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POPULATION SIZE AND NEST SITE SELECTION OF THE SPANISH SPARROW *PASSER HISPANIOLENSIS* IN THE REGION OF THE RIVER KRKA (CROATIA)

ABSTRACT

The breeding range of the Spanish sparrow, *Passer hispaniolensis*, in Croatia is rapidly expanding. We studied the size of the nesting population and selection of nest site in an area partially included in the Krka National Park. Our results confirm that between 2004 and 2007 in the wider area of the Krka National Park the Spanish sparrow had occupied new localities, and that the number of 160 pairs recorded in 2003 had more than doubled (300–350) by 2007. In the study area, Spanish sparrows nest most commonly in the canopies of introduced planted trees (e.g. *Morus alba*, *Platanus occidentalis*, *Populus nigra* cv. *italica*). This strategy, with a good access to and diversity of potential nesting sites, enables a further expansion of the species.

Keywords: Spanish sparrow *Passer hispaniolensis*, invasive species, dispersal, range, Skradin, Krka National Park

INTRODUCTION

The Spanish sparrow *Passer hispaniolensis* (Fig. 1) is a Southwestern Palearctic species (Cramp and Perrins 1994). In Croatia the Spanish sparrow is a breeding bird (Kralj 1997, Lukač 2007) with up to two clutches per year (Cramp & Perrins 1994). The species is expanding its breeding range along the adriatic coast from south to northwest, or from southern Dalmatia to Istria (Rubinič 2001, Lukač 2004). The dynamics of its expansion in the Balkans has been investigated intensively (Lukač 1988, 2004) but the role of the selection of nest sites has not been adequately explored. The Spanish sparrow in Dalmatia nests in more than 15 tree species, in most cases in the canopy of planted Pine (*Pinus halepensis*, *P. nigra*, *P. maritima*), Almond (*Prunus amygdalus*), and Plane (*Platanus orientalis*), and less frequently in the canopy of Downy oak (*Quercus pubescens*), Black locust (*Robinia pseudoacacia*), Wild olive (*Olea silvestris*), Green olive tree (*Phillyrea latifolia*), Mediterranean cypress (*Cupres sussempervirens*), Elm (*Ulmus* sp.),

Tamarisk (*Tamarix* sp.) and Palm (*Palma* sp.) trees, and in riverine areas on Silver and Black poplar (*Populus alba*, *P. nigra*) and Willow (*Salix* sp.) trees (Rubinič 2001, Lukač 2004, Mužinić and Purger 2006). The importance of these tree species selected for nesting for the Spanish sparrows' range expansion is not understood.

The goal of this study was to investigate the significance of nest sites of the invasive bird species Spanish sparrow with respect to the selected tree species and to estimate the population size in the lower course of river Krka.



Fig. 1. Spanish sparrow *Passer hispaniolensis* (Photo by J. Mužinić)

MATERIAL AND METHODS

Study area

The study was conducted in the town of Skradin and in Čulišićke bare in the vicinity of the village Dubravice (WJ75 according to 10×10 km UTM grid), situated in the wider area of the lower course of river Krka. Skradin is a small town located on the right bank of the Krka (Fig. 2). It does not have a developed city centre and most buildings (except for those along the main street) are up to two storeys high, surrounded by gardens and orchards. The unique feature of this town are avenues of old mulberry trees (*Morus alba*) in the alley of Skradin sericulturists (Aleja skradinskih svilara, Fig. 3), planted

to breed silk-worms (*Bombix mori*). The wetland area Čulišićke bare is situated between the Podbare bay of river Krka and the village Dubravice, south of the hamlet Čulišić (Fig. 4), and is administered by the Krka National Park. The riverside is bordered by reed beds, marshlands and meadows,

and the area gradually ascends towards the



Fig. 2. Town Skradin located on the right bank of Krka (Photo by J. Mužinić)



Fig. 3. Alley of Skradin sericulturists (Aleja skradinskih svilara) in Skradin, the location of Spanish sparrow, nests (Photo by J.J. Purger)



Fig. 4. Čulišičke bare, the area of the expansion of the nesting area of the Spanish sparrow (Photo by J.J. Purger)

hamlet (49-65 m a.s.l.). Čulišić consists of several small houses surrounded by orchards, vineyards and smaller agricultural fields.

Nest counting

To estimate the Spanish sparrow population, nests were counted outside the breeding season in early spring and autumn after defoliation, to ensure adequate conditions for detecting nests. Nests found in spring belonged to the breeding season of the previous year while those found in autumn to the current year. The exact number of nests is difficult to estimate because some pairs of the Spanish sparrow may have two clutches per year, and, furthermore, a certain number of nests may fail in the course of the year (Mužinić and Purger 2006). Because of the absence of the Spanish sparrow during winter and because the House sparrow *Passer domesticus* nests together with this species and builds similar nests, it is not possible to determine with certainty the exact number of nesting pairs of Spanish sparrows on buildings in a settlement. Due to these methodological problems, the total number of nests counted outside the breeding season probably underestimates slightly the true number of the Spanish sparrow population in the study area. We first counted nests in Skradin on 25 March 2005, representative for Spanish sparrows nesting in 2004 (Table 1). With the same method we counted nests again on 11 April 2006, but immediately before the count several trees had been cut down and branches of others had been pruned, so the results could not be considered. We repeated the nest count on 22 October 2007. The data on the probable size of the breeding population of the Spanish sparrow refer to 2004 and 2007 (Table 1). In the area of Čulišićke bare, nests were counted in the same period and with the same method. During the study we recorded all species of trees where nests were located as well as the total number of nests on each tree.

Table 1. The presence of the Spanish sparrow, *Passer hispaniolensis*, in Skradin in 2004 and in 2007 with respect to the tree species (°native, *introduced, *invasive)

Tree species		Number of trees with nests		Total number of nests	
		2004	2007	2004	2007
<i>Morus alba</i>	+	26	21	42	39
<i>Platanus occidentalis</i>	+	1	1	21	60
<i>Populus nigra cv. italica</i>	+	5	10	17	52
<i>Acer negundo</i>	+*	5	3	17	6
<i>Ulmus minor</i>	o	5	1	17	3
<i>Robinia pseudoacacia</i>	+*	4	2	7	4
<i>Juglans regia</i>	o	2	2	2	2
<i>Prunus amygdalus</i>	o	1	0	1	0
<i>Celtis australis</i>	o	1	3	1	5
Total: 9		53	43	125	171

RESULTS AND DISCUSSION

Data collected in the past (Kralj 2007) show that the Spanish sparrow had been nesting in the Krka National Park area since the 1990s. Colonies were on the plateau near Brnjica (UTM WJ85) and in the bays of Čulišičke bare (UTM WJ75) and Polje (Rupe) (UTM WJ76). Birds were sighted in other areas of the National Park (Miljevci, Gornji Radići) but nesting was not confirmed (Kralj 2007). The population size in the Krka National Park in 2003 was around 160 pairs (Kralj 2007).

On 12 April 2004 we detected Spanish sparrows nesting in Pakovo Selo (UTM WJ85), with 11 nests in the canopies of five Mediterranean hackberry trees, *Celtis australis*, and six nests and 10-12 birds on three Mediterranean hackberry trees in a courtyard in Konjevrate (UTM WJ84). Because the Spanish sparrow had not been recorded in the Konjevrate area in the past and because Marguš (2005) did not include the species in the list of the birds of that area, it is possible that the observed pairs were the first to settle in the area.

We were not able to count or estimate the number of pairs nesting on buildings in Skradin. In this area, the Spanish sparrow mostly has chosen canopies of planted introduced trees (Table 1). In 2004 native trees accounted for 17% ($n = 21$) of all nest trees, and in 2007 for no more than 6% ($n = 10$) (Table 1). In 2007, 171 nests were recorded in Skradin (UTM WJ75) alone (Table 1). This number exceeds the entire population of the Krka National Park recorded by Kralj (2007) in 2003.

In Skradin, the number of trees with nests in 2007 was somewhat smaller than in 2004 (Table 1), but the difference was not statistically significant (chi-square with Yates's correction = 0.33, $P = 0.56$). However, the number of nests in 2007 was higher, although, again, not statistically significant (chi-square with Yates's correction = 3.29, $P = 0.07$).

In Čulišičke bare eight to ten pairs of Spanish sparrows were found nesting on houses and in the canopies of Poplar (*Populus nigra* cv. *italica*) and Almond (*Prunus amygdalus*) trees from 2004 to 2005 (Mužinić and Purger 2007). No new nests were recorded in 2006. From 2004 to 2006, in Čulišičke bare 50-60% of nests ($n = 5-6$) were located on buildings. In 2007, we counted 58 nests (83%) on 20 Poplar trees, and eight nests (11%) on three Walnut (*Juglans regia*) trees. Four nests (6%) were found under eaves and gutters of houses in Čulišič. While between 2004 and 2006 only around ten pairs nested in Čulišičke bare, the number had increased to 70 in 2007. Marques et al. (2002) also reported that nest location was highly variable with respect to the chosen tree species, age and structure.

In the study area, Spanish sparrows most often nested in the canopies of planted introduced tree species (e.g. *Morus alba*, *Platanus occidentalis*, *Populus nigra* cv. *italica*) (Table 1), which, combined good access to and diversity of potential nesting sites, enables a further expansion of the species.

Taking all results into account, we conclude that 300-350 pairs of Spanish sparrows nested in the wider area of Krka National Park in 2007. The number of nests in relation to available nesting locations probably did not reach its limit yet in Skradin or Čulišićke bare. This is confirmed by the finding that 60 nests of Spanish sparrows were observed on a single Plane tree in the centre of Skradin, while a neighbouring Plane tree had no nests at all. It is also evident that nests were found on 26 (16%) of the total number of 160 existing mulberry trees in Skradin. In Čulišićke bare, Spanish sparrows placed their nests in Poplars, using around 20 of the total of 42 trees in the avenues. We propose that the size of the Spanish sparrow population was not limited by access to nest sites but by some other limiting factor such as food or competition. Our observations of differential nest distribution within a colony, with highest density in the central part, support reports by Marques et al. (2002), confirming that colonies are constrained by nest predation.

The colony of 60 nests on a single plane tree in Skradin in 2007 is close to the largest colony of Spanish sparrows ever recorded on a single tree in Croatia. A colony of 100 nests was observed in Islam Latinski, District of Zadar, on 31 July 2001, on the about 250 years old "Green oak", *Quercus viridis*, a hybrid between the Austrian oak (*Quercus cerris* f. *austriaca*) and the evergreen Holm oak (*Q. ilex*) (Štahan 2001, Devčić- Buzov 2006).

Our results confirm that between 2004 and 2007 in the wider area of the Krka National Park the Spanish sparrow had occupied new localities and that the number of 160 pairs recorded in 2003 had more than doubled by 2007. Nests were preferably built in canopies of planted introduced tree species, confirming the adaptability of the Spanish sparrow. Our conclusions support those by Martin and Fitzgerald (2005) who argued for the House sparrow, *Passer domesticus*, that "a predilection for trying new foods and being attracted to novel objects may in part explain how this species has so successfully invaded new areas".

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