# 3D models related to the publication: "Trophic differentiation between the endemic Cypriot mouse and the house mouse: a study coupling stable isotopes and morphometrics"

Sabrina Renaud[1*], Eleftherios Hadjisterkotis[2], George P. Mitsainas[3], Emilie A. Hardouin[4]

[1] *Laboratoire de Biométrie et Biologie Evolutive (LBBE), UMR 5558 CNRS, Université Claude Bernard Lyon 1, Université de Lyon, Villeurbanne, France*
[2] *Agricultural Research Institute, P.O. Box 22016, 1516, Nicosia, Cyprus*
[3] *Section of Animal Biology, Department of Biology, University of Patras, GR-26500 Patras, Greece*
[4] *Department of Life and Environmental Sciences, Faculty of Sciences and Technology, Bournemouth University, Poole, UK*
*__Corresponding author__: sabrina.renaud@univ-lyon1.fr

**Abstract**
This contribution contains 3D models of mandibles of Cypriot mice (*Mus* cypriacus) and house mice (*Mus musculus domesticus*) from the island of Cyprus. The niche partitioning of the two species was investigated using isotopic ecology, geometric morphometrics and biomechanics. Both species displayed generalist feeding behavior, modulated by fine-tuned adaptation to their feeding habits. The house mouse mandible, with a relatively large masseter area and an optimization for incisor biting, appears as an all-rounder tool for foraging on diverse non-natural items. These models are analyzed in the following publication: Renaud et al 2024, "Trophic differentiation between the endemic Cypriot mouse and the house mouse: a study coupling stable isotopes and morphometrics", https://doi.org/10.1007/s10914-024-09740-5.

**Keywords:** biomechanics, geometric morphometrics, Mandible morphology, *Mus cypriacus*, *Mus musculus domesticus*

Submitted: 26/09/2024, published online: 18/11/2024. https://doi.org/10.18563/journal.m3.247

## INTRODUCTION

Two cryptic species of mice coexist on Cyprus: the introduced house mouse (*Mus musculus domesticus*) and the endemic Cypriot mouse (*Mus cypriacus*), which remained unnoticed until the beginning of the 21st century (Bonhomme et al., 2004; Cucchi et al., 2006). Little is known about the ecology of this species, which however appears to be a generalist found throughout the island (Hardouin et al., 2024) except in areas with high anthropogenic pressure (Cucchi et al., 2006; Kryštufek and Vohralík, 2009). This might be due to a competitive exclusion by the house mouse (Cucchi et al., 2006), introduced to Cyprus as early as c. 8300 BC by the island's first human settlers. On a set of genotyped specimens (García-Rodríguez et al., 2018; Hardouin et al., 2024), niche partitioning between the Cypriot and the house mice was addressed using an approach combining isotopic ecology and a morpho-functional analysis of the mandible. Geometric morphometrics was used to quantify mandible morphology (see fig. 1), while biomechanical ratios were used to assess the potential functional consequences of shape differences (Anderson et al., 2014). Isotopic ecology confirmed the generalist habits of the Cypriot mouse, which exploits various natural food resources, including invertebrates. In contrast, house mice from Cyprus forage primarily on anthropic food resources. Regarding mandible morphology, both species shared common traits characteristics of omnivorous diets. Differences, however, suggested fine-tuned adaptation to their specific feeding habits. The Cypriot mouse displays a large mandible, optimized for chewing at the molars, facilitating the consumption of large and hard food items presumably abundant in the natural vegetation of Cyprus. The smaller mandible size of the house mouse is compensated by a large masseter area and optimization for incisor biting, making it an all-rounder tool for foraging on diverse non-natural items. This behavior is further supported by the frequent occurrence of unusual patterns of incisor wear.

## METHODS

Mouse heads were scanned at a cubic voxel resolution of 12 µm on the General Electric (GE) Nanotom microtomograph (µCT) of the AniRA-ImmOs platform of the SFR Biosciences, Ecole Normale Supérieure (Lyon, France). The scanning parameters were as follows: 100 kV, 70µA, 3000 projections at 360° with Cu filter. For each mouse, the right mandible (or occasionally the left mandible) was manually segmented, including the molar row and the incisor, using the software Avizo (v. 9.1, Thermo Fisher Scientific). The 3D surfaces are provided in .ply format (see table 1), and can therefore be opened with a wide range of freeware.

| Abbreviation | Taxon | Town | Latitude | Longitude | Sex | Weight [g] |
|---|---|---|---|---|---|---|
| 5GE | *cypriacus* | | 32.99 | 34.77 | male | 12.87 |
| BET2 | *cypriacus* | | 33.06 | 34.75 | male | 13.5 |
| FON1 | *cypriacus* | Foinikaria | 33.09 | 34.74 | male | 15.43 |
| FON2 | *cypriacus* | Foinikaria | 33.09 | 34.74 | male | 15.06 |
| KOU1 | *cypriacus* | Kourion | 32.88 | 34.66 | male | 14.41 |
| KOF1 | *domesticus* | Kofinou | 33.40 | 34.82 | | 10.22 |
| LEF1 | *domesticus* | Lefkara | 33.34 | 34.84 | female | 19.98 |
| MEN1 | *domesticus* | Meneou | 33.59 | 34.85 | male | 14 |
| TSE2 | *domesticus* | Tseri | 33.32 | 35.05 | female | 12.64 |
| XYL5 | *domesticus* | Xylophagou | 33.83 | 34.97 | male | 9.43 |

**Table 1.** Label, species, location of trapping, sex and weight of the deposited specimens.

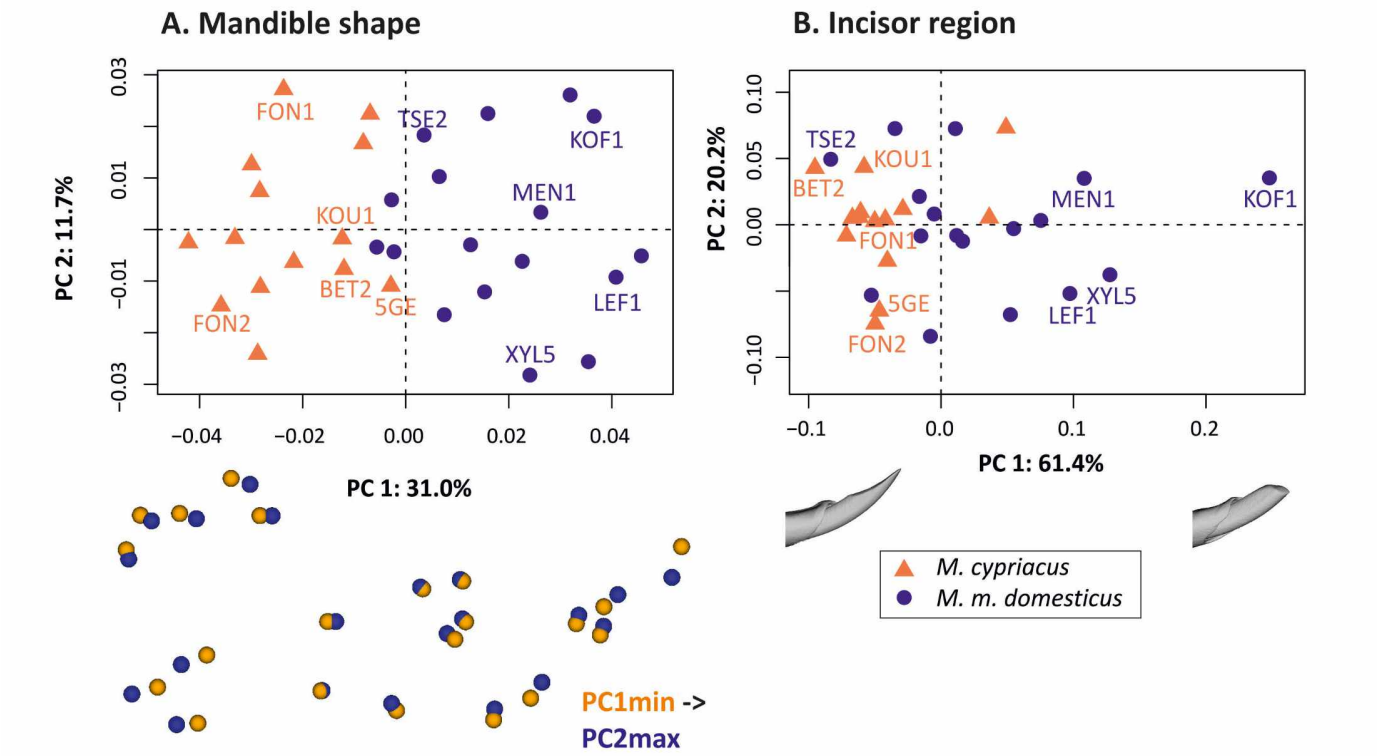


**Figure 1.** Morphospace depicting the shape variation of the whole mandible (A) and of the incisor region (B) of Cypriot and house mice from Cyprus. The first two axes of a PCA on the aligned coordinates are represented. The labels of the deposited specimens are mentioned on the plots. A. The mandible shape associated with minimum and maximum PC1 scores are represented below the plot. B. Incisors exemplifying extreme shapes along PC1 are represented along the corresponding axis.

## ACKNOWLEDGEMENTS

We deeply thank Demetra Andreou for her participation to the field work: We also acknowledge the contribution of the SFR Biosciences (UMS3444/CNRS, US8/Inserm, ENS de Lyon, UCBL) AniRa-ImmOs facility, and we particularly thank Mathilde Bouchet for her kind assistance during scanning sessions.

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ISSN: 2274-0422

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ISSN: 2274-0422