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Short note

On the Circadian Activity of Red Fox (Vulpes vulpes) and Stone Marten (Martes foina) in Agricultural Landscape of Northwestern Bulgaria During Spring-Summer Period

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Abstract. A total of 5 camera traps were set in protected area "Zlatiyata" to record the circadian activity of the Red Fox (*Vulpes vulpes*) and the Stone Marten (*Martes foina*) in agricultural habitats of Northwestern Bulgaria. During spring-summer period the Red Fox exhibited predominantly nocturnal bimodal activity with first peak during twilight (18:00-20:00) and second higher peak after midnight (00:00-02:00). Only one peak (22:00-00:00) was registered in the Stone Marten's activity.

Key words: activity, camera trapping, agricultural regions, Bulgaria.

Introduction

Among the threats to mesopredators in the European lowlands are habitat fragmentation and agricultural expansion (Faaborg et al., 1993; Rodríguez-Refojos & Zuberogoitia, 2011; Vitousek et al., 1997). The animals have to change their activity in order to adapt to the growing human influence on wildlife (Gaynor et al., 2018). Few studies on the circadian activity of Red Fox (*Vulpes vulpes*) and Stone Marten (*Martes foina*) have been conducted in agricultural (Dudin & Georgiev, 2015; Dudin, 2017) and in mountainous (Petrov et al., 2016; Tsunoda et al., 2020) regions of Bulgaria. Our study aimed to provide new data on the behavioral ecology of both species in agricultural landscape in Northwestern part of the country.

Material and Methods

The study was conducted in protected area "Zlatiyata" located in Northwestern Bulgaria (for map and more information on the study area, please see Petrov et al. (2022)). The area is a plateau with bushy slopes and intensive agriculture on the surface, ensuring an open habitat for the wild animals.

The study was conducted from 1-Mar-22 to 31-Aug-22 A total of 5 camera traps (BolyGuard BG590-K2) were set up on threes along the predators' trails. No baits or lures were used. The devices were angled at 45-90 degrees to the trails. The height the devices were mounted on the trees was tailored to the size of the studied species, the slope of the terrain and the available vegetation. The cameras were set to take 3 consecutive photos with 5 minutes delay. The images of a particular species separated by thirty-minute interval were treated as an independent observation (one event).

Results and Discussion

The Red Fox (Fig. 1- left) demonstrated bimodal nocturnal activity and the Stone

Marten (Fig. 1 - right) - unimodal nocturnal activity.

The smaller peak in the activity of *V. vulpes* was around twilight 18:00-20:00 and the second was after midnight (00:00-02:00). *M. foina* exhibited one peak before midnight 22:00-00:00 during the study period (Fig. 2).

Fig. 2. Red Fox (*Vulpes vulpes*) - in the left and Stone Marten (*Martes foina*) - in the right, photographed in protected area "Zlatiyata", Northwestern Bulgaria.

Compared to the previous study (Petrov et al., 2022) the Red Fox has changed the peaks of its activity. During the spring-summer period, the peaks of the bimodal fox activity shifted approximately four hours earlier than those during the autumn-winter period (Fig. 3). The Stone Marten maintained the same peak before midnight in spring-summer period as in the autumn-winter period revealed by Petrov et al. (2022), but no second peak was observed (Fig. 4).

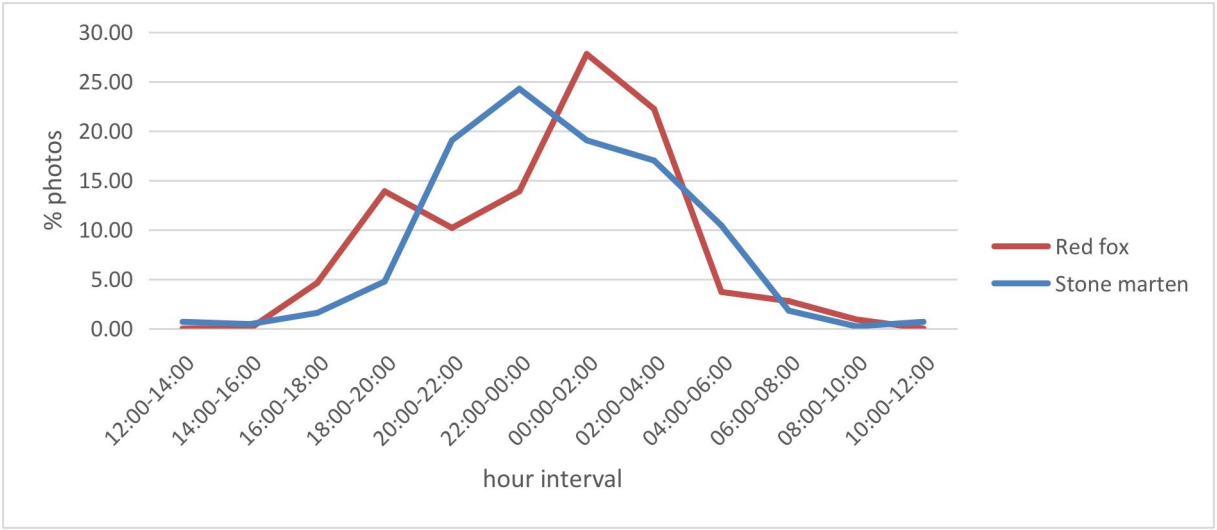

Fig. 2. Activity of the Red Fox (*V. vulpes*) and the Stone Marten (*M. foina*) during spring-summer period in protected area "Zlatiyata", Northwestern Bulgaria.

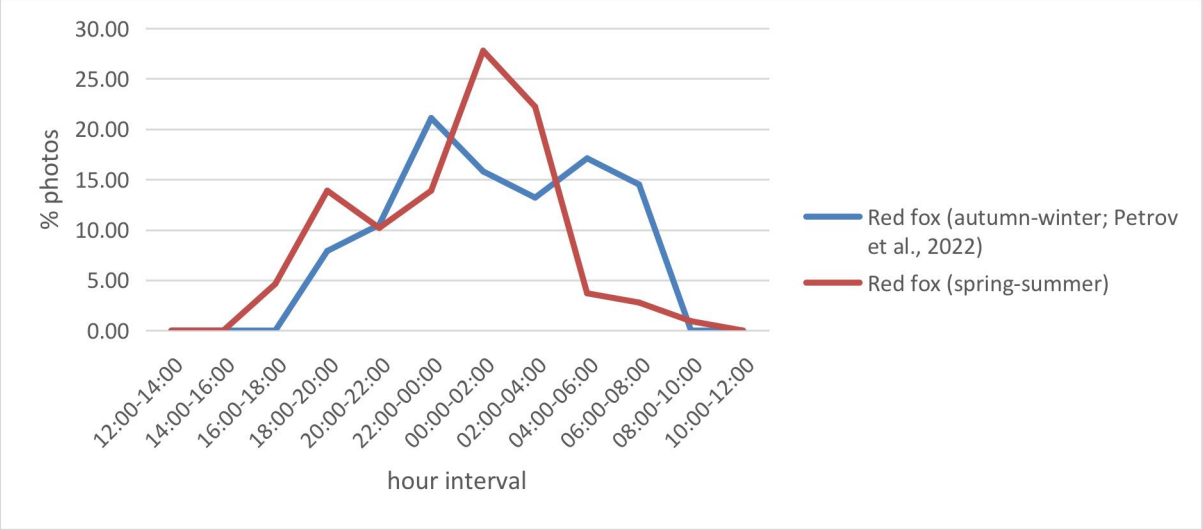

Fig. 3. Season comparison of the activity of the Red Fox (*V. vulpes*) in protected area"Zlatiyata", Northwestern Bulgaria.

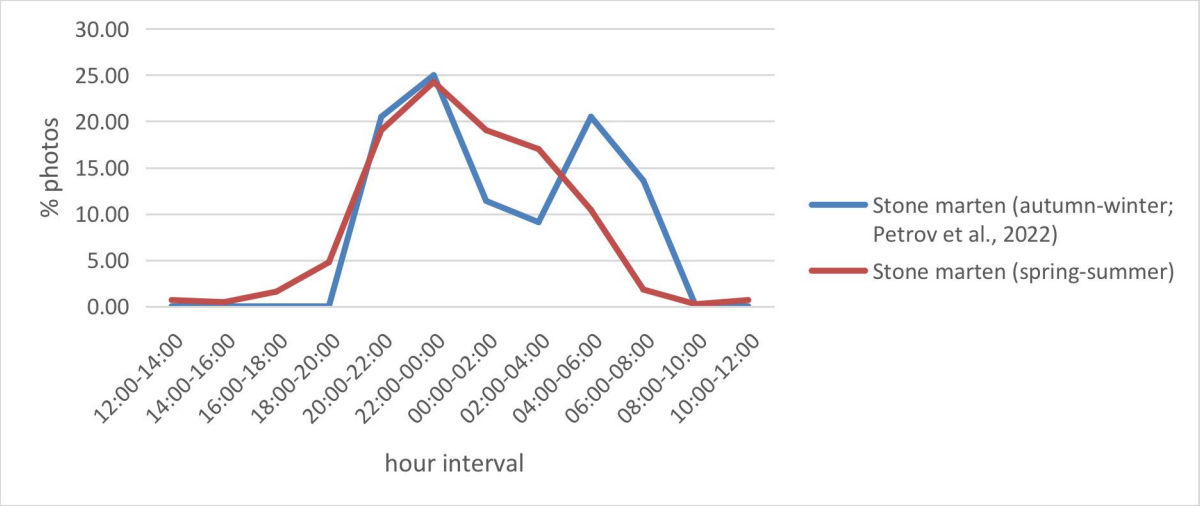

Fig. 4. Season comparison of the activity of the Stone Marten (*M. foina*) in protected area "Zlatiyata", Northwestern Bulgaria.

Compared to the mountain regions (Petrov et al., 2016; Tsunoda et al., 2020) both studied predators in agricultural habitats exhibited similar predominantly nocturnal activity during spring-summer period. While the activity of *V. vulpes* peaked twice in the mentioned habitats, *M. foina* demonstrated unimodal activity in agricultural region during investigated period, different to the bimodal in the mountains.

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