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## Food items in pellets of the barn owl *Tyto alba* from four sites of the Algarve, Portugal

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**Abstract.** Barn owl pellets from four sites in the Algarve (Burgau, Cruzinha, Lagoa and Castro Marim) were analysed in order to determine the food composition of this species in this area of southern Portugal. About half of the diet consists of small rodents, mainly *Mus spretus* and *Microtus duodecimcostatus*. Other rodents such as *Apodemus sylvaticus*, *Rattus rattus* and *Mus musculus* were less taken by the barn owl. *Crocidura russula* were found in considerable numbers, while *Suncus etruscus* occurred in smaller quantities. Evidence of birds in the pellets: the house sparrow *Passer domesticus*, a locally common species, was found mostly at Burgau, while both chiffchaff *Phylloscopus collybita* and goldfinch *Carduelis carduelis* were identified once or twice. Insects of mostly larger species like the rhinoceros beetle, mole-cricket and grasshopper were found in marginal numbers. Despite local variation, the results of this pellet study provide information of the species composition and relative abundance of the prey in this southernmost portion of the Algarve.

**Key words.** Barn owl, small mammals, pellets, Algarve, Portugal.

### Introduction

In Portugal and Spain several studies have focused on the foraging ecology of the barn owl *Tyto alba* by using their pellets (Niethammer 1970, Herrera 1974a, Diez Villacanas & Morilla 1974, Campos 1978, Temme 2000). All prey composition analyses show basically a large amount of agreement throughout the Iberian peninsula. However, local differences in the prey species assemblage occur due to variations in distribution, habitat and season. Furthermore, differential predation methods of prey selection may be influenced by the vulnerability, age or social behavior of the respective prey items. One cannot gain a complete picture therefore of the structure of small mammal communities from owl pellet studies alone. Despite these limitations, such analyses often provide a first approximation of the prey composition of the study areas. Additional information on the distribution of small mammals and the food habits of the barn owl along the south coast of the Algarve and other areas of southern Portugal are still welcome.

### Methods and Materials

A total of about 200 regurgitated barn owl pellets was collected at four sites along the southern coast of the Algarve: 107 from a barn near Burgau (27 March 1997) and 36 were taken on 13 July 1998 in the Castro Marim area and sent to the A Rocha Field Study Centre and Bird Observatory, Cruzinha. About 24 were collected at the station itself on 6 October 1998. Over a period of four years (1995 to 1999), the author was able to gather a further 68

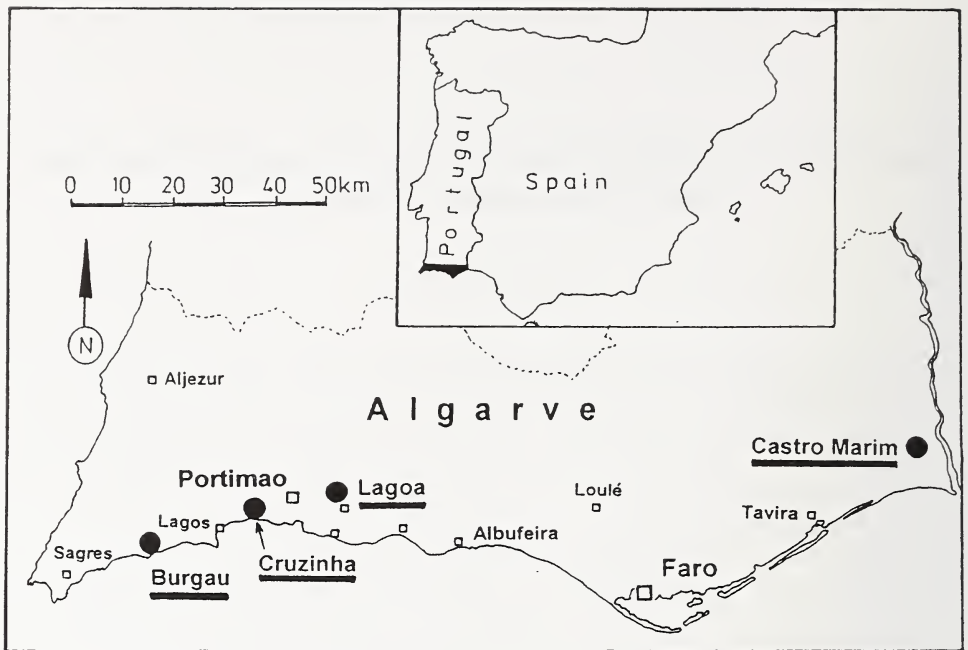


Fig. 1. Map of the Algarve, Portugal, showing the pellet collecting sites Burgau, Cruzinha, Lagoa and Castro Marim. – Karte des Algarve, Portugal, mit den Gewöllaufsammelplätzen Burgau, Cruzinha, Lagoa und Castro Marim.

pellets at a farm a few km northeast of Lagoa. All four sites are located between the Algarve towns of Sagres to the west and Castro Marim to the east (Fig.1).

The period when the pellets were regurgitated and their exact number was difficult to determine, since additional fragments or single skulls were found under each roost. However, an exact number is not of great importance for such studies.

A stereo microscope with a 20–40x magnification was used to identify skulls, teeth and other remains. Helpful descriptions, figures, dental formulae and other details are given in Björvall & Ullström (1986), Corbet & Ovenden (1982), Niethammer & Krapp (1978, 1990), Görner & Hackethal (1987), Genoud & Hutterer (1990), MacDonald & Barret (1993), März (1987) and Spitzenberger (1990). Bird remains are often far more difficult to identify than those of rodents. The horn-shields of the bill (Rhamphotheca) are usually digested and a large reference skull collection would be necessary for comparison. As some birds have characteristic beak features, such as quail *Coturnix coturnix*, blackbird *Turdus merula*, song thrush *T. philomelos*, house sparrow *Passer domesticus* and corn bunting *Miliaria calandra*, these species were identified, while smaller insectivores remain undetermined.

#### Site description

All four collection sites show a similar mosaic of landscape; composed of farmlands, orchards, meadows, waste grasslands with small creeks or rivers, scattered buildings, farmhouses with barns, and small villages. A few basic differences between the sites should be highlighted: near Burgau extensive rolling hills with natural vegetation border one side of the area, while at Castro Marim salt pans and fish ponds are predominant.

## Results and Conclusions

### Mammals

#### Pygmy white-toothed shrew, *Suncus etruscus*

Found throughout the Mediterranean countries including the entire Iberian peninsula (Sans-Coma et al. 1981). Its distribution is concentrated nearer to the coast. Of these four Algarve samples, it was the fourthmost abundant prey species (Tab. 1).

#### White-toothed shrew, *Crocidura russula*

Widely distributed throughout south-west Europe including the Iberian peninsula and was the thirdmost common prey species, found at all four collecting sites in reasonable numbers (Fig. 1,2, Tab.1).

#### Garden dormouse, *Eliomys quercinus*

Little is known about population densities of this nocturnal and arboreal rodent. On the Iberian peninsula it is apparently only taken opportunistically because it is rarely found in barn owl pellets (see: Campos 1978, Temme 2000) and in this study only once in the Castro Marim sample.

#### Water vole, *Arvicola sapidus*

On 7 October 1999, M. Bolton showed the author pellets collected at Cruzinha, containing two skulls of the water vole. Personal observations revealed, that this vole is relatively common in wet habitats of the Algarve. Probably due to its larger size, this rodent is taken only occasionally by barn owls (see: Garde & Escala 1993). It was not found at the other 3 collecting sites.

#### Mediterranean pine vole, *Microtus duodecimcostatus*

Although two similar species (*M. lusitanicus*, *M. cabreræ*) live mainly in the north-western parts of the Iberian peninsula, the eastern and southern areas including the Algarve are occupied by *M. duodecimcostatus* (Niethammer 1970, 1982, Engels

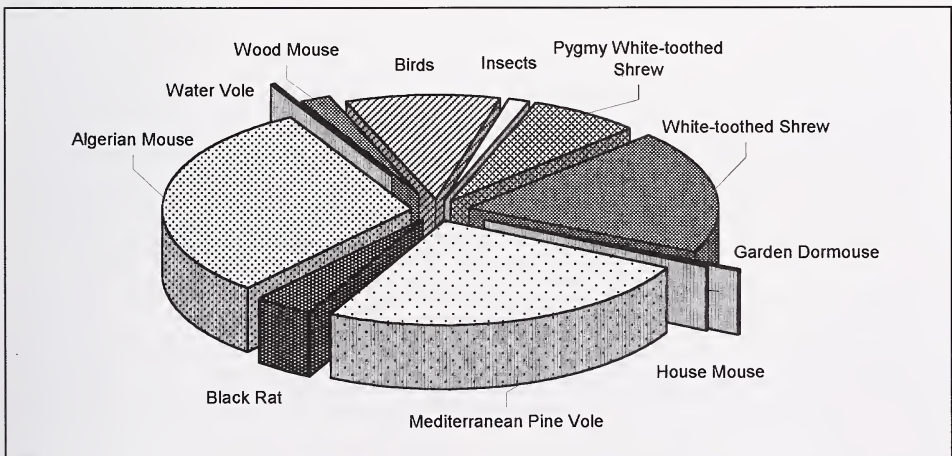


Fig. 2. Percentages of the total prey species found at the four collecting sites. – Prozentuale Verteilung aller an den 4 Gewöllaufsammlerplätzen nachgewiesenen Beutetiere.

1972, Campos 1978, Ramalhinho & Madureira 1979). Although this vole was present only twice at Cruzinha, it is generally the secondmost important prey species in many areas in the Algarve region (Tab. 1).

Wood mouse, *Apodemus sylvaticus*

Little information is available about the preferred habitat and population sizes of this rodent within the Algarve. Judging from the total of 12 specimens found in the pellets, this species occurs throughout the Algarve region, but in small numbers. The lack of this species at Cruzinha could be explained by the relatively low sample size.

Algerian mouse, *Mus spretus*

In contrast to *M. musculus*, it occupies cultivated land, scrub, open woodland and other damp natural environments, where it is easily taken by owls. In this study it makes up the high percentage of 31% of the total catch (Tab. 1, Fig. 2). This indicates an agreement with other studies (Niethammer 1970, Engels 1972, Ramalhinho & Madureira 1979) and makes it the most important food item in Portugal and the coastal region of the Algarve.

House mouse, *Mus musculus*

Closely associated with human dwellings, living mainly indoors. This makes it less susceptible to fall prey to the barn owl and only one was identified at Burgau.

Black rat, *Rattus rattus*

Based on the authors observations, this rat species lives not only in deserted farm-houses or barns, but also in urban environments, in tourist centers, in fields and nat-

Table 1. Food items from 200 Barn owl pellets collected at Burgau, Cruzinha, Lagoa and Castro Marim.

Location	Burgau	Cruzinha	Lagoa	Castro Marim	total	% (rounded)
Number of pellets	71	26	68	36	201	—
Pygmy White-toothed Shrew	5	—	1	32	38	7.2
White-toothed Shrew	39	8	10	44	101	19.2
Garden Dormouse	—	—	—	1	1	0.2
Water Vole	—	2	—	—	2	0.4
Mediterranean Pine Vole	21	2	87	21	131	25.0
Algerian Mouse	40	45	13	63	161	30.6
House Mouse	1	—	—	—	1	0.2
Wood Mouse	8	—	1	3	12	2.0
Black Rat	3	3	12	3	21	4.0
Unidentified Birds	—	—	7	3	10	2.0
Quail	—	—	—	1	1	0.2
Chiffchaff	1	—	—	—	1	0.2
Blackbird	—	1	—	—	1	0.2
Song Thrush	—	2	—	—	2	0.4
Housesparrow	26	1	2	—	29	5.5
Goldfinch	2	1	—	—	3	0.6
Corn Bunting	—	2	1	1	4	0.8
Rhinoceros-Beetle	1	—	1	—	2	0.2
Mole-Cricket	2	—	2	—	4	0.8
Wart Biter	—	—	—	2	2	0.4
Totals:	149	67	136	174	526	100.1

ural habitats in the Algarve. Since adults are rather large to be taken as prey, all specimens were juveniles. At the collecting site near Lagoa, one agricultural building was occupied by one breeding pair of barn owls. Since this barn is periodically heavily infested with this rodent, it was found frequently in this sample.

### Birds

The quail *Coturnix coturnix* is often heard during the breeding season and is common in several places in the Algarve. However, it is only taken occasionally by barn owls, as judged from Castro Marim and a pellet study in the Alentejo Province north of the Algarve (Temme 2000).

Chiffchaff *Phylloscopus collybita* is a common winter visitor from northern Europe to the Algarve and frequents varied habitats. A few skull fragments were found in the pellets.

The blackbird *Turdus merula* is common throughout the Algarve. Its large size makes it a more occasional prey.

Song thrush *Turdus philomelos* is a common winter visitor to the Algarve. On the evening of 19th December 1998, I noticed about 60 specimens, flying in small flocks towards a common roost while passing the farm buildings near Lagoa. Therefore it is not surprising that two individuals were discovered in the pellets.

### Goldfinch, *Carduelis carduelis*

The goldfinch is a common resident bird species of the Algarve and hence caught occasionally. The specimen was identified by a ring found in one pellet at Cruzinha, where it had been ringed two years before at this research station.

### The house sparrow, *Passer domesticus*

Although this species is widely distributed throughout the Algarve, it was found mainly in the Burgau sample (Tab. 1). Local variation in sparrow populations, individual food preference or an extremely high population density at Burgau might be responsible for this difference.

### Corn bunting, *Miliaria calandra*

The corn bunting is fairly abundant as a breeding species in parts of the Algarve. During the non-breeding season, flocks of various sizes tend to move about the fields and can be seen in many areas of the Algarve (Own obs., Bolton 1987). The small numbers found at Cruzinha and Castro Marim may indicate only occasional catches. In areas with higher densities of corn buntings as in Alentejo Province, the number taken is considerably higher (Temme 2000).

### Insects

#### Rhinoceros beetle, *Oryctes nasicornis*

The large rhinoceros beetles, identified by their horns in the Burgau and Lagoa samples are probably actively taken by the Barnowl.

#### Mole cricket, *Gryllotalpa gryllotalpa*

This insect is locally very common in the Algarve and was present at Burgau and Castro Marim.

Wart biter, *Dectius* spec.

Fractions of large grasshoppers were only found twice, both at Castro Marim. These were tentatively assigned to this genus. Although grasshopper species are common in the Algarve, in this region they apparently are not often taken by the barn owl.

### Discussion

This study points out local differences in the numbers of prey species along the Algarve coast. The prey assemblage agrees in general with barn owl pellet studies from other regions in both Portugal and Spain (Niethammer 1970, Engels 1972, Herrera 1974a, Diez Villacanas & Morillo 1974, Campos 1978 etc.). However, seasonal changes in populations within the region lead to local variations and confuse any interpretative analysis of food composition. Furthermore, it may reflect the seasonal and ecological changes of prey population densities available to the barn owls in this region. Herrera 1974b stated that in Mediterranean countries barn owls have to eat more poor food items such as birds, amphibians and large insects than in temperate European zones. This probably does not hold true in some regions of southern Portugal. The Algerian mouse and partly also the Mediterranean pine vole are so abundant, that they probably compensate for the lower mammal diversity within this in this region.

Additionally, this study at least reveals that these small mammals have a tremendous reproduction rate and at times may reach extremely high population densities. Despite the shortcomings of owl pellet studies in the interpretation of ecological questions, they do provide a general picture of the distribution of the main prey items and their relative numbers.

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### Zusammenfassung

Etwa 200 Gewölle der Schleiereule *Tyto alba* wurden an vier Orten (Burgau, Cruzinhas, Lagoa und Castro Marim) entlang der Algarveküste, Portugal, gesammelt. Die prozentualen Anteile der Beutetiere an diesen zwischen 25 bis 50 km weit auseinander liegenden Aufsammlerplätzen variierten erheblich. Als Grund dafür ist in erster Linie die jeweilige Biotopstruktur der unterschiedlichen Fangreviere der Schleiereulen zu sehen. Die Heckenhausmaus ist mit insgesamt 31 % an allen vier Aufsammlerstationen Burgau, Cruzinha und Castro Marim das wichtigste Beutetier. Lediglich die Proben von Lagoa zeigten einen niedrigeren Wert von 11%, was auf das Fehlen von reicher Deckung auf den großen Brachflächen ehemals landwirtschaftlich genutzter Felder und Sandabschürfungflächen zurückgeführt werden kann. Dafür fand sich dort zahlreicher die Mittelmeer-Kleinwühlmaus, die an den drei übrigen Stationen stark zurücktrat. Beide Arten verfügen über enorme Reproduktionspotentiale und erreichen zeitweise hohe Populationsdichten. Damit sind beide Kleinsäuger für die Schleiereulen in diesem Bereich die bedeutendste Nahrungsgrundlage. Biotopunterschiede oder auch interspezifische Konkurrenz mit der Heckenmaus mögen für die geringe Präsenz der Waldmaus von insgesamt nur 2 % eine Rolle spielen. Während letztere bei Burgau noch gut vertreten ist, fehlt sie bei Cruzinha ganz, wohl bedingt durch die relativ kleine Stichprobe. Andere Nagetiere wie die Hausmaus (0,2 %) und die Hausratte (4,0 %) sind meist in nur kleinen Anzahlen nachzuweisen. Eine Ausnahme fand sich bei Lagoa, wo die Hausratte zeitweise häufig in Scheunen festzustellen war. So lag hier der Prozentsatz mit 9 % wesentlich höher. Unter den

Crocidurinae ist der Anteil der Hausspitzmaus in portugiesischen Schleiereulengewöllen meist hoch. Das bestätigte sich auch an diesen 4 Aufsammlern mit 19% der Gesamtbeute. Dagegen tritt die Etruskerspitzmaus stark zurück (7%) oder fehlte bei Cruzinha. Ein stärkeres Vorkommen konnte dagegen bei Castro Marim ermittelt werden. Kleinvögel, insbesondere Insektenfresser, sind gegenwärtig nicht alle sicher zu bestimmen. Es fehlen die Hornscheiden (Rhamphotea), die meist verdaut sind. Auch ausreichendes Vergleichsmaterial liegt noch nicht vor. Einige charakteristische und im Algarve häufige Arten wie Wachtel, Haussperling, Grünfink und Grauwammer waren dagegen leicht zu erkennen. Der Haussperling, sowohl im Freiland als auch in der Umgebung von ländlichen Anwesen häufig, gehörte bei Burgau zur regelmäßigen Vogelbeute. Andere Vogelarten wie Stieglitz wurden nur dreimal und der Zilpzalp als Wintergast jeweils nur einmal gefunden. Durch Fragmente konnten Nashornkäfer, Maulwurfsgrillen sowie einige große Laubheuschrecken nachgewiesen werden.

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