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Black Kite *Milvus migrans* in Slovenia – its distribution, phenology, breeding and habitat

Črni škarnik *Milvus migrans* v Sloveniji – razširjenost, fenologija, gnezditev in habitat

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Between 1984 and 2017, 1,388 Black Kites were recorded, mostly in lowlands with 70% of observations made at Dravsko polje. They were observed from sea level to around 1,600 m a.s.l. with an average elevation of 271 m a.s.l. The species was present in Slovenia from mid-March to early December with indistinct spring and autumn migrations. The highest number of observations was recorded in May. The Black Kite was observed in 71 out of 238 10x10 km grid squares in Slovenia (29.8%), with more observations around known breeding sites and at sites with higher observer effort. Both the number of observations and the number of probable and confirmed breeding pairs increased. In 2011–2018, 10 breeding pairs were found at 7 sites (3–7 per year). Additionally, 11 probable breeding pairs at 9 sites (0–6 pairs per year) were found. The breeding population in 2011–2018 is estimated at 10–21 pairs with an average breeding density of 0.3–0.9 breeding pairs per 100 km^2. The highest density was recorded at Dravsko polje with 0.6–2.2 breeding pairs per 100 km^2. If possible breeding (breeding attempts) were also taken into consideration, the estimate would be up to five breeding pairs higher. The species was recorded at known breeding sites in most years after the breeding was confirmed. Black Kites were observed closer to larger water bodies and to rubbish tips than expected by chance. More Black Kites were recorded in areas with a lower percentage of forest and arable land and a higher percentage of meadows, settlements and wetlands.

Key words: breeding population, breeding density
Ključne besede: gnezdeča populacija, gnezditvena gostota

1. Introduction

The Black Kite *Milvus migrans* inhabits open landscapes of Europe, Asia, Africa and Australia (Del Hoyo *et al.* 1994). It inhabits almost all of Europe, with the exception of northern latitudes and most Mediterranean and Atlantic islands (Cramp 1998), representing around 11% of global range (BirdLife International 2018). The European population of Black Kite is estimated at 81,200–109,000 pairs (BirdLife International 2015), representing less than 24% of the global population (Birdlife international 2004). The largest European breeding populations are in Russia (30,000–50,000), France (22,500–26,300), Spain (2,500–10,000) and Germany (2,700–4,100).

With the exception of Italy (700–1,200 pairs), our neighbouring countries have small breeding populations in the range of 50 to 500 pairs (Birdlife international 2004).

In the 19th and early 20th century, Black Kite was present in Slovenia, but was rare and with no breeding record (Freyer 1824, Schiavuzzi 1883, Schulz 1890, Reiser 1925). It had the same status in the first half of the 20th century, when the species was a non-breeding visitor in NE Slovenia (Matvejev & Vasič 1973). Until 1990, when breeding was documented for the first time at Leško polje (Kozinc 1991), its breeding status in Slovenia was uncertain (Geister 1995). In 1999, the second breeding pair was confirmed at the confluence of the Sava and Ljubljanica Rivers (hereinafter referred to as "Confluence"), central Slovenia (Košir 1997, Kozamernik 2000), with the breeding population estimated at 1–3 breeding pairs at that time (Birdlife international 2004). Between 2000 and 2011, several breeding pairs were confirmed or considered probable. Confirmations were as follows: at Medvedce water reservoir in 2004 (hereinafter referred to as "Medvedce"; Kerček 2005, Bordjan & Božič 2009), in the Vipava valley in 2008 (Figelj 2007a), second and third pairs at Dravsko polje in 2009 and 2011. Nest building was observed near Žovnek water reservoir in 2009 (J. Novak *pers. comm.*). In 2011, the breeding population was estimated at 10–20 breeding pairs (Denac *et al.* 2011). Thereupon, breeding was confirmed in the eastern part of Ljubljansko barje (Denac 2016).

In Slovenia, Birds of Prey (Accipitriformes and Falconiformes) were mostly included in multiple species studies (e.g. Kmecl & Rižner 1993, Gregori & Šere 2005, Bordjan & Božič 2009, Škornik 2012, Bordjan 2012, 2015) and only rarely did they constitute a central part of study. Thus in more than 30 years of Acrocephalus magazine, there are only 19 articles with Birds of Prey as a central part of study, with most of them covering local problems of distribution (Bračko 1990, 1998, Božič 1992, Gjerkeš & Lipej 1992, Trebušak *et al.* 1999, Mihelič & Brajnik 2006, Figelj 2007b, Denac 2010) or nesting (Smerdu 1981, Škornik 1985, Kozinc 1991, Marenče 1998). One deals with the bird's diet (Kozinc 1999), one with conservation (Luskovec 1990) and one with unusual influx (Hanžel 2015). Considering all our journals, papers on Griffon Vulture *Gyps fulvus* (Mihelič & Genero 2005), White-tailed Eagle *Haliaeetus albicilla* (Vrezec *et al.* 2009), Common Kestrel *Falco tinnunculus* (Šumrada & Hanžel 2012) and Red Kite *Milvus milvus* (Bordjan 2017) submit a more detailed review of the status of certain birds of prey in Slovenia. Moreover, in the past 50 years, out of 38 Raptor species (also including Birds of Prey) 71% were part of a monitoring scheme and only 18% of species were part of national monitoring, while others were included in more or less local studies (Vrezec 2012). The purpose of this article is to give a more detailed overview of the Black Kite's distribution, phenology, breeding population development and habitat in Slovenia in the light of new knowledge and data.

2. Methods

Data on the Black Kite in Slovenia was obtained from the ornithological literature, as well as directly from observers. All volumes of the following journals were checked: Acrocephalus, Biota, Falco and Svet ptic up to and including the last issue published in 2017. Additionally, Google Scholar was used with key words "Črni škarnik" and "*Milvus migrans*" or "Black Kite" for Slovenia. Data from online data base NOAGS (Atlas ptic 2018) were obtained. Observations were also collected directly and indirectly from other observers.

Data till the end of 2017 were used for temporal and spatial distribution, but for breeding the 2018 breeding season was included as well. Data were drawn in map using program ArcGis 10.4.1 (ESRI 2015) and also used to calculate altitude and distance to the nearest large water body (rivers and lakes or fishponds with min. 3 ha of water surface), rubbish dump and settlements. Data on altitude were clustered in 100 meter groups to mask potential discrepancies between actual observation and point in the map. For breeding distribution coarser, 10x10 km squares were used, as well as smaller 2x2 km squares for habitat analysis. All entered points were overlaid with the 2x2 km grid (containing 5,405 squares) and percentage of land use (MKGP 2017) was calculated for squares with Black Kite observations (1,021 observations in 184

squares). For habitat analysis, 1,100 random points were generated in Arc GIS in 2x2 km grid, and those that were outside Slovenia were later removed (amounting to 1,090 points in 1,000 2x2 km squares). Distance to large water body, rubbish dump and settlements and share of land use was calculated for random points and 2x2 km squares with random points. For labelling breeding status, confirmed and probable breeding was used. Data were labelled as confirmed breeding in proximity of known nest sites or when one or two individuals remained in the same area for longer period (two or more observations distanced at least one month) in combination with courtship display, copulation, observation of fledged young (together with parents up to first half of August) or regular (at least two observations at least one week apart in breeding period) flights to a potential nest site. Observations were labelled as probable breeding when one or two individuals remained in the same area for a longer period within main breeding period (20 May–25 July), or observation of courtship display or copulation with the absence of later observations. Exception is the area of Krška ravan where breeding status given by Denac *et al*. (2009) was used. Observations in the western part of the Vipava valley were separated due to distance between two clusters of observations that are located more than 10 km from known nest site. Although Black Kites may go as far as 20 km from the nest in search of food during nesting, most feeding flights are made within 10 km from nest (Meyburg & Meyburg 2009). For the purpose of seasonal dynamics, we distributed data in 37 ten-day periods that are explained in more detail by Bordjan & Božič (2009). A regular monitoring of waterbirds and birds of prey has been conducted at Medvedce since 2002 (Bordjan & Božič 2009) and Rački ribniki – Požeg Country Park since 2011. From study at Medvedce, the average temporal distribution of Black Kite presence per visit was calculated in a ten-day period.

3. Results

3.1. Temporal distribution

We gathered data on 1,388 individuals between 1984 and 2017 (Figure 1). 70.7% of observations come from Dravsko polje and 61.5% from the breeding site at Medvedce. The number of observed Black Kites rose steadily with 7.6 individuals per year before 2001 and 124.4 between 2011 and 2017 (Pearson's r: 0.84; N = 32; $P < 0.001$). Even without individuals from Medvedce, the number of observations rose from average 7.3 to 20.1 individuals per year (Pearson's r: 0.61; N = 32; $P < 0.001$). Most observations (1,021) involved single individuals (780) with more than ten individuals simultaneously observed only three times; 12 individuals were observed at Ljubljana rubbish dump (central Slovenia), 15 near Kromberk (Gorica, SW Slovenia) and 16 around Medvedce (NE Slovenia).

Black Kite was present in Slovenia between mid-March and the beginning of December (Figure 2). The earliest observation dates to 14 Mar when one individual was observed near Maribor (NE Slovenia) in 2002 (Lončar 2003) and one at Ljubljansko barje (central Slovenia) in 2009 (Rubinić *pers. comm*.). Spring migration in Slovenia was weak in March and the number of observations peaked in May (Figure 2). In Slovenia, the maximum of observed individuals dates to mid-May. After the spring migration peak, observations decreased steadily until the beginning of October with some observations made between the end of October and December (Figure 2). The latest observation was from 8 Dec at Lake Cerknica (A. Škoberne & M. Cvetko *pers. comm*.).

The seasonal distribution was monitored more closely on breeding grounds at Medvedce (NE Slovenia) in 2002–2018. Black Kites were present continuously between mid-March and late September (Figure 3) with one observation in November (Bordjan 2004). The probability of observing a Black Kite at Medvedce in this particular period was on average 0.47 observations per visit and varied widely from 0.04–0.71 obs / visit (Figure 3). It was highest between late April and late July. Lowest probability was in 2002 (0.17 obs / visit) and in 2008 (0.25 obs. / visit) and highest in 2018 (0.63 obs. / visit).

3.2. Spatial distribution

Black Kite was observed in 71 out of 238 10x10 km squares covering Slovenia (29.8%; Figure 4). Observations were made in most flatlands of Slovenia with the exception of land around the Mura river.

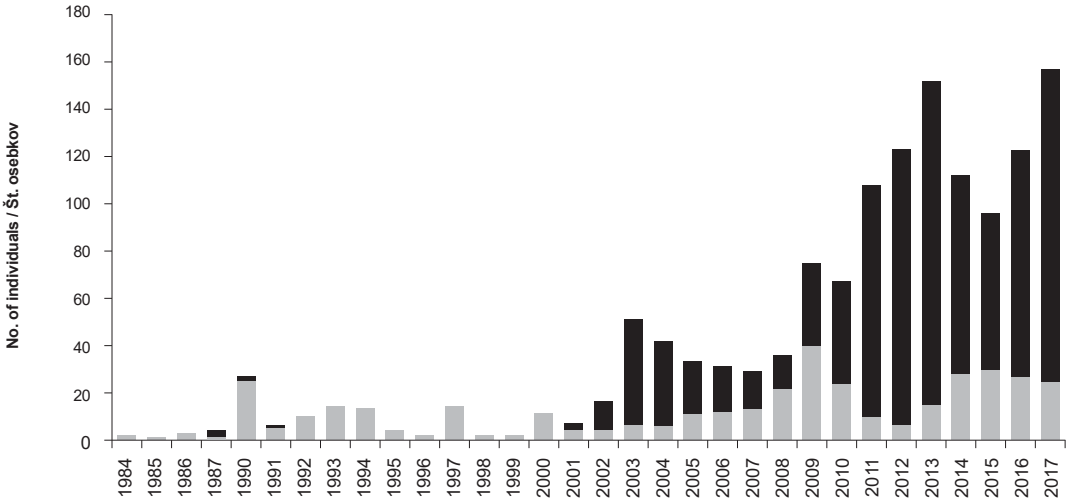

Figure 1: Number of Black Kites *Milvus migrans* observed between 1984 and 2017 in Slovenia. Black columns refer to observations at Medvedce water reservoir (NE Slovenia) and grey to observations from the rest of Slovenia).

Slika 1: Število črnih škarnikov *Milvus migrans*, opazovanih med letoma 1984 in 2017 v Sloveniji. Črni stolpci ponazarjajo opazovanja z zadrževalnika Medvedce (SV Slovenija), sivi pa opazovanja iz preostale Slovenije.

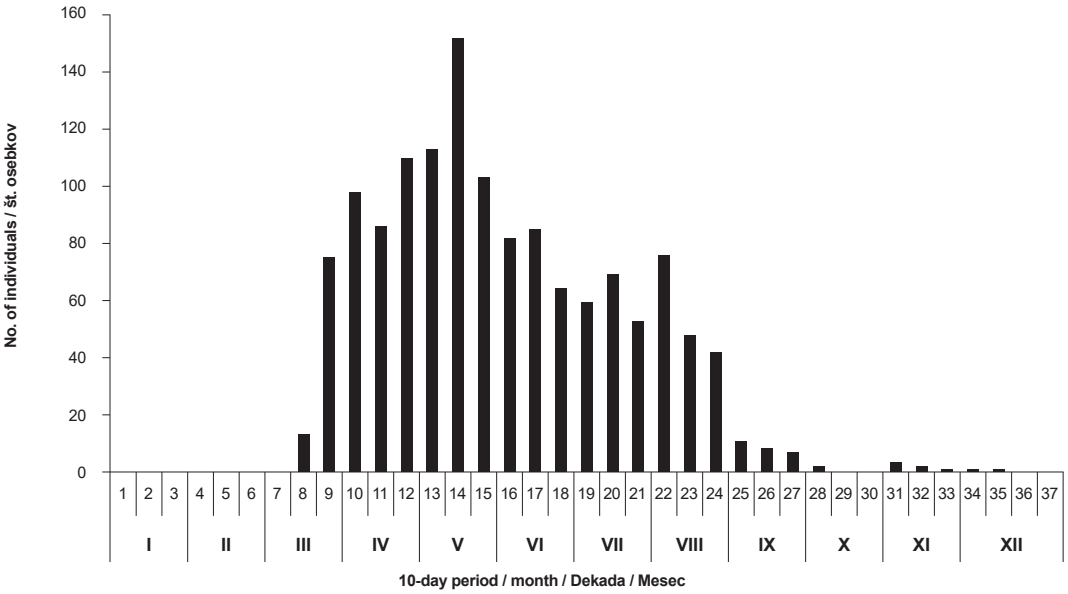

Figure 2: Number of Black Kites *Milvus migrans* observed in separate 10-day periods in Slovenia

Slika 2: Število črnih škarnikov *Milvus migrans*, opazovanih po posameznih dekadah v Sloveniji

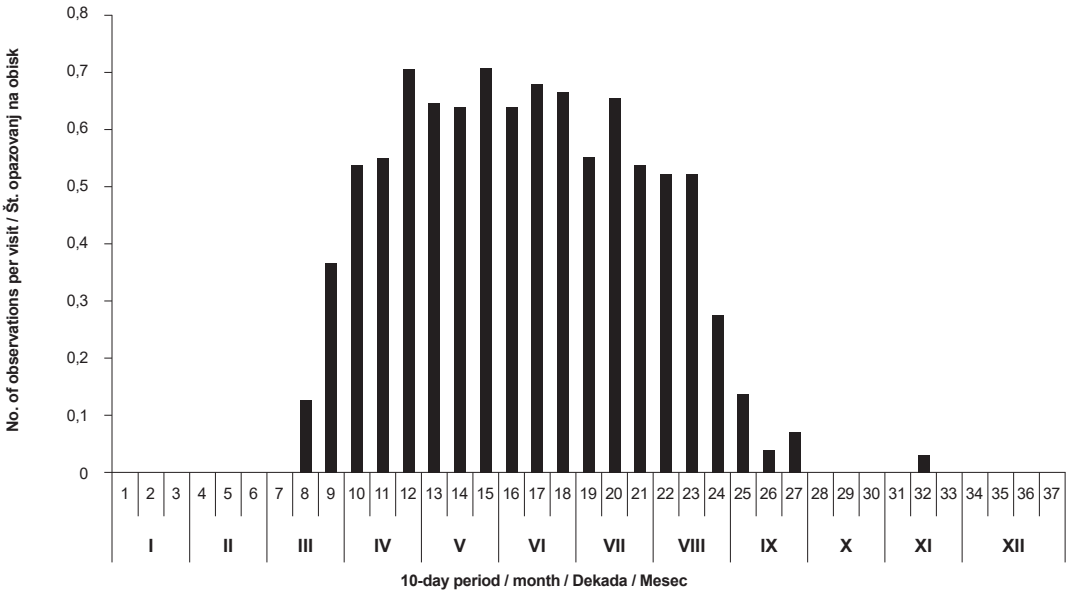

Figure 3: Seasonal dynamics of Black Kite *Milvus migrans* at Medvedce water reservoir (NE Slovenia) during 10-day periods between 2002 and 2010

Slika 3: Sezonska dinamika opazovanj črnega škarnika *Milvus migrans* na zadrževalniku Medvedce (SV Slovenija) po dekadah v obdobju 2002–2010

Highest densities of observations were recorded in the squares with confirmed breeding sites and squares with higher observation effort (i.e. Lake Cerknica). Black Kite observations were missing from extensive forested and mountainous areas.

Black Kite was recorded on the Slovenian coast in Sečovlje saltpans at sea level (Jančar 1991, Sovinc & Šere 1993). Highest altitude was recorded during bird of prey count on Breginjski stol in 2010 (Denac 2010) just below 1,600 m a.s.l. Only eight records were made above 1,000 m a.s.l. Average altitude of Black Kite observations is 271 m a.s.l. and 309 m a.s.l., if Medvedce data are excluded. Black Kites were observed more often than would be expected at random below 300 m a.s.l. (Figure 5).

3.3. Breeding of Black Kite *Milvus migrans* in Slovenia

Between 1990 and 2018, ten confirmed breeding pairs were observed at seven sites (Figure 6). Three were observed only in a single year. The observations indicate that pairs at the confirmed breeding sites bred there more or less regularly (Figure 6), with above mentioned exceptions and Leško polje where breeding data were absent for 22 years. The only pairs that were observed at breeding sites continuously were those at Medvedce and in Rački ribniki – Požeg Country Park, both with regular monitoring. From 2005 onwards, 3–7 pairs were registered in any given year.

In Slovenia, eleven pairs at nine sites meet criteria for probable breeding (Figure 7). With the exception of western part of the Vipava valley, N part of Ljubljana basin and NE part of Dravsko polje, the observations of Black Kites were more irregular then those for confirmed pairs. From 2000 onward, 0–6 probable pairs were observed in any given year.

The breeding population of Black Kites (considering confirmed and probable pairs in any given year) has risen steadily from 1–4 breeding pairs between 1990 and 2000 to 2–11 pairs in 2000–2010 and 6–12 pairs in 2011–2018 (Figure 6). The 10 confirmed or probable pairs

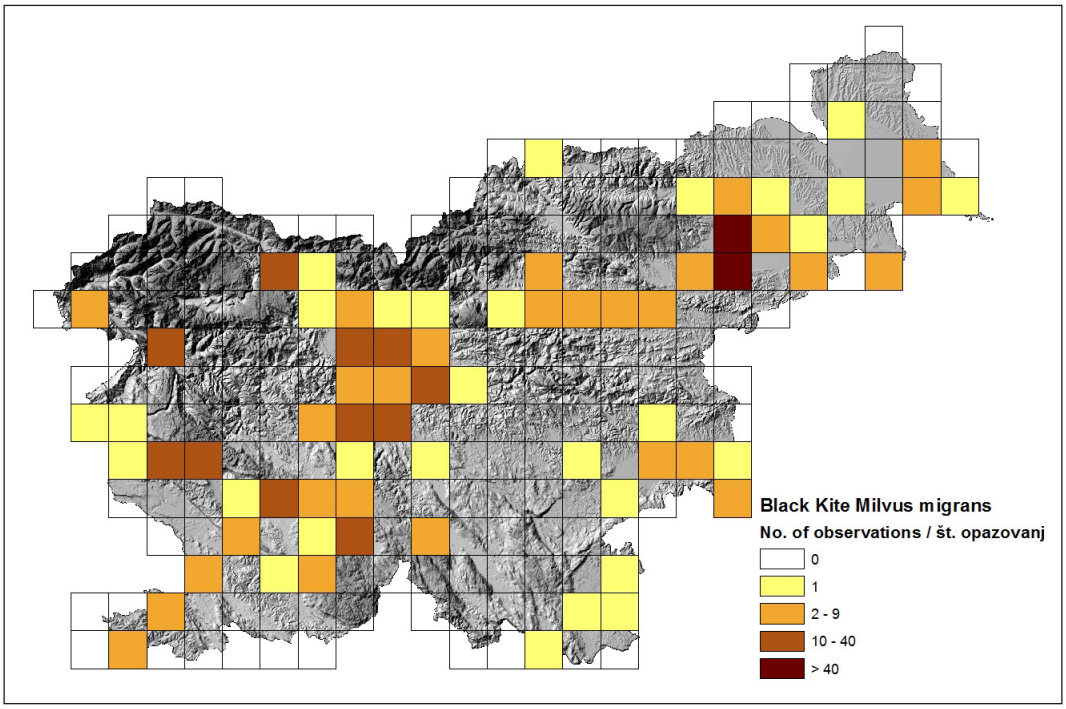

Figure 4: Distribution of Black Kite *Milvus migrans* in Slovenia with the number of observations in 10x10 km squares

Slika 4: Razširjenost črnega škarnika *Milvus migrans* v Sloveniji s prikazom števila opazovanj po posameznih kvadratih 10x10 km

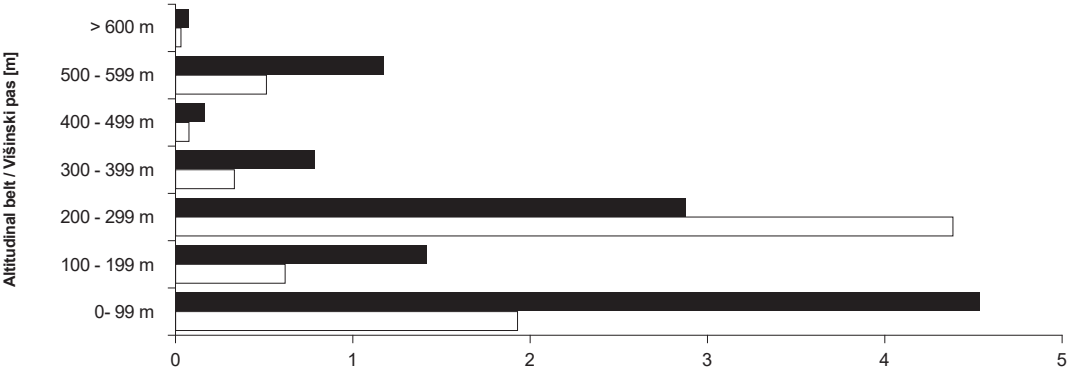

Figure 5: Distribution of Black Kite *Milvus migrans* in altitude belts compared to available area per altitudinal belt including data from Medvedce water reservoir (white) and without (black)

Slika 5: Razširjenost črnega škarnika *Milvus migrans* po nadmorskih pasovih glede na razpoložljivo površino posameznega nadmorskega pasu, vključujoč podatke z zadrževalnika Medvedce (belo) in brez (črno)

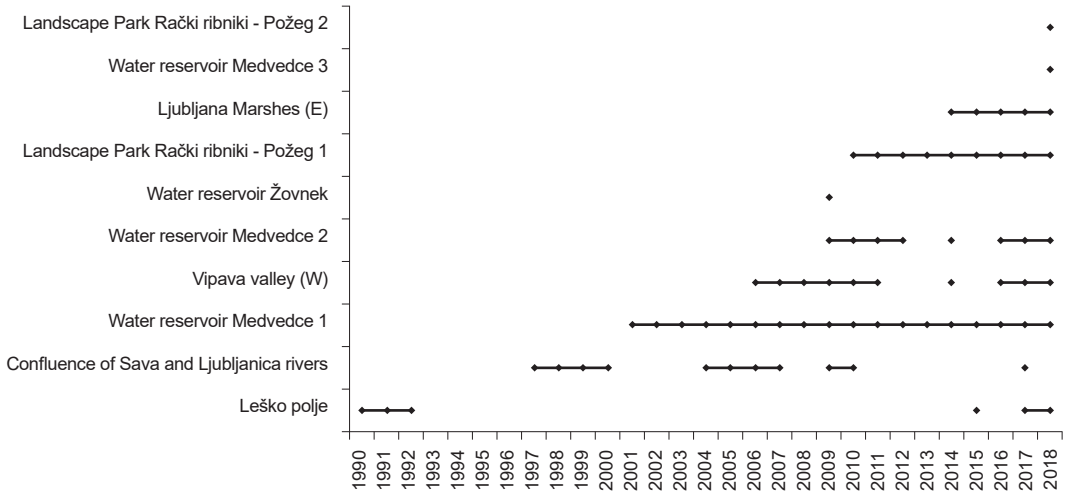

Figure 6: Yearly presence of Black Kites *Milvus migrans* at confirmed breeding sites

Slika 6: Pojavljanje črnega škarnika *Milvus migrans* na potrjenih gnezdiščih v posameznih letih

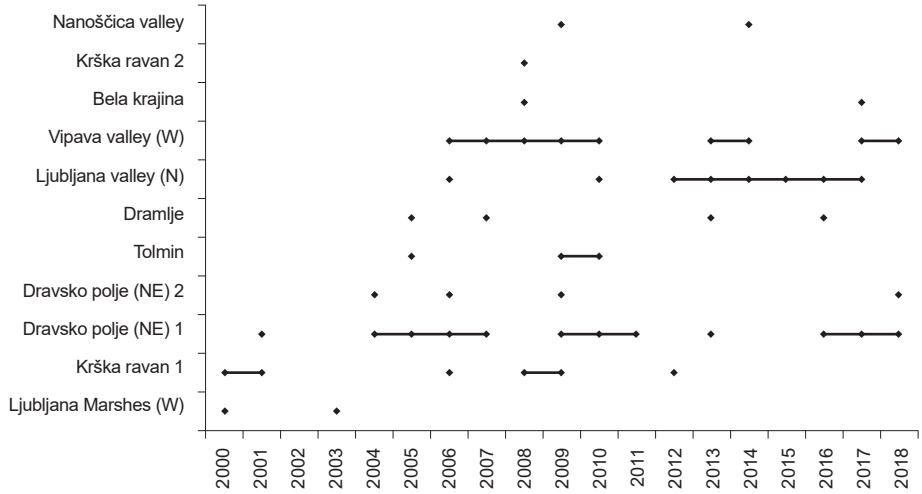

Figure 7: Yearly presence of Black Kites *Milvus migrans* at probable breeding sites

Slika 7: Pojavljanje črnega škarnika *Milvus migrans* na verjetnih gnezdiščih v posameznih letih

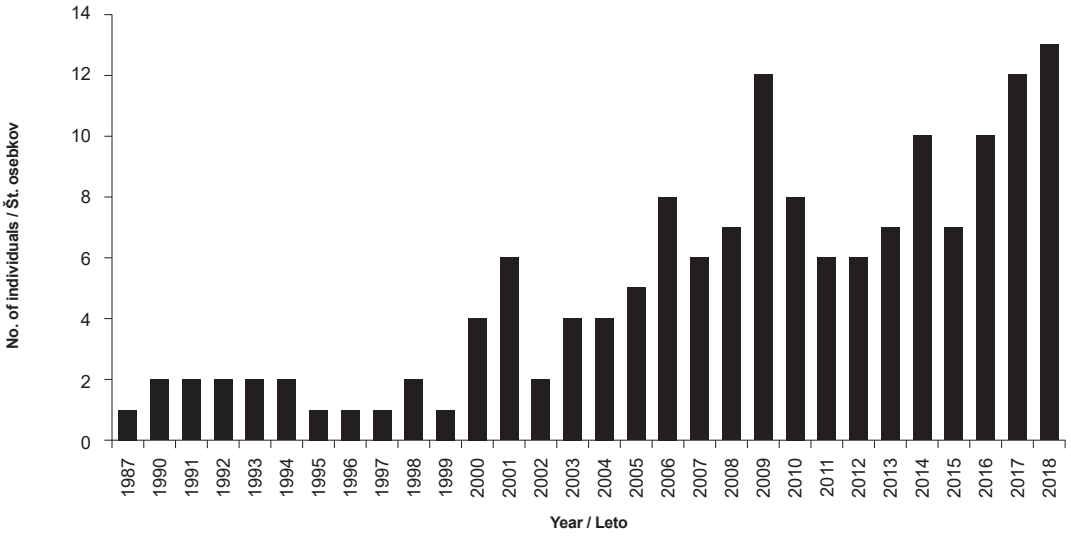

Figure 8: The dynamics of Black Kite *Milvus migrans* breeding pair numbers in Slovenia. Data includes confirmed and probable breeding attempts as well as possible breeding at otherwise confirmed breeding sites.

Slika 8: Dinamika števila gnezdečih črnih škarnikov *Milvus migrans* v Sloveniji. Podatki vključujejo potrjene in verjetne pare ter možne pare na sicer potrjenih gnezdiščih.

from the past ten years can be considered regular breeders, and as there was a total of 21 confirmed or probable breeding pairs, the population was estimated at 10–21 breeding pairs in Slovenia.

The breeding distribution is shown in figure 9. From the first observation of possible breeding in 1987 to the estimated breeding population in 2018, the population has been estimated to rise by 0.34 pairs/year (Figure 8). The average breeding density of Black Kites is 0.3–0.9 bp/100 km^2 with the highest at Dravsko polje, i.e. 0.6–2.2 bp/100 km^2 (Table 1). No semi-colonial breeding was observed. Closest nests were little less than five kilometres apart for three pairs near Medvedce in 2018.

3.4. Habitat

Black Kite observations were recorded closer to larger water bodies and rubbish dumps than expected from random points, but not to settlements (Table 2). Black Kites were observed in squares with less forest cover than would be expected (Table 2). More than half (58%) of all 2x2 km squares with Black Kite observations had less than 25% of forest cover and 85% of less than 50% as opposed to squares with random points (15% and 38%). Also, Black Kites were observed more often in squares with higher share of arable land (on average arable land covered 28% 2x2 km squares), meadows (24%), urban area (11%) and wetlands (3%; Table 2).

4. Discussion

The number of observed Black Kites and their breeding population in Slovenia rose during the past three decades to 10–21 breeding pairs and more than 120 observations per year on average. This trend is similar to that in Carinthia (Petutsching & Probst 2017), but could merely reflect a trend in our knowledge of breeding population in Slovenia and also the intensified observation effort with surveys for the national Breeding Bird Atlas (Mihelič 2002), Natura 2000 Monitoring Schemes (Mihelič 2005), Farmland Bird Index (Božič 2007), local monitoring schemes; i.e. Medvedce (Bordjan & Božič 2009), Lake Cerknica (Bordjan 2012), accumulations on the Drava river (L. Božič *pers. comm.*) and new available

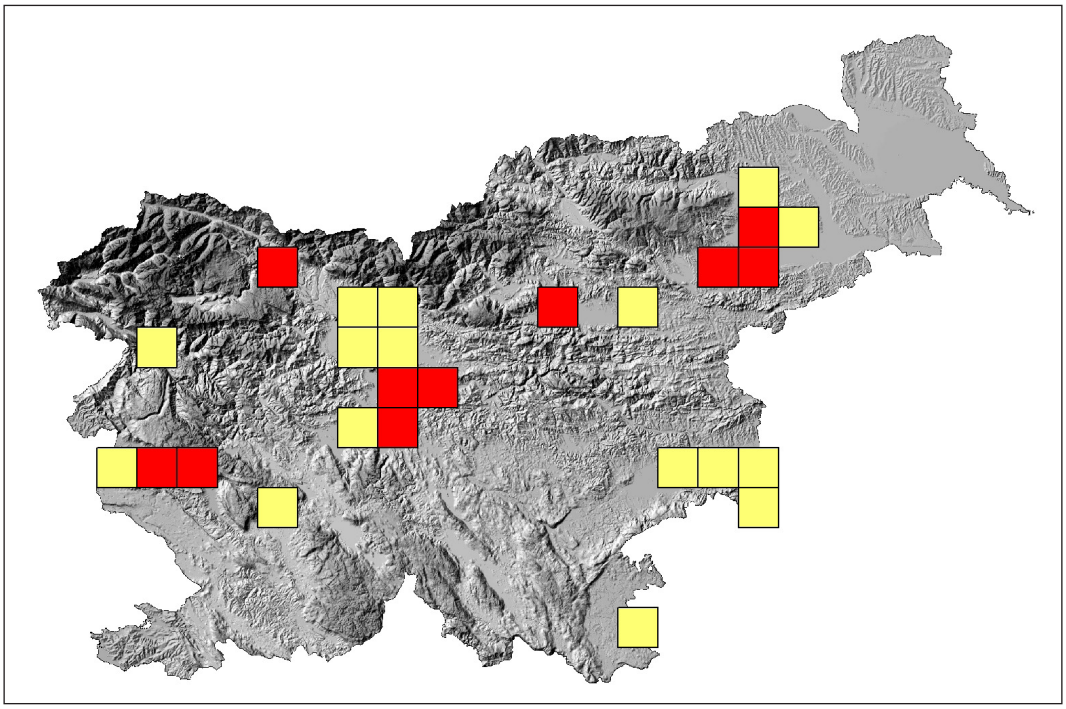

Figure 9: Breeding distribution of Black Kite *Milvus migrans* in Slovenia of confirmed (red) and probable breeding pairs (yellow) in 10x10 km squares

Slika 9: Razširjenost potrjenih (rdeče) in verjetnih (rumeno) gnezdečih parov črnega škarnika *Milvus migrans* v Sloveniji v kvadratih 10x10 km

Table 2: T-test values between habitat variables of Black Kite *Milvus migrans* observations (N = 1482) and random points (N = 1090). Area represents an average share of individual land uses per 2x2 km square.

Tabela 2: Rezultati T-testa med habitatnimi spremenljivkami opazovanj črnih škarnikov *Milvus migrans* (N = 1482) ter naključnih točk (N = 1090). Površina ponazarja delež povprečne rabe na kvadrat 2x2 km.

		Random		Black Kite			
		Mean	SD	Mean	SD	t-value	*P*
Distance [m]	Large water body	3621.7	2698.4	1176.4	1523.7	18.56	< 0.01
	Rubbish dump	9981.4	5164.1	6097.4	3520.3	14.95	< 0.01
	Settlement	367.8	382.9	396.6	350.3	-1.39	0.16
Area	Arable land	0.10	0.18	0.28	0.24	-12.28	< 0.01
	Meadows	0.19	0.14	0.24	0.18	-4.35	< 0.01
	Forest	0.57	0.27	0.25	0.22	15.02	< 0.01
	Urban area	0.05	0.08	0.11	0.14	-7.92	< 0.01
	Wetland	0.01	0.03	0.03	0.07	-8.10	< 0.01
	Other	0.08	0.10	0.08	0.09	-0.73	0.46

databases (Mihelič 2016). This is possible since it is in contradiction with the broader European trend, where the breeding population suffered a substantial decline in the past century (Viñuela & Sunyer 1994, Birdlife International 2004) and its current trend is uncertain (BirdLife International 2015). On the other hand at least locally, i.e. Dravsko polje, the population has risen substantially (from 1 to 7 pairs) and it may be similar to the population increase in Sicily (Sará 2003) that does not reflect national trend in Italy (Sergio & Boto 1999), where negative trends prevail (Sergio *et al.* 2003). Similarly, the trend differs in different parts of Austria with Carinthian population rising (Petutsching & Probst 2017) and the population in Donau-Auen National Park decreasing (Probst & Schuhbauer 2010). Overall it seems that the population trend in Slovenia is at least stable, with some local increases. The estimate of breeding population is similar to the one given by Denac *et al*. (2011) but includes only confirmed and probable and not possible breeding pairs. With the latter, the estimate would probably be higher by up to 5 pairs.

In Slovenia, Black Kite habitat is similar to habitat requirements in other countries, i.e. low forest cover and proximity to wetlands (Cramp 1998, Probst & Schuhbauer 2010). Wetlands and large water bodies that are rich in food are essential for Black Kite (Sergio *et al.* 2003, 2005) with increased breeding density and success in their proximity (Sergio & Boto 1999, Salvati *et al.* 2001, Sergio *et al.* 2003). Fish are important part of the Black Kite's diet (Probst & Schuhbauer 2010). Thus it is not surprising that most of our records were made at or near wetlands. The breeding density even rises with the size of wetland, but also with the size of open land (Sergio *et al.* 2005), as is the case in Slovenia. Open rubbish dumps represent important feeding areas for Black Kite (Blanco 1994) and most of our breeding pairs include one in their territory.

If the Black Kite's absence from the Alps (N and NW Slovenia) and hills of W, S and E Slovenia (hills of Zasavje, Snežnik, Kočevje, Polhograjsko, Škofjeloško and Cerkljansko) could be explained with higher altitudes and forest cover (Cramp 1998), the reason for its absence from Pomurje is more complex. Almost complete absence of observations in apparently suitable habitat (low altitude and open mosaic landscape with many water bodies) in NE Slovenia is somewhat surprising. There were only few records indicating possible breeding along the lower Mura River so far (i.e. Božič 1998). One of the reasons may lie in arable land, since Black Kites tend to avoid intensive farmland (Tanferna *et al.* 2013) and their breeding density decreases with the size of intensive arable land (Sergio *et al.* 2003). On the other hand, Dravsko polje is also known for its ample intensively farmed land, but this may be compensated with many shallow fishponds and drainage ditches. One explanation may be that colonisation has not reached Pomurje as yet. It is increasing on Dravsko polje but it is still rare in Styria, Austria (R. Probst *pers. comm.*).

Although Black Kite can cross high mountains on its migration (R. Probst *pers. comm.*), it is a lowland species (Salvati *et al.* 2001), which is also in agreement with observations in Slovenia. In Northern Italy, Black Kite breeds between 240 and 870 m a.s.l. with average at 515 m a.s.l. (Sergio & Boto 1999), although breeding density rises with lowering altitude (Sergio *et al.* 2003). In Switzerland, most pairs breed below 600 m a.s.l., and individuals observed higher in the Alps are thought to be non-breeding individuals on foraging trips (Schmid *et al* 1998), just like those on Breginjski stol (Denac 2010).

Migrating individuals in March correspond to peak migration across the Strait of Gibraltar and Suez (Panuccio *et al.* 2014). Similar to the central Mediterranean (Panuccio & Agostini 2010), the spring migration in Slovenia is weak in March, but unlike the Straight of Messina it does not peak in mid-April (Corso 2001), but rather in May. It is often difficult to separate breeding from migrating individuals, especially as the percentage of immature individuals is significant during the second part of migration (Panuccio & Agostini 2010). Seasonal dynamics differs from that in Algeria, where peak in the number of individuals is in August but similarly, Black Kites leave their breeding area at the end of September (Boumaaza *et al*. 2016). Although no Black Kites were observed in winter, such observations are expected in the future since wintering population is increasing in Europe, including all our neighbouring countries (Literák *et al*. 2017).

5. Povzetek

Med letoma 1984 in 2017 je bilo opazovanih 1388 osebkov črnega škarnika večinoma po nižinah z glavnino opazovanj na Dravskem polju (70,0 %). Opazovanja so razporejena od morske gladine do nekaj pod 1600 m n.m. s povprečno nadmorsko višino 271 m. Črni škarnik se v Sloveniji pojavlja med sredino marca in začetkom decembra z neizrazito spomladansko in jesensko selitvijo. Največje število opazovanj je v maju. Črni škarnik je bil opazovan v 71 od 238 kvadratih 10 x10 km (29,8 %), z večjim deležem opazovanj na gnezdiščih in območjih z večjim številom opazovalnih dni. Tako število opazovanj v posameznem letu kot tudi število potrjenih in verjetnih gnezdečih parov je v Sloveniji naraščalo. V obdobju 2011–2018 je bilo najdenih 10 gnezdečih parov na sedmih lokacijah (3–7 v vsakem letu). Ob teh je bilo najdenih še 11 verjetno gnezdečih parov na devetih lokacijah (0–6 v vsakem letu). Gnezdeča populacija v obdobju 2011–2018 šteje 10–21 verjetno in potrjeno gnezdečih parov s povprečno gnezditveno gostoto 0,3–0,9 gp/100 km^2. Najvišja gostota parov je na Dravskem polju (0,6–2,2 gp/100km^2). Ob upoštevanju možnih gnezditev bi bila ocena višja za do 5 gp. Na potrjenih gnezdiščih je gnezdil v večini let po potrditvi, najbolj konstantno na območju rednih monitoringov vodnih ptic in ujed. Črni škarnik je pogosteje opazovan ob večjih vodnih telesih in bližje smetiščem, kot bi pričakovali naključno. Hkrati so bila opazovanja razporejena na območjih z nižjim deležem gozda in njivskih površin ter z višjim deležem travnikov, naselij in mokrišč.

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