

Characteristics of the hunting behavior of the Red-footed Falcon (*Falco vespertinus*) in South-Eastern Bulgaria

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Abstract. Hunting behavior was studied in a small breeding population of Red-footed Falcons in SE-Bulgaria and in a transitory migrants of the same species. A total of seven types of hunting strategies were performed by the Red-footed Falcons which can be rapidly switched from one to another in relation to the available type of prey, the speed and direction of the wind. It was recorded that the hovering series were longer in calm weather (wind speed < 2 m/s) and in strong winds (over 5 m/s) than in moderate winds (2 – 5 m/s). Difference was found in the mean length of the hovering series between the migrating and local breeding Red-footed Falcons. The hunting success of the finished attacks of the Red-footed Falcons was in overall 59.6 %.

Key words: hovering, climatic conditions, red-footed falcon

Introduction

The study is focused on the different types of hunting strategies used by the Red-footed Falcon (*Falco vespertinus* L. 1758) (hereafter RFF) and especially on hovering. The characteristics of hunting behavior of that falcon species are poorly studied. Most of the specialized studies on that topic were completed in Hungary (Palatitz 2012, Palatitz *et al.* 2015) and Slovakia (Chavko & Kristin 2017).

In Bulgaria RFF is a common transitory migrant but its breeding population is small -15 -50 breeding pairs (Palatitz *et al.* 2009). In two small breeding colonies of RFF found in Sliven district, SE-Bulgaria the length of the hovering series, their number and hunting success of RFF was studied in relation to the sex of the birds, the period of their life cycle and the current climatic conditions. We wanted to find whether these factors affect the hunting strategy and more specifically the duration of the hovering series. Also we searched for differences in hovering series performed by breeding RFF and migrating RFF in same habitats in Sliven district.

Material and Methods

Field observations were conducted on six pairs of RFF from two colonies nesting on poplar trees in Sliven district, SE Bulgaria. The study of the breeding RFF was conducted in the period 2013-2015. The habitats around the nesting trees were arable lands (maize, sunflower, alfalfa) and pastures. Observations in the colonies were made from mid-May until late July covering all the phases of the breeding period. Hunting behavior of RFF migrating during spring in the same area was studied for comparison. There is well presented spring migration of the species in that area from mid-April to mid-May with flocks reaching up to 300-400 birds. Most of the observations of the hunting behavior were conducted in the period 20 April - 6 May, 2013 -2017 at arable lands and pastures around the town of Sliven

and the villages of Zhelyu Voyvoda, Kamen, Galabintsi, Krushare, and Elenovo. These locations are situated at 8 - 20 km from the nesting colonies.

A total of 217 hovering series of different individuals were measured using electronic chronometer. From these series 108 were measured during the breeding period and 109 during the spring migration. Climatic conditions were described in every visit on the study sites but for the wind speed we used concrete numerical data from the closest meteorological station – Sliven (https://rp5.ru/Weather_archive_in_Sliven). Hunting success was calculated for all types of prey caught by the falcons. Distances of the hunting birds from the nests were measured on Google Earth after taking the coordinates by a GPS.

Results

During the incubation period and the first stage of feeding of the nestlings hunting was performed only by the males. Females joined the hunting process 5-6 days after the hatching. They were hunting at much smaller distances from the nest compared to the males.

A total of seven types of hunting strategies were performed by the RFF-s which were rapidly switched from one to another. These types of hunting strategies included: hovering; gliding against the wind; hovering, combined with gliding; soaring; hunting on the ground; attack from a perch; aerial hunting (usually for insects) using active flight.

One of the most important factors determining the hunting activity of RFF, the type of hunting strategy used and the length of the hovering series was the wind speed. It was recorded that the hovering series were longer in calm weather (wind speed < 2 m/s) – mean duration 9.96 sec. and in strong winds (over 5 m/s) – mean duration 8.11 sec. than in moderate winds (2 – 5 m/s)- mean duration – 5.19 sec. The differences were significant – calm weather vs moderate wind - Student's T test result (two-tailed) = 7,56027E – 08 ($p < 0.001$); strong wind vs moderate wind - Student's T test result (two-tailed) = 0,000714001 ($p < 0.001$). Hovering can be used by the RFF during winds reaching up speed of 15-17 m/s, including during rain. Usually if the wind speed was between 10 and 17 m/s hovering was combined with gliding. In stronger winds, over 17 m/s hovering series were switched to series of gliding. In calm weather (wind speed < 2 m/s) hovering was often replaced by attacks from a perch, from the ground or by active flight. Combining of hovering with gliding and soaring was a common event.

Difference was found in the mean length of the hovering series between the migrating and the breeding RFF. During the breeding period both sexes showed similar mean length of hovering series (Fig.1). Two-tailed Student's T-test results revealed that hovering series of the breeding RFF were significantly longer than the series performed by the migrating birds (Fig. 1). For both sexes the test result corresponded to probability $p < 0.01$. During the migration period the males had significantly longer hovering series than the females (T-test, $p < 0.05$) (Fig.1).

It was found that 25.3% (60/237) of the hovering series were finished with real attacks, without difference between the sexes - for females 25% (23/92), for the males – 25.5 % (37/145). The hunting success of the finished attacks of the RFF was in overall 59.6 % (37/62), for the females - 65.2% (15/23), for the males- 56.4% (22/39). The difference between the sexes was not significant (chi-square test result – 0.46635).

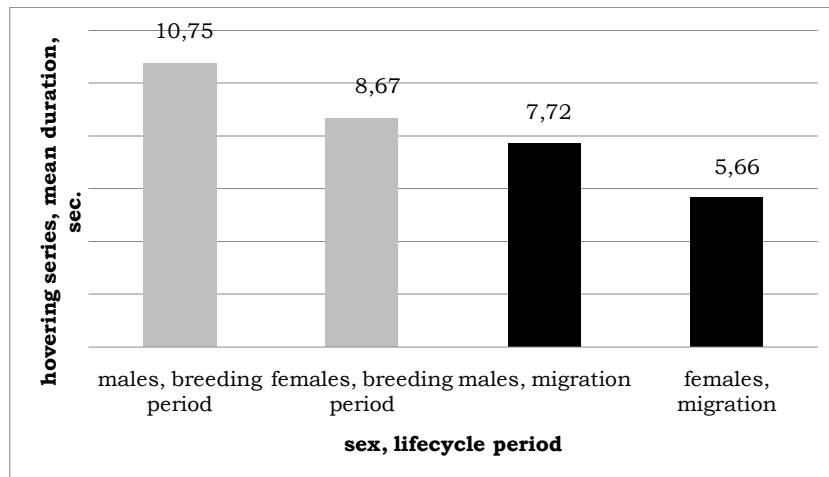


Fig. 1. Mean duration of the hovering series of Red-footed Falcons in relation to the sex and period of the lifecycle of the birds.

Discussion

It was proved that during the breeding period the female RFF-s have much smaller individual feeding territory - 38 - 322 ha compared to the males - 310 - 3467 ha (Palatitz 2012). During the present study it was recorded that females' flights for food were much shorter in time and at much smaller distances from the nest compared to the male's flights. For the Pannonian subpopulation of RFF it was found that the total frequency of the flights off the nest for searching food is higher for the females compared to the males (Chavko & Kristin 2017). The last finding can be explained with the shorter distance covered by the females allowing them to have more hunting attempts per day. Females spend much more time in the nest or close to it which can be explained with their higher parental care effort including nest defense like it was proved for the Northern Hobby (*Falco subbuteo* L. 1758) (Sorci & Bogliani 2001).

In Hungary the RFF's hunting success of vertebrate prey varied between 17% and 66% (mean- 48%) in relation to the habitat at the hunting place and the distance from the nest (Palatitz 2012, Palatitz *et al.* 2015). Thus the mean hunting success of RFF in Hungary- 48% seem to be lower compared to the hunting success calculated for the Bulgarian RFF - 59.6%, but it should be taken in account that in our sample hunting success was calculated on the basis of all captured prey.

Hunting strategy can be rapidly changed by the RFF in a response to the changes in the current climatic conditions. Such flexibility was proved also for the Lesser Kestrels (*Falco naumanni* Fleischer, 1818) studied in Spain (Hernandez-Pliego *et al.* 2017).

It the present work it was shown that moderate winds offer optimal conditions for hovering of the RFF. Most probably hovering in calm weather or during strong winds leads to too high energy losses for the birds thus being replaced by other types of hunting strategies.

Migratory birds are usually exposed to long-term active flights and especially during spring migration often in unfavorable weather conditions. These factors can lead to much higher energetic losses and other negative impacts to the fitness and health status of the migratory birds (Lindström *et al.* 2000). That can explain the observed much shorter hovering series of the migrating RFF compared to the breeding RFF.

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