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## Short Note

**Morphological measurements of pine marten in central Italy**Paola BARTOLOMMEI<sup>a,\*</sup>, Emiliano MANZO<sup>a</sup>, Cristina BENCINI<sup>a</sup>, Roberto COZZOLINO<sup>a</sup><sup>a</sup>*Fondazione Ethoikos, Convento dell'Osservanza, 53030 Radicondoli (Siena), Italy*

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**Abstract**

The knowledge of morphological features of species can help to understand other related biological aspects. In Italy the European pine marten *Martes martes* seems to show a recent expansion of its distribution, however information on this species in our country are scarce. Very few data on biometric measurements are available, mainly referring to the Sardinian population, and the only published study on mainland populations was based exclusively on cranial morphology. For these reasons we aimed to provide external morphological data on thirty-three adult pine marten in Tuscany, central Italy. In addition, we found that pine marten appear to be quite distinguishable from the sibling species stone marten *M. foina* by inspection of coat colour and marking pattern, showing that qualitative diagnosis of external morphological traits can be very useful to identify this species in central Italy. In fact, genetic analyses on samples of hair confirmed the correct species identification.

The European pine marten *Martes martes* is widely distributed in Europe, and in Italy it seems to have shown a recent expansion of its range, including cultivated and anthropic areas (Balestrieri et al. 2009; Grelli et al. 2014; Bartolommei et al., unpublished data). However most of the studies on pine marten are carried out in central and north Europe and little is known about this species in our country. The knowledge of morphological features of species can help to understand other related biological aspects, especially for quite similar sympatric species, like pine marten and stone marten *Martes foina*. In Italy very few data on biometric measurements of pine marten are available, and mainly refer to the Sardinian population (Murgia et al., 1995; Genovesi and De Marinis, 2003), whilst the only published study on mainland populations was based exclusively on cranial morphology (Loy et al., 2004). For these reasons we aimed to provide external biometric measurements on pine marten in central Italy.

Data on thirty-three adult pine martens (19 males and 14 females) were collected from May 2005 to April 2013, in western Tuscany, Italy. Nineteen individuals (11 males and 8 females) were caught in La Selva Forest ( $43^{\circ}13'N, 11^{\circ}4'E$ ) by live traps (Havahart model) baited with fresh eggs. Trapped animals were anaesthetized using Zoletil 20, individually marked by a Passive Integrated Transponders (PITs) and released at the point of capture. In addition, fourteen individuals (8 males and 6 females) road-killed close to the forest were collected. From each animal, age class, sex and six morphometric measures (weight, head-body length, tail length, hind foot length, ear length and width) were recorded and biological samples (hair) were collected for genetic analysis. The age class was determined using tooth wear. The body weight of the animals was measured using Pesola spring balances (precision: 50 g) whereas the body dimensions were measured using a calipers (precision: 1 mm) (Tab.1). All measurements were taken by the same operator (PB). During the same period we also collected data on six adult stone marten (4 males and 2 females), three of them (1 male and two females) were trapped and three (all males) were found road-killed in the same study area. Species identification was carried out first in

the field by inspection of coat colour and marking pattern, then by molecular analysis using the polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) method described in Ruiz-González et al. (2008). We checked the colour variability of coat, of body sides, rhinarium, *pinnae*, pads, muzzle (between nose and eyes and between eyes and ears), and the colour, size and shape of the throat patch (Vercillo et al., 2003). The genetic analysis confirmed that all individuals have been identified successfully, showing that we were able to identify pine martens by examination of coat colour and marking. Although it is known that it is very difficult to distinguish the two species on the basis of qualitative morphological traits (Anderson, 1970; Reig, 1992), these results show that the morphological diagnosis could be very useful to identify pine marten in central Italy.

Biometric measurements are showed in Tab. 1. We compared morphological features of males and females (Wilcoxon Mann-Whitney rank-sum test, R Core Team 2013) (Tab.1). Males showed significantly higher values of body weight ( $W=168$ ,  $p=0.040$ ), head-body length ( $W=189.5$ ,  $p=0.038$ ), hind foot length ( $W=184.5$ ,  $p=0.0006$ ) and ear width ( $W=161.5$ ,  $p=0.038$ ), in agreement with the sexual dimorphism of the species (Genovesi and De Marinis, 2003). The greatest differences were found in the hind foot length (Tab.1), while no differences were detected in tail length ( $W=173$ ,  $p=0.148$ ) and ear length ( $W=109.5$ ,  $p=0.160$ ).

Compared to the unpublished data on four adult males in Tuscany reported by Genovesi and De Marinis (2003), our males showed slightly higher values of body weight, head-body length, tail length and hind foot length and a greater variability of these measurements, especially of head-body length (data by Genovesi and De Marinis (2003): body weight min-max 1.00–1.60 kg, mean  $\pm$  SD  $1.38 \pm 0.29$  kg; head-body length min-max 46–50 cm, mean  $\pm$  SD  $47.9 \pm 1.7$  cm; tail length min-max 19–24 cm, mean  $\pm$  SD  $22 \pm 2.2$  cm; foot length min-max 8.5–9.5 cm, mean  $\pm$  SD  $9.1 \pm 0.5$  cm). However, these differences may be due to the small sample size mentioned by Genovesi and De Marinis (2003). The same four morphological features were measured by Deiana et al. (1998) in twenty-one adult males of Sardinia pine marten, with very similar results to those reported by Genovesi and De Marinis (2003),

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**Table 1** – External biometric measurements of 33 adult pine martens (weight in kg; length, height and width in cm; SD=standard deviation).

	Males				Females			
	N	Mean	SD	Min-Max	N	Mean	SD	Min-Max
Body weight	18	1.55	0.32	0.90-1.97	13	1.35	0.18	1.01-1.70
Head-body length	18	49.3	3.2	41.0-55.6	14	46.5	3.1	41.5-52.0
Tail length	19	23.5	1.6	19.5-27.0	14	23.4	2.8	21.0-30.6
Hind foot length	18	9.3	0.5	8.5-10.4	12	8.7	0.5	8.0-9.9
Ear length	15	3.7	0.5	2.7-4.8	11	3.5	0.4	2.7-4.0
Ear width	16	3.8	0.6	2.4-4.5	14	3.4	0.4	2.8-3.9

except the body weight, which had higher values than both the Tuscan samples (data by Deiana et al. (1998): body weight min-max 1.31-2.10 g, mean  $\pm$  SD 1.72 $\pm$ 0.01 kg; head-body length min-max 43.5-50 cm, mean  $\pm$  SD 48.7 $\pm$ 1.7 cm, tail length min-max 19-25.4 cm, mean  $\pm$  SD 22.7 $\pm$ 1.4 cm; foot length min-max 8.5-10.5 cm, mean  $\pm$  SD 9.1 $\pm$ 0.5 cm). For females, data are only available for three Sardinian pine martens (Murgia et al., 1995), which appear to have lower values of head-body length and tail length (data by Murgia et al. (1995): body weight min-max 1.19-1.45 kg, mean  $\pm$  SD 1.30 $\pm$ 0.01 kg; head-body length min-max 39-40 cm, mean  $\pm$  SD 39.7 $\pm$ 0.6 cm, tail length min-max 20-22 cm, mean  $\pm$  SD 21.3 $\pm$ 0.1 cm; hind foot length min-max 8.2-9.0 cm, mean  $\pm$  SD 8.6 $\pm$ 0.4 cm).

Our data contribute to improve the knowledge of pine marten morphology. According to Vercillo and Ragni (2011) future studies should focus on searching for those morphological and morphometric characteristics that could be useful to the zoologists in determining pine marten from other marten species.

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