

PINE MARTEN (*Martes martes*) IN SOUTHERN MILAN: occurrence within a fragmented peri-urban landscape

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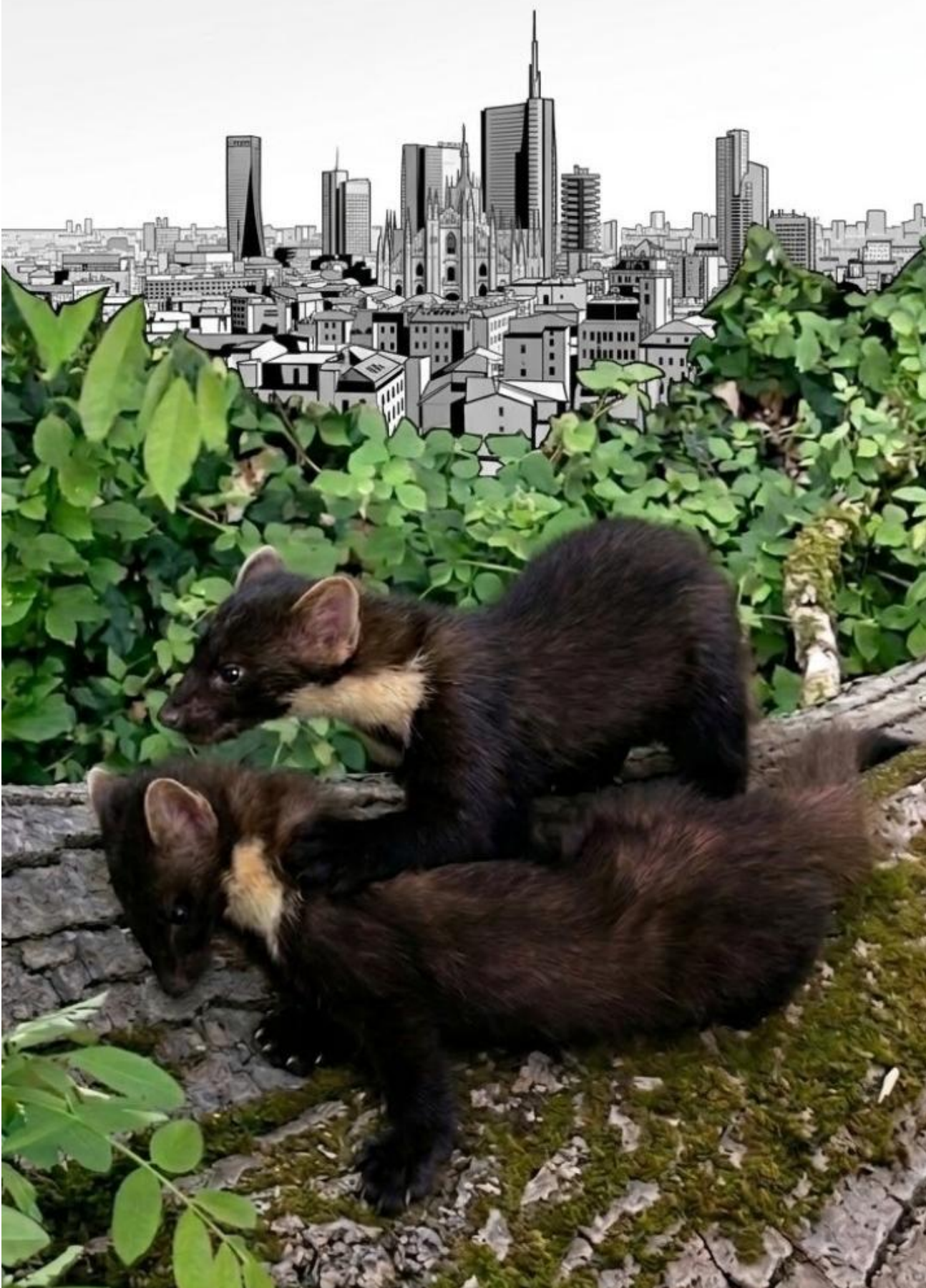


INTRODUCTION

The European pine marten, traditionally a forest species, is now documented in the intensively cultivated lowlands of north-western Italy, where its occurrence is linked to riparian woodlands and residual patches within the agricultural matrix (Balestrieri *et al.* 2016), as well as to urban and peri-urban green spaces elsewhere in the country (Ancillotto *et al.* 2026). Here, we report repeated detections in the peri-urban agricultural belt south of Milan, at the northern edge of Parco Agricolo Sud Milano.

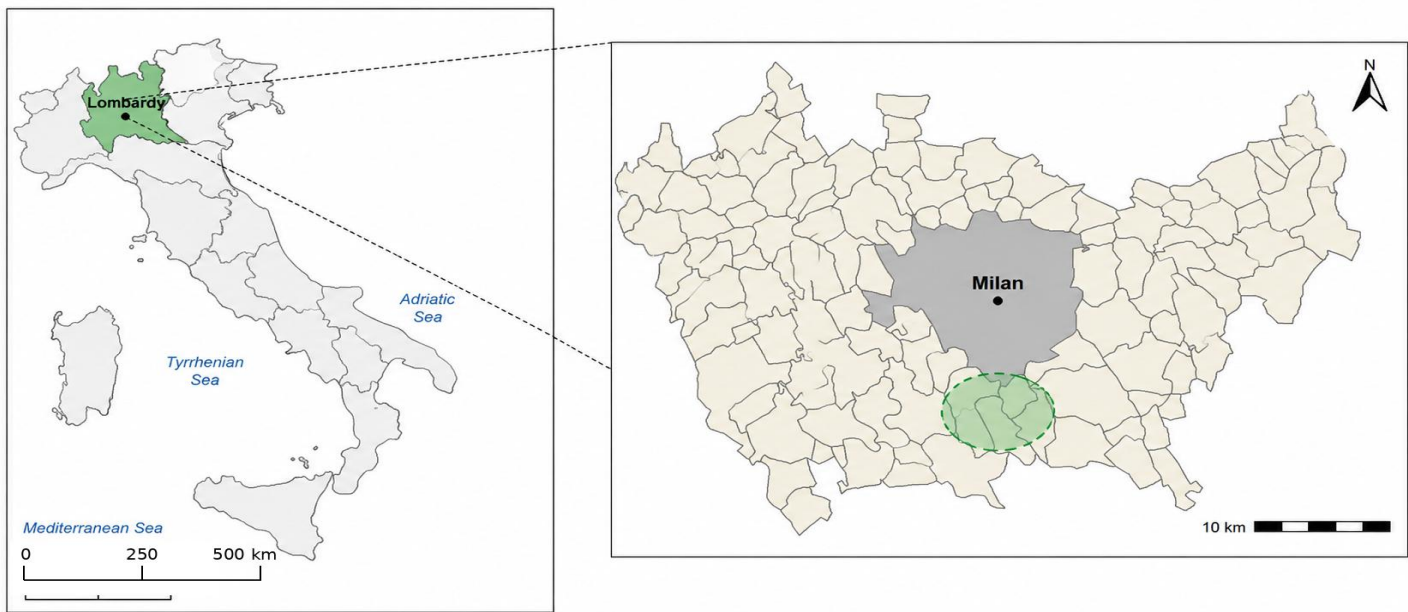
AIMS

- Document repeated occurrence and temporal continuity of *M. martes*.
- Quantify independent detection events across sampling sectors.
- Describe the diel activity pattern.
- Determine the sex of detected individuals, where possible, and investigate individual recognition based on distinctive morphological features.
- Compare detection rates between ground-only and elevated-log stations in the canal sector.



STUDY AREA

The study was conducted in the southern peri-urban sector of the Metropolitan City of Milan, approximately 10 km from the city centre and close to the northern boundary of the Parco Agricolo Sud Milano. The landscape is characterised by an agricultural matrix interspersed with roads and buildings, canals and ditches, tree belts and small woodland patches. Camera trapping focused on a continuous tree-lined canal and two smaller woodland patches. The area supports a diverse mammal community, including wild boar, roe deer, European badger, red fox, crested porcupine, red squirrel and, occasionally, wolf, and also hosts a large heronry.



RESULTS

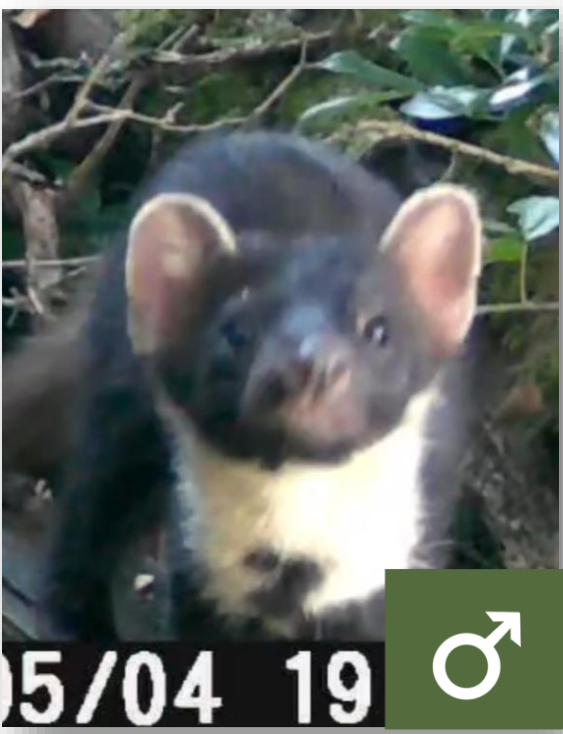
232 independent events

425 unique records

1,447 station-days

INDIVIDUALS

- Sex was determined in 50.4% of independent events
- One male and one female were repeatedly identified through throat-patch pattern and complementary morphology
- Both individuals were recorded in the same event in 24 cases, and simultaneously in 18
- No additional individuals were identified in cases where throat-patch visibility allowed individual recognition



STRUCTURES AND DETECTION RATES

- Within the canal sector, 221 of 226 independent events (97.8%) occurred at stations where woody structures were available.
- Detection rates were 2.3 independent events/100 station-days at ground-only stations, 57.1 at ground-plus-trunk stations, and 57.8 at elevated-trunk stations.

DISTRIBUTION OF DETECTIONS

- 425 unique records pooled into 232 independent events over 1,447 station-days
- 97.4% of independent events recorded along the canal (226); only 4 and 2 events in the two woodland patches
- Descriptive detection rate: 37.4 independent events/100 station-days along the canal, compared with 0.6–1.2 in the woodland patches

TEMPORAL CONTINUITY

- Pine marten detections spanned May 2025 – August 2026 and occurred in 10 different months
- Detection frequency increased markedly from May 2026, coinciding with expanded coverage of elevated logs; monthly variation therefore cannot be interpreted as seasonality

METHODS

- Opportunistic camera-trap survey using GardePro E8 cameras,
- Jan 2025–Aug 2026
- 13 functional stations
- Independent events: >30-min interval at the same functional station; times standardised to CET
- Individual identification: throat-patch pattern and complementary morphology (Raichev 2018; Green *et al.* 2026)
- Sampling adapted during the study: from mainly ground routes to increased coverage of elevated logs
- Ground-only/elevated-log detection rates compared within the canal sector to reduce confounding by sector
- Activity patterns: circular kernel density estimation. Times were standardised to CET and transformed to solar time using date-specific sunrise and sunset times for the study area, to account for seasonal variation in daylight.
- Analyses were conducted in R (version 4.6.0) using the packages *activity*, *readxl* and *ggplot2*.

DISCUSSION

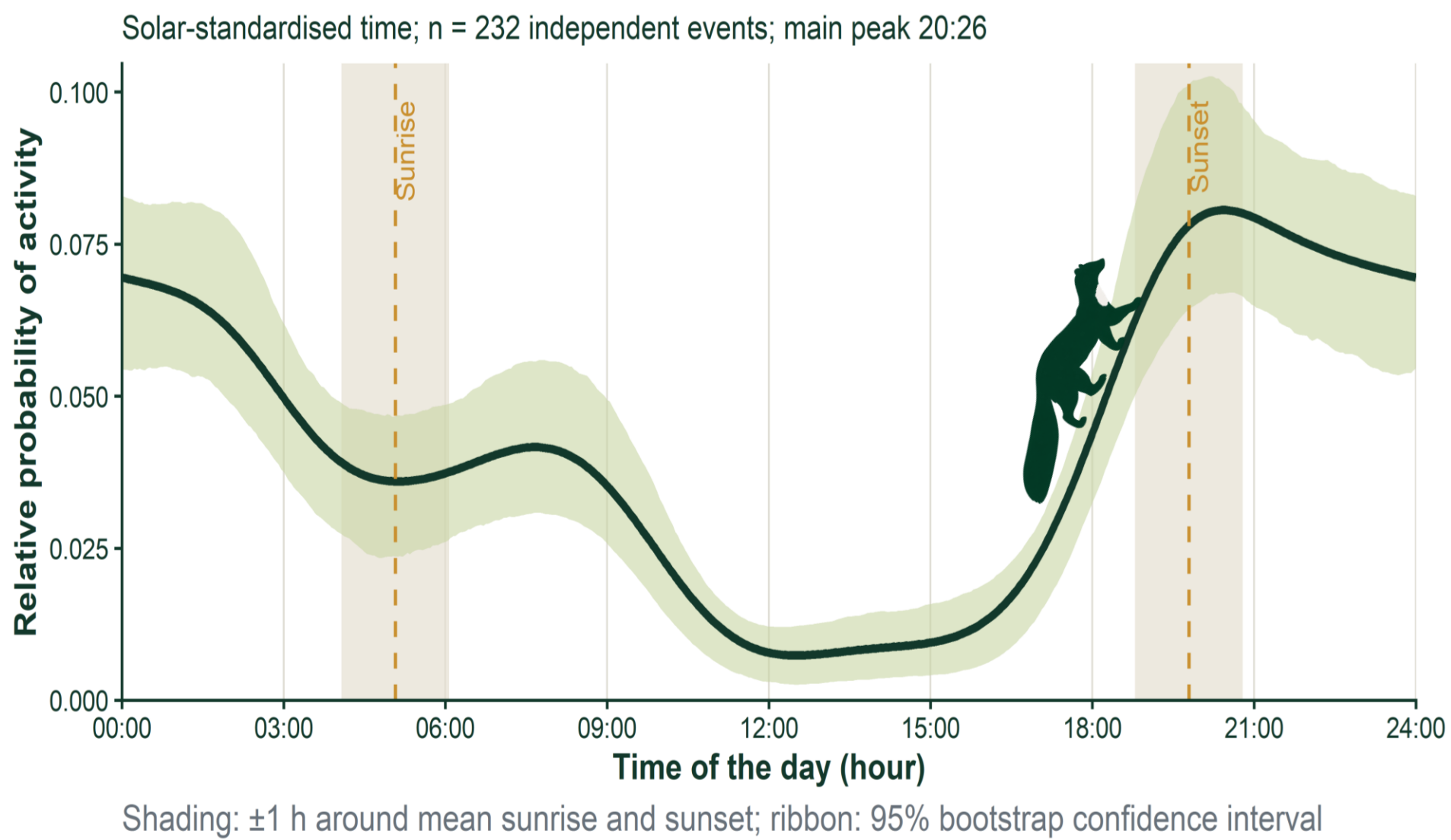
- The presence of the European pine marten (*Martes martes*) in the metropolitan area of Milan was confirmed.
- Temporal continuity and repeated identification of the same male and female indicate sustained use of the area by at least two individuals rather than occasional passage. No additional individuals were identified when throat-patch visibility allowed individual recognition, although no inference can be made on reproduction or population size.
- Detections were strongly concentrated along the tree-lined canal compared with the two woodland patches. Although differences in sampling effort and camera placement preclude a direct comparison of habitat use among sectors, this pattern suggests that the canal may represent an important component of the area used by pine martens.
- These findings are consistent with the documented expansion of the species across north-western Italy and with its use of urban and peri-urban green spaces elsewhere (Balestrieri *et al.* 2016; Ancillotto *et al.* 2026).
- Within the canal sector, detection rates were markedly higher at elevated-log camera placements than at ground-only placements, suggesting frequent use of logs and highlighting their value for detecting the species (Angoh *et al.* 2023; Schwegmann & Storch 2024).
- The observed activity pattern was predominantly nocturnal and crepuscular, consistent with that reported for the species (Monterroso *et al.* 2014; Mori *et al.* 2022; Ancillotto *et al.* 2026).

Key message: even small, infrastructure-adjacent woodland patches can be important components of the peri-urban environment used by pine marten, helping sustain its occurrence there.

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PATTERNS OF ACTIVITY RHYTHMS

78.0% of independent events between 18:00 and 06:00 CET



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