

THE KESTREL *Falco tinnunculus* IN SLOVENIA – A REVIEW OF ITS DISTRIBUTION, POPULATION DENSITY, MOVEMENTS, BREEDING BIOLOGY, DIET AND INTERACTIONS WITH OTHER SPECIES

Postovka *Falco tinnunculus* v Sloveniji – pregled njene razširjenosti, populacijske gostote, disperzije, gnezditvene biologije, prehrane in interakcij z drugimi vrstami

TANJA ŠUMRADA¹ & JURIJ HANŽEL²

¹ Župančičeva 14, SI–1000 Ljubljana, Slovenija, e-mail: sumrada.tanja@gmail.com

² Židovska ulica 1, SI–1000 Ljubljana, Slovenija, e-mail: jurij.hanzel@gmail.com

The paper discusses the breeding and non-breeding distribution and population density of the Kestrel *Falco tinnunculus* in Slovenia, its movements, breeding biology, hunting behaviour, diet and interactions with other species. The data were collected from published works and directly from observers. The species' breeding distribution is shown as a comparison of both national breeding bird atlases, which indicated no convincing changes in its distribution. The non-breeding season population estimate (1,000–2,000 ind.) is lower than the breeding population estimate (1,500–2,000 pairs). The Kestrel breeds at altitudes from 0 to 2,050 m a.s.l.; outside the breeding season, it has been observed at altitudes of up to 1,700 m a.s.l. At least part of the breeding population migrates, apparently more or less towards SSW. The breeding season lasts from February to July. It nests in trees, buildings, cliffs, nestboxes and on electricity pylons. In trees it uses abandoned nests of corvids. On buildings it nests mainly on ledges and in various openings. It often nests on industrial and residential buildings. On cliffs it nests in natural openings and in abandoned nests of other species. It lays 3–9 eggs, usually five. It hunts over open terrain by windhovering, active aerial pursuit and stooping onto the ground from perches. It feeds mainly on small mammals and, to a lesser extent, on passerines, reptiles and invertebrates. It interacts with other species during hunting, nest-site selection and breeding itself. Platyhelminthic, nematode, ixodid and insect parasites have all been recorded on the Kestrel.

Key words: Kestrel, *Falco tinnunculus*, Slovenia, distribution, population density, movements, breeding biology, diet, interactions

Ključne besede: postovka, *Falco tinnunculus*, Slovenija, razširjenost, populacijska gostota, disperzija, gnezditvena biologija, prehrana, interakcije

1. Introduction

The first to mention the Kestrel *Falco tinnunculus* in the territory of Slovenia was probably SCOPOLI (1769), who wrote that the species was “not rare in Carniola”. ZOIS (1790/1800) referred to it with the vernacular name “postojka”. In the 19th century, the species was described by various authors from different parts of Slovenia. On the coast, where it was believed to be uncommon, its breeding was recorded in Koper, Piran and the Sečovlje valley (SCHIAVUZZI 1879). In Carniola, it was a common species (ERJAVEC 1995),

nesting in cliffs, castles and towers (FREYER 1842). Around Celje it nested in cliffs and coniferous trees (SEIDENSACHER 1864), while its breeding in Štajerska at the beginning of the 20th century is described by REISER (1925). Interestingly, he wrote that it was rarer than the Lesser Kestrel *F. naumanni* at the time.

In the second half of the 20th century, the breeding (GEISTER 1995) and wintering (SOVINC 1994) populations were surveyed and their sizes estimated within the two ornithological atlases. Most studies of the species were performed in Primorje (e. g. LIPEJ 1993 & 1997, MARČETA 1994A). The first mention of

its breeding in the region from this period was from Sečovlje, where a pair nested in a belfry (GREGORI 1976A). ŠMUC (1980) made the first mention of the species nesting in abandoned saltworkers' houses. This was followed by intense monitoring of the Kestrel's breeding population in Sečovlje salina from 1983 (LIPEJ 1993) to 1993, when the last pairs bred there (MARČETA 1994A). Elsewhere in Slovenia, it is mentioned as a breeder in several local faunistic overviews (e. g. JANČAR 1997, JANČAR & TREBUŠAK 2000, TOME *et al.* 2005). Two dedicated surveys of the species have also been carried out: one in Ljubljana (HANŽEL & ŠUMRADA 2008) and the other in Celje (GAMSER 2008). Breeding ecology and biology were studied by MARČETA (1994A), while the rest of published works concern mainly random observations (e. g. DENAC 1991, ŠEGULA 2001).

The aim of this paper is to analyse all available expert knowledge on the Kestrel in Slovenia from 1950 to 2012. It presents data on its distribution, population density, movements, breeding biology, hunting, diet and known examples of interactions with other species.

2. Materials and methods

2.1. Sources of data

Data on the Kestrel in Slovenia were obtained from expert ornithological and biological literature, as well as directly from observers.

We used two methods to search for data in the literature: (1) We utilised the string "Ključne besede=ptiči ALI Ključne besede=ptice" ("Key words=ptiči OR Key words=ptice") to search The union bibliographic/catalogue database (COBIB. SI). Sources published before 1950 and works published in *Acrocephalus* were excluded from the search. We checked all search results until the end of 2011, excluding fictional works. (2) We checked all volumes of the following journals: *Acrocephalus* (ISSN 0351-2851), *Acta Biologica Slovenica* (ISSN 1408-3671, ISSN 0520-1969), *Annales* (ISSN 1408-533X, 0353-8281), *Biota* (ISSN 1580-4208), *Falco* (ISSN 1318-5411), *Natura Sloveniae* (ISSN 1580-0814), *Scopolia* (ISSN 0351-0077), *Svet ptic* (ISSN 1580-3600), *Varstvo narave* (ISSN 0506-4252) and *Zbornik Biotehniške fakultete Univerze v Ljubljani: Veterinarstvo* (ISSN 1408-3442, 0300-0362) up to and including the last issue published in 2011. In addition, we checked all bachelor's, master's and doctoral theses concentrating on ornithology.

Published works were divided in four categories

according to their topic: (1) systematic distribution surveys, (2) ecological and/or biological studies, (3) results of ringing and (4) other works. A given work was allocated to a single category. The first category contains dedicated surveys of the Kestrel and faunistic surveys that mentioned the species in their results, regardless of the study area size. The second category contains works reporting results of detailed research on the ecology and biology of the Kestrel, either independently or together with other species. The fourth category contains all other works, including reports on random observations, local reviews of observations, expert discourses and popular science articles.

We contacted observers by email or telephone. This request for information included all Slovenian observers, who have published their works in *Acrocephalus* in the past 10 years, or those who publish their observations on news groups Ljubitelji ptic and LSDOPPS. In total, we contacted 118 observers, from whom we gathered unpublished data about nests. The reporting form requested the following information: nest-site location, year of discovery, years of nesting, type (building, tree, cliff, other) and subtype (more detailed classification within a type) of nest-site, placement of nest (more precise localisation on a building or tree), tree species (only for nests in trees) and height of nest from the ground (judged to a 5-metre interval). It was possible to add optional data on the temporal course of breeding, number of nestlings, breeding success and miscellaneous interesting observations. The altitude above sea level was determined using the location given and Google Earth to an accuracy of 10 m. The same sample of observers was used to gather data on observations from the non-breeding season, from alpine areas, of observed flocking and of interactions with other species.

2.2. Distribution and population density

The distribution and size of the breeding population in Slovenia was based on Ornithological Atlas of Slovenia (GEISTER 1995) and the database of the New Ornithological Atlas of Breeding Birds in Slovenia (NOAGS) (DOPPS *unpubl.*). Data are shown in a 10 × 10 km UTM grid.

At the local and regional levels, various bird surveys from past decades contributed to the knowledge on the Kestrel breeding distribution (e. g. VREŠ & VRHOVNIK 1984, GREGORI 1989, ŠKORNIK *et al.* 1990, POLAK 1993, LIPEJ & GJERKEŠ 1994, VOGRIN 1997, VREZEC 1997, SURINA 1999, TOME 2001,

POKORNY 2003, VOGRIN 2004, VOGRIN & MIKLIČ 2004B, GREGORI & ŠERE 2005, MOHAR 2005). Due to the spatial scattering of study areas, non-uniform methodology and differences in the duration of field work, a comparison of these results is not given.

Breeding density was calculated based on results of local surveys and expressed as the number of breeding pairs per 1 km². If the number of breeding pairs in an area was given as an interval, the mean was used for calculation. The size of the study area was adopted from the literature or calculated using the Geographic information system (GIS). Altitude above sea level was determined to an accuracy of 50 m. The study areas were divided by statistical region within Slovenia (SURS 2011) and allocated to habitat type based on the description of the study area. The breeding density for Sečovelje salina is given as a mean for the 1983–1993 period (LIPEJ 1993, MARČETA 1994A). The breeding population in Maribor was estimated using data from observers and published literature. For the cliffs of Kraški rob, MARČETA (1994A) expressed breeding density in 1991–1994 as the number of nests per length of cliffs (28 km) from the border with Italy north of Socerb to the border with Croatia at Mlini.

The wintering population was systematically surveyed within The Atlas of Wintering Birds in Slovenia (SOVINC 1994). If the number of wintering individuals in an area was given as an interval, the mean was used for calculation of density.

To determine urban distribution, all settlements with more than 3,000 inhabitants were defined as urban. This criterion is met by 67 settlements in Slovenia (SURS 2011).

2.3. Diet

MARČETA (1994A) analysed pellets from nests and roosts, as well as prey remains from plucking posts at or near the nests. Percentage of prey units of a single type was calculated relative to the total number of prey units in pellets, whereas the percentage of prey biomass was assessed relative to the total biomass of prey. The biomass of a given prey type was defined as the product of the number of prey units and the mean mass of a given prey type, based on estimates from literature. The percentage of pellets containing a given prey type relative to the total number of pellets was also calculated. In Sečovelje salina, 155 pellets were studied and 100 at Kraški rob. The percentages are calculated based on the number of pellets in a given area. Plucking posts were defined as sites where Kestrels ate their prey and left its remains. The prey units identified by direct observation and photography

at nests were added to the number of prey units found at plucking posts. Because only scales and claws of lizards were ever found, this was counted as a single prey unit in a given pellet (MARČETA 1994A).

2.4. Statistical analysis

Mean numbers of nestlings in nests of different types were compared with one-way analysis of variance (ANOVA). Mean dimensions of eggs and mean numbers of nestlings in nests in trees and on buildings were compared with an unpaired *t*-test for equal variances. SPSS 20.0 (IBM 2011) was used for the analysis.

3. Results and discussion

3.1. Sources of data

In total, we gathered 190 published works, distributed by categories as follows: (1) systematic distribution surveys – 56, (2) ecological and biological research – 21 (12 of which were studies on parasites), (3) results of ringing – 10 and (4) other works – 103. Unpublished data on nests was gathered from 34 observers. Data on miscellaneous observations was gathered from 18 observers (excluding observers that sent data both on nests and miscellaneous observations).

3.2. Distribution and population density

Breeding distribution and densities

A comparison of the results of Ornithological Atlas of Slovenia (GEISTER 1995) and data from the database of NOAGS (DOPPS *unpubl.*) showed that the Kestrel was registered in more squares in the more recent atlas survey (193 vs. 132). This difference could be a consequence of better coverage, while data on a possible population expansion in the past two decades are not known. In the more recent atlas, the Kestrel was absent from nine squares in which it had been present in the first atlas (Figure 1). Eight of these squares include the state border. GEISTER (1995) estimated the national population at 1,500–2,000 breeding pairs.

Although the reasons given in the Materials and methods jeopardise the validity of a comparison, calculated densities at the local level (Table 1) (mean 0.5 pairs/km²) are lower than those based on results of farmland bird surveys in Slovenia in 2010 (1.13 pairs/km²) and 2011 (1.61 pairs/km²) (DOPPS 2011). The mean breeding density for the cliffs of Kraški rob was 0.2 pairs/km (MARČETA 1994A).

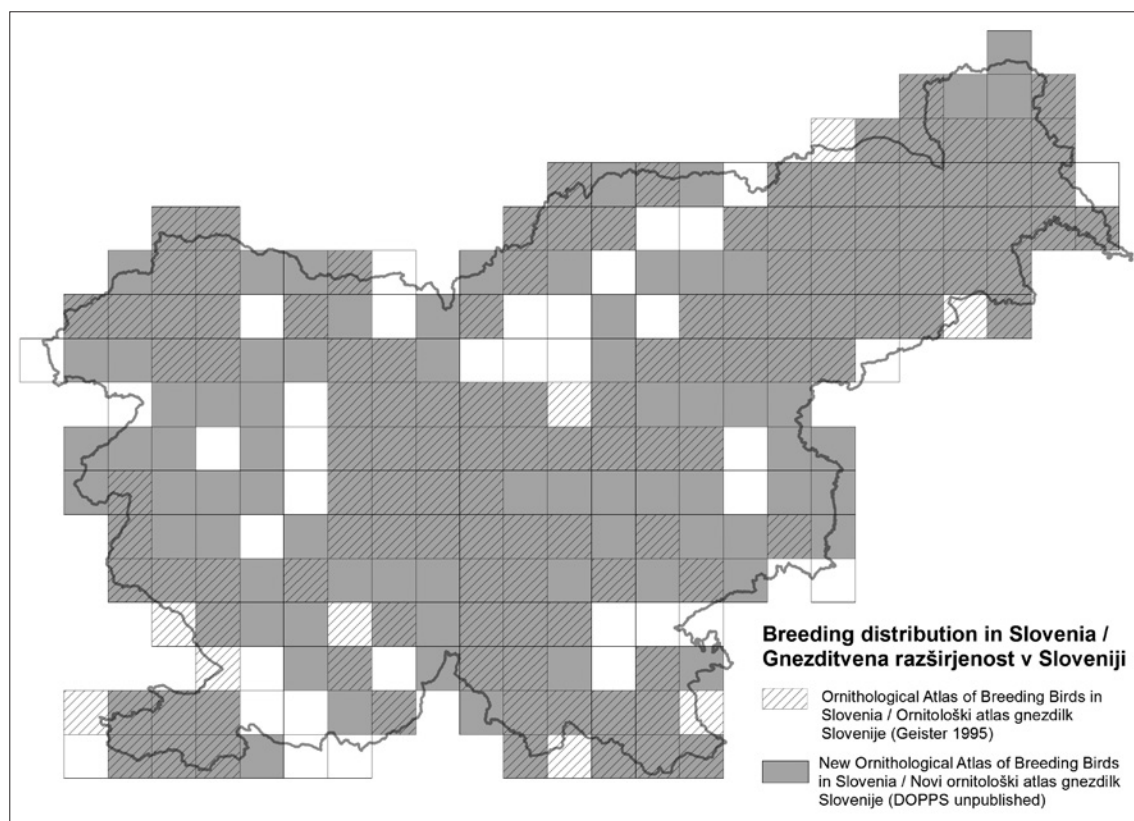


Figure 1: Breeding distribution of the Kestrel *Falco tinnunculus* in Slovenia; adapted from GEISTER (1995) and DOPPS (*unpubl.*)

Slika 1: Gnezditvena razširjenost postovke *Falco tinnunculus* v Sloveniji; povzeto po GEISTER (1995) in DOPPS (*neoblj.*)

Winter distribution and densities

The national estimate of the wintering population (1,000–2,000 individuals) (SOVINC 1994) was lower than the breeding estimate (GEISTER 1995). At Ljubljansko barje, Kestrels overwinter (ŠERE 1984), but the wintering population is smaller than the breeding one, although quantitative data are not known (TOME *et al.* 2005). A similar trend was noted in the Dol pri Ljubljani community (TRONTELJ 2008). The numerical difference in size between the two populations was not given. Based on monitoring in 10-day periods it was found that the number of individuals in the vicinity of Medvedce reservoir is lower in winter than in the warmer part of the year (BORDJAN & BOŽIČ 2009). In the Municipality of Ljubljana, the number of individuals counted in winter (28 individuals in polygons, 15 along all homogenous transects) was considerably lower than in the breeding season (Tables 1 & 2) (TOME *et al.* 2011). In winter, Kestrels can be found in the inner city of Ljubljana as well (SOVINC & ŠERE 1993 & 1994).

In Central Europe, the Kestrel is a partial migrant (CRAMP 1980). The population structure (ratio of immigrating individuals and individuals from the local breeding population) and behaviour of wintering individuals are hard to predict and mostly depend on local circumstances and weather (VILLAGE 1990, RIEGERT & FUCHS 2011). In contrast to the breeding season, Kestrels in winter are highly territorial and maintain their hunting territories (VILLAGE 1990). Despite known local densities (Table 2) (mean 0.2 ind./km²), a complete elucidation of the Kestrel's wintering in Slovenia requires further research.

The Kestrel overwinters in Slovenia even in years when the snow cover is several decimetres high (ŠERE 1984, BOŽIČ & BOMBEEK 2003). The influence of snow cover and other weather factors on winter distribution and density in Slovenia is unknown. The number of days with snow cover negatively influences the wintering population with birds subsequently leaving the area (partially migratory population from the Czech Republic, RIEGERT & FUCHS 2011) and

Table 1: Breeding densities of the Kestrel *Falco tinnunculus* in Slovenia (A – agricultural landscape, C – costal habitat, G – grassland, U – urban, W – woodland, IBA – Important Bird Area)**Tabela 1:** Gnezditvene gostote postovke *Falco tinnunculus* v Sloveniji (A – kulturna krajina, C – obalni habitat, G – travišča, U – urbano okolje, W – gozd, IBA – Mednarodno pomembno območje za ptice)

Region, study area/ Regija, območje raziskave	Habitat	Elevation (m a.s.l.)/ Nadmorska višina (m)	Year(s)/ Leto (-a)	No. of breeding pairs/ Št. gnezdečih parov	Study area size/ Površina območja raziskave (km ²)	Breeding density (pairs/km ²)/ Gnezditvena gostota (pari/km ²)	Reference / Vir
Pomurska							
Veržej (Murska ravan)	A, W	200	1986	4	20.0	0.2	BIBIČ & JANŽEKovič (1989)
IBA Reka Mura / River Mura	A, W	200–250	1999	60–80	140.6	0.5	POLAK (2000)
Podravska							
Drava river between Maribor and Ptuj	A	250	1989–1992	16	76.0	0.2	BRAČKO (1997)
IBA Reka Drava / River Drava	A	150–300	1995–1999	35–40	83.0	0.7	POLAK (2000)
IBA Doli Slovenskih goric / Slovenske gorice	A	250–350	1993–2002	8–10	49.6	0.2	Božič (2003)
Golf-links Ptuj (Dravska ravan)	A	250	2003	1	0.6	1.7	VOGRIN & MIKLIČ (2004A)
Medvedce reservoir, Pragersko (Dravska ravan)	A	250	2002–2008	3	9.8	0.3	BORDJAN & Božič (2009)
Ptuj	U	250	2000–2010	3–5	9.0*	0.4	D. BOMBEK & L. Božič (<i>pers. comm.</i>)
Maribor	U	250	2000–2011	5–10	43.5*	0.2	this work / to delo
Savinjska							
Volččke (Savinjska ravan)	A	250	1993–1994	2	0.9	2.2	ŠTUMBERGER (1994)
Kozjansko regional park	A	100–600	1999	10–20	198.0	0.1	JANČAR & TREBUŠAK (2000)
Polzela (Savinjska ravan)	A	300	1998	2–3	13.7	0.2	VOGRIN (2000)
Celje	U	250	2008	8	22.5*	0.4	GAMSER (2008)
Ljubčna in Zadobrova (Savinjska ravan)	A	300	2008	7	8.1*	0.9	GAMSER (2008)
Spodnjeposavska							
Jovski (Krško plain)	A	150	1992–1993	1–2	4.6	0.3	TRONTELJ & VOGRIN (1993)
IBA Krakovski gozd / Krakovo forest	A, W	150	1999	4–6	40.0	0.1	POLAK (2000)
Sava river between Krško and Jesenice na Dolenjskem	A	150	2008	10–15	32.0	0.4	DENAC <i>et al.</i> (2009)

Continuation of Table 1 / Nadaljevanje tabele 1

Region, study area/ Regija, območje raziskave	Habitat	Elevation (m a.s.l.)/ Nadmorska višina (m)	Year(s)/ Leto (-a)	No. of breeding pairs/ Št. gnezdečih parov	Study area size/ Površina območja raziskave (km ²)	Breeding density (pairs/km ²)/ Gnezditvena gostota (pari/km ²)	Reference / Vir
Jugovzhodna Slovenija							
IBA Kočevsko - Kolpa	W	200–1300	1994–1999	10–15	990.0	0.0	POLAK (2000)
IBA Ribniška dolina / Ribnica valley	A, G	500–600	1994–1999	2–3	39.8	0.1	POLAK (2000)
Osrednjeslovenska							
Ljubljansko barje	A	300	1989–1996	30	180.0	0.2	TOME <i>et al.</i> (2005)
Ljubljana	U	300	2007	27	32.7	0.8	HANŽEL & ŠUMRADA (2008)
Community of Dol pri Ljubljani	A	300	2004–2005	?	33.3**	0.4	TRONTELJ (2008)
Municipality of Ljubljana	A	300–800	2010–2011	82–261	275.0**	0.5–1.8	TOME <i>et al.</i> (2011)
	U					1.0–3.0	
Gorenjska / Goriška							
Triglav national park	A, G, W	200–2850	1991–1996	31–100	839.8**	0.1	JANČAR (1997)
Notranjsko-kraška							
IBA Cerkiško jezero / Lake Cerknica	G	550–600	1992	2–4	35.0	0.1	POLAK (2000)
IBA Planinsko polje / Planina polje	G	450	1992–1999	1–2	16.0	0.1	POLAK (2000)
IBA Porečje Nanošice / Nanošiča river basin	A, G	550	1999	2–5	14.3	0.3	POLAK (2000)
IBA Dolina Reke / Reka valley	A	400–500	1994–1999	2–3	17.0	0.2	POLAK (2000)
Obalno-kraška							
Sečovelje salina (Fontanigge)	C	0	1983–1993	6.7 (3–12)	3.6	1.9 (0.8–3.4)	LIPEJ (1993), MARČETA (1994A)
Kraški rob	A, G	150–700	1980–1994	5–10	70.0*	0.1	LIPEJ & GJERKEŠ (1994)
IBA Kras	G, W	50–1050	1995–2000	4–8	580.0	0.0	POLAK (2000)
Čičarija	G	700–1000	2002	1	5.0	0.2	GEISTER (2002)

* Study area size was measured with GIS / Površina območja je bila izmerjena s pomočjo GIS, ** SURS 2011

also breeding density in the ensuing year (sedentary population from Germany, KOSTRZEWA & KOSTRZEWA 1991).

Alpine distribution

Most observations of the Kestrel above 1,500 m a.s.l., i.e. 12 published works, 15 records from observers and 13 records from the NOAGS database (DOPPS *unpubl.* – only records with exact location are included) are from the Julian Alps (GREGORI 1977, BIBIČ 1994, BRAČKO 1995B, DENAC 2010), in Triglav National Park even above 2,000 m a.s.l. (MATVEJEV 1983, JANČAR 1997). In the Kamnik-Savinja Alps, birds were observed at Kalška gora (1,800 m, July 2011), at Korošica under Ojstrica (1,900 m, August 2009) (M. GAMSER *pers. comm.*) and in Grintovci above 2,000 m a.s.l. (Božič 2003, DOPPS *unpubl.*). In the Western Karavanke, birds were observed on the ridge of Košuta at Veliki vrh (2,000 m, 12 Aug 2011, R. ROZMAN *pers. comm.*), at Begunjščica and Stol (RUBINIČ 2000, DOPPS *unpubl.*) and on the slopes of Vajnež (2,100 m, 11 Aug 2011, J. VIDMAR *pers. comm.*). In the Eastern Karavanke, an individual was observed on Peca at about 2,000 m a.s.l. (25 May 1988, BRAČKO 1990). Above 1,500 m a.s.l., Kestrels were observed also on Porezen (1,600 m, 6 Jul 2006, RIJAVEC 2007, DOPPS *unpubl.*) and Blegoš (1,550 m, 30 Jul 2000, VUKELIČ 2001).

The highest observation in Slovenia is from the summit of Grintavec in the Kamnik-Savinja Alps at 2,540 m a.s.l. (August 2012) (M. GAMSER *pers. comm.*). In the Austrian part of Carinthia, Kestrels have been observed at 2,200 m a.s.l. (FELDNER *et al.* 2006), in the French Alps up to 3,580 m a.s.l. (DUBOIS *et al.* 2008) and in Switzerland up to 3,000 m a.s.l. (highest observation at about 4,000 m a.s.l.) (MAUMARY *et al.* 2007).

Winter data from alpine areas are scarce. In Triglav National Park, the highest recorded Kestrel in winter was observed at 1,700 m a.s.l. (KMECL 1997). In Switzerland, Kestrels usually leave areas above 1,200 m a.s.l., except for some southern slopes that are not covered by snow. The highest wintering bird was observed at 2,500 m a.s.l. in 1993 (MAUMARY *et al.* 2007).

Urban distribution and densities

Most records and publications on the species' urban breeding are from Ljubljana. Apart from single observations from the past (ŠERE 1982, SOVINČ & ŠERE 1993 & 1994, SENEGAČNIK *et al.* 1998), a systematic survey of the species was carried out in the inner city in 2007 (HANŽEL & ŠUMRADA 2008).

Table 2: Winter density of the Kestrel *Falco tinnunculus* in Slovenia

Tabela 2: Gostota prezimujočih osebkov postovke *Falco tinnunculus* v Sloveniji

Region, study area/ Regija, območje raziskave	Elevation (m a.s.l.)/ Nadmorska višina (m)	Year(s)/ Leto (-a)	No. of wintering individuals/ Št. prezimujočih osebkov	Study area size / Površina območja raziskave (km ²)	Winter density (ind./km ²)/ Gostota prezimujočih osebkov (os./km ²)	Reference / Vir
Podravska						
Drava river between Maribor and Ptuj	250	1989–1992	20	76.0	0.3	BRAČKO (1995A)
Drava plain	250	2001	19	45.0*	0.4	BOŽIČ & BOMBEK (2003)
Medvedce reservoir, Pragersko (Drava plain)	250	2002–2008	0–4	9.8	0.2	BORDJAN & BOŽIČ (2009)
Osrednjeslovenska						
Municipality of Ljubljana	300–800	2010–2011	28	275.0**	0.1	TOME <i>et al.</i> (2011)

* Study area size was measured with GIS / Površina območja je bila izmerjena s pomočjo GIS, ** SURS 2011

The calculated breeding density in Ljubljana is relatively high compared to other European cities (HANŽEL & ŠUMRADA 2008). Within the preparation of the ornithological atlas of Ljubljana, a breeding population estimate was given for the entire municipality (TOME *et al.* 2011, Table 1). For Maribor, there are some published records of breeding in the city's surroundings (DENAC 1991, BRAČKO 1995A), but Kestrels also nest at several sites within the city itself (T. BASLE, F. BRAČKO *pers. comm.*). In Celje, Kestrels were surveyed in 2008 (GAMSER 2008). In the historical centre of Kranj, Kestrels were not recorded (GEISTER 1980). According to the observations from recent years, the species does not breed there and is observed in the centre only occasionally (B. BLAŽIČ *pers. comm.*). In a bird survey in Velenje in 1999, the Kestrel was not recorded (POKORNY 2001). In Koper it bred on the outskirts in silos of the Koper Harbour (LIPEJ 1997), while records of the species breeding in the city centre are not known (D. STANIČ *pers. comm.*). Kestrels also breed in Ptuj (D. BOMBEEK & L. BOŽIČ *pers. comm.*). Among smaller Slovenian towns, survey was performed in Žalec (VOGRIN 2006), but no Kestrels were recorded there.

3.3. Movements

The movements of the Slovenian Kestrel population can be interpreted using data from bird ringing scheme. These are published in the literature (Božič 1998 & 2009, ŠERE 2009) and stored in the database of the Slovenian Bird Ringing Centre, which operates within the Slovenian Museum of Natural History. We collected data on 34 recoveries of Slovenian-ringed birds from abroad and of birds ringed abroad and then recovered in Slovenia. There are no records of Kestrels that were both ringed and recovered in Slovenia. The oldest recovery is from June 1932, and the most recent recovery from December 2001. Most (58.8%) recoveries are from before 1950. An individual ringed as a nestling in Slovenia and recovered in Austria 1,892 days later (i. e. slightly more than 5 years) was the most longevous.

At least part of the Slovenian population migrates outside the borders of the country. A total of 977 Kestrels were ringed. Among these, 597 individuals (Božič 2009) were ringed between 1927 and 1982 and 380 between 1983 and 2008 (ŠERE 2009). 24 birds (0.03%) were recovered abroad. Most of the ringing was done between 1935 and 1940 (426 ind.) and most of the recoveries are also from this period (18 ind.). Recoveries were made in Austria (2 ind.), Croatia (4 ind.), France (1 ind.) and Italy (17 ind.).

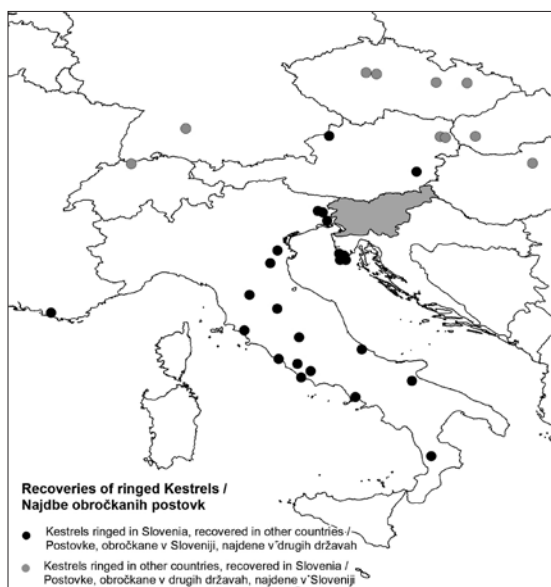


Figure 2: Recoveries of ringed Kestrels *Falco tinnunculus* in Slovenia and abroad (n = 34); adapted from Božič (2009), ŠERE (2009) and data from the Slovenian Bird Ringing Centre

Slika 2: Najdbe obročkanih postovk *Falco tinnunculus* v Sloveniji in tujini (n = 34); povzeto po Božič (2009), ŠERE (2009) in podatkih Slovenskega centra za obročkanje ptic

These Kestrels were ringed as nestlings (15 ind.), first-years (1 ind.), adult males (2 ind.) and adult females (3 ind.). For three individuals, the sex and age were unknown. Except for a single adult male ringed on 17 Sep, the rest were ringed between 10 May and 20 Jul, i. e. during the breeding season.

Individuals recovered abroad were caught (1), found shot (21), found dead following a traffic incident (1), and found dead after electrocution (1). The median (Interquartile range) distance travelled was 362 (358) km (all birds, n = 24) and 370 (247) km for juveniles. Birds ringed as nestlings were found dead (n = 14) a median (IQR) 202 (376) days after ringing. Most nestlings (n = 8) did not survive their first year. Mortality is highest in the first year of life (SPINA & VOLPONI 2008). Surviving juveniles can, provided that there is enough food and unoccupied territories, start breeding in the following breeding season (VILLAGE 1990).

The main direction of movement for Slovenian birds appeared to be SSW (Figure 2), but the small sample size and recovery bias need to be taken into account. Birds ringed as nestlings were found in their first autumn in Croatia (1 ind.) and Italy (6 ind.) and in their first spring (2 Apr) in Italy (1 ind.). Other birds ringed as nestlings were recovered later in their

life. Birds ringed as nestlings in Austrian Carinthia were found in Ibiza and Morocco (FELDNER *et al.* 2006). Dispersal of juveniles begins in July after the breeding season. Most migrate within 50–100 km of their nests (KOSTRZEWA & KOSTRZEWA 1993) in all directions (CEPÁK *et al.* 2008).

Other recoveries of birds of a known age ($n = 13$) were made in late summer and autumn (31 Jul–24 Oct, 9 recoveries), winter (20 Dec–20 Jan, 3 recoveries) and spring (31 Mar, 1 recovery). In summer and autumn, individuals were recovered in Austria (1), France (1) and Italy (7), in winter in Austria (1) and Italy (2), and in spring in Italy (1). Due to the lack of recoveries, the percentage of adults returning to their nest-sites in Slovenia cannot be assessed, although site fidelity is known to be very high (94%) (CEPÁK *et al.* 2008).

A total of 10 Kestrels from abroad were recovered in Slovenia. They were from Austria (2), the Czech Republic (4), Germany (1), Hungary (1), Slovakia (1) and Switzerland (1). They had been ringed as nestlings (7) or their sex and age were unknown (3). Except for one individual of unknown sex, ringed on 3 Mar, the rest were ringed between 20 May and 14 Aug. Individuals were caught (1), found shot (3), found dead after traffic incidents (2) and found dead due to an unknown cause (4). Birds ringed as nestlings were found dead ($n = 7$) a median (IQR) 300 (157) days after ringing. Three birds did not survive their first year.

Several authors observed large numbers of Kestrels in Slovenia mostly in August and September – 15 individuals at lake Cerknica on 9 Sep 1994

(SENEGAČNIK *et al.* 1998), 34 individuals at the same site on 21 Jul 2011 (A. ŠKOBERNE *pers. comm.*), and 25 individuals at Nanos on 18 Sep 2007 (D. STANIČ *pers. comm.*) A similar phenomenon was observed in England and Scotland in September. Most birds were juveniles hunting close to one another in a single area, before winter territories became established (VILLAGE 1990). In Slovenia, flocking was also observed in spring: 25 individuals at Ljubljansko barje on 5 Apr 1992 (RUBINIČ 1994) and 13 individuals in Štajerska on 14 Apr 1995 (BRAČKO 1996).

3.4. Breeding biology

Breeding phenology

The breeding season of the Kestrel in Slovenia lasts from February to July (Table 3). Birds arrive at their breeding grounds in late February and early March (MARČETA 1994A & 1994B, KMECL 2001). Territorial flights at Kraški rob began in the second half of March when the birds also copulated (MARČETA 1994A). In Gorenjska and at Ljubljansko barje birds copulated in April (GEISTER 1983, SOVINC & ŠERE 1994). Copulation can occur earlier: copulation was observed on 1 Feb in Hoče (SOVINC & ŠERE 1996). Kestrels in Sečovlje salina began laying eggs between the first third of April and the first third of June, most commonly in the last third of April (MARČETA 1994A). Egg-laying at Kraški rob occurred in May, most commonly in the first two thirds (MARČETA 1994A). At Ljubljansko barje, egg-laying was observed on 6 May (JUREČIČ 1992). In

Table 3: Breeding phenology of the Kestrel *Falco tinnunculus* in Slovenia. The table is based on data cited in the text.

Tabela 3: Fenologija gnezditve postovke *Falco tinnunculus* v Sloveniji. Tabela je izdelana na podlagi podatkov v besedilu.

Breeding activity/ Gnezditvena aktivnost	February/ Februar			March/ Marec			April/ April			May/ Maj			June/ Junij			July/ Julij			August/ Avgust		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Arrival at breeding grounds/ Prihod na gnezdišče																					
Copulation / Kopulacija																					
Beginning of egg-laying/ Začetek leženja jajc																					
Hatching / Izvalitev																					
Fledging / Speljanje																					
Chicks' staying in vicinity of nest/ Zadrževanje mladičev v okolici gnezda																					

Ormož, an incubating female was observed on 6 Apr (D. DENAC *pers. comm.*). This means that the first egg was laid on 1 Apr at the latest, given that females lay individual eggs at 2-day intervals and begin incubating after the third egg (VILLAGE 1990). Based on available data, females in Slovenia also lay eggs at 2-day intervals (JUREČIČ 1992) and begin incubating after the third or fourth egg (JUREČIČ 1992, MARČETA 1994A). The latest known case of breeding was from Koper, where a nest with eggs was found on 26 Jul – it is unknown whether this was the first or second clutch (LIPEJ 1997). In Sečovlje salina (MARČETA 1994A) and in Ormož (D. DENAC *pers. comm.*), the first chicks hatched in the last third of May and the first third of June, at Ljubljansko barje in the second third of June (JUREČIČ 1992) and in Ljubljana in the last third of June (KMECL 2001). At Ljubljansko barje, the last chick hatched two days after the first one (JUREČIČ 1992). Chicks at Ljubljansko barje and in Ljubljana fledged in the second third of July, chicks from a different nest in Ljubljana as early as on 10 Jun (D. DENAC *pers. comm.*). After fledging,

the chicks remain near the nest throughout July and August (JUREČIČ 1992, MARČETA 1994B). The breeding season of Kestrels utilizing nests that had been used in the same season by Carrion Crows *Corvus cornix* and Ravens *Corvus corax* differs markedly from the temporal course described above. These Kestrels start breeding in the second half of May (D. BORDJAN *pers. comm.*) Such breeding has been documented in several consecutive years at the same location and is therefore probably due to occupancy of suitable nest-sites, rather than a failure of the first clutch.

Nest distribution

Kestrels mainly breed solitarily, but concentrations of nests at certain sites have been recorded: in Sečovlje salina, eight pairs bred in 1989 on 3.6 km²; the mean distance to the closest neighbouring nest was 384 m (shortest distance 110 m) (MARČETA 1994A), in the Ter cliffs in Savinjska valley six pairs bred in 1983 (CERAR 1986), but the size of these cliffs is unknown. Concentrations also occur around blocks of flats in

Table 4: Type, subtype and height of urban and non-urban nest-sites of Kestrel *Falco tinnunculus* (n = 116) (U – urban nest-site, N – non-urban nest-site)

Tabela 4: Tip, podtip in višina urbanih in neurbanih gnezdišč postovke *Falco tinnunculus* (n = 116) (U – urbano gnezdišče, N – neurbano gnezdišče)

Type and subtypes of nest site/ Tip in podtipi gnezdišča	No. of nests/ Št. gnezd		Percentage/ Odstotek (%)		Nest height, measured from ground level (median, interquartile range)/ Višina gnezda od tal (mediana, interkvartilni razmik) (m)	
	U	N	U	N	U	N
Park, tree row or group of trees/ Park, drevored ali skupina dreves	8	12	18.2	16.7	10.6 (6.3)	13.8 (5.6)
Solitary tree / Posamezno drevo	6	14	13.6	19.4	12.5 (5)	9.1 (8.1)
Forest edge / Gozdni rob	1	3	2.3	4.2	17.5 (–)	6.3 (–)
Forest / Gozd	3	4	6.8	5.6	12.5 (6.9)	16.3 (6.3)
Other / Drugo	0	1	0.0	1.4	–	2.5 (–)
Tree / Drevo	18	34	40.9	47.2	11.4 (5.3)	11.3 (7.9)
1- or 2-storey residential building/ 1- ali 2-nadstropna stanovanjska stavba	1	6	2.3	8.3	2.5 (–)	6.9 (3.8)
Multi-storey residential building/ Večnadstropna stanovanjska stavba	12	0	27.3	0.0	19.5 (7.7)	–
Church / Cerkev	4	6	9.0	8.3	17.5 (12.0)	7.5 (5.0)
Industrial building / Gospodarsko poslopje	7	7	15.9	9.7	15.0 (17.5)	20.0 (16.3)
Castle or ruins / Grad ali razvaline	1	4	2.3	5.6	12.5 (–)	12.5 (8.8)
Building / Stavba	25	23	56.8	31.9	18.2 (10.4)	9.0 (10.8)
Cliff / Skalna stena	0	8	0.0	11.1	–	38.1 (11.9)
Electricity pylon / Steber daljnovoda	1	5	2.3	6.9	12.5 (–)	20.0 (13.3)
Other / Drugo	0	2	0.0	2.8	–	7.5 (–)
Total / Skupaj	44	72	100.0	100.0	11.7 (8.8)	13.3 (11.3)

towns: in Podlubnik at the outskirts of Škofja Loka, four nests were found on 2 ha (M. PODLOGAR *pers. comm.*). Concentrations in such areas are also known from abroad: in Novi Sad, eight nests were found on 8 ha (RUŽIĆ *et al.* 2010).

Nesting sites

We gathered data on 116 Kestrel nests in Slovenia. The oldest record was from 1987, the most recent from 2011 (median = 2008). The lowest nest was at 150 m a.s.l., the highest at 1,750 m a.s.l. (median = 290 m, IQR = 110 m). Based on available data, the lowest nest found in Slovenia was in Sečovlje salina (1.5 m) (MARČETA 1994A) and the highest in Triglav National Park (2,050 m) (JANČAR 1997). In the French Alps, Kestrels breed up to 2,500 m a.s.l. (DUBOIS *et al.* 2008), whereas in Switzerland the highest lying nests were at 2,650 and 2,850 m a.s.l. (MAUMARY *et al.* 2007). In Austrian Styria, the highest lying nests was at 1,940 m a.s.l., while fledged nestlings were often observed up to 2,400 m a.s.l. (SAMWALD 1997).

The Kestrels nested in trees, on buildings, cliffs, electricity pylons, hayracks and in electrical enclosure on lamp posts. Nests were most commonly (n = 52) in trees in abandoned nests of other species (Table 4), which is similar to published data (GREGORI 1972, DENAC 1991, BRAČKO 1997, GREGORI 2002, GREGORI & ŠERE 2005, TRONTELJ 2008). In urban areas, the highest proportion of nests was in groups of trees (parks, lines of trees), while in non-urban environment the majority were in solitary trees (Table 4). Contrary to our data and results of local bird surveys from other parts of Slovenia, Kestrels at Ljubljansko barje do not nest in forests and their edges (TOME *et al.* 2005). Nests were found both on coniferous and broad-leaved trees (Table 5), which is similar to the results of other authors (KOZINC 2003). For 32 (61.5%) of all nests in trees, the species that had built it was identified: 19 were built by Carrion Crow, 11 by Magpie *Pica pica* and one each by Jay *Garrulus glandarius* and Raven. Kestrels have been observed occupying nests of these species by other authors as well (SOVINC *et al.* 1993, BRAČKO 1997, ŠERE 1997, VOGRIN 2009).

Among nests on buildings (n = 48), those on industrial buildings such as factory halls and silos predominated (Table 4). Nests were built on ledges or in different openings, such as ventilation shafts. Breeding on such buildings is also described by SOVINC & ŠERE (1993), LIPEJ (1997), KMECL (2001), GREGORI & ŠERE (2005) and TRONTELJ (2008). Among the nests, for which the state of the building was determined (n = 40), 35 (88%) were on actively used buildings. On residential buildings nests were in

Table 5: Tree species with Kestrel *Falco tinnunculus* nests (n = 52)

Tabela 5: Drevesne vrste, na katerih so bila najdena gnezda postovke *Falco tinnunculus* (n = 52)

Tree species/ Drevesna vrsta	No. of nests/ Št. gnezd	Percentage/ Odstotek (%)
<i>Picea</i> sp.	19	36.5
<i>Quercus</i> sp.	10	19.2
<i>Pinus</i> sp.	6	11.5
<i>Tilia platyphyllos</i>	6	11.5
<i>Populus</i> sp.	3	5.8
<i>Betula</i> sp.	2	3.9
<i>Robinia</i> sp.	2	3.9
<i>Salix alba</i>	2	3.9
<i>Prunus padus</i>	1	1.9
<i>Malus domestica</i>	1	1.9

attics, ventilation shafts, on balconies, windowsills and under the roof edges. Kestrels also nested on balconies of inhabited flats.

Ten nests were found on churches, which represents 17.3% of nests found on buildings. All the nests were in openings on belfries. Data collected by the Centre for Cartography of Fauna and Flora (CKFF) during bat surveys show that Kestrels bred on six out of 1,450 churches surveyed (CKFF 2011). Bat surveys were done in June (M. PODGORELEC *pers. comm.*). In a survey of 26 churches at Ljubljansko barje in 1986, no Kestrel nests were found, even though there were suitable openings on 15 churches (TOME 1986). The percentage of nests on churches in our survey is relatively high probably because belfries are conspicuous buildings and these nests were hence overrepresented in a random survey like ours.

On castles and ruins, the Kestrel nested in openings in walls and in attics. Based on data collected by CKFF (2011), it bred in one out of 25 castles surveyed. In Sečovlje salina, it nested in holes in walls of abandoned saltworkers' houses. Most of the nests were in holes that had an elevated bottom edge of the entrance. The substratum in these holes was fine sand. Nests in the salina (n = 29) were on average ($\pm$ SD) 3.2 ± 0.7 m (range 2.4–4.1 m) above ground, the average height of the entrance being 21 ± 5 cm (range 15–33 cm), the width 26 ± 7 cm (range 20–45 cm), and the depth 33 ± 7 cm (range 20–48 cm) (MARČETA 1994A).

All nests on cliffs (n = 8) were in holes on natural rock faces, as opposed to man-made cliffs, e. g. in quarries (Table 4). At Kraški rob, the holes were protected from precipitation and had a soft surface

into which Kestrels could dig a small depression to lay eggs into (MARČETA 1994B). The surface consisted of soil, feces, pellets and remains of prey. Also at Kraški rob, a Kestrel pair occupied a Jackdaw's *Corvus monedula* nest inside a hole in a cliff. Average ($\pm$ SD) measurements of nest entrances ($n = 14$) were: height from the ground 17 ± 2 m (range 14–21 m), height of entrance 31 ± 5 cm (range 25–40 cm), width 35 ± 13 cm (range 24–76 cm) and depth 44 ± 18 cm (range 20–80 cm) (MARČETA 1994A). Kestrels use cliffs as nesting localities also in the mountains (GREGORI 1972 & 1977).

Kestrels nesting on high-voltage electricity pylons ($n = 6$) occupied nests of Ravens and Carrion Crows. Breeding in nests of Carrion Crows on electricity pylons at Dravsko polje was surveyed by JANŽEKOVIČ & ŠORGO (1995). The authors believe that solitary trees, used as nesting sites by both species, had been cut down in the area due to developing agriculture. Electricity pylons thus became a surrogate nesting site for Carrion Crows, whose nests were then occupied by Kestrels (JANŽEKOVIČ & ŠORGO 1995). Among the nests reported by observers, four were at Dravsko polje and one each near Celje and in the Pomurje region.

One nest was found on a hayrack, which was previously described by GEISTER (1995). A nest was found in an electrical enclosure on a lamp post. There are no previous reports of such a nest-site in Slovenia.

Three nests were in nestboxes (one on a residential building, two on industrial buildings). Such breeding has already been recorded (JUREČIČ 1992, SURINA 1999, HAVLIČEK & KOGOVŠEK 2003). In the Štajerska region, nine nestboxes were mounted in the years 1999–2001, of which 80% were occupied in 2002 (DENAC 2002).

Eggs and clutch

The characteristics of Kestrel eggs were determined at Sečovelje salina and Kraški rob (MARČETA 1994A). The ground colour was white or a light brownish orange. An extreme example of coloration was an almost completely white egg with fine streaks at its blunt end. Spots were mainly brownish orange, on some eggs also dark- or light-brown. On some eggs, larger spots were concentrated on one half and smaller spots on the other, which made the eggs look darker on one half. A malformed egg was greyish brown with small brown spots. This egg was also smaller and more roughly textured than the rest. On average ($\pm$ SD), the eggs ($n = 81$) were 39.1 ± 1.1 mm (range 36.8–43.2 mm) long and 31.5 ± 0.7 mm (29.9–32.8 mm) wide. Eggs from Sečovelje salina ($n = 57$) and Kraški rob ($n = 24$) did not differ significantly in length (t -test, $t = 1.794$, $df = 79$, $P = 0.0766$), but the eggs from Kraški rob were

statistically significantly wider (t -test, $t = 2.474$, $df = 79$, $P = 0.0155$) by 0.4 mm.

In Sečovelje salina, a clutch contained a mean of five eggs (4–6, $n = 13$), while at Kraški rob near Črni Kal the mean clutch contained 4.8 (4–6, $n = 5$) eggs (MARČETA 1994A). On the edge of Trnovski forest, three eggs were found in a nest (it is unknown whether the clutch was complete) (T. VELIKONJA *pers. comm.*), at Ljubljansko barje five eggs were found (JUREČIČ 1992, ŠERE 1997), six near Lesce (B. KOZINC *pers. comm.*) and nine in Ljubljana (D. FEKONJA *pers. comm.*) A clutch of this size is rare; such examples are believed to involve clutches of two females (VILLAGE 1990, KOSTRZEWA & KOSTRZEWA 1993). The reasons for two females laying eggs in the same nest are not known.

Data on clutch size was reported for 31 nests, of which 13 were on buildings, 17 in trees and one on a hayrack. The percentage of nests on buildings is the same as in the entire sample, whereas the percentage of nests in trees is by 9.6% higher. The mean number of chicks ($\pm$ SD) was 3.0 ± 1.1 . Differences in mean number of chicks between nests on different structures ($F_{6,21} = 0.621$, $P = 0.712$) and differences in mean number of chicks between nests on buildings and in trees (t -test, $t = 0.6316$, $df = 28$, $P = 0.533$) were not statistically significant. Three successfully fledged chicks were observed in Ljubljana (KMECL 2001) and the same number in Čičarija (GEISTER 2002). At Ljubljansko barje, five chicks were observed on the nest, of which four fledged successfully (JUREČIČ 1992).

3.5. Hunting

Three methods of hunting have been observed in Slovenia: (1) hunting on the ground preceded by windhovering (VIDELER *et al.* 1983) (GREGORI 1986, KOZINC 2003), (2) active aerial pursuit (BRAČKO 1995B) and (3) hunting on the ground from a perch. Different structures are used as perches, e. g. power lines (POGAČAR *et al.* 2003), posts (MARČETA 1994A, VOGRIN 2000 & 2004), houses (MARČETA 1994A) and trees (ŠERE 1999). Hunting from a perch was also used by two individuals hunting vesper bats *Vespertilionidae* in Ljubljana. They used a ledge to prey on bats that landed on the wall at the entrance to their colony (ŠEGULA 2001). Kestrels can hunt bats also by active aerial pursuit, in which case they adapt their daily activity to the time when bats leave their colonies at dusk (NEGRO *et al.* 1992). Such hunting has not been observed in Slovenia and the events from Ljubljana were probably an exception to the usual hunting habits.

After a successful catch, the Kestrel often flies to

a nearby higher structure, such as a tree or electricity pylon (MARČETA 1994A, ŠERE 1999, ŠEGULA 2001). Hiding (VILLAGE 1990) or storing of prey near the nest (REJT *et al.* 2000) has not been observed in Slovenia, even though this has commonly been seen abroad and might influence breeding success (REJT 2006).

Kestrels in various parts of Slovenia hunt over open areas. These are most commonly meadows or fields (e. g. LIPEJ 1997, KERČEK 2005) and areas above the tree line in mountains (MATVEJEV 1983). In the centre of Ljubljana, Kestrels hunt on or between buildings (ŠEGULA 2001) and in small parks (HANŽEL 2011), or feed on the periphery of the city (SOVINC 1994).

The Kestrel's home-range does not necessarily correspond to the territory it defends actively. During breeding, males may fly some kilometres from the nest in search of food. Although hunting grounds of neighbouring pairs overlap, hunting individuals do not express territorial behaviour during their encounters. Even when nests of neighbouring pairs are close together, Kestrels actively defend only a small territory around the nest and avoid one another during hunting farther away (VILLAGE 1990). Kestrels from Sečovelje salina hunted on arable land and grasslands up to 2 km from their nests and did not interact with one another during hunting (MARČETA 1994A). Conflicts probably arise when the hunting range of an individual overlaps with the territory of another pair (RIEGERT *et al.* 2007), but studies that could demonstrate such a phenomenon have not been done in Slovenia. On the other hand, wintering Kestrels establish hunting territories, which they defend actively (VILLAGE 1990), especially if there is shortage of food (CRAMP 1980). Interactions during hunting in winter have not been documented in Slovenia.

Data on distance between nests and hunting grounds in Slovenia are scarce. Kestrels at Kraški rob flew up to 2.5 km away from their nests and descended as much as 300 m in altitude below their nests (MARČETA 1994A). In Ljubljana, all nests were within 4 km of large open areas on the periphery (HANŽEL & ŠUMRADA 2008). In conjunction with observational data we can surmise that Kestrels hunt both in the periphery and in the city itself during breeding. Research in cities of comparable size show that Kestrels, breeding in the city, hunt mostly on its periphery (RIEGERT *et al.* 2007).

3.6. Diet

The Kestrel's diet was studied by MARČETA (1994A), whose results are summarized in Table 6. In Sečovelje salina, 83 prey units were studied and 23 at Kraški rob.

In the Primorje region, mammals represented the highest percentage of biomass and appeared in most of the pellets (Table 6). Except for one bat, all other mammalian prey items were shrews Soricidae, voles Arvicolidae and mice Muridae. These were identified down to the level of genus (2) and species (5) (MARČETA 1994A). Elsewhere in Slovenia, single observations of voles caught by Kestrels are known (KOZINC 1987, ŠERE 1999, HAVLIČEK & KOGOVŠEK 2003). A Kestrel was also observed hunting at the entrance to a vesper bat colony (ŠEGULA 2001).

Only passerines have been recorded in Kestrel prey in Slovenia. MARČETA (1994A) identified them to the level of "Blackbird-sized passerine" and "Chaffinch-sized passerine", but examples of preying on sparrows *Passer* sp. (SOVINC & ŠERE 1993) and Alpine Accentors *Prunella collaris* (BRAČKO 1995B) are also known. VOGGIN (2009) believes that Kestrels prey on passerines mostly in winter.

In the Primorje region, several authors described reptiles as Kestrel's prey (LIPEJ 1997), specifically green lizards *Lacerta viridis* / *L. bilineata* (PLANINC 1994) and Italian Wall Lizards *Podarcis sicula* (LIPEJ 1988, MARČETA 1994A). Examples of preying on Common Wall Lizards *P. muralis* are known from Ljubljana (P. TRONTELJ *pers. comm.*). Remains of a Slow Worm *Anguis fragilis* and a colubrid snake Colubridae were found in pellets (MARČETA 1994A). At plucking posts, reptiles represented the highest percentage of prey units, but were less common in pellets (Table 6). The author noted that lizard skulls had never been found in pellets, while their bones were found only occasionally, probably due to digestion (MARČETA 1994A).

Invertebrates are less often mentioned as the Kestrel's prey (GREGORI 1986, LIPEJ 1997) than vertebrates. Invertebrates were common prey, but their contribution to biomass in pellets was small (Table 6). With the exception of one centipede *Scolopendra* sp. and one scorpion *Euscorpius* sp., all other prey units were insects. Insects of four orders (beetles Coleoptera, earwigs Dermaptera, mantises Mantoptera, grasshoppers Orthoptera) were identified. Furthermore, six families (Carabidae, Scarabaeidae, Forficulidae, Mantidae, Acrididae, Gryllotalpidae), two genera (*Cetonia*, *Geotrupes*) and two species (European Mole Cricket *Gryllotalpa gryllotalpa*, Praying Mantis *Mantis religiosa*) were identified (MARČETA 1994A).

The Kestrel's diet differs depending on latitude, regional characteristics of hunting grounds and time of year. Small mammals, mostly voles, are its main prey (CAVÉ 1968), while other prey types become an important alternative when the availability of small

Table 6: Diet of the Kestrel in Primorje based on pellet analysis; adapted from MARČETA 1994A (B – prey biomass, KR – Kraški rob, N – number of prey units, SS – Sečovlje salina)

Tabela 6: Prehrana postovke v slovenskem Primorju na podlagi analize izbljuvkov; povzeto po MARČETA 1994A (B – biomasa plena, KR – Kraški rob, N – število enot plena, SS – Sečoveljske soline)

Prey type/ Tip plena	Prey units/ Enote plena				Prey biomass/ Biomasa plena				Pellets containing a given prey type/ Pojavljanja plenav izbljuvkih (%)		Plucking posts/ Skubišča
	SS		KR		SS		KR		SS	KR	
	N	%	N	%	B (g)	%	B (g)	%	%	%	
Mammalia	124	19.7	86	31.5	2915.8	46.5	2632.4	63.1	78.7	81.0	22.6
Aves	38	6.0	18	6.6	1321.0	21.1	590.0	14.2	24.5	18.0	20.8
Reptilia	55	8.7	29	10.6	1622.0	25.9	864.0	20.7	35.5	29.0	50.9
Hexapoda	413	65.6	140	51.3	414.1	6.6	83.1	2.0	97.4	51.0	5.7
Total / Skupaj	630	100.0	273	100.0	6272.9	100.0	4169.5	100.0	–	–	100.0

mammals is low (VILLAGE 1990). In Slovenia, the diet of Kestrels in Sečovlje salina and at Kraški rob can be compared, whereas comparisons with other areas are not possible due to the lack of research. In general, the two areas did not differ in the percentage of reptiles and birds in prey (MARČETA 1994A). Small mammals were more important at Kraški rob, while there was a higher percentage of insects in Sečovlje salina. The author attributed these differences to hunting habitat characteristics, altitude (Kraški rob is at a mean altitude of 400 m a.s.l.), and the distribution of different prey types.

The diet of Kestrels breeding in urban environment can differ from that described above. KÜBLER *et al.* (2005) compared dietary ecology in three zones in Berlin that differed in density of buildings. Small mammals eaten by Kestrels on the periphery were replaced by birds in the city centre. On the other hand, a study in a small Czech town showed that small mammals were still the dominant prey type and that the distance of nest from the city centre did not influence their percentage in diet (RIEGERT *et al.* 2009). Due to a high breeding density in Ljubljana (HANŽEL & ŠUMRADA 2008), the diet of urban Kestrels in this and other Slovenian cities would be worth studying.

3.7. Interactions

The Kestrel interacts with other species during hunting, nest-site selection and breeding itself. Three examples of cleptoparasitism have been described in Slovenia. In two of these, it was the Kestrel that took

prey from another species: a House Sparrow *Passer domesticus* caught by a Carrion Crow (JANČAR 1999) and a small mammal caught by a Great Grey Shrike *Lanius excubitor* (BOMBEEK 2003). At Ljubljansko barje, a Red-footed Falcon *F. vespertinus* took a vole *Microtus* sp. from a Kestrel sitting in the same tree (ŠERE 1999).

In many instances, random encounters with other species are uneventful (MARČETA 1994A, VREZEC 1995), but agonistic reactions have been recorded from different parties. Both at Ptujsko jezero reservoir (DENAC 2005) and in Sečovlje salina (MARČETA 1994A) Common Terns *Sterna hirundo* aggressively drove Kestrels away from the vicinity of their breeding colonies. During the breeding season, both male and female Kestrels attack several species approaching their nests. These also include larger species, such as Yellow-legged Gull *Larus michahellis* and Raven (MARČETA 1994A, BRAČKO 1995B). In Ljubljana, agonistic reactions to Carrion Crows are common (C. MARHOLD & T. ŠUMRADA *pers. comm.*).

Kestrels can be tolerant to species breeding in the immediate vicinity of their nests, e. g. Hobby *F. subbuteo* (PERUŠEK 2004) and Raven (CERAR 1986). Sometimes the two species nest in the same tree. In Ljubljana, a Magpie nested in the same tree (ŠERE 1997) and a Long-eared Owl *Asio otus* (T. BERCE *pers. comm.*) in Ivanjkovci near Ormož. In an abandoned electrical substation at Ljubljansko barje, a pair of Kestrels nested along with Jackdaws, Starlings *Sturnus vulgaris*, House and Tree Sparrows *Passer montanus* in the same year (HAVLIČEK & KOGOVŠEK 2003). In Sečovlje salina, a Kestrel nested on the outer and a Jackdaw on the

inner side of the same wall (LIPEJ 1993).

In Sečovelje salina and at Kraški rob, the only potential competitors for nest-sites were Rock Dove *Columba livia* and Jackdaw, but an influence of competition between the species was not registered (LIPEJ 1993, MARČETA 1994A). Near Medvedce reservoir, D. BORDJAN (*pers. comm.*) observed nests of Carrion Crows and Ravens where the Kestrel nested immediately after the former species had finished their breeding season. The importance of Carrion Crow nests on high voltage electricity pylons at Dravsko polje for Kestrels was studied by JANŽEKOVIČ & ŠORGO (1995). Judging from agonistic behaviour of both species near pylons with nests, the authors suggested that Kestrels actively competed also for nests that had already been occupied. In the Prekmurje region, L. BOŽIČ (*pers. comm.*) observed a Kestrel breeding in a nest that had originally probably been built by Carrion Crows for more than a decade. In some years, a pair of Hobbies bred in the same nest.

An example of competition for nest-sites was noted in Brezovica near Ljubljana (E. VUKELIČ *pers. comm.*), where a nest was occupied by Long-eared Owls after Kestrels had bred there successfully the year before. In a nest at Bled golf course, where Long-eared Owls bred one year, a fight between the two species was noted the following year. In that year neither species bred successfully (B. KOZINC *pers. comm.*). TOME (2007) found an active nest of Long-eared Owls, where a Kestrel egg was present together with four eggs of the former species. This nest later failed. It is unknown whether the owl occupied a deserted nest where a Kestrel had already begun laying or whether it displaced the Kestrel violently. Because both species feed on small mammals (VILLAGE 1990, TOME 1994), they are potential competitors also in terms of prey (KORPIMÄKI 1987, RIEGERT *et al.* 2009).

Based on mean prey weight in pellets (15.28 g in the Kestrel), the Tawny Owl *Strix aluco* (13.05 g) is a potential competitor at Kraški rob. The Eagle Owl *Bubo bubo* (489.5 g) and Golden Eagle *Aquila chrysaetos* (3,208 g) hunt considerably heavier prey (LIPEJ *et al.* 2005). The calculation for Kestrel was based on MARČETA's (1994A) work, whereas that for Tawny Owl was made based on pellet analysis from one site near Sočerga (LIPEJ *et al.* 2005). The Tawny Owl is probably a competitor only in certain habitats, e. g. cities (RANAZZI *et al.* 2000).

In SW Slovenia, remains of Kestrels were found in the prey of Eagle Owl, where it comprised an insignificant percentage of total prey (Falconidae 0.6% of total by mass, 0.9% by number of prey items; $n = 2,392$) (MIHELIČ 2002). An Eagle Owl at Kraški rob

preyed on all the nestlings in a Kestrel's nest, followed by the female of the pair two years later (MARČETA 1994A). Nests of the two species were 1.5 km apart. Based on GREGORI (1976B), it can be inferred that the two species bred simultaneously in the same rock face at Osp. The Kestrel's breeding success in this case is unknown. The two species are known to have bred successfully in the same cliff in the Vipava valley and Kraški rob. In these examples, the Kestrels used holes that were probably inaccessible to Eagle Owl predation due to their small size and great depth (T. MIHELIČ *pers. comm.*).

VILLAGE (1990) believes that the most likely predators of Kestrels are Goshawk *Accipiter gentilis*, Eagle Owl and other diurnal raptors (Peregrine *Falco peregrinus*, Sparrowhawk *Accipiter nisus* and Golden Eagle) and owls (Tawny Owl). Among mammals, Domestic Cat *Felis catus* and Fox *Vulpes vulpes* are mentioned. Apart from anthropogenic factors, nest predation was one of the key reasons for the extinction of the breeding population in Sečovelje salina (LIPEJ 1993). Beech Martens *Martes foina*, the only predators of Kestrel in the salina, preyed on eggs, nestlings of various ages and females on nests (MARČETA 1994A, PLANINC 1994).

3.8. Parasites

Parasites from the phyla of flatworms Platyhelminthes, roundworms Nematoda, from the class of insects and family of ticks Ixodidae have been recorded on the Kestrel in Slovenia. Platyhelminth parasites of Kestrels are flukes Trematoda and tapeworms Cestoda. From the latter class, *Cladotaenia globifera* (BRGLEZ 1981A) and *Mesocostoides perlatus* (BRGLEZ 1981B) were found in the intestine of Kestrels. The fluke *Strigea falconis* (BRGLEZ 1976 & 1977) was found on individuals from different regions of Slovenia. In some individuals, the nematodes *Cyanea spinosa* (BRGLEZ 1980 & 1981B) and *Synhimantus robertdolfusi* (BRGLEZ 1984) were found in the proventriculus and oesophagus respectively. *Synhimantus laticeps* was recorded in the oesophagus of a Kestrel from Osp from the late 19th century (BRGLEZ 1981B). Acanthocephalans recorded are *Centrorhynchus aluconis* and *Centrorhynchus globocaudatus* (BRGLEZ 1981B).

There is a single published record documenting ixodid parasitism: two nymphae of *Hyalomma marginatum* fed on the same individual (TOVORNIK 1990, TRILAR 2004). In Sečovelje salina, the dipteran *Carnus hemapterus* parasitized on nestlings (T. TRILAR *pers. comm.*). Bird lice Mallophaga species *Degeeriella rufa rufa* and *Laemobothrion tinnunculi* were also

found on examined Kestrels (BRELIH & TOVORNIK 1961).

Kestrels can also be infested by blood parasites (KORPIMÄKI *et al.* 1995), but this has not been recorded in Slovenia. Investigating the connection between parasite infestation and various environmental factors, as well as the impact of parasites on Kestrel population, dynamics and breeding success (FARGALLO *et al.* 2001, MARTÍNEZ-PADILLA & MILLÁN 2007) provide a research subject for the future.

Acknowledgements: We thank all those who sent us their data and observations, which helped make the paper more complete: Tilen Basle, Tomaž Berce, Primož Bizjan, Blaž Blažič, Dominik Bombek, Dejan Bordjan, Luka Božič, Franc Bračko, Branko Brečko, Damijan Denac, Katarina Denac, Ivan Esenko, Dare Fekonja, Andrej Figelj, Jernej Figelj, Matej Gamser, Peter Grošelj, Vojko Havliček, Andrej Hudoklin, Aleš Jagodnik, Tomaž Jančar, Dane Katalinič, Dušan Klenovšek, Urša Koce, Boris Kozinc, Mojca Kuster, Miha Kronovšek, Lea Likozar, Cvetka Marhold, Tomaž Mihelič, Jure Novak, Alenka Petrinjak, Alen Ploj, Miha Podlogar, Monika Podgorelec, Matjaž Premzl, Primož Presetnik, Aleksander Pritekelj, Žiga Iztok Remec, Rok Rozman, Andrej Sovinc, Domen Stanič, Rudolf Tekavčič, Davorin Tome, Tomi Trilar, Peter Trontelj, Zlata Vahčič, Tomaž Velikonja, Barbara Vidmar, Jani Vidmar, Al Vrezec in Eva Vukelič. We are grateful to Tomaž Mihelič for data collected in preparation for The New Ornithological Atlas of Breeding Birds in Slovenia. Radoš Šumrada helped us make the map of recovered ringed Kestrels and Dare Fekonja enabled us access to the data of the Slovenian Bird Ringing Centre. We appreciate Tomi Trilar's help with finding appropriate references on parasites of the Kestrel.

4. Povzetek

Članek obravnava razširjenost in populacijsko gostoto postovke *Falco tinnunculus* v Sloveniji v gnezditvenem in negnezditvenem obdobju, njeno disperzijo, gnezditveno biologijo, lov, prehrano in odnose z drugimi vrstami. Podatki so bili zbrani iz literature in od opazovalcev. Razširjenost gnezdeče populacije je predstavljena s pomočjo primerjave rezultatov obeh nacionalnih atlasov, ki ni pokazala prepričljivih znakov sprememb razširjenosti. Ocena velikosti populacije zunaj gnezditvene sezone (1000–2000 os.) je nižja od gnezdeče (1500–2000 parov). Gnezdi na višinah od 0 do 2050 m nadmorske višine, v negnezditvenem obdobju je bila opazovana na višinah

do 1700 m. Vsaj del slovenske populacije se odseli, zdi se, da predvsem proti jugu-jugozahodu. Gnezditveno obdobje postovke traja od konca februarja do julija. Gnezdi na drevesih, stavbah, v skalnih stenah, na stebrih daljnovodov in v gnezdilnicah. Na drevesih gnezdi v starih gnezdih vranov Corvidae. Na stavbah gnezdi predvsem na policah in v različnih odprtinah. Pogosto si naredi gnezdo na gospodarskih poslopih in v stanovanjskih zgradbah. V skalnih stenah gnezdi v naravnih odprtinah in v opučenih gnezdih drugih vrst. Postovka izleže 3–9 jajc, običajno pet. Lovi na odprtih površinah s predhodnim lebdenjem v vetru nad lovno površino, lovom na tleh s preže in aktivnim lovom v zraku. Prehranjuje se predvsem z malimi sesalci, v manjši meri pa s pevci Passeriformes, plazilci in nevretenčarji. Postovka vstopa v interakcije z drugimi vrstami med lovom, pri izbiri gnezditvenih mest in med samim gnezdenjem. Na postovki so bili doslej ugotovljeni zajedavci iz debla ploskavcev Platyhelminthes in glist Nematoda ter iz razreda žuželk in družine klopov Ixodidae.

5. References

- BIBIČ, A. (1994): Navadna postovka *Falco tinnunculus*, kačar *Circaetus gallicus*. – *Acrocephalus* 15 (64): 99.
- BIBIČ, A. & JANŽEKOVICH, F. (1989): Ptici Veržaja in okolice. – *Acrocephalus* 10 (41/42): 45–50.
- BOMBEK, D. (2003): Postovka *Falco tinnunculus*, veliki srakoper *Lanius excubitor*. – *Acrocephalus* 24 (118): 110–111.
- BORDJAN, D. & BOŽIČ, L. (2009): Pojavljanje vodnih ptic in ujed na območju vodnega zadrževalnika Medvedce (Dravsko polje, SV Slovenija) v obdobju 2002–2008. – *Acrocephalus* 30 (141/142/143): 55–163.
- BOŽIČ, I. A. (1998): Postovke (*Falco* sp.) na Ljubljanskem barju. – *Moj mali svet* 30 (9): 36–37.
- BOŽIČ, I. A. (2009): Rezultati obročkanja ptičev v Sloveniji: 1926–1982. – *Scopolia*, Suppl. 4: 23–110.
- BOŽIČ, L. (2003): Mednarodno pomembna območja za ptice v Sloveniji 2. Predlogi Posebnih zaščitnih območij (SPA) v Sloveniji. Monografija DOPPS št. 2. – DOPPS, Ljubljana.
- BOŽIČ, L. & BOMBEK, D. (2003): Hribski škrjanec *Lullula arborea*. – *Acrocephalus* 24 (118): 112–113.
- BRAČKO, F. (1990): Peca – 2125 m. – *Acrocephalus* 11 (43/44): 37–38.
- BRAČKO, F. (1995A): Lokalni ornitološki atlas Drave (Maribor–Ptuj) 1989–1992 (začasno poročilo). – *Acrocephalus* 16 (68/69/70): 58–61.
- BRAČKO, F. (1995B): Navadna postovka *Falco tinnunculus*. – *Acrocephalus* 16 (71): 126.
- BRAČKO, F. (1996): Sokolič *Falco columbarius*. – *Acrocephalus* 17 (74): 32–33.
- BRAČKO, F. (1997): Ornitološki atlas Drave od Maribora do Ptuja (1989–1992). – *Acrocephalus* 18 (82): 57–97.
- BRELIH, S. & TOVORNIK, D. (1961): Prispevek k poznavanju

- tekutov (Mallophaga) Jugoslavije I. – Biološki vestnik 9 (1): 93–107.
- BRGLEZ, J. (1976): Uporabnost histološke tehnike pri parazitoloških favnističnih raziskavah strigeididnih sesačev. – Zbornik Biotehniške fakultete Univerze v Ljubljani, Veterinarstvo 13 (2): 197–209.
- BRGLEZ, J. (1977): Zajedavci pri pticah v Sloveniji. Trematoda. – Zbornik Biotehniške fakultete Univerze v Ljubljani, Veterinarstvo, Suppl. 3.
- BRGLEZ, J. (1980): Dve vrsti spirurid (Nematoda, Spiruridae Oerley, 1885) pri ujedah v Sloveniji. – Zbornik Biotehniške fakultete Univerze v Ljubljani, Veterinarstvo 17 (1): 99–104.
- BRGLEZ, J. (1981A): *Cladotaenia globifera* (BATSCH, 1786), Taeniidae Ludwig, 1886, pri nekaterih ujedah v Sloveniji. – Zbornik Biotehniške fakultete Univerze v Ljubljani, Veterinarstvo 18 (2): 185–189.
- BRGLEZ, J. (1981B): Zajedavci pri pticah v Sloveniji. Cestoda, Nematoda, Acanthocephala. – Zbornik Biotehniške fakultete Univerze v Ljubljani, Veterinarstvo, Suppl. 5.
- BRGLEZ, J. (1984): *Synhimatus robertdolfusi* Desportes, 1948, Acuariidae Seurat, 1913, pri ujedah v Sloveniji. – Zbornik Biotehniške fakultete Univerze v Ljubljani, Veterinarstvo 21 (1): 163–166.
- CAVÉ, A. J. (1968): The breeding of the Kestrel, *Falco tinnunculus* L., in the reclaimed area Oostelijk Flevoland. – Netherlands Journal of Zoology 18 (3): 313–407.
- CRAMP, S. (ed.) (1980): Handbook of the Birds of Europe, the Middle East and North Africa. The Birds of the Western Palearctic. Vol. II. Hawks to Bustards. – Oxford University Press, Oxford.
- CEPÁK, J., KLVAŇA, P., ŠKOPEK, J., SCHRÖPFER, L., JELÍNEK, M., HOŘÁK, D., FORMÁNEK, J. & ZÁRYBNICKÝ, J. (eds.) (2008): [Atlas of bird migration in Czech Republic and Slovakia.] – Aventinum, Praga. (in Czech)
- CERAR, M. (1986): Poročilo iz Gornje Savinjske doline. – Acrocephalus 7 (29): 35–36.
- CKFF (2011): Podatkovna zbirka CKFF (avgust 2011). – Center za kartografijo favne in flore, Miklavž na Dravskem polju.
- DENAC, D. (1991): Navadna postovka *Falco tinnunculus*. – Acrocephalus 12 (49): 154.
- DENAC, D. (2002): Pomoč gnezdečim postovkam v naseljih. – Svet ptic 8 (2): N III.
- DENAC, D. (2005): Navadna čigra *Sterna hirundo*. – Acrocephalus 26 (124): 49.
- DENAC, D., SMOLE, J. & VREZEC, A. (2009): Naravovarstveno vrednotenje avifavne ob Savi med Krškimi in Jesenicami na Dolenjskem s predlogom novega mednarodno pomembnega območja (IBA) za ptice v Sloveniji. – Natura Sloveniae 11 (1): 25–57.
- DENAC, K. (2010): Census of migrating raptors at Breginjski Stol (NW Slovenia) – the first confirmed bottleneck site in Slovenia. – Acrocephalus 31 (145/146): 77–92.
- DOPPS (2011): Monitoring splošno razširjenih vrst ptic za določitev slovenskega indeksa ptic kmetijske krajine – poročilo za leto 2010; poročilo za leto 2011. – DOPPS, Ljubljana.
- DOPPS (unpubl.): Novi ornitološki atlas gnezdil Slovenije NOAGS. – DOPPS, Ljubljana.
- DUBOIS, P. J., LE MARÉCHAL, P., OLIOSSO, G. & YÉSOU, P. (2008): [New inventory of birds of France.] – Delachaux et Niestlé, Paris. (in French)
- ERJAVEC, F. (1995): Domače in tuje živali v podobah. – Mladinska knjiga, Ljubljana.
- FARGALLO, J. A., BLANCO, G., POTTI, J. & VIÑUELA, J. (2001): Nestbox provisioning in a rural population of European Kestrels: breeding performance, nest predation and parasitism. – Bird Study 48 (2): 236–244.
- FELDNER, J., RASS, P., PETUTSCHNIG, W., WAGNER, S., MALLE, G., BUSCHENREITER, R. K., WIEDNER, P. & PROBST, R. (2006): Avifauna Kärntens. Die Brutvögel. – Naturwissenschaftlicher Verein für Kärnten, Klagenfurt.
- FREYER, H. (1842): Fauna der in Krain bekannten Säugethiere, Vögel, Reptilien und Fische. – Eger'schen Gubernial Buchdruckerei, Ljubljana.
- GAMSER, M. (2008): Popis kavk in navadnih postovk v Celju. Raziskovalna naloga. – Osnovna šola Ljubečna.
- GEISTER, I. (1980): Slovenske ptice: priručnik za opazovanje in proučevanje ptic. – Mladinska knjiga, Ljubljana.
- GEISTER, I. (1983): Prispevek k poznavanju ornitofavne Bobovka. – Acrocephalus 4 (17/18): 43–54.
- GEISTER, I. (1995): Ornitološki atlas Slovenije. – DZS, Ljubljana.
- GEISTER, I. (2002): Popis gnezdečih ptic na planoti med Goličem, Lipnikom in Kavčičem (Čičarija, Slovenija). – Annales 12 (1): 85–92.
- GREGORI, J. (1972): Ptice okolice Kranjske gore: prispevek k poznavanju ornitofavne Slovenije. Diplomatska naloga. – Univerza v Ljubljani, Biotehniška fakulteta, Oddelek za biologijo.
- GREGORI, J. (1976A): Okvirni ekološki in favnistični pregled ptičev Sečoveljskih solin in bližnje okolice. – Varstvo narave 9: 81–102.
- GREGORI, J. (1976B): Ornitološki izlet v Osp. – Proteus 38 (7): 275–279.
- GREGORI, J. (1977): Ekološki in favnistični pregled ptičev severozahodne Slovenije. – Larus 29/30: 33–75.
- GREGORI, J. (1986): Ptiči Sorice in Soriške planine. pp. 94–100 In: BOLE, J. (ed.): Sorica in Soriška planina. – Muzejsko društvo, Škofja Loka.
- GREGORI, J. (1989): Favna in ekologija ptičev Pesniške doline (SV Slovenija, Jugoslavija). – Scopolia 19: 1–59.
- GREGORI, J. (2002): Ptiči ob Muri. pp. 65–71 In: GOGALA, A. (ed.): Narava Slovenije, Mura in Prekmurje. – Prirodoslovni muzej, Ljubljana.
- GREGORI, J. & ŠERE, D. (2005): Ptiči Šaleških jezer in okolice. – Prirodoslovni muzej Slovenije, Ljubljana.
- HANŽEL, J. (2011): Postovka. – Svet ptic 17 (3): 28–29.
- HANŽEL, J. & ŠUMRADA, T. (2008): Popis gnezdeče populacije postovk *Falco tinnunculus* v Ljubljani in značilnosti njenih gnezdišč v letu 2007. – Acrocephalus 29 (138/139): 149–153.
- HAVLIČEK, V. & KOGOVŠEK, I. (2003): "Trafognezdilnica" na Barju. – Svet ptic 9 (3): 26–27.
- IBM (2011): IBM SPSS Statistics, ver. 20.0 – IBM, Armonk.
- JANČAR, T. (1997): Ornitološki atlas gnezdil Triglavskega narodnega parka 1991–1996. Projektno poročilo. – DOPPS, Ljubljana.
- JANČAR, T. (1999): Siva vrana *Corvus corone cornix*, postovka *Falco tinnunculus*. – Acrocephalus 20 (92): 33.
- JANČAR, T. & TREBUŠAK, M. (2000): Ptice Kozjanskega

- regijskega parka. – *Acrocephalus* 21 (100): 107–134.
- JANŽEKOVIC, F. & ŠORGO, A. (1995): Gnezdenje sive vrane (*Corvus corone cornix*) in navadne postovke (*Falco tinnunculus*) na visokonapetostnih daljnovodnih stebrih. – *Elektrotehniški vestnik* 62 (2): 88–90.
- JUREČIČ, S. (1992): Navadna postovka *Falco tinnunculus*. – *Acrocephalus* 13 (51): 49–50.
- KERČEK, M. (2005): Ptice akumulacije Medvedce. Diplomski naloga. – Univerza v Mariboru, Pedagoška fakulteta, Oddelek za biologijo.
- KMECL, P. (1997): Zimski ornitološki atlas Triglavskega narodnega parka. Projektno poročilo. – DOPPS, Ljubljana.
- KMECL, P. (2001): Postovka *Falco tinnunculus*. – *Acrocephalus* 22 (108): 177–178.
- KORPIMÄKI, E. (1987): Dietary shifts, niche relationships and reproductive output of coexisting Kestrels and Long-eared Owls. – *Oecologia* 74 (2): 277–285.
- KORPIMÄKI, E., TOLONEN, P. & BENNETT, G. F. (1995): Blood parasites, sexual selection and reproductive success of European Kestrels. – *Ecoscience* 2 (4): 335–343.
- KOSTRZEWA, R. & KOSTRZEWA, A. (1991): Winter weather, spring and summer density, and subsequent breeding success of Eurasian Kestrels, Common Buzzards, and Northern Goshawks. – *The Auk* 108 (2): 342–347.
- KOSTRZEWA, R. & KOSTRZEWA, A. (1993): Der Turmfalke. – AULA Verlag, Wiesbaden.
- KOZINC, B. (1987): Navadna postovka *Falco tinnunculus*. – *Acrocephalus* 8 (33): 44.
- KOZINC, B. (2003): Popis ptičev na Bledu. – *Golf* 9 (2): 51.
- KÜBLER, S., KUPKO, S. & ZELLER, U. (2005): The kestrel (*Falco tinnunculus*) in Berlin: investigation of breeding biology and feeding ecology. – *Journal of Ornithology* 146 (3): 271–278.
- LIPEJ, L. (1988): Postovka. – *Lovca* 71 (5): 138–139.
- LIPEJ, L. (1993): Status in ogroženost gnezditvene populacije navadne postovke (*Falco tinnunculus*) na Sečoveljskih solinah. – *Annales* 3 (3): 29–36.
- LIPEJ, L. (1997): Gnezdenje navadne postovke *Falco tinnunculus* na robu Škocjanskega zatoka. – *Falco* 11: 49–50.
- LIPEJ, L. & GJERKEŠ, M. (1994): Ujede (Falconiformes) in sove (Strigiformes) Slovenske Istre. – *Annales* 4 (4): 53–62.
- LIPEJ, L., GJERKEŠ, M. & LIPEJ, B. (2005): Vloga pernatih plenilcev na meji med flišem in krasom. pp. 367–380 In: ROŽAC-DAROVEC, V. (ed.): Meje in konfini. – Založba Annales, Koper.
- MARČETA, B. (1994A): Gnezditvena biologija in ekologija navadne postovke (*Falco tinnunculus*) v Slovenskem primorju. Diplomski naloga. – Univerza v Ljubljani, Biotehniška fakulteta, Oddelek za biologijo.
- MARČETA, B. (1994B): Stanje in ogroženost gnezdilcev sten črnokalskega Kraškega roba. – *Annales* 4 (4): 43–52.
- MARTÍNEZ-PADILLA, J. & MILLÁN, J. (2007): Prevalence and intensity of intestinal parasitism in a wild population of nestling Eurasian Kestrel *Falco tinnunculus*. – *Aredola* 54 (1): 109–115.
- MATVEJEV, S. D. (1983): Ptice Triglavskog nacionalnog parka i susednih predela. – *Larus* 33/34/35: 69–91.
- MAUMARY, L., VALLOTTON, L. & KNAUS, P. (2007): Die Vögel der Schweiz. – Schweizerische Vogelwarte, Sempach & Nos Oiseaux, Montmollin.
- MIHELČ, T. (2002): Prehrana velike uharice *Bubo bubo* v jugozahodni Sloveniji. – *Acrocephalus* 23 (112): 81–86.
- MOHAR, P. (2005): Ekološka in naravovarstvena analiza ptic gnezdil ob reki Savi med Hrastjem in Litijo. Diplomski naloga. – Univerza v Ljubljani, Biotehniška fakulteta, Oddelek za biologijo.
- NEGRO, J. J., IBÁÑEZ, C., PÉREZJORDÁ, J. L. & DELARIVA, M. J. (1992): Winter predation by Common Kestrel *Falco tinnunculus* on Pipistrelle Bats *Pipistrellus pipistrellus* in Southern Spain. – *Bird Study* 39 (3): 195–199.
- PERUŠEK, M. (2004): Škrjančar *Falco subbuteo*. – *Acrocephalus* 25 (123): 225.
- PLANINC, G. (1994): Prispevek k poznavanju gnezditvene ekologije navadne postovke na Sečoveljskih solinah v letu 1990. – *Annales* 4 (4): 233–236.
- POGAČAR, P., JANČAR, S. & PREPELUH, J. (2003): Postovka. Raziskovalna naloga. – Osnovna šola Božidarja Jakca Ljubljana.
- POKORNY, B. (2001): Poletna sestava združbe ptic mesta Velenje. pp. 128–139 In: ŠALEJ, M. (ed.): Velenje: zbornik raziskovalnega tabora v letih 1999 in 2000. – ERICo, Inštitut za ekološke raziskave, Velenje.
- POKORNY, B. (2003): Ptice v občini Šmartno ob Paki. pp. 223–233 In: ŠALEJ, M. & ŠTERBENK, E. (ed.): Šmartno ob Paki: zbornik raziskovalnega tabora ERICa v letih 2001 in 2002. – ERICo, Inštitut za ekološke raziskave, Velenje.
- POLAK, S. (1993): Ptice gnezdilke Cerkniškega jezera in bližnje okolice. – *Acrocephalus* 14 (56/57): 32–62.
- POLAK, S. (ed.) (2000): Mednarodno pomembna območja za ptice v Sloveniji. Monografija DOPPS št. 1. – DOPPS, Ljubljana.
- RANAZZI, L., MANGANARO, A. & SALVATI, L. (2000): The breeding success of Tawny Owls (*Strix aluco*) in a Mediterranean area: a long-term study in urban Rome. – *Journal of Raptor Research* 34 (4): 322–326.
- REISER, O. (1925): Die Vögel vom Marburg an der Drau. – Mitteilungen des Naturwissenschaftlichen Vereines für Steiermark. Band 61, Graz.
- REJT, Ľ. (2006): Does larder-hoarding affect the condition of chicks in urban kestrels? – *Biologia* 61 (2): 221–224.
- REJT, Ľ., TURLEJSKI, K., BRONCHE, K. & TOPCZEWSKI, A. M. (2000): Can food caching increase frequency of feeding in urban Kestrels *Falco tinnunculus*? – *Acta Ornithologica* 35 (2): 217–221.
- RIEGERT, J., FAINOVÁ, D., MIKEŠ, V. & FUCHS, R. (2007): How urban Kestrels *Falco tinnunculus* divide their hunting grounds: partitioning or cohabitation? – *Acta Ornithologica* 42 (1): 69–75.
- RIEGERT, J. & FUCHS, R. (2011): Fidelity to roost sites and diet composition of wintering male urban Common Kestrels *Falco tinnunculus*. – *Acta Ornithologica* 46 (2): 183–189.
- RIEGERT, J., LÖVY, M. & FAINOVÁ, D. (2009): Diet composition of Common Kestrels *Falco tinnunculus* and Long-eared Owls *Asio otus* coexisting in an urban environment. – *Ornis Fennica* 86 (4): 123–130.
- RIJAVEC, A. (2007): Poročilo o delu ornitološke skupine. pp. 51–54 In: KODELE KRAŠNA, I. (ed.): Biološko

- raziskovalni tabor "Novaki 2006". – Zavod RS za varstvo narave, Ljubljana.
- RUBINIČ, B. (1994): Ribji orel *Pandion haliaetus*. – *Acrocephalus* 15 (63): 54.
- RUBINIČ, B. (2000): Begunjsčica in Stol. – *Svet ptic* 6 (4): 18–19.
- RUŽIČ, M., TOPIČ, G., ŠČIBAN, M. & SPREMO, N. (2010): Prostorni raspored, odabir mesta za gneždenje in gostina gneždenja obične vetruške *Falco tinnunculus* u Novom Sadu. – *Ciconia* 19: 89–96.
- SAMWALD, O. (1997): Turmfalke *Falco tinnunculus*. pp. 114–115 In: SACKL, P. & SAMMWALD, O. (eds.): Atlas der Brutvögel der Steiermark. – BirdLife Österreich - Landesgruppe Steiermark & Steiermärkisches Landesmuseum Joanneum, Graz.
- SCHIAVUZZI, B. (1879): [List of birds living in Istria, particularly in the marshes of Piran.] – *Bollettino della Società Adriatica di Scienze Naturali in Trieste* 4: 53–76. (in Italian)
- SCOPOLI, G. A. (1769): Annus I. Historico-Naturalis. Descriptiones avium. – Sumtib. Christ. Gottlob Hilscheri, Lipsiae.
- SEIDENSACHER, E. (1864): Die Vögel von Cilli. – *Mitteilungen des Naturwissenschaftlichen Vereines für Steiermark* 2: 57–90.
- SENEGAČNIK, K., SOVINC, A. & ŠERE, D. (1998): Ornitološka kronika 1994, 1995. – *Acrocephalus* 19 (87/88): 77–91.
- SOVINC, A. (1994): Zimski ornitološki atlas Slovenije. – Tehniška založba Slovenije, Ljubljana.
- SOVINC, A. & ŠERE, D. (1993): Ornitološka kronika za leto 1991. – *Acrocephalus* 14 (58/59): 140–144.
- SOVINC, A., TOME, D. & TRONTELJ, P. (1993): Ornitološki atlas Ljubljanskega barja – poročilo o poteku popisovanja. – *Acrocephalus* 14 (60): 145–151.
- SOVINC, A. & ŠERE, D. (1994): Ornitološka kronika za leto 1992. – *Acrocephalus* 15 (64): 102–106.
- SOVINC, A. & ŠERE, D. (1996): Ornitološka kronika za leto 1993. – *Acrocephalus* 18 (75/76): 97–100.
- SPINA, F. & VOLPONI, S. (2008): [Atlas of Bird Migration in Italy. No. 1. Non-Passeriformes.] – Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Roma. (in Italian)
- SURINA, B. (1999): Ornitofavna zgornjega dela doline Reke in bližnje okolice – *Annales* 9 (2): 303–314.
- SURS (2011): Statistični letopis 2011. – Statistični urad Republike Slovenije, Ljubljana.
- ŠEGULA, B. (2001): Postovka *Falco tinnunculus*. – *Acrocephalus* 22 (108): 177.
- ŠERE, D. (1982): Ptiči Stožic pri Ljubljani, 1972–1982 – favnistični pregled, obročkanje in najdbe. – *Acrocephalus* 3 (13/14): 1–61.
- ŠERE, D. (1984): Navadna postovka *Falco tinnunculus*. – *Acrocephalus* 5 (19/20): 24.
- ŠERE, D. (1997): Postovka *Falco tinnunculus*, sraka *Pica pica*. – *Acrocephalus* 18 (84): 158.
- ŠERE, D. (1999): Rdečenoga postovka *Falco vespertinus*. – *Acrocephalus* 20 (93): 57–58.
- ŠERE, D. (2009): Kratko poročilo o obročkanih ptičih v Sloveniji, 1983–2008. – *Scopolia*, Suppl. 4: 111–174.
- ŠKORNIK, I., MAKOVEC, T. & MIKLAVEC, M. (1990): Favniški pregled ptic slovenske obale. – *Varstvo narave* 16: 49–99.
- ŠMUC, A. (1980): Ptice Sečoveljskih in Ulcinjskih solin. Diplomatska naloga. – Univerza v Ljubljani, Biotehniška fakulteta, Oddelek za biologijo.
- ŠTUMBERGER, B. (1994): Popis ptic volčeskkih travnikov (Celje) in njihovo naravovarstveno ovrednotenje. – *Acrocephalus* 15 (65/66): 123–134.
- TOME, D. (1986): Cerkev – pribežališče za sove? – *Acrocephalus* 7 (30): 53–55.
- TOME, D. (1994): Diet composition of the Long-eared Owl in central Slovenia: seasonal variation in prey use. – *Journal of Raptor Research* 28 (4): 253–258.
- TOME, D. (2001): Nekaj značilnosti avifavne Pivških jezer. – *Annales* 11 (2): 271–276.
- TOME, D. (2007): Nest defense and some rare breeding events in Long-eared Owls (*Asio otus*). – *Journal of Raptor Research* 41 (2): 170–173.
- TOME, D., SOVINC, A. & TRONTELJ, P. (2005): Ptice Ljubljanskega barja. Monografija DOPPS št. 3. – DOPPS, Ljubljana.
- TOME, D., VREZEC, A., KOCE, U. & BORDJAN, D. (2011): Ptice Ljubljane in okolice. Končno poročilo. – Nacionalni inštitut za biologijo, Ljubljana.
- TOVORNIK, D. (1990): The Significance of the Birds (Aves) as the Hosts and Disseminators of Ixodid Ticks (Yugoslavia). – *Biološki vestnik* 38 (2): 77–107.
- TRILAR, T. (2004): Ticks (Acarina: Ixodidae) on birds in Slovenia. – *Acrocephalus* 25 (123): 213–216.
- TRONTELJ, P. (2008): Ptice občine Dol pri Ljubljani. pp. 293–353 In: OMERZU, S. (ed.): Iz dežele Jurija Vege. Zbornik občine Dol pri Ljubljani 1. – Občina Dol pri Ljubljani, Ljubljana.
- TRONTELJ, P. & VOGRIN, M. (1993): Ptice Jovsov in predlogi za njihovo varstvo. – *Acrocephalus* 14 (61): 200–209.
- VIDELER, J. J., WEIHS, D. & DAAN, S. (1983): Intermittent gliding in the hunting flight of the kestrel, *Falco tinnunculus* L. – *Journal of Experimental Biology* 102 (1): 1–12.
- VILLAGE, A. (1990): The Kestrel. – T & A D Poyser, London.
- VOGRIN, M. (1997): Pojavljanje in prelet ujed na Dravskem polju (SV Slovenija). – *Falco* 11 (12): 31–34.
- VOGRIN, M. (2000): Nekatere vrste ptic gnezdil na kmetijski površini v spodnji Savinjski dolini. – *Sodobno kmetijstvo* 33 (11/12): 508–509.
- VOGRIN, M. (2004): Ptice na hmeljiščih v spodnji Savinjski dolini. – *Acrocephalus* 25 (120): 27–29.
- VOGRIN, M. (2006): Ptice v mestih. – *Proteus* 69 (4): 165–170.
- VOGRIN, M. (2009): Ptice med Pohorjem in Haložami. pp. 469–488 In: GRADIŠNIK, S. (ed.): Zbornik občine Slovenska Bistrica III: Svet med Pohorjem in Bočem. – Zavod za kulturo, Slovenska Bistrica.
- VOGRIN, M. & MIKLIČ, A. (2004A): Ptice gnezdilke na golf igrišču Ptuj. – *Biota* 5 (1/2): 77–86.
- VOGRIN, M. & MIKLIČ, A. (2004B): Ptice gnezdilke melioracijskih jarkov sredi intenzivnih kmetijskih površin Dravskega polja. – *Biota* 5 (1/2): 87–92.
- VREZEC, A. (1995): Rjavi lunj *Circus aeruginosus*. – *Acrocephalus* 16 (71): 125.
- VREZEC, A. (1997): Ujede in sove Dravinjske doline. – *Falco* 11 (12): 17–20.

T. ŠUMRADA & J. HANŽEL: The Kestrel *Falco tinnunculus* in Slovenia – a review of its distribution, population density, movements, breeding biology, diet and interactions with other species

- VREŠ, B. & VRHOVNIK, D. (1984): Ornitološki pogled na Dravograjsko jezero. – *Acrocephalus* 5 (19/20): 11–16.
- VUKELIČ, E. (2001): Poročilo o delu ornitološke skupine na raziskovalnem taboru študentov biologije Cerkno 2000. pp. 63–68 In: Raziskovalni tabor študentov biologije Cerkno 2000. – Zavod za tehnično kulturo Slovenije, Gibanje znanost mladini, Ljubljana.
- ZOIS, S. (1790/1800): *Aves terrestres Europae*. – [<http://www.dlib.si/?URN=URN:NBN:SI:DOC-YJ3DA9MZ>], 16/5/2012.

Arrived / Prispelo: 28. 5. 2012

Accepted / Sprejeto: 19. 12. 2012