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A contribution to the knowledge of diet composition of the Barn Owl *Tyto alba* in the area of Pisa (Italy)

Prispevek k poznavanju prehrane pegaste sove *Tyto alba* na območju pise (Italija)

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Abstract

We examined the pellets of the Barn Owl *Tyto alba*, collected in Pisa, Italy, in 2012. Altogether, 219 specimens of small mammals were found in 85 pellets. The Barn Owl diet was composed of ten species of small mammals, representing three different families (Muridae, Cricetidae, Soricidae). The main prey species was the Wood Mouse *Apodemus sylvaticus*, followed by the House Mouse *Mus musculus* and the Savi's Pine Vole *Microtus savii*. While the smallest of the small mammals from the area, the Etruscan Shrew *Suncus etruscus*, was well represented in the pellets, some larger species of small mammals were not represented at all. The reason for such result may lie in the upper limit for our Barn Owl's prey size. Results suggest that optimal prey weight for our Barn Owl may be between 26–75 g of body mass, however, the prey can be occasionally as heavy as almost 100 g, represented by adult Rat *Rattus* spp. Nevertheless, our results may not reflect the true hunting strategy of the Barn Owl, but the availability of a certain food item at one point in time.

1. Introduction

Barn Owl *Tyto alba* (Scopoli, 1769) is a widespread resident across much of Europe, which accounts for less than a quarter of its global range (Birdlife International 2004). Its diet has been studied more extensively than that of any other bird of prey (Mikkola 1983, Everett *et al.* 1992, Taylor 1994, 2009, Bontzorlos *et al.* 2005, Leonardi & Dell'arte 2006). It mostly hunts small terrestrial mammals, mainly rodents (Mikkola 1983, Taylor 1994), members of the three mammal families Soricidae (shrews), Cricetidae (voles) and Muridae (mice and rats) (Mikkola 1983, Brichetti & Fracasso 2006). Occasionally it preys on insects, amphibians, reptiles, birds (Mikkola 1983, Taylor 1994, Bontzorlos *et al.* 2005, Leonardi & Dell'arte 2006), fish and arthropods (Bontzorlos *et al.* 2005). Its pellets are easy to find and small mammal bone parts are well preserved and easy to identify (Paspali *et al.* 2013). However, its hunting tactics remain controversial (Tores *et al.* 2005). Most researchers claim that the Barn Owl shows no food preferences and that the abundance of each species in the diet is a true reflection of prey abundance or accessibility in the field (Bunn *et al.* 1982, Tores *et al.* 2005, Yom-Tov & Wool 1997). On the other hand, some researchers suggest that it shows preference for small-sized prey and that its diet does not reflect the abundance of prey species in the field (Mikkola 1983, Tores *et al.* 2005, Yom-Tov & Wool 1997). These contrasting assumptions supposedly originate from different length of the studies (Tores *et al.* 2005). In his study, Contoli (1981) asserts that analysis of Barn Owl diet can provide information on the availability of small mammal prey species in a particular area, even when only few pellets are available (Bose & Guidali 2001). Mikkola (1983) suggests that the study of the Barn Owl's diet is suitable for determining the presence of nocturnal small mammal species within its hunting territory. On the other hand, some researchers have claimed that the Barn Owl is a selective predator, hunting its prey by preference (Yom-Tov & Wool 1997, Tores *et al.* 2005) and that its diet would not represent the true abundance of prey species in the field (Tores *et al.* 2005).

Nevertheless, studies that compared pellet analyses with data from field trapping have also shown that prey size is an obvious limiting factor

Figure 1: Study area near Marina di Pisa in Italy where the Barn Owl pellets were collected

Slika 1: Obravnavano območje blizu kraja Marina di Pisa (Italija), kjer so bili nabrani izbljuvki pegaste sove

(Tores *et al.* 2005, Yom-Tov & Wool 1997). And for that, its diet may reflect not the true hunting strategy of a predator, but the availability of a certain food item at one point in time (Tores *et al.* 2005, Yom-Tov & Wool 1997). A selective predator is expected to consume a narrow range of prey species regardless of their abundance, while an opportunistic predator will take its prey in proportion to its abundance at any point in time (Tores *et al.* 2005, Yom-Tov & Wool 1997).

The Italian population of the Barn Owl is poorly known (Galeotti 2003). It appears to be declining in almost the entire Po Valley and in some central Italian areas of Mugello and province of Florence (0,03 pairs/km^2) (Galeotti 2003). In Tuscany, its population is estimated at 500-1,500 pairs, which are locally in decline (Brichetti & Fracasso 2006).

The aim of our study was to: (1) present the diet of a local Barn Owl in Pisa (Italy); (2) examine whether its diet reflects species assemblage of the local fauna of small mammals in the community the owl preyed upon, and (3) to check if there is an upper limit in prey size.

This paper should be considered to contribute to the knowledge of the Tyto alba 's diet in Italy.

2. Materials and methods

2.1. Study area

Pellets were collected in an abandoned house (43°39'38.2"N 10°17'55.9"E) near Marina di Pisa in Italy. Marina di Pisa lies on the left bank of the Arno River and is located directly north of Tirrenia and about 10 kilometres west from Pisa. The area is mostly cultivated with fields of corn and cereals, with coniferous woods nearby. The climate in this region is warm and temperate (Merkel 2018). Precipitation occurs mostly in winter, with relatively little rain in the summer. The average annual temperature is 14.8°C and the average annual rainfall is 877 mm (Merkel 2018).

2.2. Methods

Pellets (n=85) were collected in July 2012 during a single visit of the nest site. We only collected pellets that were 4 – 5 days old (still damp and soft), 1 – 2 months old (dried out, black and shiny) or 2 – 4 months old (black colour slowly wears off, and they turn progressively grey). We determined the age of the pellets collected by following Chandler (2011).

Their content was examined in the laboratory. Pellets were examined individually. To identify the skulls, teeth and other remains found in pellets, a stereo microscope with 20x magnification was used. We identified the remains to the species level by following Kryštufek (1985) and Aulagnier *et al.* (2009). The mean body mass of prey was taken from literature Aulagnier *et al.* (2009). Statistical analysis was conducted in the programme Past version 3.16 (Hammer *et al.* 2001).

3. Results

We identified 219 individual mammal species from 85 pellets. The owl's diet was composed of ten species of small mammals representing three different families, Muridae, Cricetidae and Soricidae (Table 1).

The main prey species of the Barn Owl was Wood Mouse (*Apodemus sylvaticus*) (34.7%). The second most important prey species in its diet was House Mouse (*Mus musculus*) (16.9%), followed by

the Savi's Pine Vole (*Microtus savii*) (14.9%). The presence of Black Rat (*Rattus rattus*) and Brown Rat (*Rattus norvegicus*) was low (0.45 %).

The commonest prey weight in the investigated area was 11 – 30 g (Figure 2). Only in two cases was the prey heavier than 70 g, reaching a maximum of almost 100 g. In both cases, the prey species was an adult Rat (*Rattus rattus* and *Rattus norvegicus*, respectively).

We tested if there were statistically significant differences between the proportions of prey species in different samples (Table 2). Only a single prey item in the pellet was present in 18.8% of all pellets collected. The observed proportion of all species found in the pellets contained a single prey item, and the proportion expected from the content of all pellets showed statistical differences between

Table 1: Proportion of species identified from pellets of the Barn Owl (*Tyto alba*) found in an abandoned house near Marina di Pisa, Italy, in July 2012 (N=219)

Tabela 1: Delež vrst, ki so bile identificirane iz izbljuvkov pegaste sove (*Tyto alba*), najdenih v zapuščeni hiši blizu Marina di Pisa (Italija) julija 2012 (N=219)

Family	Species	Proportion (%)	Number of prey (N)
Muridae	**Wood Mouse** *(Apodemus sylvaticus)*	34,7	76
	House Mouse *(Mus musculus)*	16,9	37
	Yellow-Necked Mouse *(Apodemus flavicollis)*	2,7	6
	Black Rat *(Rattus rattus)*	0,45	1
	Brown Rat *(Rattus norvegicus)*	0,45	1
Cricetidae	**Savi's Pine Vole** *(Microtus savii)*	14,9	33
	European Water Vole *(Arvicola terrestris)*	9,6	21
Soricidae	**Lesser White-Toothed Shrew** *(Crocidura suaveolens)*	13,2	29
	Etruscan Shrew *(Suncus etruscus)*	3,6	8
	Bicolored Shrew *(Crocidura leucodon)*	3,2	7

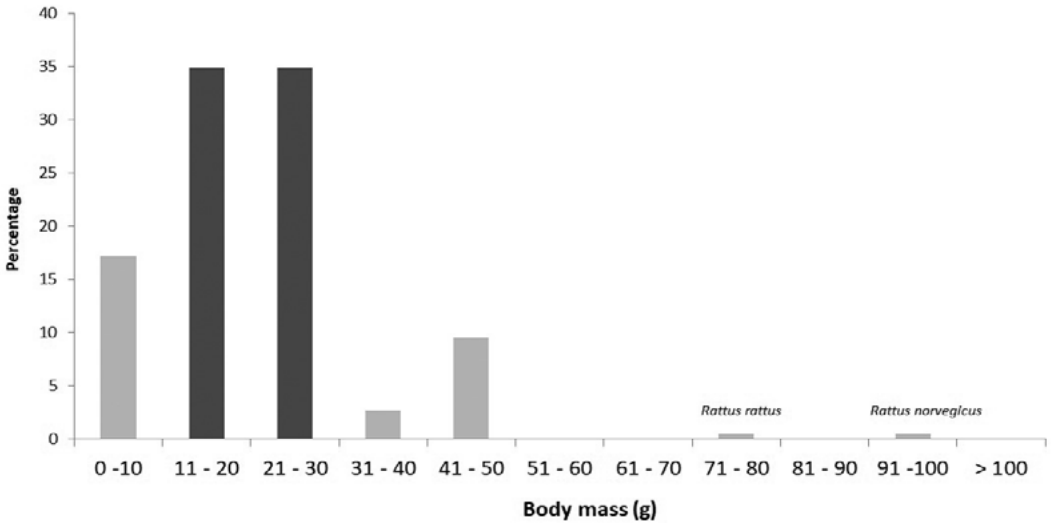

Figure 2: The percentage of individual mass classes of prey in the diet of Barn Owl *(Tyto alba)* from the pellets found in an abandoned house near Marina di Pisa, Italy, in July 2012 (N=219)

Slika 2: Odstotek posameznih masnih razredov plena v prehrani pegaste sove *(Tyto alba)*, ki so bili najdeni v izbljuvkih, nabranih v zapuščeni hiši blizu kraja Marina di Pisa (Italija) julija 2012 (N=219)

Table 2: Chi-square test of expected and observed percentage of small mammals where one prey item was present in a pellet (N=16)

Tabela 2: Hi-kvadrat test med pričakovanimi in opazovanimi odstotki malih sesalcev, kjer je bil v izbljuvku najdena vsaj ena enota plena (N=16)

Species	Expected	Observed	P
Apodemus sylvaticus	34.7	43.8	N.S.
Mus musculus	**16.9**	**0**	**< 0.001**
Microtus savii	15.1	12.5	N.S.
Crocidura suaveolens	13.2	6.3	N.S.
Arvicola terrestris	**9.6**	**37.5**	**< 0.001**
Suncus etruscus	3.7	0	N.S.
Crocidura leucodon	3.2	0	N.S.
Apodemus flavicollis	2.7	0	N.S.
Rattus rattus	0.5	0	N.S.
Rattus norvegicus	0.5	0	N.S.
χ^2 *– test = 47.7*			**< 0.001**

samples. The comparison of two samples, first representing the whole sample and other containing only one item, showed statistically significant differences indicating that the hunting strategy of our Barn Owl is not opportunistic.

4. Discussion

Small mammals were the most important prey in the Barn Owl's diet in the area of Marina di Pisa, Italy. The most preyed species was the Wood Mouse, which is consistent with the articles of other authors (Lovari *et al.* 1976, Lovari 1974, Mikkola 1983, Obuch & Benda 2009, Chandler 2011). Small presence (2.7%) of the Yellow-necked Mouse in the diet may be due to the fact that habitat suitable for this species is very rare within the hunting area of the Barn Owl. The important species in the diet was also Lesser White-toothed Shrew with the frequency of 13.2%, while its congeneric species, the Bicoloured White-toothed Shrew, was four times less common. The Etruscan Shrew is making a very small contribution to our Barn Owl diet. This may be due to the fact that species is very small in size and has a low biomass. The presence of Black Rat and Brown Rat was low, and its presence can be explained by a farm and farmland in the study area.

In his study of the Barn Owl diet, Taylor (1994) analyzed pellets from the different European countries. He assumed that one pellet per day is produced by an owl, and came up with a figure of about 75g of food per day needed for the adult Barn Owl. This indicates that prey body mass is a limiting factor. This may be due to the fact that for any predator, and particularly a flying one, there may be an upper limit for prey size which can be captured and carried away (Taylor 1994). The results from our analysis of the pellets indicate that our Barn Owl does not prey opportunistically. The

commonest prey weight in the investigated area was 11 – 30 g. Only in two cases was the prey heavier than 70 g, reaching a maximum of almost 100 g. In both cases, the prey species was an adult Rat (*Rattus rattus* and *Rattus norvegicus*, respectively). Numbers of prey individuals of small mammals in our pellets are showing that by increasing the number of prey items within a single pellet the relative abundance of large species – in this case, the heaviest of the five most commonly preyed species is *Arvicola terrestris* – decreases, whereas on the other hand the smallest species *Suncus etruscus* was only detected in pellets with four and five prey items and never less. Our results suggest that pellet contents do not reflect the relative abundance of small mammals in the area, but it can be used as a complementary tool to supplement the faunal lists of small mammals in a given area. This study also indicates that Barn Owl may not be an opportunistic predator as the proportion of small mammals in different samples of pellets greatly differs and an obvious upper limit in prey body size exists for our Barn Owl.

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Povzetek

Preučili smo izbljuvke pegaste sove *Tyto alba*, zbrane v okolici Pise (Italija) leta 2012. Skupno smo našli 219 osebkov malih sesalcev v 85 izbljuvkih. Prehrano pegaste sove je sestavljalo 10 vrst malih sesalcev iz treh družin (Muridae, Cricetidae, Soricidae). Glavna vrsta v prehrani je bila gozdna miš *Apodemus sylvaticus*, sledita ji hišna miš *Mus musculus* in Savijeva kratkouha voluharica *Microtus savii*. Najmanjša vrsta z območja, etruščanska rovka *Suncus etruscus*, je bila dobro zastopana v izbljuvkih, medtem ko nekaterih večjih vrst nismo ugotovili, kar morda odseva zgornjo mejo velikosti za plen pegaste sove. Zdi se, da je optimalna teža plena med 26 in 75 g, občasno pa upleni tudi osebke, ki tehtajo do 100 g, npr. odrasle podgane *Rattus* spp. Kljub vsemu se moramo zavedati, da naši rezultati kažejo na razpoložljivost plena v določenem časovnem obdobju, ne pa nujno prehranske strategije pegaste sove.

Key words: Barn Owl, *Tyto alba*, diet, small mammals, Pisa, Italy
Ključne besede: Pegasta sova, *Tyto alba*, prehrana, mali sesalci, Pisa, Italija

5. References

Aulagnier S., Haffner P., Mitchell-Jones, A. J., Moutou F., Zima J. (2009): Mammals of Europe North Africa and the Middle East. –A&B Black London.

Birdlife International (2004): Birds in Europe: population estimates trends and conservation status. – BirdLife International Cambridge.

Brichetti P. Fracasso G. (2006): Ornitologia Italiana Vol.3 Stercorariidae-Caprimulgidae. – Alberto Perdisa Editore Bologna.

Bontzorlos V. Peris S. Vlachos G. C. Bakaloudis D. (2005): The diet of Barn Owl in the agricultural landscapes of central Greece. – Folia Zoologica. 54 (1/2): 99–110.

Bose M. Guidali F. (2001): Seasonal and geographic differences in the diet of the Barn Owl in an agro-ecosystem in northern Italy. – Journal of Raptor Research 35 (3): 240–246.

Bunn D.S. Warburton A.B. Wilson R.D.S. (1982): The Barn Owl. – Poyser Calton.

Chandler D. (2011): Barn Owl. Firefly Books. – New Holland Publishers (UK) Ltd.

Contoli L. (1981): Ruolo dei Micromammiferi nella nicchia trofica del barbagianni (Tyto alba) nell'Italia Gentro Meridionale. – Avocetta 5: 49–64.

Everett M. Prestt I. Wgagestaffe R. (1992): Barn and bay owls. Owls of the World: Their Evolution Structure and Ecology – Peter Lowe London.

Galeotti P. (2003): Barbagianni. In: Uccelli d'Italia. (a cura di: Spagnesi M. Serra L.). Quad. Cons. Natura 16 Min. Ambiente – Ist. Naz. Fauna Selvatica: 202–204.

Hammer O. Harper D.A.T. Ryan P.D. (2001): Past: Paleontological Statistics software package for education and data analysis. – Palaeontologia Electronica 4(1).

Kryštufek B. (1985): Naša rodna zemlja. 4 Mali sesalci (Mladinska raziskovalna akcija "Okolje v Sloveniji" III Raziskovanje tal). – Prirodoslovno društvo Slovenije Ljubljana.

Leonardi G. Dell'arte G. (2006): Food habits of the Barn Owl (*Tyto alba*) in a steppe area of Tunisia. – Journal of Arid Environments 65: 677–681.
Lovari S. (1974): The feeding habits of four raptors in central Italy. – Raptor Research 8: 61–63.
Lovari S., Renzoni A., Fondi R. (1976): The Predatory Habits of the Barn Owl (Tyto Alba Scopoli) in Relation to the Vegetation Cover. – Italian Journal of Zoology 43: 173–191.
Merkel A. (2018): Climate data – climate: Marina di Pisa. Accessible online: https://en.climate-data.org/location/710944/
Mikkola H. (1983): Owls of Europe. – T. & AD Poyser, London.
Obuch J., Benda P. (2009): Food of the Barn Owl (*Tyto alba*) in the Eastern Mediterranean. – Slovak Raptor Journal 3: 41–50.
Paspali G., Oruci S., Koni M., Wilson I. F., Krystufek B., Bego F. (2013): Seasonal variation of small mammals in the diet of the barn owl (*Tyto alba*) in the Drinos River valley southern Albania. – Turkish Journal of Zoology 37: 97–105.
Taylor I. (1994): Barn owls: Predator-prey relationship and conservation. – Cambridge University press, Cambridge.
Taylor I. R. (2009): How owls select their prey: a study of Barn Owls *Tyto alba* and their small mammal prey. – Ardea: 97(4): 635–644.
Tores M., Motro Y., Motro U., Yoram Y.T. (2005): The Barn Owl – a selective opportunist predator. – Israel Journal of Zoology 51: 349–360.
Yom-Tov Y., Wool D. (1997): Do the contents of Barn Owl (*Tyto alba*) pellets accurately represent the proportion of prey species in the field? – Condor 99: 972–976.

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