Mixed feeder	Open, Light Cover, Forest, Mountain	Palombo, 2009; Rozzi, 2010; personal observation

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Asoletragus gentryi	*Sus sondaari, Nesogoral* sp., *Nesogoral melonii, Nesogoral cenisae, Asoletragus gentryi, Chasmaportetes melei, Pannonictis* sp., *Mustela* sp., *Macaca* aff. *M. majori,*	*Chasmaportetes melei*	*Sus sondaari, Nesogoral* sp., *Nesogoral cenisae, Nesogoral melonii*	Mixed feeder	Open, Light Cover, Forest, Mountain	Palombo, 2009; Rozzi, 2010; personal observation
Bubalus depressicornis Holocene	*Sus celebensis, Bubalus depressicornis, Homo sapiens*	*Homo sapiens*	*Sus celebensis*	Browser	Forest, Swamp	van den Bergh et al., 2001; personal observation
Bison priscus siciliae	*Lutra trinacriae, Panthera leo spelaea, Hippopotamus pentlandi, Palaeoloxodom mnaidriensis, Crocuta crocuta spelaea, Cervus elaphus siciliae, Dama carburangelensis, Bison priscus siciliae, Bos primigenius siciliae, Ursus arctos, Canis lupus, Vulpes vulpes, Sus scrofa*	*Panthera leo spelaea, Crocuta crocuta spelaea, Ursus arctos, Canis lupus*	*Hippopotamus pentlandi, Palaeoloxodom mnaidriensis, Cervus elaphus siciliae, Dama carburangelensis, Bos primigenius siciliae, Sus scrofa, Equus hydruntinus*	Grazer	Open	Masini et al., 2008; personal observation

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Bos primigenius siciliae	*Lutra trinacriae, Panthera leo spelaea, Hippopotamus pentlandi, Palaeoloxodom mnaidriensis, Crocuta crocuta spelaea, Cervus elaphus siciliae, Dama carburangelensis, Bison priscus siciliae, Bos primigenius siciliae, Ursus arctos, Canis lupus, Vulpes vulpes, Sus scrofa*	*Panthera leo spelaea, Crocuta crocuta spelaea, Ursus arctos, Canis lupus*	*Hippopotamus pentlandi, Palaeoloxodom mnaidriensis, Cervus elaphus siciliae, Dama carburangelensis, Bison priscus siciliae, Sus scrofa, Equus hydruntinus*	Grazer	Open	Masini et al., 2008; personal observation
Bubalus sp. (Saitin-syo, Tainan prefecture)	*Bubalus* sp., *Sus* sp., *Panthera* sp., *Stegodon akashiensis, Macaca* sp., *Cervus sintikuensis, Cervus (Rusa)* sp., *Cervus (Sika)* sp., *Mammuthus armeniacus taiwanicus, Rhinoceros sinensis hayasakai*	*Tomistoma taiwanicus, Panthera* sp.	*Sus* sp., *Stegodon akashiensis, Cervus sintikuensis, Cervus (Rusa)* sp., *Cervus (Sika)* sp., *Mammuthus armeniacus taiwanicus, Rhinoceros sinensis hayasakai*	Grazer	Open, Light Cover, Forest, Swamp	Otsuka, 1984; Hayasaka, 1942; van den Bergh et al., 2001

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Duboisia santeng	*Trachypithecus cristatus, Macaca fascicularis, Homo erectus, Cuon trinilensis, Panthera tigris trinilensis, Prionailurus bengalensis, Stegodon trigonocephalus, Rhinoceros sondaicus, Sus brachygnathus, Muntiacus muntjak, Cervus* sp.*, Axis lydekkeri, Duboisia santeng, Bubalus palaeokerabau, Bibos palaesondaicus*	*Homo erectus, Cuon trinilensis, Panthera tigris trinilensis, Gavialis bengawanicus, Crocodylus siamensis*	*Stegodon trigonocephalus, Rhinoceros sondaicus, Sus brachygnathus, Muntiacus muntjak, Cervus* sp.*, Axis lydekkeri, Bubalus palaeokerabau, Bibos palaesondaicus*	Browser	Forest	van den Bergh et al., 2001; Christine Hertler personal communication; personal observation

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Bubalus palaeokerabau	*Trachypithecus cristatus, Macaca fascicularis, Homo erectus, Cuon trinilensis, Panthera tigris trinilensis, Prionailurus bengalensis, Stegodon trigonocephalus, Rhinoceros sondaicus, Sus brachygnathus, Muntiacus muntjak, Cervus* sp.*, Axis lydekkeri, Duboisia santeng, Bubalus palaeokerabau, Bibos palaesondaicus*	*Homo erectus, Cuon trinilensis, Panthera tigris trinilensis, Gavialis bengawanicus, Crocodylus siamensis*	*Stegodon trigonocephalus, Rhinoceros sondaicus, Sus brachygnathus, Muntiacus muntjak, Cervus* sp.*, Axis lydekkeri, Duboisia santeng, Bibos palaesondaicus*	Grazer	Open, Light Cover, Forest, Swamp	van den Bergh et al., 2001; Christine Hertler personal communication; personal observation

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Bibos palaesondaicus	*Trachypithecus cristatus, Macaca fascicularis, Homo erectus, Cuon trinilensis, Panthera tigris trinilensis, Prionailurus bengalensis, Stegodon trigonocephalus, Rhinoceros sondaicus, Sus brachygnathus, Muntiacus muntjak, Cervus* sp.*, Axis lydekkeri, Duboisia santeng, Bubalus palaeokerabau, Bibos palaesondaicus*	*Homo erectus, Cuon trinilensis, Panthera tigris trinilensis, Gavialis bengawanicus, Crocodylus siamensis*	*Stegodon trigonocephalus, Rhinoceros sondaicus, Sus brachygnathus, Muntiacus muntjak, Cervus* sp.*, Axis lydekkeri, Duboisia santeng, Bubalus palaeokerabau*	Mixed feeder	Open, Light Cover, Forest	van den Bergh et al., 2001; Christine Hertler personal communication; personal observation

Insular taxon	**Large mammal richness**	**Predators**	**Competitors**	**Diet**	**Habitat**	**Source**
Epileptobos groeneveldtii	*Bibos* sp., *Homo erectus, Lutrogale palaeoleptonyx, Pachycrocuta brevirostris, Panthera tigris, Panthera pardus, Viverra zibetha, Manis palaeojavanica, Stegodon trigonocephalus, Stegodon*? *hypsilophus, Elephas hysudrindicus, Tapirus indicus, Rhinoceros sondaicus, Rhinoceros unicornis, Sus brachygnatus, Sus macrognatus, Hexaprotodon sivalensis,Muntiacus munjak, Rusa* sp., *Cervus* sp., *Axis lydekkeri, Axis ngebungensis, Duboisia santeng, E. groeneveldtii, B. palaeokerabau, Bibos palaesondaicus*	*Homo erectus, Pachycrocuta brevirostris, Panthera tigris, Panthera pardus, Gavialis bengawanicus, Crocodylus siamensis*	*Bibos* sp., *Stegodon trigonocephalus, Stegodon*? *Hypsilophus, Elephas hysudrindicus, Tapirus indicus, Rhinoceros sondaicus, Rhinoceros unicornis, Sus brachygnatus, Sus macrognatus, Hexaprotodon sivalensis,Muntiacus munjak, Rusa* sp., *Cervus* sp., *Axis lydekkeri, Axis ngebungensis, Duboisia santeng, B. palaeokerabau, Bibos palaesondaicus*	Mixed feeder	Open, Light Cover, Forest	van den Bergh et al., 2001; Rozzi et al., 2013; Christine Hertler personal communication

Insular taxon	Large mammal richness	Predators	Competitors	Diet	Habitat	Source
Bubalus cebuensis	*Bubalus cebuensis, Elephas* sp., *Stegodon*sp.	0	*Elephas* sp., *Stegodon* sp.	Grazer/mixed feeder	Light Cover, Heavy Cover	Croft et al., 2006; personal observation
Ovibos moschatus wardi	*Canis lupus, Ursus arctos, Ursus maritimus, Ovibos moschatus wardi, Homo sapiens, Alopex lagopus, Vulpes vulpes, Mustela erminea, Gulo gulo, Rangifer tarandus, Capreolus capreolus*	*Canis lupus, Ursus arctos, Ursus maritimus, Homo sapiens*	*Rangifer tarandus, Capreolus capreolus*	Grazer/mixed feeder	Open, Light Cover	Tener, 1965; Lent, 1988; personal observation
Bos primigenius bubaloides	*Bos primigenius bubaloides, Ursus arctos, Equus* sp., *Vulpes vulpes, Equus hydruntinus, Capreolus capreolus, Mustela* sp., *Cervus elaphus*	*Ursus arctos*	*Equus* sp., *Equus hydruntinus, Capreolus capreolus, Cervus elaphus*	Grazer/mixed feeder	Open, Light Cover	Azzaroli, 1978; personal observation
Capricornis sp.	*Capricornis* sp., *Sus scrofa, Homo sapiens, Cervus nippon, P. naumanni*	*Homo sapiens*	*Sus scrofa, Cervus nippon, P. naumanni*	Browser	Heavy Cover, Forest, Mountain	Kawamura, 2003; Sondaar & Van der Geer, 2005; Van der Geet et al., 2010

13.2. Evolutionary rates of body size divergence

Variable	Description
Dt	Time in isolation expressed in millions of years
d	The proportional difference between the sample means (d = $\bar{y}_2$-$\bar{y}_1$)
sp	The pooled standard deviation of the samples (= of the ln body mass)
I	The time interval between the samples, I = $t_2 - t_1$, estimated in generations (number of generations per time interval)

Insular taxon	Time in isolation (years)	Dt	Evolutionary rates (darwins)	Generation time (years)	I	Max body mass insular taxon	Min body mass insular taxon	sp	d	D	Evolutionary rates (haldanes)
Bos primigenius taurus	117	0,000117	-4169,67586	4,892849	23,91245	538,3025	248,9914	0,192751	-0,48785	-2,531	-0,10584
Bubalus cebuensis	10000	0,01	-189,9947645	3,900925	2563,495	187,1164	128,7342	0,093495	-1,89995	-20,3213	-0,00793
Ovibos moschatus wardi	10000	0,01	-4,780299726	4,681448	2136,091	?	?	?	-0,0478	?	?
Capricornis crispus	10000	0,01	-67,44850855	2,929093	3414,026	91,23374	25,15228	0,322119	-0,67449	-2,0939	-0,00061
Bison sp.	10000	0,01	57,82989711	7,083294	1411,773	1722,874	1463,942	0,040715	0,578299	14,2035	0,010061
Bubalus sp.	100000	0,1	-4,453765528	5,685662	17588,1	1865,491	151,7858	0,627202	-0,44538	-0,7101	-4E-05
Capricornis sp.	10000	0,01	-62,12737801	2,96974	3367,298	?	?	?	-0,62127	?	?

Insular taxon	**Time in isolation (years)**	**Dt**	**Evolutionary rates (darwins)**	**Generation time (years)**	**I**	**Max body mass insular taxon**	**Min body mass insular taxon**	**sp**	**d**	**D**	**Evolutionary rates (haldanes)**
Capricornis sumatraensis (Punung fauna)	10000	0,01	23,28737308	3,705057	2699,014	?	?	?	0,232874	?	?
Duboisia santeng	100000	0,1	-11,28041099	3,001021	33322	163,8237	12,67679	0,639755	-1,12804	-1,76324	-5,3E-05
Bubalus palaeokerabau	100000	0,1	1,050811503	6,556888	15251,14	2343,635	91,18172	0,811651	0,105081	0,129466	8,49E-06
Epileptobos groeneveldtii	100000	0,1	-6,167966591	5,152491	19408,09	864,2936	264,0824	0,296413	-0,6168	-2,08087	-0,00011
Bibos palaesondaicus	100000	0,1	-2,85018955	5,307119	18842,61	1167,91	180,2301	0,467184	-0,28502	-0,61008	-3,2E-05
Myotragus palomboi	100000	0,1	-14,87536159	2,571339	38890,25	38,80388	18,32376	0,18758	-1,48754	-7,93013	-0,0002
Myotragus kopperi	1000000	1	-1,698119418	2,434851	410702,7	70,7554	6,228084	0,60754	-1,69812	-2,79507	-6,8E-06

Insular taxon	Time in isolation (years)	Dt	Evolutionary rates (darwins)	Generation time (years)	I	Max body mass insular taxon	Min body mass insular taxon	sp	d	D	Evolutionary rates (haldanes)
Myotragus pepgonellae	1000000	1	-1,030441516	2,894505	345482,2	91,49336	12,13544	0,505034	-1,03044	-2,04034	-5,9E-06
Myotragus batei	1000000	1	-1,991203634	2,256865	443092,5	29,24093	15,40776	0,160175	-1,9912	-12,4315	-2,8E-05
Myotragus antiquus	1000000	1	-1,845926811	2,343401	426730,1	59,94942	4,247565	0,661789	-1,84593	-2,7893	-6,5E-06
Myotragus balearicus	1000000	1	-1,69773052	2,435096	410661,4	59,92505	3,593422	0,703497	-1,69773	-2,41327	-5,9E-06
Bos sp.	1000	0,001	-3,074215713	5,255511	190,2764	813,3452	289,5547	0,258203	-0,00307	-0,01191	-6,3E-05
Bubalus mindorensis	1000000	1	-1,565678742	4,253701	235089,4	367,9236	90,68854	0,350111	-1,56568	-4,47195	-1,9E-05
Myotragus binigausensis	1000000	1	-1,632196946	2,47678	403750	46,80058	6,657467	0,487539	-1,6322	-3,34783	-8,3E-06
Bison antiquus (Ayer Pond)	1000	0,001	-27,69567392	6,245935	160,1041	?	?	?	-0,0277	?	?

Insular taxon	Time in isolation (years)	Dt	Evolutionary rates (darwins)	Generation time (years)	I	Max body mass insular taxon	Min body mass insular taxon	sp	d	D	Evolutionary rates (haldanes)
Bos primigenius bubaloides	1000	0,001	-873,1146889	4,998367	200,0653	564,4637	269,4761	0,184849	-0,87311	-4,72339	-0,02361
Nesogoral meloni	1000000	1	-1,604049232	2,408836	415138,3	25,732	24,135	0,016018	-1,60405	-100,14	-0,00024
Nesogoral sp	1000000	1	-1,462270081	2,498934	400170,6	?	?	?	-1,46227	?	?
Nesogoral cenisae	1000000	1	-1,4007205	2,53909	393841,9	36,835	24,276	0,10424	-1,40072	-13,4374	-3,4E-05
Asoletragus gentryi	1000000	1	?	2,278944	438799,8	21,583	18,677	0,036153	?	?	?
Bison priscus siciliae	10000	0,01	-58,24409786	5,244119	1906,898	1211,968	193,4137	0,458792	-0,58244	-1,26951	-0,00067
Bos primigenius siciliae	10000	0,01	-67,63490623	5,259698	1901,25	1237,963	247,4604	0,402493	-0,67635	-1,6804	-0,00088
Bubalus depressicornis	1000000	1	-2,597303946	3,256322	307094,9	132,666	40,51658	0,296531	-2,5973	-8,75896	-2,9E-05
Bubalus depressicornis	1000000	1	-2,504126194	3,335863	299772,5	174,6371	29,97232	0,440609	-2,50413	-5,68333	-1,9E-05
Bubalus quarlesi	1000000	1	-2,650496909	3,211768	311355	131,6929	30,62625	0,364654	-2,6505	-7,26853	-2,3E-05

Insular taxon	Time in isolation (years)	Dt	Evolutionary rates (darwins)	Generation time (years)	I	Max body mass insular taxon	Min body mass insular taxon	sp	d	D	Evolutionary rates (haldanes)
Capricornis swinhoei	10000	0,01	-114,9967457	2,589702	3861,448	56,91079	3,330603	0,709583	-1,14997	-1,62062	-0,00042
Bubalus sp. (Saitin-syo, Tainan prefecture)	100000	0,1	-0,97073411	6,222415	16070,93	?	?	?	-0,09707	?	?

13.3. References

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Appendix V

14. Appendix V

14.1. Values of HI, JLB and MZW

Variable	Description
HI	the height of the unworn M3 crown divided by the occlusal width of the same tooth
JLB	the anterior jaw length, measured from the base of the first incisor to the premolar/molar boundary
MZW	muzzle width, measured at the outer junction of the boundary between the maxilla and the premaxilla

Insular taxon	HI	JLB	MZW	Source
Capricornis crispus	2,10	1,475141895	0,529802999	Personal observation
Duboisia santeng	3,56	1,697728727	0,705480913	Personal observation
Bubalus palaeokerabau	2,78	2,158719109	0,944736711	Personal observation
Bibos palaesondaicus	1,82	1,947476944	?	Personal observation
Myotragus balearicus	5,65	1,296505073	0,57336125	Bover (2004); personal observation
Bubalus mindorensis	2,19	1,85626265	1,045600667	Personal observation
Nesogoral	5,00	1,373023412	0,49751355	Personal observation
Bison priscus siciliae	3,55	1,974627958	?	Personal observation
Bos primigenius siciliae	4,40	1,738145305	?	Personal observation
Bubalus depressicornis	4,43	1,86	0,78	Mendoza & Palmqvist (2007); personal observation
Bubalus quarlesi	2,59	1,80035802	0,710996318	Personal observation
Capricornis swinhoei	3,36	1,740610213	0,477243399	Personal observation

14.2. Values of RI Mc, RI Mt, FSI, HSI

Variable	Description
RI Mt	Robusticity Index of Metatarpal
RI Mc	Robusticity Index of Metacarpal
HSI	Hindlimb Shortening Index
FSI	Forelimb Shortening Index

Variable	Description
TLFL	the total length of the forelimb long bones
TLHL	the total length of the hindlimb long bones
RL	lenght of radius
McL	lenght of metacarpal
TL	lenght of tibia
MtL	lenght of metatarsal

Insular taxon	TLFL	RL/TLFL	McL/TLFL	FSI	Source
Bubalus depressicornis	487,85	35,73	22,91	0,13	Personal observation
Bubalus mindorensis	620,66	37,17	19,99	0,09	Personal observation
Bubalus quarlesi	508,58	34,43	22,96	0,13	Personal observation
Bubalus arnee	739,84	38,18	22,78	0,08	Personal observation
Capricornis crispus	492,76	33,12	25,52	0,16	Personal observation
Capricornis swinhoei	445,77	35,86	22,33	0,14	Personal observation
Capricornis sumatraensis	613,35	35,93	25,73	0,12	Personal observation
Duboisia santeng	476,68	36,70	33,93	0,19	Personal observation
Bibos palaesondaicus	903,60	34,45	24,14	0,08	Personal observation
Bison priscus siciliae	832,83	38,60	22,63	0,07	Personal observation
Nesogoral	431,28	34,50	31,97	0,21	Personal observation
Ovibos moschatus wardi	672,54	35,80	21,34	0,09	Personal observation
Myotragus balearicus	313,71	40,44	17,32	0,14	Andrews, 1915; personal observation

Insular taxon	TLHL	TL/TLHL	MtL/TLHL	HSI	Source
Duboisia santeg	586,13	3,15	3,99	0,13	Personal observation
Bubalus depressicornis	588,69	2,59	4,45	0,10	Personal observation
Bubalus mindorensis	726,10	2,70	4,76	0,08	Personal observation
Bubalus quarlesi	575,76	2,54	4,60	0,10	Personal observation
Bubalus arnee	930,17	2,67	4,53	0,06	Personal observation
Capricornis crispus	593,80	2,42	4,23	0,10	Personal observation
Capricornis swinhoei	532,46	2,41	4,71	0,10	Personal observation
Capricornis sumatraensis	742,08	2,50	4,35	0,08	Personal observation
Bubalus palaeokerabau	1196,45	2,76	4,60	0,05	Personal observation
Bison priscus siciliae	892,89	2,75	4,12	0,07	Personal observation
Nesogoral	489,36	2,61	3,60	0,15	Personal observation
Ovibos moschatus wardi	778,11	2,54	4,91	0,07	Personal observation
Myotragus balearicus	351,23	2,34	4,53	0,15	Andrews, 1915; personal observation
Myotragus pepgonellae	359,39	2,40	5,56	0,12	Personal observation
Myotragus kopperi	309,15	2,26	5,55	0,13	Personal observation

Insular taxon	RI Mc	RI Mt	Source
Myotragus balearicus	0,41	0,26	Andrews, 1915; personal observation
Nesogoral	0,11	0,09	Personal observation
Duboisia	0,09	0,09	Personal observation
Bubalus palaeokerabau	0,27	0,17	Personal observation
Bubalus depressicornis	0,20	0,14	Personal observation
Bubalus mindorensis	0,30	0,19	Personal observation
Bubalus cebuensis	?	0,16	Personal observation
Bubalus quarlesi	0,19	0,13	Personal observation
Capricornis swinhoei	0,18	0,13	Personal observation
Capricornis crispus	0,15	0,11	Personal observation
Bison priscus siciliae	0,17	0,18	Personal observation
Bos primigenius siciliae	0,22	0,13	Personal observation
Bibos palaesondaicus	0,19	?	Personal observation
Bos primigenius bubaloides	0,18	?	Personal observation
Myotragus palomboi	?	0,23	Personal observation
Myotragus pepgonellae	0,45	0,34	Personal observation
Myotragus kopperi	0,42	0,32	Personal observation
Myotragus antiquus	0,33	?	Personal observation
Bos primigenius taurus	0,16	0,12	Berteaux & Guintard (1995)

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