Occurrence of Red Kites *Milvus milvus* in Serbia based on birds tracked by telemetry devices

Pojavljanje rjavih škarnikov *Milvus milvus*, spremljanih s telemetrijo, v Srbiji

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1. Introduction

Red Kite *Milvus milvus* is an opportunistic raptor of mixed habitats containing fragmented forests and open land for breeding and roosting. It is essentially a European species, and outside Europe it is found only scattered in North Africa. The total population of Western Palearctic (and of the world) is between 25,000 and 33,000 breeding pairs, with Germany, Switzerland, France, and Spain being the most important areas for its occurrence and accounting for about 90% of the world population (GÉNSBØL & THIEDE 2008, BIRDLIFE INTERNATIONAL 2015).

The Red Kite breeding population in Serbia became nearly extinct during the second half of the 20th century (RAŠAJSKI & MARINKOVIĆ 2000), as fewer than 10 breeding attempts were recorded since 1950 (ŠĆIBAN *et al.* 2015). During 1977– 1996, Red Kites were observed in the breeding period at only three locations. In the second half of the 20th century, there were also few observations of Red Kites outside the breeding period, including wintering birds (RAŠAJSKI & MARINKOVIĆ 2000). At the end of the century, however, the species appeared more and more often even during the breeding period (PUZOVIĆ 2002). The estimated population was 3-5 pairs at that time, and the trend was defined as increasing (with breeding pairs numbering 2-3 in Vojvodina, 0-1 in Central Serbia, and 1 in Kosovo and Metohija) (Puzović et al. 2003). Breeding has not been confirmed since the beginning of the 21st century, although the birds were present during the breeding period at several sites in Vojvodina (ŠćIBAN et al. 2015). Nevertheless, the breeding population in Serbia and Montenegro was estimated at 3-5 pairs (BIRDLIFE INTERNATIONAL 2004). More recently, the estimate of breeding pairs in Serbia was only 0-1 for the 2008-2012 period (BIRDLIFE INTERNATIONAL 2015). Similarly, PUZOVIĆ et al. (2015) classified the Red Kite population in Serbia as probably extinct, with possibly just one breeding pair. Outside the breeding period, there were few observations of Red Kites throughout the year (Rašajski & Marinković 2000, Šćiban et al. 2015). Although the species is still rare in Serbia, some additional observations have been published (RAKOVIĆ 2003, MÉRŐ & ŽULJEVIĆ 2011), with the species occurring especially during the breeding time (Šćiban 2003, Tucakov 2005, Hulo 2016).

In 2014, we began using telemetry to study the biology of Red Kite populations in Austria, the Czech Republic, and Slovakia. These countries are located in the eastern part of an area where Red Kite occurs at a relatively low density, its population including only 28-35 breeding pairs (an estimate for 2011-2012), about 125 pairs (2015), and approximately 9 pairs (2014) in Austria, the Czech Republic, and Slovakia, respectively (BIRDLIFE INTERNATIONAL 2015, RAK 2016, MADERIČ & SVETLÍK 2015). Because some individuals tagged with loggers occurred in Serbia, we were able to characterize some spatiotemporal activities of Red Kites in this country. That is the aim of this paper. Information about Red Kite habitat demands in southeastern parts of Europe can be helpful from a pan-European point of view in protecting this threatened raptor species.

2. Methods

From 10 July 2014 until 31 March 2018, a total 95 Red Kites were fitted with telemetry devices in the Czech Republic (61 birds), Austria (26 birds), and Slovakia (8 birds). Some of these birds (5 from the Czech Republic, 3 from Austria, 5 from Slovakia) were found to be using Serbian territory and could be characterized as being there during the post-breeding (autumn) migration and/or spring migration.

Saker H loggers (20 g; Ecotone, Sopot, Poland) were used to track the birds. The loggers were fitted onto the backs of birds using harnesses (backpack) with 6 mm Teflon ribbon encircling the body by two loops around the bases of the wings and joined in front of the breastbone. The loggers work in GPS (global position system)/GSM (global system for mobile communication) systems or in GPS/ GSM/UHF (ultra-high frequency). GPS positions of the birds were collected according to individual setting (1 position fixed every 5 min to 6 h) and were sent by SMS (short message service) via local mobile telephone operators to the Ecotone Center in Poland, where they were saved and archived or data were uploaded by receivers locally and again saved and archived. Coordinates of bird positions providing the basis of information about their occurrence were transformed into curves on a map in order to visualize the spatiotemporal activities of the birds examined. Subsequent positions were connected by line on the figure using GIS (geographic information system) and ArcGIS and QGIS software, and ESRI Basemaps (ESRI Global Inc., USA, www.qgis.org) were used for GIS analysis and map visualization.

We analyzed data for the stay of each Red Kite tracked in Serbia, and we counted the number of days in individual months during which each bird stayed in Serbia. We also determined the locations used by each bird as points localized by GPS and connected them by lines as the shortest distance between the two points. Using combined temporal and spatial data, we determined areas in Serbia most attractive for migrant Red Kites.

3. Results and discussion

We found 13 Red Kites that occurred from 2014 until the end of March 2018 in Serbia (Table 1). These birds stayed in Serbia for a total of 138 days. The birds occurred mostly in the northwestern part of Serbia in Vojvodina within an area bordering Croatia (Figure 1). Crossings of the border were frequently observed in the western part of Serbia (at the borders with Bosnia and Herzegovina, Montenegro, Albania). We revealed two main periods of Red Kite occurrences in Serbia (Figure 2). The first period was from March until June, with the most observations occurring in April. The second period was from August until November, with the most observations in October. One Red Kite (D 6162) died during its stay in Serbia. This occurred on 21 September 2017 near the village of Ritiševo in the northeastern part of Serbia. The body of this bird was found (Figure 3) and subsequent laboratory examination revealed



Figure 1: Occurrence of tagged Red Kites *Milvus milvus* during their stays in Serbia. Circles depict the positions of birds. Every line connects successive GPS positions of a bird. The yellow triangle shows the place where one poisoned bird was found. Country abbreviations: AL – Albania; BG – Bulgaria; BIH – Bosnia and Herzegovina; H – Hungary; HR – Croatia; MK – Macedonia; MNE – Montenegro; RO – Romania; SRB – Serbia.

Slika 1: Pojavljanje s telemetrijo spremljanih rjavih škarnikov *Milvus milvus* v Srbiji. Krožci označujejo položaj ptic, črte pa povezujejo njihove zaporedne lokacije. Trikotnik označuje kraj najdbe zastrupljenega osebka. Okrajšave držav: AL – Albanija; BG – Bolgarija; BIH – Bosna in Hercegovina; H – Madžarska; HR – Hrvaška; MK – Makedonija; MNE – Črna gora; RO – Romunija; SRB – Srbija.



Figure 2: Dynamics of the annual occurrence of Red Kites *Milvus milvus* in Serbia. Numbers of days were counted as number of one bird/one day stays, 2014-2018, cumulative data.

Slika 2: Sezonska dinamika pojavljanja rjavih škarnikov Milvus milvus v Srbiji. Sešteti so dnevi, ki jih je v posameznem mesecu posamezna ptica preživela v državi, 2014-2018, kumulativni podatki.

poisoning of the bird by carbofuran (Naučni institut za veterinarstvo "Novi Sad", Novi Sad, Serbia, Dr. Radomir Ratajac, 2 February 2018).

Whereas South European Red Kite populations are resident, most of the North European birds migrate to winter around the Mediterranean, with some flying on to North Africa and Turkey (GÉNSBØL & THIEDE 2008). Interestingly, in the past 25 years an increasing proportion of the population in Sweden, Germany, Switzerland, and France has spent the winter close to or within the breeding range, as has always been the case for the small population in central Wales. This tendency is possibly due to milder winters in recent decades and perhaps also to the greater availability of food. The young birds migrate separately, ahead of the adults, which are then probably influenced by the weather conditions (GÉNSBØL & THIEDE 2008).

As revealed in this study, Red Kites originating from central Europe appear in Serbia. In some parts of central Europe, the population density is now slowly growing. In the Czech Republic, for example, Red Kite recolonized the country after about 100 years of absence, and 1976 was the year of the first confirmed breeding (ŠŤASTNÝ *et al.* 2006). Since that time, the population has expanded to 30–50 breeding pairs in 1985–1989, 70–100 breeding pairs during 2001–2003, and to about 125 breeding pairs at present (BIRDLIFE INTERNATIONAL 2004, ŠŤASTNÝ *et al.* 2006, RAK 2016). Further east within eastern Europe, Red Kites breed only sporadically in a limited number of pairs (3–10 pairs in Belarus, 1–10 pairs in Ukraine, 1–6 pairs in Russia, and probably no breeding pairs in Romania and Bulgaria) (BIRDLIFE INTERNATIONAL 2015).



Figure 3: Cadaver of a poisoned Red Kite *Milvus milvus* with a telemetry logger. The bird D 6162 (see Table 1) died near Ritiševo on 21 September 2017. Photo: I. Đorđević.

Slika 3: Truplo zastrupljenega rjavega škarnika *Milvus milvus*. Ptica D 6162 (glej tabelo 1) je poginila blizu Ritiševa dne 21. 9. 2017. Foto: I. Đorđević.

 Table 1: Red Kites fitted with telemetry loggers and registered in Serbia (each bird was tagged as a pullus at a nest).

 Country abbreviations: A, Austria; CZ, Czech Republic; SK, Slovakia

Tabela 1: Rjavi škarniki, opremljeni z oddajniki, ki so bili registrirani v Srbiji (vsak osebek označen kot mladič v gnezdu). Krajšave držav: A, Avstrija; CZ, Češka; SK, Slovaška.

Red Kite number/ Številka rjavega škarnika	Origin of bird: country, coordinates of the nest, year/ Izvor ptice: država, koordinate gnezda, leto	Terms of occurrence in Serbia/ Obdobje pojavljanja v Srbiji	No. of days spent in Serbia/ Št. dni preživetih v Srbiji
CT 753	CZ, 48.78 N, 17.06 E, 2016	14 Oct. 2016	1
CT 754	CZ, 48.75 N, 17.03 E, 2016	4-5 Oct. 2016	2
CT 1457	CZ, 48.78 N, 17.07 E, 2017	28-29 Jul. 2017	2
CT 1682	CZ, 48.62 N, 16.95 E, 2016	27-29 Mar. 2017	3
CT 1913	CZ, 48.75 N, 16.78 E, 2017	14-18 Aug. 2017, 19-23 Sep. 2017	10
D 5603	SK, 48.93 N, 21.75 E, 2015	23-24 Aug. 2015, 26-31 Aug. 2015, 3-4 Sep. 2015, 12-13 Sep. 2015, 19- 20 Sep. 2015, 22-30 Sep. 2015, 1-3 Oct. 2015, 5-13 Oct. 2015, 16-25 Oct. 2015, 28-31 Oct 2015, 22-23 Apr. 2016, 11-12 Jun. 2016, 20-21 Sep. 2016, 16-17 Mar. 2017, 24 Mar. 2017	58
D 5605	SK, 48.93 N, 21.75 E, 2015	2-3 Sep. 2015	2
D 5607	SK, 48.93 N, 21.84 E, 2016	22-28 Oct. 2016	7
D 6161	SK, 48.93 N, 21.84 E, 2016	28 Mar. 2018	1
D 6162	SK, 48.90 N, 21.77 E, 2017	19-21 Sep. 2017	3
JC 57509	A, 48.42 N, 16.85 E, 2015	12-15 Nov. 2015	4
JC 57514	A, 48.55 N, 16.77 E, 2015	21-23 Sep. 2015, 21-22 Oct. 2015, 24-25 Oct. 2015, 28-31 Oct. 2015, 1-3 Nov. 2015, 17-30 Apr. 2016, 1-13 May 2016, 2-3 Apr. 2017	43
JC 75455	A, 48.60 N, 16.92 E, 2016	8-9 Jun. 2017	2

We found that Red Kites occurred mostly in the western part of Vojvodina. In Croatia, Red Kites nested rarely in the northeastern part of the country (Croatian Baranja) until the 1960s (BARIŠIĆ 2013). Recently, no breeding pairs have been known there (BIRDLIFE INTERNATIONAL 2015) and, according to the Croatian Bird Migration Atlas (KRALJ et al. 2013), it seems that Red Kite migration routes lie outside this country. Nevertheless, some vagrants and wintering birds are known. Wintering in Croatian Baranja was noted from 2002 (BARIŠIĆ 2013), but exact data were scarce. In 2002, at least two Red Kites wintered in Croatian Baranja (Томік in BARIŠIĆ 2013). Recently, seven Red Kites were observed in Jagodnjak in Croatian Baranja during 26-27 January 2015, together with one black

kite *Milvus migrans* (LITERÁK *et al.* 2017). Eight wintering Red Kites were observed at the same place in Jagodnjak on 22 January 2017 (I. LITERÁK & H. MATUŠÍK, *unpublished observation*). In Punitovce in Slavonia (bordering on Croatian Baranja), 11 and 2 wintering Red Kites were observed on 21 January 2016 and on 23 January 2017, respectively (I. LITERÁK, R. PETRO, H. MATUŠÍK, *unpublished observation*). In an adjacent area of Hungarian Baranya, some Red Kites have wintered as well (for example, one bird was observed in January 2016) and recently most of the breeding territories within Hungary have been located there (DUDÁS 2014, MÓROCZ *et al.* 2015, NAGY *et al.* 2016).

Baranja/Baranya is a historical geographical region between the Danube and Drava rivers.

Its territory is now divided between Croatia and Hungary. In Serbia (bordered by Croatia and Hungary including Baranja/Baranya), Red Kites stopped to nest in the second half of the 20th century (RAŠAJSKI & MARINKOVIĆ 2000). It now seems that Red Kites occur in the southern part of the Pannonian Basin (Baranja/Baranya/Vojvodina Province of Serbia) more frequently than in the second half of the 20th century, not only based on our results but also according to some direct observations (A. TOMIK pers. comm.). This lowland area has a character of agricultural landscape with small fields and meadows, small to medium-sized forest patches and small villages which probably meets the requirements of Red Kites. Other parts of Serbia were used by Red Kites to a substantially lesser extent.

The pattern and dynamics of Red Kites' occurrence in Serbia corresponded well to the notion that Red Kites presently occur in Serbia during spring and autumn migrations. The Red Kite population has been well monitored in Switzerland, and we can see some similarities (AEBISCHER 2009). In Switzerland, juvenile Red Kites started their migration between 27 September and 9 October. The birds arrived to their winter quarters between 3 October and 25 October. Juveniles then left their winter quarters between 10 March and 26 April (adults between 4 January and 14 March). Similarly as in Serbia, the spring migration of Red Kites in Switzerland peaks in April and the autumn migration during October.

We can speculate that as the density of Red Kites in central Europe continues to increase, the wintering of Red Kites in Vojvodina will occur more often than in the past. This area could become the next core area for Red Kite nesting in Serbia, thereby extending the area in Baranja/Baranya that is suitable for recovery of the wintering and nesting Red Kite population. Young Red Kites originating in Austria, the Czech Republic, and Slovakia and migrating through Serbia could provide a base for the next breeding population in this area, which has landscape characteristics appropriate for Red Kite breeding. Since the 1970 discovery of the first roosts of wintering Red Kites in Switzerland, the numbers of wintering and nesting birds have steadily increased (AEBISCHER 2009). Thus, the tendency to winter in central Europe is real, even though many individuals continue, as in the past, to migrate to south Europe (AEBISCHER 2009).

At present, the most pertinent threat for Red Kites in Europe is illegal direct poisoning, indirect poisoning from pesticides, and secondary poisoning from consuming rodents poisoned by rodenticides spread on farmland (SMART *et al.* 2010, BIRDLIFE INTERNATIONAL 2015). We documented a case of illegal poisoning with carbofuran in a Red Kite in Serbia.

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4. Abstract

A total of 13 Red Kites *Milvus milvus* fitted with GPS/GSM telemetry loggers in central Europe were tracked in Serbia from 10 July 2014 until 31 March 2018. These birds remained in Serbia for 138 days (counted as number of one bird/one day stays). Red Kites occurred mostly in the Vojvodina Province (NW Serbia). They were registered most often in April and October, which corresponded to their spring and autumn migrations. It is possible that Red Kites occur in Serbia more often than formerly, and this could in future result in this threatened European raptor's more frequently wintering and breeding within the country.

Povzetek

S telemetrijskimi napravami smo označili 13 rjavih škarnikov *Milvus milvus* v srednji Evropi in med 10. 7. 2014 in 31. 3. 2018 spremljali njihovo pojavljanje v Srbiji. Ti osebki so se v Srbiji zadrževali 138 dni. Večina opazovanj je iz Vojvodine (SZ Srbija). Najpogosteje so se pojavljali med selitvijo – aprila in oktobra. Morda se vrsta v Srbiji pojavljala pogosteje, kot smo domnevali doslej, v prihodnje se zato lahko nadejamo njenega pogostejšega prezimovanja ali celo gnezdenja v državi. Key words: *Milvus milvus*, raptor, vagrancy, migration, poisoning

Ključne besede: *Milvus milvus*, ujeda, selitev, zastrupitev

5. References

- AEBISCHER A. (2009): Migration and wintering of Swiss Red Kites assessed by satelite telemetry. pp. 48–51. In DAVID F. (ed.). Proceedings of the Red Kite International Symposium, October 17-18, 2009, Montbéliard, France. – LP Mission Rapaces and LPO Franche-Comté, Paris, France.
- BARIŠIĆ S. (2013): Crvena lunja Red Kite Milvus milvus Linnaeus, 1758. pp. 75–76. In TUTIŠ, V., KRALJ J., RADOVIĆ D., ĆIKOVIĆ D., BARIŠIĆ S. (eds.), Crvena knjiga ptica Hrvatske, Red Data Book of Birds of Croatia. – Ministarstvo zaštite okoliša i prirode, Državni závod za zaštitu prirode, Republika Hrvatska, Zagreb.
- BIRDLIFE INTERNATIONAL (2004): Birds in Europe: Population Estimates, Trends and Conservation Status. BirdLife Conservation Series No. 12. – BirdLife International, Cambridge.
- BIRDLIFE INTERNATIONAL (2015). European Red List of Birds. The IUCN Red List of Threatened Species. – Office for Official Publications of the European Communities, Luxembourg.
- DUDÁS M. (2014): A vörös kanya (*Milvus milvus*) európai elterjedési (fészkelési) viszonyai és a magyarországi állományának fenntartási lehetösége. – Heliaca 12: 55–65.
- GÉNSBØL B., THIEDE W. (2008): Collins Birds of Prey. HarperCollins Publishers, London.
- HULO Î. (2016): Posmatranje ušatog gnjurca Podiceps auritus, riđe lunje Milvus milvus i male čigre Sternula albifrons u severnoj Bačkoj. – Ciconia 24/25: 19.
- KRALJ J., BARIŠIĆ S., TUTIŠ V., ĆIKOVIĆ D. (2013): Atlas selidbe ptica Hrvatske, Croatian Bird Migration Atlas. – Hrvatska akademija znanosti i umjetnosti, Zavod za ornitologiju, Zagreb.
- LITERÁK I., HORAL D., ALIVIZATOS H., MATUŠÍK H. (2017): Common wintering of black kites (*Milvus migrans migrans*) in Greece, and new data on their wintering elsewhere in Europe. – Slovak Raptor Journal 11: 91–102.
- MÉRŐ T. O., ŽULJEVIĆ A. (2011): Red Kite Milvus milvus. – Acrocephalus 33 (150/151): 235.
- Mórocz A., BANK L., KOVÁTS L., ORBÁN A., VÁCZI M., HARASZTHY L. (2015): A vörös kánya (*Milvus milvus*) magyarországi helyzete 2015-ben. – Heliaca 13: 39.
- MADERIČ B., SVETLÍK J. (2015): Haja červená (*Milvus*). *milvus*). Birds of Prey and Owls – Journal of Raptor Protection of Slovakia 11: 18.

- NAGY Z., NAGY K., HORVÁTH M., ORBÁN Z. (2016): Elkészült a 2016. évi XIII. Országos Sasleltár. – [www.mme.hu/elkeszult-2016-evi-xiii-orszagossasleltar], 29/01/2016.
- PUZOVIĆ Š. (2002): Nova posmatranja crvene lunje Milvus milvus u Srbiji tokom reproduktivnog perioda. – Ciconia 11: 136–139.
- PUZOVIĆ S., SIMIĆ D., SAVELIĆ D., GERGELJ J., TUCAKOV M., STOJNIĆ N., HULO I., HAM I., VIZI O., ŠĆIBAN M., RUŽIĆ M., VUČANOVIĆ M., JOVANOVIĆ T. (2003):
 Ptice Srbije i Crne Gore – veličine gnezdilišnih populacija i trendovi: 1990–2002. – Ciconia 12: 35–120.
- PUZOVIĆ S., RADIŠIĆ D., RUŽIC M., RAJKOVIĆ D., RADAKOVIĆ M., PANTOVIĆ U., JANKOVIĆ M., STOJNIĆ N., ŠĆIBAN M., TUCAKOV M., GERGELJ J., SEKULIĆ G., AGOŠTON A., RAKOVIĆ M. (2015): Ptice Srbije: procena veličina populacija i trendova gnezdarica 2008-2013. – Bird Protection and Study Society of Serbia; Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia.
- RAK D. (2016): Luňák červený (*Milvus milvus*). Zpravodaj Skupiny na ochranu a výzkum dravců a sov 16: 14–16.
- RAKOVIĆ M. (2003): Posmatranje crvene lunje *Milvus milvus* u Valjevu. – Ciconia 12: 189.
- RAŠAJSKI J., MARINKOVIĆ S. (2000). Crvena lunja *Milvus milvus* (Linnaeus, 1758). pp. 45–50. In PUZOVIĆ S. (ed.) Atlas ptica grabljivica Srbije, mape rasprostranjenosti i procene populacija 1977–1996. – Závod na zaštitu prirode Srbije, Beograd.
- ŠĆIBAN M. (2003): Posmatranja crvene lunje *Milvus* milvus u Bačkoj tokom maja i avgusta 2003. – Ciconia 12: 189.
- ŠĆIBAN M., RAJKOVIĆ D., RADIŠIĆ D., VASIĆ V., PANTOVIĆ U. (2015): Birds of Serbia – Critical List of Species. – Institute for Nature Conservation of Vojvodina Province and Bird Protection and Study Society of Serbia, Novi Sad.
- SMART J., AMAR A., SIM I.M.W., ETHERIDGE B., CAMERON D, CHRISTIE G., WILSON J.D. (2010): Illegal killing slows population recovery of a re-introduced raptor of high conservation concern – the Red Kite *Milvus milvus*. – Biological Conservation 143: 1278–1286.
- Šřastný K., Вејčек V., Нидес К. (2006): Atlas hnízdního rozšíření ptáků v České republice 2001-2003. – Aventinum, Praha.
- Тисакоv М. (2005): Red Kite *Milvus milvus.* Acrocephalus 26 (124): 56.

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