

SMALL MAMMALS SUBRECENT FAUNAS AT
MEDITERRANEAN ISLANDS. 1. CABRERA ISLAND
(Mammalia: *Rodentia*, *Lagomorpha*)

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SUMMARY. The biometrical characterization of subrecent small mammals of the Cabrera Island is given. The faunistical composition recorded and the morphological characteristics of the specimens studied suggest a mammalian community different that the present day one, and allows to establish a model of some of the faunistic events wich composed the colonization process of the mammalian biota of Cabrera.

RESÚM. Es presenta la caracterització biomètrica dels micromamífers subrecents de l'illa de Cabrera. La composició faunística trobada i les característiques morfològiques dels especimens estudiats suggereixen una comunitat de mamífers diferent de l'actual, i permeten establir un model d'alguns dels esdeveniments faunístics que formen part del procés de colonització de la biota mastozoològica a Cabrera.

INTRODUCTION

This is the first of a series of at least five articles about the ancient faunas of small mammals living on various mediterranean islands (Cabrera, Eivissa, Sardinia, Menorca and Mallorca) during holocenic and/or historical times, in presence of the man. In several of the mediterranean islands (*i.e.*: Chios, Pantelleria, Malta) their holocenic (subfossil) faunas have already been studied (STORCH, 1970; FELTEN & STORCH, 1970; BESENECKER, SPITZENBERG & STORCH, 1972). In our works we have included remains furnished by deposits situated in a greater range of time, and thus the term «subfossil» is not the most accurate to designate our faunas, which are better described as subrecent.

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Cabrera is the main island of the archipelago by same name situated 13 Km South the island of Mallorca. Its Port is 20 Km from Colònia de St. Jordi (Mallorca). It has a area of 15.7 km² and a maximum altitude of 172 m above sea level (Puig del Picamosques). Its a dry typical mediterranean climate, with less then 400 mm year of precipitation. Their climactic vegetation is a maquis included in the dominium of the *Oleo-Ceratonion*. There are abandoned cultivated fields and in the Port area a small military garrison of about thirty men and a peasant family are living. At begining of XIX century it was used as a concentration camp to which 9000 French prisoners were brought.

The scientific works about the mammals inhabiting Cabrera are numerous. CABRERA (1904) mentioned the Garden Dormouse *Eliomys quercinus* (as *E.gymnesicus*) on the Island of Cabrera. MAYOL (1974), in a divulgation article mentioned the two rats *Rattus rattus* and *R.norvegicus*, the House Mouse *Mus musculus*, the Rabbit *Oryctolagus cuniculus*, the Hedgehog *Erinaceus algirus* and the Genet *Genetta genetta*. REY (1974: unpublished) found specimens or remains of *E.algirus*, *Pipistrellus savii*, *R.rattus*, *M.musculus*, *A.sylvaticus*, *O.cuniculus* and *G.genetta*, but he indicates that the current presence of *A.sylvaticus* should be confirmed, due to the fact that only a few remains have been obtained of this species in Barn Owl pellets. ALCOVER (1977a) mentioned a few subrecent remains of *A.sylvaticus* in the Avenc des Frare, and he pointed out also that this species is not a component of the current mammalian fauna form Cabrera. It is also mentioned in the description of *A.sylvaticus eivissensis* (ALCOVER, 1977b), where their extinction on Cabrera is compared with the extinction on Malta (STORCH, 1970) and Chios (KOCK, 1974). Finally, there is information about the Genet of Cabrera in the article describing *G.genetta isabelae* (DELIBES, 1977) and in a work about the food of the Carnivora on islands (ALCOVER, in press).

In the present paper the bionomical study of the species that composed the ancient fauna of small mammals of Cabrera is given, and the possible changes that have taken place in this fauna in subrecent times are suggested.

DEPOSITS

The remains studied here are been furnished by three deposits from Cabrera (see Fig. 1): 1. Avenc des Frare (Puig del Picamosques). 2. Natural shelter near the peasant home. 3. Cliffs situated 500 m from Ca'n Feliu. Both form their preservation and from the clustering of the obtained remains, it is possible to establishe that they probably originated form ancient owl pellets, surely

of *Tyto alba*. On Table 1 the minimum number of individuals found at the deposits is showed. These figures are calculated from the bone that, in each particular case, is the most frequently repeated (SANS-COMA, 1974).

It has not been possible to make any accurate dating of any of these deposits, as opposed to other deposits from the Balearics, because the remains found here are not related to any cultural remains. Nevertheless, from the presence of *R.rattus* it can be supposed that these deposits are relatively recent. This species is not found in the subfossiliferous deposits from the larger Balearics; the most ancient remains of the Black Rat found on these islands proceed from a cesspool of the XVI century at Mallorca. (Ca'n Pont i Vic, Ciutat de Mallorca; Rosselló-Bordoy, *pers.com.*). It must be supposed that the Black Rat colonized Cabrera from a majorcan stock.

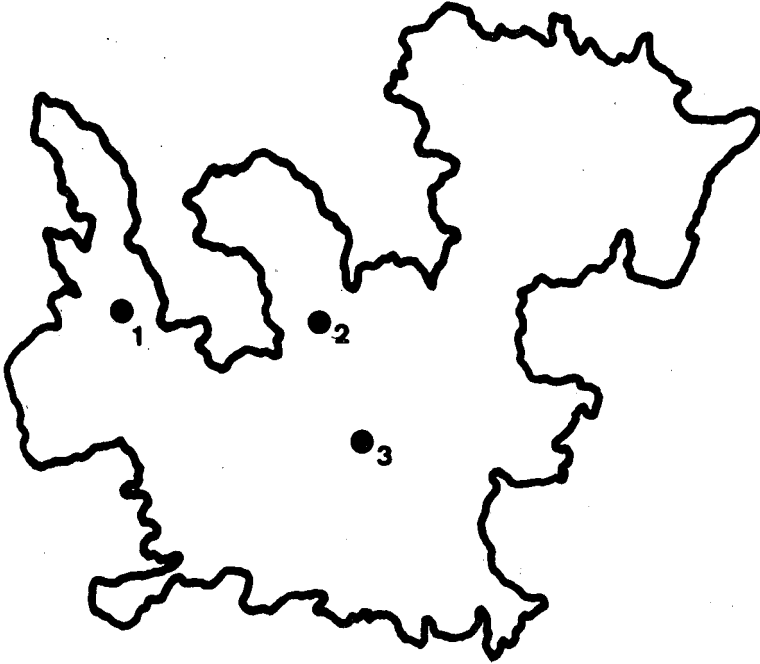


FIG. 1

Map showing the localization of the deposits studied here.
Mape de localització de els diferents deposits esudiats en el present treball.

	1	2	3	TOTAL	
				n	%
<i>Apodemus sylvaticus</i>	2	3	60	65	43.3
<i>Rattus rattus</i>	3	3	17	23	15.3
<i>Mus musculus</i>	—	—	2	2	1.3
<i>Oryctolagus cuniculus</i>	—	—	1	1	0.67
<i>Aves</i>	—	12	2	14	9.3
<i>Lacerta lilfordi</i>	—	23	11	34	22.7
<i>Tarentola mauritanica</i>	—	3	8	11	7.3
TOTAL	5	44	101	150	100.0

TABLE 1

Minimum number of individuals obtained at different caprarian deposits.
 Número mínim d'individus obtinguts als diferents jaciments de Cabrera.

The recorded variety in the distribution of individuals by species in deposits 2 and 3 is noticeable (see Fig. 2; we cannot talk about proportions on deposit 1). This takes us to assume that, either those deposits are from different times (in which the faunistic composition would have changed because of different ecological conditions) or that is a consequence of very strong yearly oscillations in the subrecent small mammal population of Cabrera, similar to the ones recorded in several populations of Murids on islands where predator mammals are absent (BERRY, 1968)¹. The scarcity of remains of *M. musculus*, a species that live now on the island in relatively high abundance, is also noticeable.

BIONOMY, ECOLOGY AND COLONIZATION

Apodemus sylvaticus (Linnaeus, 1758)

Material: Deposit 1: 3 mandibular fragments, 1 premaxillar, 1 humerus without proximal epiphysis, 1 femur without distal epiphysis, 8 tibia without proximal epiphysis, 1 pelvis. Deposit 2: 5 mandibular fragments, 1 maxillar. Deposit 3: 99 mandibular fragments, 38 maxillars, 43 humerus without proximal epiphysis, 9 ulna without distal epiphysis, 4 radius without distal epiphysis, 50 femora without distal epiphysis, 2 femora with distal epiphysis (one of them patological), 39 tibia without proximal epiphysis (one patological), 29 pelvis.

¹ In our latitudes very pronounced yearly oscillations are recorded, but not evaluated, in the *R. rattus* populations from very small islands (i.e.: Es Vedrà, Illa den Colom) where the predators seems absent and where not any other Murid is recorded until the present.

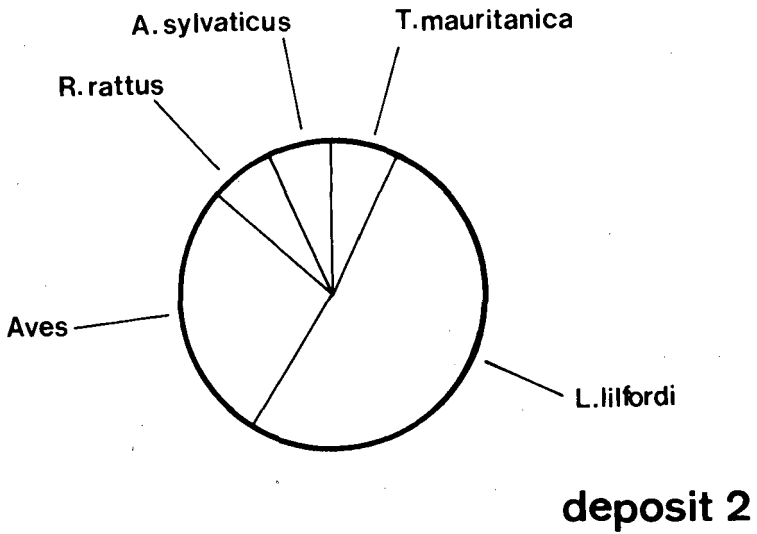
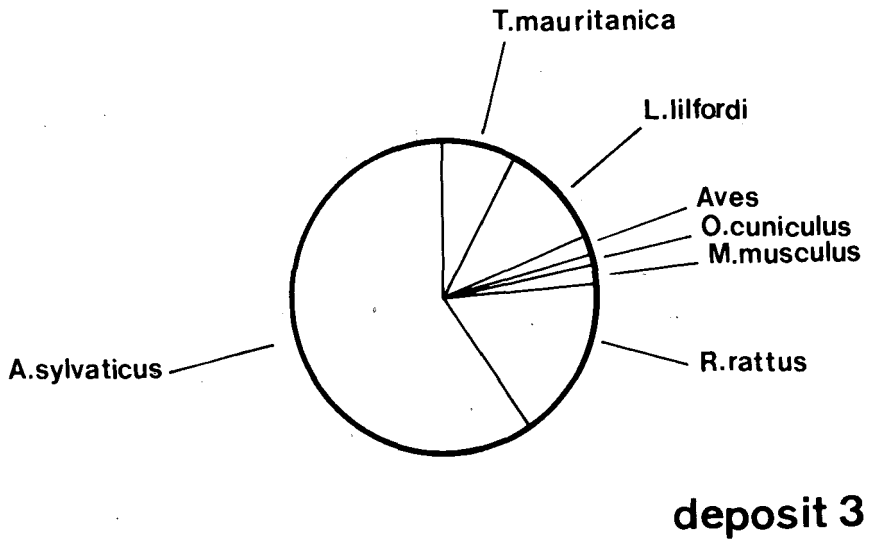


FIG. 2

Graph showing the different proportions of individuals recorded on deposits 2 and 3.
Gràfica que mostra les diferents proporcions d'individus registrada als depòsits 2 i 3.

Comparison material: Mallorca: 14 mandibles, 20 humerus without proximal epiphysis, 18 femora without distal epiphysis, 18 tibia without proximal epiphysis. Menorca: 12 mandibles, 7 humerus without proximal epiphysis, 7 femora without distal epiphysis, 11 tibia without proximal epiphysis. Eivissa: 70 mandibles, 13 humerus without proximal epiphysis, 17 femora without distal epiphysis, 18 tibia without proximal epiphysis. Formentera: 51 mandibular fragments, 5 humerus without proximal epiphysis, 30 femora without distal epiphysis, 20 tibia without proximal epiphysis.

On Table 2 the cranial and long bone measurements of the subrecent *A.sylvaticus* from Cabrera are given. For the biometrical study only the material furnished in deposit 3 has been taken, because the other two deposits have furnished a too small number of *A.sylvaticus* remains and its biometrical study cannot be made. The relative age of the different specimens has been determined by the FELTEN (1952) criteria of teeth ware. The individuals with a teeth ware corresponding to classes 4 and 5 of this author have been clustered as adults; the average values given on Table 2 have been based on them. In the

	n	\bar{x}	X min — X max
LM	12	15.325	14.60 — 16.05
SMI	46	4.20	3.90 — 4.50
H (-)	35	12.90	11.05 — 14.30
U (-)	6	16.525	15.40 — 16.10
R (-)	4	13.36	12.95 — 14.10
F (+)	1	19.95	— —
F (-)	22	17.07	14.90 — 19.45
T (-)	21	21.08	16.90 — 22.90

TABLE 2

Average (\bar{x}) and extreme (x min — x max) of mandibular and long bones measurements of the Cabrera Wood Mouse. LM = Mandibular Length; SMI = Molar Teeth row Length; H (-) = Humerus without proximal epiphysis Length; U (-) = Ulna without distal epiphysis Length; R (-) = Radius without distal epiphysis Length; F (+) = Femur with distal epiphysis Length; F (-) = Femur without distal epiphysis Length; T (-) = Tibia without proximal epiphysis Length.

Valors mitjanes (\bar{x}) i extremes (x min — x max) de les diferents mesures mandibulars i dels ossos llargs dels Ratolins de Rostoll *Apodemus sylvaticus* de Cabrera.

	LM	SMI	H (-)	T (-)	F (-)
MALLORCA	14.77 (14) 14.40 — 15.60	3.95 (14) 3.60 — 4.20	12.44 (20) 11.30 — 14.00	20.99 (18) 19.55 — 22.30	16.84 (18) 15.30 — 17.75
MALLORCA ¹ (subfosils)			12.9 (5) 11.9 — 13.7	23.53 (18) 19.1 — 25.9	18.87 (19) 17.0 — 21.0
MENORCA	14.71 (12) 14.15 — 15.80	4.13 (12) 3.95 — 4.25	12.61 (7) 12.25 — 13.35	20.84 (11) 19.85 — 22.30	16.80 (7) 16.20 — 18.30
EIVISSA	15.93 (70) 14.90 — 18.00	4.09 (20) 3.80 — 4.30	12.92 (13) 12.35 — 13.45	22.60 (18) 20.95 — 23.50	17.87 (17) 16.20 — 19.65
FORMENTERA	15.46 (42) 14.20 — 16.60	3.94 (51) 3.60 — 4.35	12.85 (5) 12.05 — 13.50	22.66 (20) 21.10 — 24.50	17.91 (30) 16.25 — 18.90
ELBA ²	15.15 (13) 14.5 — 15.9		13.8		
CHIOS ³ (subfosils)		3.8 (83) 3.5 — 4.0	12.4 (17) 11.8 — 13.3	(2) 20.7 — 21.0	16.3 (6) 15.5 — 16.9
MALTA ⁴ (subfosils)		4.3 (38) 4.1 — 4.8	12.2 (217) 8.6 — 14.2	19.30 (110) 14.0 — 24.1	16.3 (459) 9.4 — 20.6
PANTELLERIA ⁵	15.1 (7) 14.5 — 15.9	4.2 (7) 4.0 — 4.3			
PANTELLERIA ⁵ (subfosils)		4.6 (7) 4.4 — 4.8	(2) 13.1 — 14.2		18.1 (1)

TABLE 3

Average and extreme values of various mandibular and long bone measurements of the *A. sylvaticus* from the comparison localities.
Valors mitjanes i extremes d'algunes de les mesures mandibulars i dels ossos llargs dels *A. sylvaticus* de les localitats de comparació.

¹After UERPMMANN (1971). ²After KAHMANN i NIETHAMMER (1971). ³After BESENECKER, SPITZENBERG & STORCH (1972).

⁴After STORCH (1970). ⁵After FELTEN & STORCH (1970). Calculated values.

postcranial skeleton, differences between adults and juvenils have not been found, but it seems correct to obtain the average values of the different measurements from the whole of the sample because, from the study of the mandibles, it is derived that we are faced with a osteological sample of *A.sylvaticus* that basically includes adult animals.

The average and extreme values of the long bones measurements of the *A.sylvaticus* proceeding from localities of comparison are given on Table 3. Only those values for LM, SMI, H (-), F (-) and T (-) are presented, because they are the only ones from which we have sufficient material of the Cabrera subrecent population. It can be appreciated that the values of \bar{x} and x_{\max} obtained in the Cabrera Wood Mouse are nearer to those of different island populations included traditionally on subspecies *dichrurus* (Mallorca, Menorca, Corsica, Sicily) than to any other subspecies. It must be considered that the subrecent population of Cabrera is very biometrically related to the *dichrurus*-subspecies, even though some of their measurements are overpassing a little the recorded variability in this subspecies (*i.e.*: x_{\max} H (-) = 14.30; x_{\max} SMI = 4.50).

The *A.sylvaticus* extinction at Cabrera must be related to the introduction and expansion of *R.rattus* and to deforestation of the island. Two factors coinciding when the island was transformed in a military concentration camp. In this sense the extinction of this species would be comparable to the one that took place in historical times in Malta and Chios.

***Rattus rattus* (Linnaeus, 1758)**

Material: Deposit 1: 6 mandibular fragments, 5 humerus without proximal epiphysis, 3 ulna without distal epiphysis, 1 radius without distal epiphysis, 3 femora without distal epiphysis, 3 tibia without proximal epiphysis, 3 pelvis. Deposit 2: 2 mandibular fragments, 1 ulna without distal epiphysis, 1 pelvis. Deposit 3: 31 mandibular fragments, 10 maxillars, 19 humerus without proximal epiphysis, 11 ulna without distal epiphysis, 2 radius without distal epiphysis, 1 radius with distal epiphysis, 14 femora without distal epiphysis, 1 femur with distal epiphysis, 21 tibia without proximal epiphysis, 1 tibia with proximal epiphysis, 9 pelvis.

Comparison material: Cabrera: skull, mandibles and postcranial skeleton (uncomplet) of 7 adults and subadults.

The remains of *R.rattus* obtained at subrecent deposits from Cabrera are abundants, and they represent the 15.3% of the minimum number of vertebrate individuals and the 22.2% of the small mammals. Those proportions are not

frequent in the present day recorded food range of the Barn Owls *Tyto alba* at Balearics, where *R.rattus* constitutes a 5-10% of the wole of small mammals. On the other hand, the Barn Owls selectively do not trap *Rattus* sp. because of their great size (SANS-COMA, 1974), and thus the figures given on Table 1 are a very biased sample of the actual proportions of the animals in Nature. A proportional strong presence of very old animals (with a very extremely worn teeth, as have never been observed in the larger Balearics; see Fig. 3) suggest the absence of predator mammals during the deposition of the analysed fauna.

	Subrecent population				Present day population	
LM	25.58	(5)/23.95-27.10			23.35	(7)/20.30-25.45
SMI	7.14	(27)/6.50-7.90			6.92	(7)/6.65-7.30
H (-)	15.25	15.70	20.00	20.20	19.31	(4)/17.05-23.00
	20.30	20.85	20.95	21.10		
	21.20	21.95	22.15	24.30		
	25.65					
U (-)	15.95	26.80			23.56	(6)/19.20-26.60
R (+)	23.20					(2)/22.50-23.20
R (-)	21.85	22.00			19.58	(6)/15.80-22.20
F (+)	34.70				29.83	(5)/24.20-32.60
F (-)	16.05	16.40	18.80	21.40	26.18	(5)/22.20-30.20
	23.20	26.20	27.15	27.95		
	28.20	28.65	28.70	28.85		
	30.10	30.25				
T (+)	36.50				33.39	(4)/28.15-37.25
T (-)	19.05	20.35	21.60	22.15	30.98	(5)/27.20-34.95
	23.60	27.65	27.90	30.80		
	34.45	35.85	36.60	37.50		
SMS	7.34	(9)/6.60-7.80			7.15	(7)/6.45-7.70

TABLE 4

Measurements of subrecent and present day *R.rattus* from Cabrera.

Mesures dels *R.rattus* subrecents i actuals de Cabrera.

	M ₁		M ₂		M ₃	
	L	l	L	l	L	l
Subfossil population	2.86 (26) 2.56-3.04	1.76 (26) 1.28-1.92	1.98 (22) 1.76-2.24	1.87 (22) 1.76-2.08	1.71 (10) 1.60-1.92	1.62 (10) 1.44-1.76
Present day population	2.86 (7) 2.72-2.88	1.86 (7) 1.76-1.92	2.03 (7) 1.92-2.24	1.92 (7) 1.88-1.96	1.67 (7) 1.60-1.92	1.62 (7) 1.44-1.76

	M ¹		M ²		M ³	
	L	l	L	l	L	l
Subfossil population	3.10 (8) 2.88-3.20	2.06 (8) 1.92-2.08	2.24 (7) 1.92-2.56	1.99 (7) 1.92-2.08	1.83 (7) 1.60-1.92	1.62 (7) 1.44-1.76
Present day population	2.99 (7) 2.72-3.20	2.06 (7) 1.92-2.08	2.15 (7) 1.92-2.40	1.93 (7) 1.82-2.08	1.76 (7) 1.60-1.92	1.58 (7) 1.44-1.60

TABLE 5

Dental measurements of the subrecent and present day *R.rattus* from Cabrera. L: Length. l: width.
Mesures dentàries dels *R.rattus* subrecents i actuals de Cabrera.

On Table 4 the measurements of the mandibles, maxillars and different long bones of *R.rattus* from Cabrera are given. The average values of the long bones measurements are not calculated because the sample contains a varied mixture of individuals of different ages. The \bar{x} of LM is calculated from the adult individuals, while the \bar{x} of SMI and SMS contains adults and juvenile specimens. The length of the molar row is very constant independantly of the age, and therefore the average for the whole ensemblage of individuals is considered correct. The dental measurements are given on Table 5. The similarity of dental measurements in subrecent and present day populations of Cabrera *R.rattus* is very strong.

At present *R.rattus frugivorus* is the most abundant small mammal species on Cabrera island. The Brown Rat *R.norvegicus* is know from a sole specimen trapped at peasant home, 24.7.1973 (Alcover collection, Ciutat de Mallorca; ♂; Head-Body Length: 194 mm, Tail Length: 157 mm, Ear Length: 21 mm; Posterior Foot Length: 40 mm; Condilobasal Length: 40.30 mm). Several attempts to trap new specimens of this species have been unsuccessful, and therefore any new evidence of their current presence exists. This leads us to believe that *R.norvegicus* is a colonizer species of Cabrera with unknown succes.

Mus musculus (Linnaeus, 1758)

Material: Deposit 3: 2 mandibular fragments, 2 femora without distal epiphysis, 1 maxillary fragment.

Comparison material: Cabrera: 8 right mandibles, 6 femora without distal epiphysis.

Very few remains of *M.musculus* have been recorded. Their specific identification is due to their M_1 size and morphology, and to the presence of a well developed third trochanter in the femur (DARVICHE, 1978). The measurements obtained from the short subrecent materials are in the range recorded in the House Mouse form (*brevirostris* x *musculus*) now inhabiting Cabrera, as showed Table 6. This species is found as a subfossil on Mallorca (UERPMANN, 1971: S'Illot, St. Llorenç). The maxillar fragment gives only the M^1 alveole showing a typical morphotype of three root holes.

Orytolagus cuniculus (Linnaeus, 1758)

Material: Deposit 3: 1 ulna, 1 radius.

The materials furnished by deposit 3 only allows to confirm the presence of the Rabbit in Cabrera at the time that *A.sylvaticus* lived there. The remains found are not from the Barn Owl pellets.



FIG. 3

Photo of two subrecent *R.rattus* mandibles showing the great teeth ware (1) and the alveolar reabsortion (2).
Fotografia de dues mandibules subrecents de *R.rattus* que permet veure un gran desgast dentari (1) i reabsorció alveolar (2).

	M ₁		M ₂		M ₃		F (-)
	L	l	L	l	L	l	
Subfossil population	— (2) 1.32-1.44	— (2) 0.84-0.90	0.96 (2) —	— (2) 0.84-0.90	0.66 (1) —	0.60 (1) —	11.5 (1) —
Present day population	1.38 (8) 1.26-1.44	0.85 (8) 0.78-0.90	0.91 (8) 0.84-0.96	0.79 (8) 0.60-0.84	0.57 (8) 0.54-0.66	0.53 (8) 0.48-0.60	12.11 (6) 10.6-14.0

TABLE 6

Measurements of the Cabrera House Mouse *Mus musculus*.

Mesures dels ratolins domèstics *Mus musculus* de Cabrera.

Finally, it is interesting to note the absence of *Eliomys quercinus*, in spite of the opinion of CABRERA (1904). This species does not live in present time on the island, and does not form part of the subrecent studied faunas.

The subrecent faunas studied here suggests a sequence of faunistic events as follows:

1. Ancient small mammalian fauna (unknown): extinguished due to faunistic replacement?
2. Immigration and successful colonization of *A.sylvaticus* (and *O.cuniculus*)?
3. Immigration and successful colonization of *R.rattus* and *M.musculus*.
4. Extinction of *A.sylvaticus* (XIX century?)
5. Immigration and successful colonization of *G.genetta* (and *R.norvegicus*)?

At the present date any conjecture about the arrival of *E.algirus* to Cabrera is possible.

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