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Numbers, distribution and nest site characteristics of Jackdaw *Corvus monedula* in Slovenia and its conservation status

Številčnost, razširjenost in značilnosti gnezdišč kavke *Corvus monedula* v Sloveniji ter njen varstveni status

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In 2008, a coordinated census of Jackdaw *Corvus monedula* was carried out to assess breeding population, distribution and nest site selection in Slovenia. Data collection continued for unsurveyed areas in the 2009–2011 period, including information on former colonies and threats. A total of 663–794 Jackdaw pairs were recorded at 86 sites, while total Slovene breeding population was estimated to be in the range of 700–900 pairs. Over one third of pairs were recorded in Central Slovenia, notably the largest city Ljubljana (20.8%), followed by almost a quarter in the Podravje region. Most colonies numbered between 2 and 5 pairs, the largest occupying the Bežigrad district of Ljubljana (82–87 pairs). Large-scale density in geographically more or less uniform areas ranged from 3.65 pairs/10 km^2 in the Sava plain to 0.15 pairs/10 km^2 in mostly mountainous area in northern Slovenia. The majority of Jackdaws selected buildings for nesting (82.2% of pairs), while nesting in trees occurred less frequently (14.7%) and was almost entirely confined to the two easternmost regions of Slovenia. Nesting in cliffs was recorded at just two sites in Slovene Istria (3.1%). Average colony size differed significantly in relation to nest site type, with colonies in rock walls being on average the largest (median = 9.5 pairs), followed by colonies on buildings (6) and those in trees the smallest (3). Among pairs nesting on buildings, multi-storey residential buildings predominated (34.2%). A substantial percentage of population nested also on churches and tower blocks (14.4% and 13.5%, respectively). The highest percentage of pairs utilised holes in roofs (26.9%), followed by eaves (18.0%) and chimney pots (14.7%). Tree-nesting pairs occupied mostly small woods situated in open agricultural landscape. The most commonly used tree species was Beech *Fagus sylvatica* (53.1% of pairs) which hosted 14 of the total 16 forest colonies. For Jackdaws nesting in urban parks and avenues, plane trees *Platanus* sp. were the most important (30.6% of pairs). Their population stronghold was in lowlands, with 88.1% of pairs recorded at elevations under 400 m and the highest living colony in Slovenia at 578 m a.s.l. Jackdaws occurred on at least 54 specific sites in the past but became extinct there or declined severely by the time of this study. A minimum of 217–254 pairs were estimated lost at these sites, constituting a decline of 24% in c. 10–20 years. According to the IUCN criteria, Jackdaw would qualify as Vulnerable (VU) on the Red List of Slovenia. The commonest known cause of extinction/decline is renovation of buildings, a threat that is projected to escalate in the near future.

Key words: Jackdaw, *Corvus monedula*, Slovenia, census, nest-site selection, conservation
Ključne besede: kavka, *Corvus monedula,* popis, izbira gnezdišč, varstvo

1. Introduction

Jackdaw *Corvus monedula* is a sociable Corvidae species, widely distributed across large parts of Europe, extending into Central Asia as far as Lake Baikal, northern countries of the Middle East and the Maghreb. More than half of the global distribution lies in Europe where it is absent only from Iceland and the northern half of Fennoscandia (Fraissinet *et al.* 1997, BirdLife International 2016). Molecular studies revealed that the species is only distantly related to other members of the group and some revised taxonomic classifications place it in a separate genus *Coloeus*. Currently, four subspecies are recognized (del Hoyo *et al.* 2009, Gill & Donsker 2016). *C. m. spermologus* breeds in all Central European countries including Slovenia, despite different statements in the past (e.g. Matvejev & Vasić 1973, Cramp & Perrins 1994, Offereins 2003).

Jackdaw is generally well studied, being a popular model species for numerous ethological studies, focused on research of various aspects of its complex social interactions, learning and instinctive behaviour (e.g. Lorenz 1931, Röel 1978, Schwab *et al.* 2008, Davidson *et al.* 2014, Kubitza *et al.* 2015). Also, many studies of breeding biology, nest site selection, breeding and foraging habitat characteristics and predation were carried out throughout Europe (Antikainen 1980, 1987, Johnsson 1994, Soler & Soler 1993, Biondo 1998, Salvati 2002a, Unger & Peter 2002, Arnold & Griffiths 2003). Jackdaw is unique within genus *Corvus* by nesting in cavities, either natural or man-made. It is typically a colonial breeder with usually life-long pair-bonds, maintained throughout the year. Outside the breeding season Jackdaws are mostly gregarious and large communal roosts are characteristic (Cramp & Perrins 1994).

The European breeding population is estimated at 8.4–15.8 million pairs, with highest numbers (good and medium quality estimates) in European Russia (2.4–5.5 m), Spain (1.5–2.7 m), the United Kingdom (1.2–1.5 m), Ireland (814,000–2.0 m) and Belarus (350,000–400,000). Except for Poland and Germany, figures in central European countries are much lower, typically a few thousand pairs. The overall European population trend in 1980–2014 was stable, although varying between countries, regions and shorter time-periods. Large increases were reported from some important countries in NW Europe (e.g. Belgium, Finland, Sweden, UK). Trends in Central Europe were mixed with large long-term declines in the Czech Republic and Hungary and a stable population in Germany. However, populations increased in Austria, Switzerland and Poland since 2000, while the species declined in Germany (BirdLife International 2015, EBCC 2016). Relying on a rather vague population estimate given in the Ornithological Atlas of Slovenia (Ornitološki atlas Slovenije; data mostly collected throughout the 1980s) (Geister 1995), the long-term trend in Slovenia was assessed as large decline (BirdLife International 2015).

Dedicated national surveys of its breeding populations and nest sites were carried out in Austria in 1993/94 (Dvorak 1996) and Switzerland in 1949/50, 1972–78 and 1989 (Zimmermann 1951, Riggenbach 1979, Vogel 1990). Furthermore, results of several regional surveys from Austria and Germany were published (Schmidt 1988, Model 1996, Rudolph 2000, Brader & Samhaber 2003, 2005, Gschwandtner 2005, Hoi-Leitner 2016). The only similar study from Slovenia was the regional census, carried out in 1998 on the Dravsko polje plain in NE Slovenia (Vogrin 1998). In early 1990s, Jackdaw was included in the study of cliff-nesting birds of the Kraški rob escarpment, SW Slovenia (Marčeta 1994). Apart from these, only a handful of short notes reporting on more interesting breeding season records is available (e.g. Perušek 1994, Štumberger 2003). As of the early 2000s, a reliable and up-to-date overview of Jackdaw numbers, distribution and nest sites in the country was non-existent.

This paper presents results of the first comprehensive Jackdaw census in Slovenia aimed to (1) produce reliable national and regional breeding population and density estimate(s), (2) improve knowledge of general and elevational distribution in the country, (3) obtain characteristics of nest sites, and (4) collect information on former colonies/nest sites and cause of extinction/decline to allow a more profound evaluation of recent trend, potential threats and conservation status of the species.

2. Methods

2.1. National census and breeding data collection

In 2008, a coordinated country-wide census was launched. Generally, observers were invited to participate via DOPPS–BirdLife Slovenia web page, the journal Svet ptic and a specifically prepared leaflet. Special survey forms, instructions and maps were prepared. Areas where Jackdaws were expected to be widely distributed according to prior knowledge (Ljubljana, lowlands of Central Slovenia, part of the Podravje region) were divided into census plots and assigned to individual volunteer observers. Similarly,

observers were allocated to all sites where Jackdaws were known to occur in the past or were suspected to occur. The census was implemented in two parts: the first between 1 Mar and 15 Apr aimed at locating breeding Jackdaws, the second between 1 May and 15 Jun aimed at surveying and mapping nest sites. Observers were advised to perform the census by midday to avoid effects of Jackdaw roosting aggregations which can also occur in the breeding season (Cramp & Perrins 1994, Schmidt 1999b). Targeted data collection continued in the 2009–2011 period by means of (1) subsequent visits to unsurveyed plots, settlements and locations (requested or carried out by the author), (2) correspondence with experts/local ornithologists, (3) checking database entries at the Novi ornitološki atlas gnezdilk Slovenije (http://atlas.ptice.si; NOAGS), managed by DOPPS–BirdLife Slovenia and (4) considering available casual records.

Data collection was performed on two levels: (1) mandatory general section where information on location (as accurate as possible), date of observation, number of Jackdaws (pairs or individuals) and type of observation (breeding, foraging – observations of Jackdaws on the ground outside settlements or using urban open space, flying over – observed only flying and not seen landing) was required, and (2) detailed survey of nest sites.

2.2. Nest site survey

Basic *nest site types* (building, tree and cliff) were further divided into the following *nest site subtypes*: one- and two-storey residential building (1–2 levels), multi-storey residential building (3–7 levels), tower block (>8 levels), church, castle, outbuilding (warehouse, stable, barn, silo etc.), industrial building (factory complexes etc.), continuous forest, isolated wood in open agricultural landscape, urban park or avenue, orchard, isolated tree (open country, outside urban areas), natural cliff and quarry. Recording the street/road name and house number of buildings with nesting Jackdaws was required, and more precise description of the nest site encouraged (e.g. exact number of storeys, name of the building or area, etc.).

For detailed description of *nest hole placement*, i.e. kind of a nest hole used (not necessarily equal to nest as several pairs can access their nests through the same hole on the building and nests can be situated up to several metres from the entrance, e.g. in attics), the following categories were used: chimney pot, eaves (part of the roof projecting beyond the face of a wall), inner jutting roof (window corner or edge, balcony, vault etc.), wall, roof (between roof tiles or in the outer edge of the roof without eaves), tree hole, and area of damaged branch (cavity formed on the spot where branch was broken or cut off). Additionally, the height of the entrance hole above ground (all nest holes) and distance of nesting trees from the nearest forest edge (forest colonies only) was estimated and state of the building (actively used or abandoned) or species/genus of nesting tree were identified if possible.

The term location refers to the precise location of nesting Jackdaw pairs, either defined as an individual building of a given subtype, in most cases identifiable by its unique postal address (nest site type building; not necessarily identical to colony as these may extend over several different buildings), or colony/site mapped with accuracy within a few tens of metres (types tree and cliff).

2.3. Former colonies and nest sites

Information on breeding Jackdaws that existed prior to 2008 but were not recorded in this study was obtained by: (1) special section of the form used for the Jackdaw census, (2) correspondence with experts/local ornithologists, (3) examination of forms filled in by volunteer observers in the "Bird of the Year 2000" (Ptica leta 2000) campaign (Smole 2000), (4) literature search, (5) NOAGS database. Data considered include location, year(s) of breeding (exact or estimated), source of information and number of pairs and cause of extinction, if known.

2.4. Breeding pair and colony criteria

All observations of Jackdaws on buildings and cliffs during the breeding season of the species (1 Mar–15 Jun) were treated as nest site records unless stated otherwise (e.g. specifically identified as non-breeders at that particular location by observers). For tree-nesters, the minimum EBCC breeding atlas code 6 (visiting probable nest site, Hagemeijer & Blair 1997) was required. Except in cases when all nest holes of individual pairs were located, the number of pairs at a colony or site was determined by dividing the total number of Jackdaws by 2. If the number of pairs early in the breeding season (1 Mar–31 Mar), broadly corresponding to pre-laying period, was higher than during the core season (1 Apr–15 Jun), or Jackdaws were not registered during the core season, the latter was regarded as minimum number and the former as maximum number of pairs. This assumption was used to account for the possibility of individuals prospecting potential nest sites but not actually nesting (cf. Davidson *et al.* 2014). Records of single individuals

without observation details that indicated nesting were counted as 0–1 pairs.

For records of Jackdaws merely seen foraging or flying over, number of pairs was determined in the same manner as for breeding observations only when the nearest known breeding locations were at least 5 km away. For observations at shorter distance, any supportive additional details (direction of flight, number of nesting pairs in surroundings, etc.) were taken into consideration to assess their breeding status. If not available, records were counted as 0–n pairs (n = no. of individuals divided by 2).

Due to often difficult delineation of a colony in extensive, more or less uniformly built up areas in settlements with numerous Jackdaws, a cluster of nesting pairs was regarded to belong to a single colony if distances among them were <500 m. Pairs nesting farther away were treated as separate colony(-ies) (cf. Dvorak 1996). The term colony is used for nesting aggregations of two or more pairs. However, in calculations of average size of colonies solitary pairs were included.

2.5. Statistics used

The Anderson-Darling test was performed to determine whether data are normally distributed. Average values of normally distributed data were expressed as means ± SD. Medians (more than 2 samples) were compared using the Kruskal-Wallis test (Fowler & Cohen 1996). For graphical depiction of numerical data box-and-whiskers plots including data within 1.5 IQR were used. Percentages of pairs were calculated from median values of minimum and maximum number of pairs.

3. Results

3.1. Numbers, distribution and breeding density

According to the criteria used, a total of 663–794 pairs were recorded at 86 sites in Slovenia. At 62 of these, all or some of the actual breeding locations were ascertained, while at others birds were only observed foraging (13), flying over (7) or their breeding locations could not be found (4) (Table 1, Figure 1).

Table 1: Number of Jackdaw *Corvus monedula* pairs recorded during the Slovene country-wide census in 2008–2011. For non-urban records, name of the nearest settlement is given. GN – breeding, PREH – foraging, PREL – flyover.

Tabela 1: Števila parov kavke *Corvus monedula*, zabeležena v vsedržavnem popisu v Sloveniji v letih 2008–2011. Pri neurbanih podatkih je navedeno ime najbližjega naselja. GN – gnezdenje, PREH – prehranjevanje, PREL – prelet.

Settlement / Naselje	Year of observation/ Leto opazovanja	Type of observation/ Vrsta opazovanja	No. of pairs / Št. parov		No. of colonies or solitary pairs/ Št. kolonij oz. posameznih parov
			min	max	
Ljubljana	2008	GN	138	165	8*
Kranj	2008	GN	59	64	3
Mirna na Dolenjskem	2008	GN	59	59	1
Cirkovce	2008	GN	25	31	2
Cerknica	2008	GN	23	23	1
Grosuplje	2008	GN	20	30	2*
Celje	2008	GN	16	16	1
Bled	2008-09	GN	14	15	2
Trebnje	2008	PREH	13	13	Unkn. / Nez.
Št. Jurij	2008	GN	12	12	Unkn. / Nez.
Beltinci	2008	GN	11	17	3*
Serdica	2008	PREH	11	12	Unkn. / Nez.
Vrhnika	2008	GN	11	12	2
Črenšovci	2008	GN	11	11	1
Podpeč	2009	GN	11	11	1
Sveta Trojica	2008	GN	11	11	1

Nadaljevanje tabele 1 / Continuation of Table 1

Settlement / Naselje	Year of observation/ Leto opazovanja	Type of observation/ Vrsta opazovanja	No. of pairs / Št. parov		No. of colonies or solitary pairs/ Št. kolonij oz. posameznih parov
			min	max	
Škofja Loka	2008	GN	11	11	1
Zg. Jakobski dol	2008	GN	10	20	1*
Pragersko	2008	GN	10	11	1
Adergas	2010	GN	10	10	1
Murska Sobota	2008	GN	9	9	2
Drenov Grič	2008	GN	8	8	1
Osp	2009	GN	8	8	1
Logatec	2008	GN	7	9	1
Ižakovci	2008	GN	7	7	1
Jesenice	2010	GN	7	7	1
Slovenj Gradec	2009	GN	7	7	Unkn. / Nez.
Sv. Trije Kralji v Slovenskih goricah	2008	GN	6	7	1
Škocjan	2009	GN	6	6	1
Brežice	2010	GN	5	6	1*
Dravograd	2011	GN	5	5	1
Ptuj	2008	GN	5	5	1
Šentilj v Slovenskih goricah	2010	GN	5	5	1
Zg. Dražen vrh	2008	GN	5	5	1
Zg. Hlapje	2011	GN	5	5	1
Ciringa	2008	PREH	4	15	Unkn. / Nez.
Lovrenc na Dravskem polju	2008	GN	4	6	1
Gančani	2008	GN	4	5	1
Jareninski dol	2008	GN	4	4	1
Kočevje	2009	PREH	4	4	Unkn. / Nez.
Lucija	2008	GN	4	4	1
Sp. Hlapje	2009	GN	4	4	1
Zdenska vas	2008	PREL	4	4	Unkn. / Nez.
Rošpoh	2008	GN	3	4	1
Flekušek	2010	GN	3	3	1
Kotlje	2008	GN	3	3	1
Počenik	2008	GN	3	3	1
Šentjernej	2008	GN	3	3	1
Ajdovščina	2008	PREH	2	3	Unkn. / Nez.
Legen	2009	GN	2	3	1
Tišina	2010	GN	2	3	1
Begunje na Gorenjskem	2010	GN	2	2	1
Breznica	2010	GN	2	2	1

Nadaljevanje tabele 1 / Continuation of Table 1

Settlement / Naselje	Year of observation/ Leto opazovanja	Type of observation/ Vrsta opazovanja	No. of pairs / Št. parov		No. of colonies or solitary pairs/ Št. kolonij oz. posameznih parov
			min	max	
Cirknica	2008	GN	2	2	1
Dragonja vas	2008	GN	2	2	1**
Krško	2008	GN	2	2	1
Lendava	2010	GN	2	2	1
Mala vas pri Grosupljem	2008	GN	2	2	Unkn. / Nez.
Mihovce	2008	GN	2	2	1**
Ormož	2011	GN	2	2	1
Slatinski Dol	2010	GN	2	2	1
Budinci	2008	GN	1	2	1
Šmarjeta	2009	GN	1	2	1
Brezula	2008	GN	1	1	1
Gačnik	2008	GN	1	1	1
Pertoča	2010	PREH	1	1	Unkn. / Nez.
Rakičan	2008	GN	1	1	1
Sotina	2008	GN	1	1	1
Sp. Gaj pri Pragerskem	2008	GN	1	1	Unkn. / Nez.
Vuhred	2008	PREH	1	1	Unkn. / Nez.
Dražen vrh	2008	PREH	0	8	Unkn. / Nez.
Jarenina	2008	PREH	0	8	Unkn. / Nez.
Jurski vrh	2008	PREH	0	8	Unkn. / Nez.
Podova	2008	GN	0	3	1
Brezovica pri Ljubljani	2009	PREL	0	1	Unkn. / Nez.
Črna vas	2010	GN	0	1	1
Dobrava, Izola	2008	PREL	0	1	Unkn. / Nez.
Dolenci	2008	PREH	0	1	Unkn. / Nez.
Izola	2009	PREL	0	1	Unkn. / Nez.
Koper	2008	PREL	0	1	Unkn. / Nez.
Log pri Brezovici	2009	PREH	0	1	Unkn. / Nez.
Pleterje	2008	GN	0	1	1
Seča	2011	GN	0	1	1
Slovenja vas	2011	PREL	0	1	Unkn. / Nez.
Slovenska Bistrica	2008	PREL	0	1	Unkn. / Nez.
Velika Ligojna	2009	PREH	0	1	Unkn. / Nez.
Total / Skupaj			663	794	77*

* Certainly (or most probably) not all colonies were found. / Zanesljivo oziroma verjetno niso bile odkrite vse kolonije.

** According to the applied criteria, pairs belong to the same colony. / Glede na uporabljene kriterije pari pripadajo isti koloniji.

Unkn. / Nez. (Unknown / Neznano) – No. of colonies is unknown or breeding locations could not be found. / Št. kolonij ni znano oziroma gnezditvene lokacije niso bile odkrite.

Over one third of pairs were recorded in Central Slovenia, notably the largest city Ljubljana (20.8%), followed by almost a quarter in Podravje. Large local populations were also registered in Gorenjska (14.8%) and Southeast Slovenia (12.4%). Although present in all main regions of the country, numbers in the Northern Primorska region were very small and breeding remained unconfirmed there (Table 2). Jackdaw pairs with known locations (580–626, 82.8% of the total) were breeding in 70 colonies and seven solitary-pair sites. Most colonies held between 2 and 5 pairs (Figures 2, 3). The largest colonies were in the Bežigrad district of Ljubljana (82–87 pairs), prison buildings at Mirna na Dolenjskem (59 pairs) and the Planina housing district of Kranj (40 pairs).

Breeding density varied markedly among UTM 10 × 10 km squares. In a square covering urban areas of Ljubljana, it reached 147 pairs/100 km^2. In predominantly rural areas, the highest densities exceeded 50 pairs/100 km^2, but were mostly well below that value (<10 pair/100 km^2) (Figure 4). Large-scale density in geographically more or less uniform areas ranged from 3.65 pairs/10 km^2 in the Sava plain to 0.15 pairs/10 km^2 in mostly mountainous area in northern Slovenia. Density of Jackdaws breeding in city centres reached 24.6 and 15.6 pairs/10 km^2 in Kranj and Ljubljana, respectively (Table 3).

3.2. Nest site types and subtypes

The majority of Jackdaws with known breeding locations selected buildings (82.2% of pairs), while nesting in trees occurred less frequently (14.7%) and was almost entirely confined to the two easternmost regions of Slovenia. In Prekmurje and Podravje, 69.2 and 40% of regional breeding pairs were tree-nesters,

Figure 1: Distribution of settlements/sites with Jackdaws *Corvus monedula* in Slovenia in 2008–2011 (N = 86). Size of the circle corresponds to the number of pairs (max) recorded.

Slika 1: Razširjenost naselij/krajev s kavkami *Corvus monedula* v Sloveniji v letih 2008–2011 (N = 86). Velikost kroga ustreza številu zabeleženih parov (max).

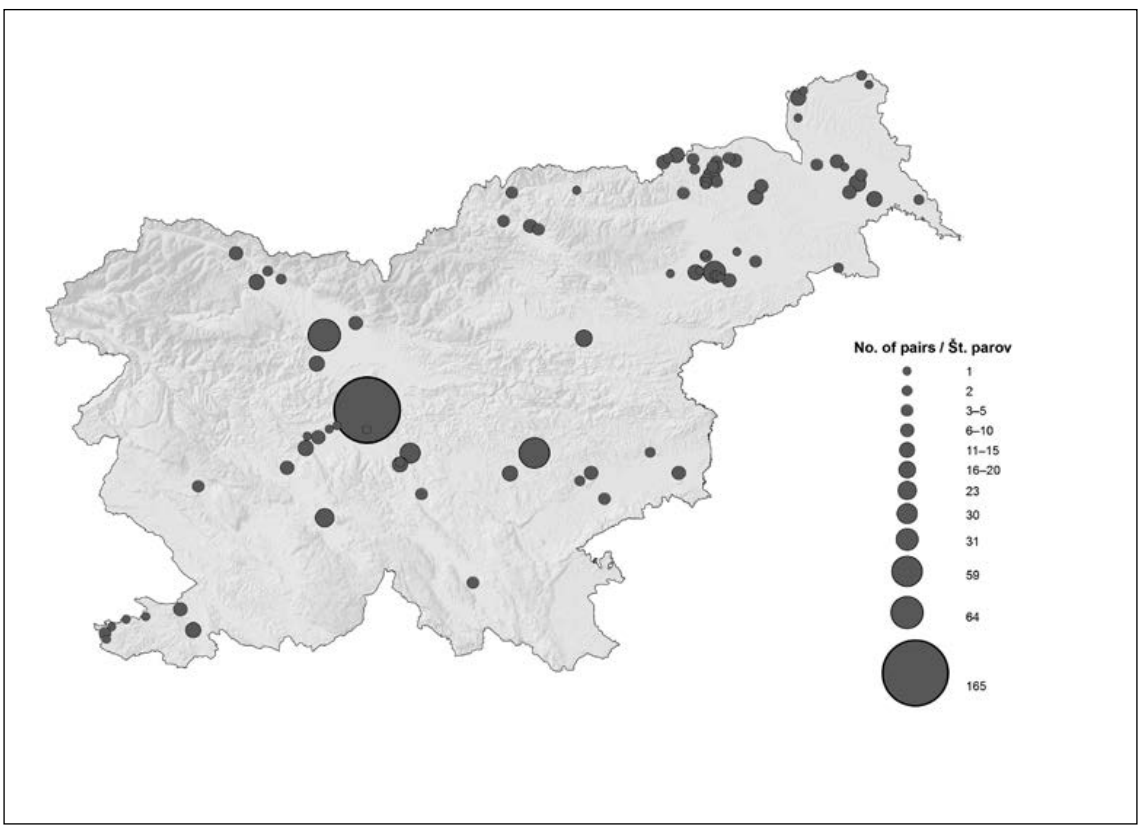

Table 2: Number and percentage of Jackdaw *Corvus monedula* pairs in macroregions (bold) and mesoregions of Slovenia in 2008–2011. Regionalisation according to Pluт (1999).

Tabela 2: Števila in odstotki parov kavke *Corvus monedula* v makroregijah (krepko) in mezoregijah Slovenije v letih 2008–2011. Regionalizacija je povzeta po Plutu (1999).

Macroregion / Makroregija	Mesoregion / Mezoregija	No. of pairs / Št. parov		Percentage of pairs/ Odstotek parov (%)
		min	max	
Pomurje	Prekmurje	61	72	9.1
Podravje		138	201	23.3
	Spodnje Podravje	40	50	6.2
	Mariborska	69	119	12.9
	Dravinjska	11	13	1.6
	Koroška	18	19	2.5
Savinjska Slovenija	Celjska	16	16	2.2
JV Slovenija		89	91	12.4
	Spodnje Posavje	7	8	1.0
	Srednja Dolenjska	82	83	11.3
Osrednja Slovenija		229	273	34.5
	Ljubljanska	202	246	30.7
	Kočevsko-ribniška	4	4	0.5
	Notranjska	23	23	3.2
Gorenjska		105	111	14.8
	Srednja Gorenjska	69	74	9.8
	Škofjeloška	11	11	1.5
	Zgornja Gorenjska	25	26	3.6
S Primorska	Goriška	2	3	0.3
J Primorska	Slovenska Istra	23	27	3.4
Total / Skupaj		663	794	100.0

respectively. Nesting in cliffs was recorded at just two sites in Slovene Istria, accounting for 3.1% of national population (Table 4, Figure 5). Forty-nine colonies and four solitary pairs were nesting on buildings, and 19 colonies and three solitary pairs on trees (Figure 3). Average colony size differed significantly in relation to nest site type (Kruskal-Wallis test, $H = 8.784$, df = 2, $P = 0.012$), with colonies in cliffs being on average the largest (median = 9.5 pairs, range = 8–11 pairs), followed by colonies on buildings (median = 6, range = 1–87) and those in trees the smallest (median = 3, range = 1–7) (Figure 6).

Most pairs nesting on buildings used multi-storey residential buildings (34.2% of pairs). A substantial percentage of population nested also on churches and tower blocks (14.4% and 13.5%, respectively), the latter being limited mostly to cities and towns of Central Slovenia. Nesting on one- and two-storey residential buildings predominated in parts of the Podravje region. Castles, outbuildings, industrial buildings and electric transformer stations proved to be of low importance for nesting Jackdaws in Slovenia (Table 4, Figure 7). There was a highly significant difference in average number of nesting pairs between main building types used (Kruskal-Wallis test, $H = 25.884$, df = 5, $P < 0.0001$). On average, the highest number of pairs nested on tower blocks and churches (median = 4, range 1–15 and 1–11, respectively) and the lowest on one-storey residential buildings (median = 1, range 1–2) (Figure 8). Most of them were in active use (96.5%).

Tree-nesting pairs occupied mostly small woods situated in open agricultural landscape (mean surface area = 7.7 ± 4.51 ha, range = 1.0–19.6 ha). Apart from three separate pairs that were obviously part of larger

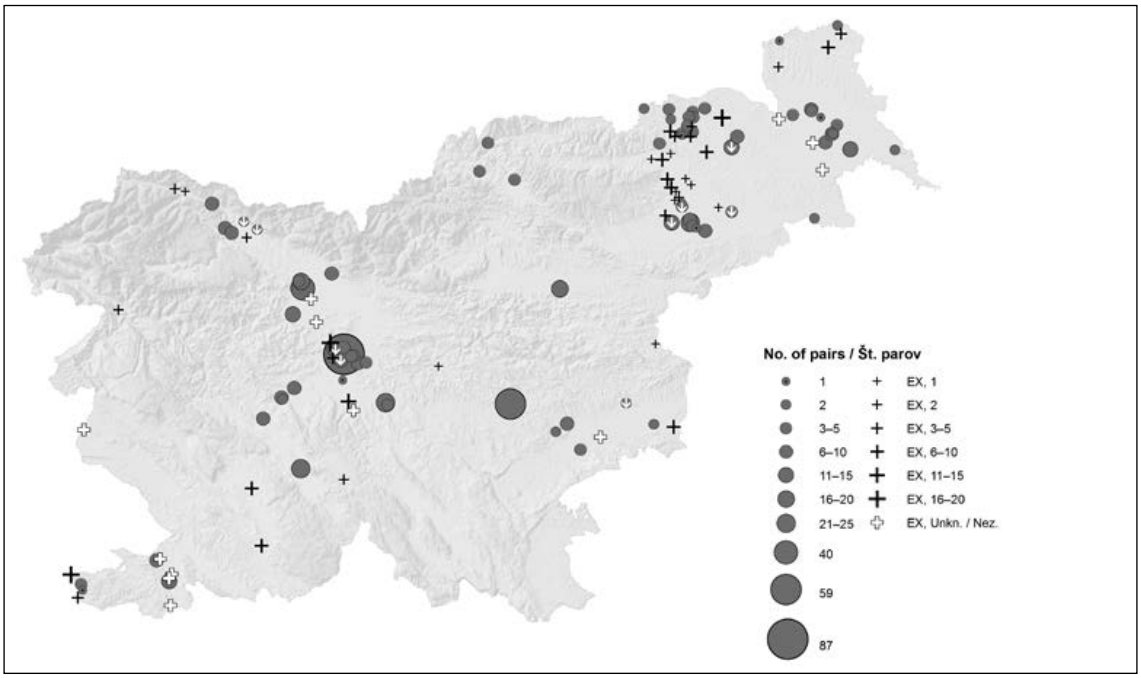

Figure 2: Jackdaw *Corvus monedula* colonies and solitary pairs in Slovenia in 2008–2011: circles depict distribution during this study (N = 77), while crosses denote pairs at sites known prior to 2008 but not recorded later on, i.e. extinct (N = 45). Downward arrow indicates colonies reduced by > 20%. Size of the symbol corresponds to the number of pairs (max, white cross = no. unknown).

Slika 2: Kolonije in posamezni pari kavk *Corvus monedula* v Sloveniji v letih 2008–2011: krogi ponazarjajo razširjenost v tej raziskavi (N = 77), križi pa pare na krajih, znanih pred letom 2008, ki kasneje niso bili zabeleženi in so torej izumrli (N = 45). Navzdol obrnjena puščica označuje kolonije, zmanjšane za > 20 %. Velikost simbola ustreza številu parov (max, beli križ = št. neznano).

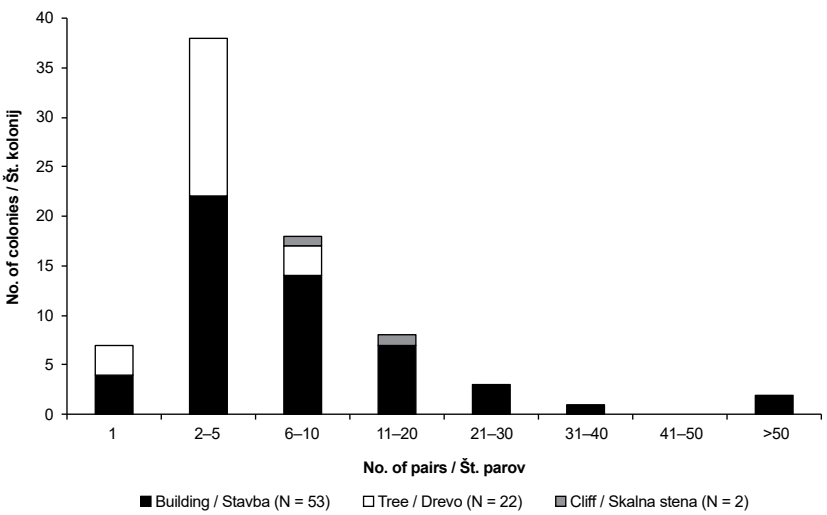

Figure 3: Number of Jackdaw *Corvus monedula* colonies/solitary pairs (N = 77) in Slovenia in 2008–2011 in different size classes (max. no. of pairs), depicted separately by nest site types

Slika 3: Število kolonij/posameznih parov kavke *Corvus monedula* (N = 77) v Sloveniji v letih 2008–2011 v različnih velikostnih razredih (max. št. parov), prikazano ločeno po tipih gnezdišč

Table 3: Breeding density of Jackdaw *Corvus monedula* in regions with records from at least five sites, and three largest cities of Slovenia in 2008–2011. No. of pairs and surface areas are given. Regions are partly modified from Perko & Orožen Adamič (1999).

Tabela 3: Gnezditvena gostota kavke *Corvus monedula* v regijah s podatki iz vsaj petih krajev in treh največjih mestih Slovenije v letih 2008–2011. Podana sta število parov in površina. Regije so delno spremenjene povzete po Perku & Orožen Adamiču (1999).

Region, city or town / Regija, mesto	Area/ Površina (km²)	No. of pairs / Št. parov		Density / Gostota (p/10 km²)	
		min	max	min	max
Goričko	492	14	17	0.28	0.35
Murska ravan	601	52	66	0.87	1.10
Slovenske gorice	1034	47	55	0.45	0.53
Dravska ravan	425	68	115	1.60	2.71
Strojna, Kozjak in Pohorje	1287	18	19	0.14	0.15
Savska ravan	676	243	276	3.59	4.08
Ljubljansko barje	180	19	24	1.06	1.33
Dolenjsko podolje	318	106	116	3.33	3.65
Krška ravan in gričevje	520	17	19	0.33	0.37
Koprska brda	326	23	27	0.71	0.83
Ljubljana	106	138	165	13.02	15.57
Celje	23	16	16	6.96	6.96
Kranj	26	59	64	22.69	24.62

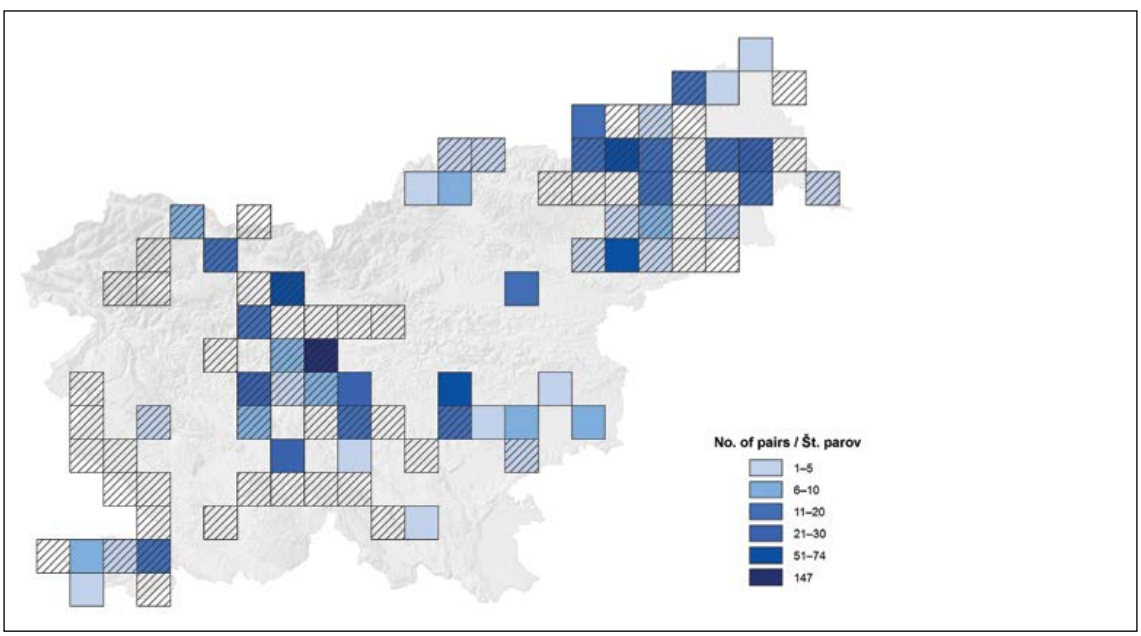

Figure 4: Number of Jackdaw *Corvus monedula* pairs (max) in UTM 10 km squares of Slovenia during this study (N = 51 squares) and distribution given in the Ornithological Atlas of Slovenia (Geister 1995) (hatched, N = 74 squares)

Slika 4: Števila parov kavke *Corvus monedula* (max) v UTM kvadratih Slovenije 10 × 10 km v tej raziskavi (N = 51 kvadratov) in razširjenost v Ornitološkem atlasu gnezdilk Slovenije (Geister 1995) (šrafura, N = 74 kvadratov)

Table 4: Nest site types (bold) and subtypes of Jackdaws *Corvus monedula* (N = 585–641 pairs) in Slovenia in 2008–2011. No. of locations (N = 170) is either number of individual buildings of a given subtype used by nesting pairs (type building) or number of colonies/sites per individual subtype (types tree and cliff).

Tabela 4: Tipi (krepko) in podtipi gnezdišč kavke *Corvus monedula* (N = 585–641 parov) v Sloveniji v letih 2008–2011. Št. lokacij (N = 170) je bodisi število posameznih stavb določenega podtipa, ki so ga uporabljali gnezdeči pari (tip stavba), bodisi število kolonij/krajev na posamezen podtip (tipa drevo in skalna stena).

Nest site type and subtype / Tip in podtip gnezdišča	No. of locations/ Št. lokacij	Percentage of locations/ Odstotek lokacij (%)	No. of pairs / Št. parov		Percentage of pairs/ Odstotek parov (%)
			min	max	
One-storey residential building / Enonadstropna stanovanjska hiša	13	7.6	11	14	2.0
Two-storey residential building / Dvonadstropna stanovanjska hiša	26	15.3	39	52	7.4
Multi-storey residential building / Večnadstropna stanovanjska hiša	54	31.8	205	214	34.2
Tower block / Stolpnica	16	9.4	81	84	13.5
Church / Cerkev	18	10.6	85	92	14.4
Castle / Grad	1	0.6	2	2	0.3
Outbuilding / Gospodarsko poslopje	2	1.2	2	3	0.4
Industrial building / Industrijski objekt	3	1.8	7	9	1.3
Other / Drugo	9	5.3	34	38	5.9
Unknown / Neznano	-	-	17	17	2.8
Building / Stavba	142	83.5	483	525	82.2
Continuous forest / Sklenjen gozd	2	1.2	8	8	1.3
Isolated wood in open agricultural landscape / Izoliran gozdiček v odprti kmetijski krajini	14	8.2	50	51	8.2
Urban park or avenue / Park, drevored	9	5.3	20	22	3.4
Orchard / Sadovnjak	1	0.6	0	1	0.1
Unknown / Neznano	-	-	5	15	1.6
Tree / Drevo	26	15.3	83	97	14.7
Natural cliff / Naravna skalna stena	2	1.2	19	19	3.1
Cliff / Skalna stena	2	1.2	19	19	3.1

building-nesting colonies, nesting in urban parks and avenues was only registered in the lowland part of Prekmurje (Table 4, Figure 5).

3.3. Nest hole placement characteristics

All of the reported certain or presumed Jackdaw nests (441–465 pairs, 62.2% of the total) were placed in cavities, i.e. different types of nest holes. The highest percentage of pairs utilised holes in the roof (26.9%), even though this nest hole type was only used at eight locations, followed by eaves (18.0%) and chimney pots (14.7%) (Table 5, Figure 9).

In tree-nesting pairs, the selection of tree holes predominated strongly (> 90% of tree-nesting pairs). The most commonly used tree species was Beech *Fagus sylvatica* (53.1% of pairs) which hosted 14 of total 16 forest colonies/solitary pairs. Average distance of nesting trees of forest colonies from the nearest forest edge was 32 ± 19.7 m (range 0–65 m). The highest percentage (30.6%) of pairs in urban parks and avenues nested in plane trees *Platanus* sp. All exclusively tree-nesting colonies (6) in urban areas used trees of this genus (Table 6, Figure 10).

Both cliff-nesting colonies used natural crevices in steep rocky faces.

Estimated height of nest holes above ground varied strongly, resulting in highly significant difference in average height of Jackdaw nests between main nest site subtypes (Kruskal-Wallis test, H=116.514, df=7, $P < 0.0001$) (Figure 11).

3.4. Elevational distribution

Breeding Jackdaws were found from sea level to lower submontane elevation belt. Population stronghold is in lowlands, with 88.1% of pairs recorded at elevations

Table 5: Nest hole placement of Jackdaws *Corvus monedula* (N = 441–465 pairs) and their percentage in Slovenia in 2008–2011. No. of locations (N = 127) is either number of individual buildings (type building) or number of colonies/sites (types tree and cliff) with a given nest placement recorded.

Tabela 5: Mesta gnezdilnih lukenj kavk *Corvus monedula* (N = 441–465 parov) in njihovi odstotki v Sloveniji v letih 2008–2011. Št. lokacij (N = 127) je število posameznih stavb (tip stavba) ali število kolonij/krajev (tipa drevo in skalna stena) z določenim mestom gnezdenja.

Nest hole placement / Mesto gnezdilne luknje	No. of locations/ Št. lokacij	Percentage of locations/ Odstotek lokacij (%)	No. of pairs / Št. parov		Percentage of pairs/ Odstotek parov (%)
			min	max	
Chimney pot / Dimnik	38	29.9	62	71	14.7
Eaves / Napušč	31	24.4	78	85	18.0
Inner jutting roof / Notranji nadstrešek	8	6.3	33	37	7.7
Wall / stena	10	7.9	55	57	12.4
Roof / Streha	8	6.3	122	122	26.9
Other (building) / Drugo (stavba)	7	5.5	21	21	4.6
Tree hole / Duplo	21	16.5	65	66	14.5
Area of damaged branch / Poškodovana veja na drevesu	3	2.4	5	5	1.1
Nest box / Gnezdilnica	1	0.8	0	1	0.1

Table 6: Tree species used for nesting by Jackdaws *Corvus monedula* (N = 76–78 pairs)

Tabela 6: Vrste gnezdilnih dreves kavk *Corvus monedula* (N = 76–78 parov)

Tree species / Vrsta drevesa	No. of colonies or locations/ Št. kolonij oz. lokacij	Percentage of locations/ Odstotek lokacij (%)	No. of pairs / Št. parov		Percentage of pairs/ Odstotek parov (%)
			min	max	
Fagus sylvatica	14	51.9	42	43	53.1
Platanus sp.	6	22.2	24	25	30.6
Fraxinus excelsior / oxycarpa	2	7.4	8	8	10.0
*Aesculus hippocastanum**	2 (B)	7.4	1	2	1.9
*Quercus robur**	1 (T)	3.7	2	2	2.5
Unknown tree / Neznano drevo*	1 (B)	3.7	1	1	1.3
Nest box on tree / Gnezdilnica na drevesu*	1 (B)	3.7	0	1	0.6

* Pairs using these tree species were part of larger colonies, nesting predominantly on buildings (B) or other trees (T). / Pari, ki so uporabljali te drevesne vrste, so pripadali večjim kolonijam, pretežno gnezdečim na stavbah (B) ali drugih drevesih (T).

under 400 m a.s.l. (Figure 12). Only five occupied sites (48–49 pairs, 6.7% of the total) are located higher than 500 m a.s.l. Begunje na Gorenjskem (578 m a.sl.) held the colony breeding at the highest altitude in Slovenia.

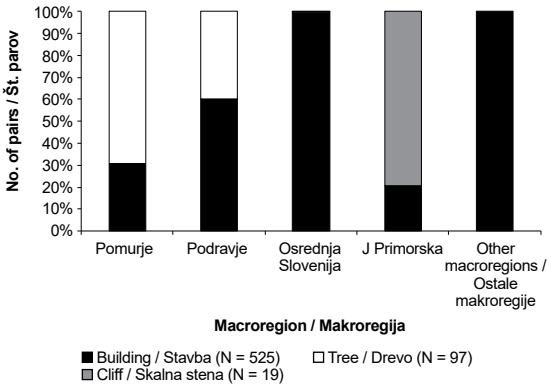

Figure 5: Percentage of Jackdaw *Corvus monedula* pairs (N = 641 pairs, max. no. of pairs) at different nest site types in macroregions of Slovenia in 2008–2011

Slika 5: Odstotek parov kavke *Corvus monedula* (N = 641 parov, max. št. parov) na različnih tipih gnezdišč v makroregijah Slovenije v letih 2008–2011

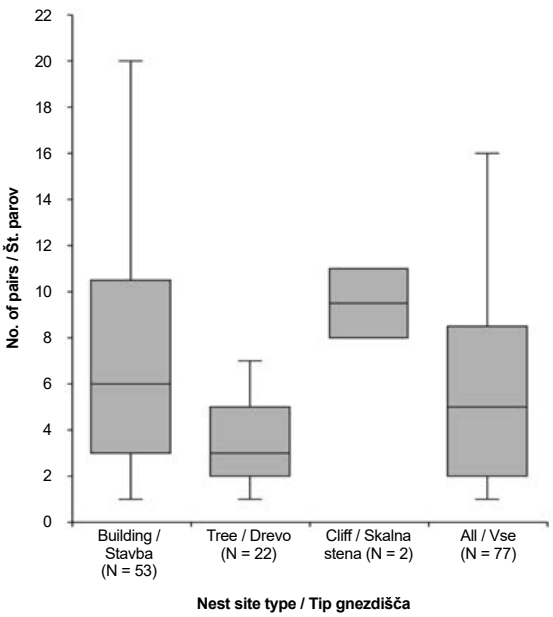

Figure 6: Colony size of Jackdaws *Corvus monedula* (N = 77) at different nest site types in Slovenia in 2008–2011

Slika 6: Velikost kolonije kavk *Corvus monedula* (N = 77) na različnih tipih gnezdišč v Sloveniji v letih 2008–2011

3.5. Past numbers and distribution

The Ornithological Atlas of Slovenia (records from 1979–1994) recorded breeding Jackdaws in 74 UTM 10 km squares; during this study, they were registered in 51 squares. Main differences include an almost complete absence of the species from the Karst Plateau (SW Slovenia) and narrower valleys in the alpine part of the country in 2008–2011. Moreover, distribution of the species was formerly more extensive and continuous in Central and NE Slovenia (Figure 4).

Jackdaw occurred at a minimum of 48 specific sites (in most cases colonies with known locations) in the past, but became extinct there by the time of this study. In further nine colonies, the number of breeding pairs decreased by > 20%. Taking into consideration possible nest site shifts between neighbouring sites, ignoring past colonies of unknown size, at least 217–254 pairs were lost at these sites (Table 7, Figure 2).

4. Discussion

The first ever successful country-wide census of breeding Jackdaws revealed a national population of several hundred pairs, substantially fewer than estimated previously (Geister 1995, BirdLife International 2004).

Despite good coverage partly achieved by extending the census over four years, it seems likely that some pairs were missed. This probably holds true for the unsurveyed parts of Ljubljana (e.g. one such part of the Šiška district held 22 pairs in 2000, P. Trontelj *in litt.*) and forest nesting population in NE Slovenia where the habitat is difficult to survey and Jackdaws are wary and inconspicuous (Cramp & Perrins 1994, Hoi-Leitner *et al.* 2016). Moreover, small numbers may have remained unnoticed elsewhere in the country. Overestimating the number of pairs due to the inclusion of non-breeders present at nest sites (cf. Dvorak 1996, Henderson *et al.* 2000) was probably offset by the overlooked pairs, especially in large colonies, densely populated areas and nest sites high above the ground (e.g. tower blocks). Considering these limitations, the total Slovene Jackdaw breeding population in the late 2000s was probably in the range of 700–900 pairs. Thus, taking into consideration the surface area, our population size is comparable with those given for similar countries in Central Europe (BirdLife International 2015).

The breeding distribution was patchy with fairly continuous occurrence at the 10 km UTM level only in a few widely separated areas, covering less than a quarter of Slovenia. Due to the fairly specific habitat requirements of the species, such a pattern

Table 7: Jackdaw *Corvus monedula* colonies and sites known prior to 2008 in Slovenia but not recorded in this study, and colonies with severely reduced no. of pairs (N = 57). For comparison, please refer to Table 1. Macroregions according to Plut (1999).

Tabela 7: Kolonije in kraji gnezdenja kavk *Corvus monedula* v Sloveniji, znani pred letom 2008, ki v tej raziskavi niso bili zabeleženi, ter kolonije, v katerih se je št. parov občutno zmanjšalo (N = 57) (primerjaj s tabelo 1). Makroregije po Plutu (1999).

Macroregion/ Makroregija	Settlement/ Naselje	Nest site type, subtype/ Tip, podtip gnezdišča	Year/ Leto	Type of observation/ Vrsta opazovanja	No. of pairs/ Št. parov		Status	Cause/ Vzrok	Source / Vir
					min	max			
Pomurje	Adrijanci	2b	1998	GN	5	7	Ex		Štumberger (2003)
Pomurje	Dolenci	2b	1998	GN	5	5	Ex		Štumberger (2003)
Pomurje	Pertoča	1	2000	GN	2	2	Ex	D	S. Forjanič, T. Börc
Pomurje	Ljutomer	1, 2	80s/ 80-ta	GN	?	?	Ex		Ž. Šalamun
Pomurje	Radenci	1	80s/ 80-ta	GN	?	?	Ex		Ž. Šalamun
Pomurje	Veržej	nez.	1986	GN	?	?	Ex		Bibič & Janžekovič (1986)
Podravje	Sv. Ana v Slovenskih goricah	1d	2002	GN	18	18	Ex	R	NOAGS
Podravje	Sp. Hoče	1d	1994	GN	9	9	Ex	R	F. Bračko
Podravje	Hrastovec v Slovenskih goricah	1e	1984	GN	8	8	Ex		F. Bračko
Podravje	Slivnica pri Mariboru	1d	1993	GN	8	8	Ex	R	Vogrin (1998)
Podravje	Sp. Dobrenje	1f	1992	GN	6	6	Ex		F. Bračko
Podravje	Maribor	1h[1]	1980	GN	4	6	Ex		F. Bračko
Podravje	Sp. Polskava	1d	1993	GN	4	4	Ex		F. Bračko
Podravje	Kušernik	2d	1985	GN	3	3	Ex		F. Bračko
Podravje	Pesnica pri Mariboru	1	1982	GN	3	3	Ex		F. Bračko
Podravje	Rače	2d	1988	GN	2	2	Ex		Vogrin (1998)
Podravje	Sp. Jakobski Dol	1a	1995	GN	2	2	Ex		F. Bračko
Podravje	Hajdoše	1a	1992	GN	1	1	Ex		Bračko (1997)
Podravje	Hotinja vas	2d	1987	GN	1	1	Ex		Vogrin (1998)
Podravje	Loka	1a	1992	GN	1	1	Ex		Bračko (1997)
Podravje	Miklavž na Dravskem polju	1a	1992	GN	1	1	Ex		Bračko (1997)
Podravje	Pekre	1a	1992	GN	1	1	Ex		F. Bračko
Podravje	Rače	1a	1993	GN	1	1	Ex		F. Bračko
Podravje	Maribor	1g	1999	GN	0	1	Ex		F. Bračko
Podravje	Pragersko	1	1993	GN	30	30	↓		F. Bračko

Nadaljevanje tabele 7 / Continuation of Table 7

Macroregion/ Makroregija	Settlement/ Naselje	Nest site type, subtype/ Tip, podtip gnezdišča	Year/ Leto	Type of observation/ Vrsta opazovanja	No. of pairs/ Št. parov		Status	Cause/ Vzrok	Source / Vir
					min	max			
Podravje	Ptuj	1	1992	GN	30	30	↓	R	Bračko (1997)
Podravje	Podova*	1a	2004	GN	23	23	↓	R	NOAGS
Podravje	Sveta Trojica	1d	2004	GN	14	14	↓		NOAGS
Savinjska Slovenija	Sedlarjevo	-	1999	PREH	0	1	Ex		Jančar & Trebušak (2000), Kmecl *et al.* (2014)
JV Slovenija	Dobova	nez.	2001	PREL	0	10	Ex		L. Božič
JV Slovenija	Krakovski gozd	2a	1976	GN	?	?	Ex		Gregori (1992)
JV Slovenija	Krško	nez.	2006	GN	4	4	↓		NOAGS
Osrednja Slovenija	Ljubljana-Šentvid	1a, 1b	2000	GN	19	19	Ex		P. Trontelj
Osrednja Slovenija	Ig	1d	2002	GN	12	13	Ex	R	Tome *et al.* (2005)
Osrednja Slovenija	Rakitnik	-	1986	PREH	7	8	Ex		S. Polak
Osrednja Slovenija	Ljubljana (Verovškova 51)	1b	1999	GN	4	4	Ex		P. Trontelj
Osrednja Slovenija	Nova vas, Bloke	nez.	2006	GN	2	2	Ex		NOAGS
Osrednja Slovenija	Šmartno pri Litiji	nez.	2007	GN	1	1	Ex		NOAGS
Osrednja Slovenija	Dobravica pri Igu	1d	1981	GN	?	?	Ex		Sovinc (1990)
Osrednja Slovenija	Trboje*	3a	1985	GN	?	?	Ex	F	Geister (1995)
Osrednja Slovenija	Zbilje*	3a	70s / 70-ta	GN	?	?	Ex	H, D	M. Žnidaršič
Osrednja Slovenija	Ljubljana-Dravlje+	1g	2000	GN	18	18	↓		P. Trontelj
Osrednja Slovenija	Ljubljana (Celovška 26 in 28)*+	1b	90s / 90-ta	GN	10	15	↓		P. Trontelj
Gorenjska	Belca	nez.	2006	GN	2	2	Ex		NOAGS
Gorenjska	Lesce	nez.	2006	GN	2	2	Ex		NOAGS
Gorenjska	Dovje	1	2006	GN	1	1	Ex		NOAGS
Gorenjska	Begunje na Gorenjskem	1d	2006	GN	4	4	↓		NOAGS
Gorenjska	Breznica	1d	2006	GN	4	4	↓		NOAGS

Nadaljevanje tabele 7 / Continuation of Table 7

Macroregion/ Makroregija	Settlement/ Naselje	Nest site type, subtype/ Tip, podtip gnezdišča	Year/ Leto	Type of observation/ Vrsta opazovanja	No. of pairs/ Št. parov		Status	Cause/ Vzrok	Source / Vir
					min	max			
S Primorska	Tolmin	-	2005	PREH	1	2	Ex		NOAGS
S Primorska	Miren	1d	1993	GN	?	?	Ex		B. Kumar
J Primorska	Podtabor, Ilirska Bistrica	3a	1984	GN	6	7	Ex		S. Polak
J Primorska	Piran*	1h[2]	90s/ 90-ta	GN	10	20	Ex	R	Škornik (2012), I. Škornik
J Primorska	Sečoveljske soline	1h[3]	80s/ 80-ta	GN	3	3	Ex		Škornik (2012), I. Škornik
J Primorska	Osp	3a	90s/ 90-ta	GN	?	?	Ex		Marčeta (1994)
J Primorska	Podpeč	3a	90s/ 90-ta	GN	?	?	Ex		Marčeta (1994)
J Primorska	Podpeč	3a	90s/ 90-ta	GN	?	?	Ex		Marčeta (1994)
J Primorska	Sočerga	3a	90s/ 90-ta	GN	?	?	Ex		Marčeta (1994)

Legend / Legenda

Settlement: for non-urban records, the name of the nearest settlement is given; **Year**: accurate year or decade to which information refers; **Nest site type and subtype**: 1 – building, 2 – tree, 1a – one- and two-storey residential building, 1b – multi-storey residential building, 1c – tower block, 1d – church, 1e – castle, 1f – outbuilding, 1g – industrial building, 1h – other building, 2a – continuous forest, 2b – isolated wood in open agricultural landscape, 2d – orchard, 3a – natural cliff; **Type of observation**: GN – breeding, PREH – foraging, PREL – flying over; **Number of pairs**: ? – unknown; **Status**: EX – extinct, ↓ – decline by > 20%; **Cause of extinction/decline (if known):** D – pulling down of the building, R – renovation of the building, F – flooding of the area by river damming, H – harvesting, D – disturbance at nest site

Naselje: pri neurbanih podatkih je navedeno ime najbližjega naselja; **Leto**: leto oziroma desetletje, na katero se nanaša podatek; **Tip in podtip gnezdišča**: 1 – stavba, 2 – drevo, 1a – eno- in dvo-nadstropna stanovanjska hiša, 1b – večnadstropna stanovanjska hiša, 1c – stolpnica, 1d – cerkev, 1e – grad, 1f – gospodarsko poslopje, 1g – industrijski objekt, 1h – druga stavba, 2a – sklenjen gozd, 2b – izoliran gozdiček v odprti kmetijski krajini, 2d – sadovnjak, 3a – naravna skalna stena; **Vrsta opazovanja**: GN – gnezdenje, PREH – prehranjevanje, PREL – prelet; Število parov: ? – neznano; **Status**: EX – izumrla, ↓ - upad za > 20 %; **Vzrok izumrtja/upada, če je znan**: D – porušenje stavbe, R – obnova stavbe, F – potopitev območja z zajezitvijo reke, H – lov oz. pobiranje osebkov, D – motnje na gnezdišču

* Pairs from the colony probably moved to other site(s) in vicinity, occupied during this study / Pari iz kolonije so se verjetno prestavili v drug(e) kraj(e) v bližini, zasedene v času te raziskave

\+ 10–12 pairs in 2008 / 10–12 parov leta 2008

\++ 7–8 pairs in 2008 (2 at Celovška 26 and 5–6 at neighbouring factory complex) / 7–8 parov leta 2008 (2 na Celovški 26 in 5 – 6 na sosednji tovarni)

[1] Barracks / Vojašnica

[2] Outer wall of the church / Obzidje cerkve

[3] Abandoned traditional saltworkers' houses / Opuščene solinarske hiše

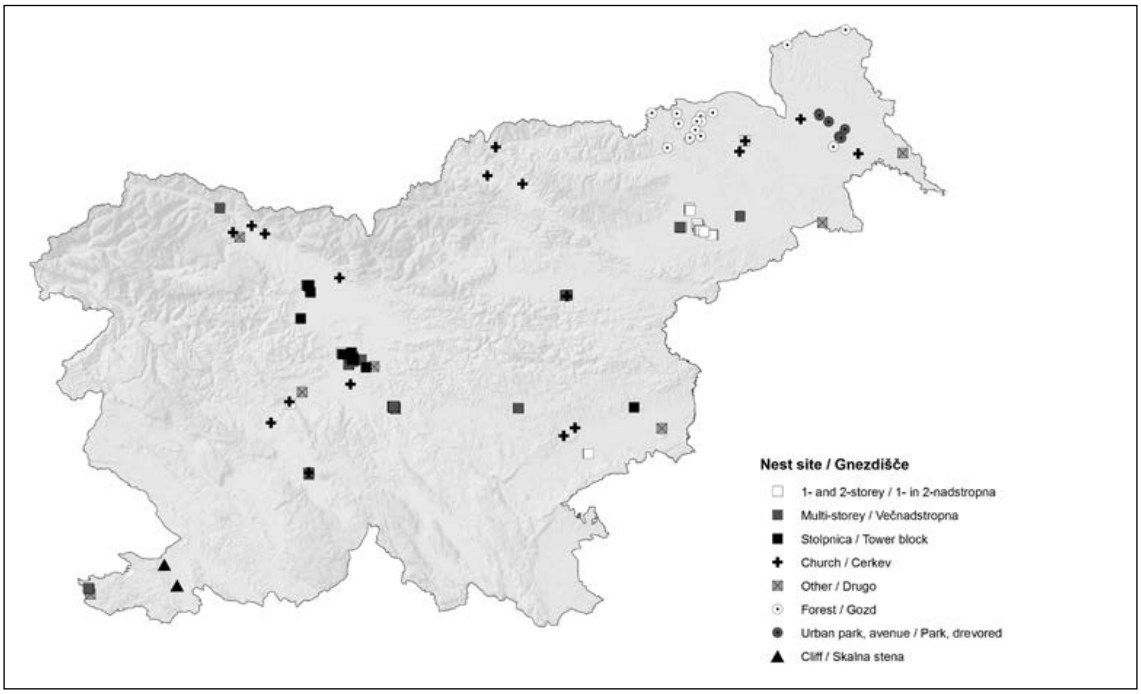

Figure 7: Distribution of nest site subtypes of Jackdaws *Corvus monedula* in Slovenia in 2008–2011 (N = 170)

Slika 7: Razširjenost podtipov gnezdišč kavke *Corvus monedula* v Sloveniji v letih 2008–2011 (N = 170)

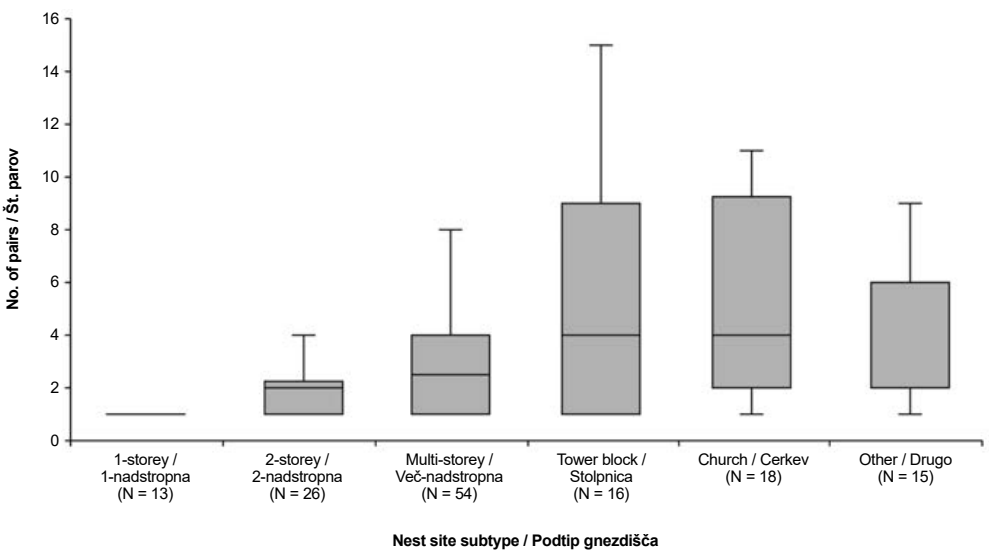

Figure 8: Number of Jackdaw *Corvus monedula* pairs nesting on individual building of a given subtype in Slovenia in 2008–2011 (N = 142)

Slika 8: Število parov kavke *Corvus monedula*, gnezdečih na posamezni stavbi določenega podtipa v Sloveniji v letih 2008–2011 (N = 142)

Figure 9: Examples of Jackdaw *Corvus monedula* nest site subtypes and nest hole placements on buildings in Slovenia in 2008–2011: (A) tower block on Dunajska street and (B) multi-storey residential building on Mašera-Spasićeva street, Ljubljana – both locations are part of the largest colony in Slovenia (circles delineate nest holes in window corners and walls, respectively) (photo: D. Fekonja); (C) Church of St. Cross, Črenšovci (nest holes in outer edge of the roof behind rain gutter); Church of the Epiphany, Sv. Trije kralji v Slovenskih goricah – (D) entrance to the nest in a bell tower through wall opening and (E) through window shutter in a belfry (photo: L. Božič); (F) chimney pot of a one-storey residential house, Cirkovce (Dravsko polje) (photo: M. Kerček)

Slika 9: Primeri podtipov gnezdišč kavke *Corvus monedula* in mest gnezdilnih lukenj na stavbah v Sloveniji v letih 2008–2011: (A) stolpnica na Dunajski cesti in (B) večnadstropna stanovanjska hiša na Mašera-Spasićevi ulici v Ljubljani – obe lokaciji sta del največje kolonije v Sloveniji (krogi označujejo gnezdilne luknje v vogalih oken in stenah) (foto: D. Fekonja); (C) cerkev sv. Križa v Črenšovcih (gnezdilne luknje v zunanjem robu strehe za žlebom); cerkev sv. Treh kraljev v Slovenskih goricah – (D) vhod do gnezda v zvoniku skozi odprtino v zidu in (E) skozi okno s polkni (foto: L. Božič); (F) dimnik na enonadstropni stanovanjski hiši v Cirkovcah (Dravsko polje) (foto: M. Kerček)

Figure 10: Nest hole placements of tree-nesting Jackdaws *Corvus monedula* in Slovenia in 2008–2011: (A) tree hole in a beech, excavated by Black Woodpecker *Dryocopus martius* (upper hole used by Jackdaw), Počenik (Slovenske gorice); (B) multiple occupied holes in a single ash tree with nesting material protruding from the upper hole, Beltinci; (C) interior of the beech wood with a nesting tree, Rošpoh (Slovenske gorice); (D) small wood situated in open agricultural landscape – typical Jackdaw nest site in the latter area; (E) tree hole and (F) cavity formed on the spot where branch was broken in planes in urban park, Murska Sobota (photo: L. Božič)

Slika 10: Mesta gnezdilnih lukenj kavk *Corvus monedula* na drevesih v Sloveniji v letih 2008–2011: (A) duplo črne žolne *Dryocopus martius* v bukvi (zgornjo je uporabljala kavka) pri Počeniku (Slovenske gorice); (B) več zasedenih dupel v enem jesenu, kjer iz zgornjega štrli gnezditveni material, Beltinci; (C) notranjost bukovega gozda z gnezdilnim drevesom, Rošpoh (Slovenske gorice); (D) izoliran gozdiček sredi kulturne krajine – tipično gnezdišče kavke na slednjem območju; (E) duplo in (F) votlina, nastala na točki, kjer je bila odlomljena veja, na platanah v mestnem parku v Murski Soboti (foto: L. Božič)

is characteristic for large parts of its range, notably in Central Europe (Dvorak *et al.* 1993, Cramp & Perrins 1994, Bauer *et al.* 2005, Maumary *et al.* 2007, Gedeon *et al.* 2014). Given the large forest area (ZGS 2011) and high proportion of elevations over 500 m a.s.l. (Šehić *et al.* 2010), similar situation in Slovenia is rather expected.

Breeding densities were high in some of the largest urban centres in the country (e.g. Kranj, Ljubljana). These were broadly similar to urban densities in different parts of Europe (e.g. Brussels, Leverkusen, Vienna, Rome, Naples), but were also up to several-fold smaller than urban densities reported for some Dutch (Amsterdam, Alkmaar, Delft) and Polish cities (Warsaw, Olsztyn, Zielona Góra) (Dwenger 1995, Salvati 2002b, Czechowski *et al.* 2013, Hoi-Leitner *et al.* 2016). However, urban densities can be inflated as foraging grounds may actually lie outside built-up zones included in the surface area used for density calculation (Salvati 2002b), as is probably the case of Kranj in this study. Densities over extensive regions (> 200 km^2) are more representative, because they are largely unaffected by plot size (Salvati 2002b). Densities in two regions of central Slovenia (Savska ravan, Dolenjsko podolje) were higher than in all districts of Austrian Styria and former East Germany, Italian province Gorizia, and counties in the Upper Rhine valley (cf. Brichetti & Fracasso 2011, Dwenger 1995, Samwald 1996, Westermann *et al.* 2006). Regions in NE Slovenia held densities within the range of those in adjacent districts across the border (Samwald 1996). However, in regions influenced by oceanic climate like the Northwest German Plain and Great Britain, but also Finland and some southern countries, large-scale densities can be several times higher. In most of the occupied 10 km UTM squares in Bulgaria several tens of pairs breed; exceptionally, their numbers reach over 1000 pairs/square (Glutz von Blotzheim & Bauer 1993, Fraissinet *et al.* 1997, Antikainen 1999, Bauer *et al.* 2005, Vasilev *et al.* 2007, Velevski *et al.* 2010, Gedeon *et al.* 2014). In Slovenia, Jackdaws selected all main nest site types characteristic of the species, with the majority using buildings as reported elsewhere. Several intriguing results emerged: (1) nesting in trees was restricted to NE Slovenia, and (2) cliff-nesting was very rare. Compared to neighbouring Austria, both types are underrepresented in terms of site/pair numbers as well as distribution. There, tree nesters constituted 20% of all pairs and were registered in seven out of nine federal states. However, the proportion of tree-nesters in NE Slovenia is remarkably high and actually very similar to adjacent Oststeirisches Hügelland (c. 50%) (Dvorak 1996, Samwald 1996). Therefore, this geographically uniform, transboundary territory designates a stronghold of tree-nesting Jackdaws in the wider region. It seems that predominance of tree-nesting in Central Europe is often restricted to smaller parts of the breeding range. This is typical also of Germany and Switzerland where, although inferior to selection of buildings in general, tree-nesters can

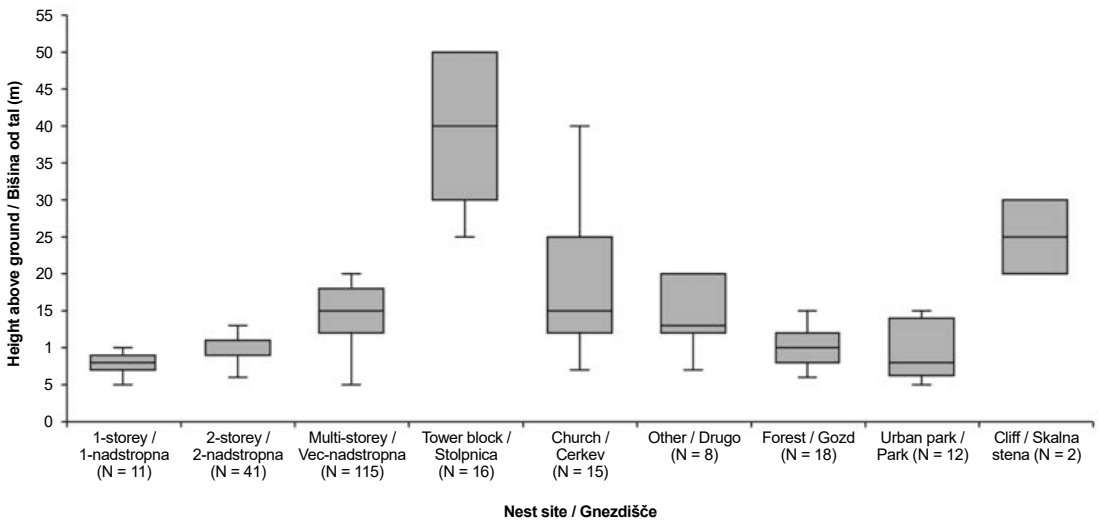

Figure 11: Height of Jackdaw *Corvus monedula* nests above ground at different nest sites in Slovenia in 2008–2011 (N = 238)

Slika 11: Višina gnezd kavke *Corvus monedula* od tal na različnih gnezdiščih v Sloveniji v letih 2008–2011 (N = 238)

regionally constitute up to 60% of all pairs, e.g. in Hessen and the canton of Bern, or even more, e.g. in the canton of Geneva (Vogel 1990, Becker 2002). The reason for such restricted range of tree-nesting in Slovenia is not clear. We can argue that a lack of suitable nest sites is not the limiting factor as Black Woodpecker *Dryocopus martius*, practically the only hole-providing species for Jackdaws nesting in forests, is numerous and widespread, being absent from only a few 10 km UTM squares (NOAGS database). The same was observed in Germany (Hoffman 2005) and probably holds true for other countries as well. However, several points might be important here (cf. Johnsson *et al.* 1993, Rudolph 2000): (1) Jackdaws nested only close to the forest edge; (2) breeding colonies occurred mainly in stands with clusters of nest holes and taking into account not all holes excavated are suitable for various reasons, this essentially limits potential nest sites to old forest sections with abundant mature trees; (3) distance to foraging grounds, i.e. Jackdaws prefer open areas usually within several hundred metres from nests (Strebel 1991, Glutz von Blotzheim & Bauer 1993, Kneubühl 1998, Unger & Kurth 2010). Based on these assumptions we can infer that favourable conditions for tree-nesting are indeed found only in hilly regions of NE Slovenia like Slovenske gorice and Goričko, where the majority of forest-nesting pairs was recorded. Here, open agricultural areas interspersed with small beech-forest islands form mosaic-like countryside with a total forest area of c. 30% (Perko & Orožen Adamič 1999), corresponding to descriptions of habitat in different regions of Europe with prevailing tree-nesters (Johnsson 1994, Samwald 1996, Rudolph 2000). Although tree-nesting is usually rather uncommon in European cities (Dwenger 1995, Salvati *et al.* 2002, Westermann *et al.* 2006, Czechowski *et al.* 2013, Hoi-Leitner *et al.* 2016), it is nevertheless surprising that it was not recorded at all in any of the largest cities of Slovenia, despite seemingly suitable trees available in parks and avenues. Nonetheless, it must be emphasized that tree nesting is scarce in many European regions or even entire countries (e.g. Handrinos & Akriotis 1997, Westermann *et al.* 2006, Vasilev *et al.* 2007). Presumably, in more urbanized areas Jackdaws may prefer buildings to trees if these provide abundant nest holes for reasons such as predator avoidance, proximity of suitable foraging sites and affinity for colonial nesting (Glutz von Blotzheim & Bauer 1993, Salvati 2002a, Salvati *et al.* 2002).

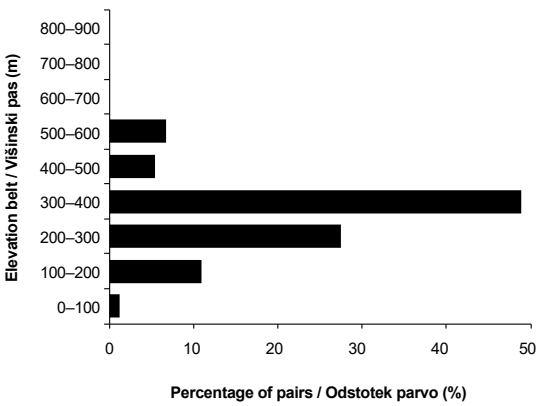

Figure 12: Elevational distribution of Jackdaw *Corvus monedula* pairs in Slovenia in 2008–2011

Slika 12: Višinska razširjenost parov kavke *Corvus monedula* v Sloveniji v letih 2008–2011

The question arises when Jackdaw began nesting on buildings in settlements in Slovenia. Historically, it was described as a tree-nesting species (Seidensacher 1860, Reiser 1925). However, bell towers and attics are already mentioned as favoured nesting places for colonies in the pre-World War 2 literature (Ponebšek & Ponebšek 1934). Later, nesting in tall buildings, churches and attics is also described (Krečič & Šušteršič 1963). For NE Slovenia, Vogrin (1998) presumed that colonization of settlements started only after WW2. Indeed, it seems likely that a major shift in nest site selection must have occurred in this period which gave rise to intensive urbanization and construction of many previously unknown building types, nowadays favoured by Jackdaws (e.g. tower blocks) (cf. Melik 1963). Regarding cliff-nesting, the situation is rather unexpected in Slovenia, given the apparently high availability of potential nest sites, notably in the alpine and Mediterranean regions. However, most sites in the alpine region are located in narrow valleys, areas dominated by extensive forest tracts or high elevations and hence unsuitable for Jackdaws. In Mediterranean regions, forests cover most of the area nowadays due to progressive overgrowing of grasslands, following widespread land abandonment in the past (Ivajnšič *et al.* 2013).

Ranking of average colony size per nest site type in this study corresponds to the findings in Austria and Switzerland, while average figures (nest site types and overall) are fairly similar to the latter and smaller than in the former (Vogel 1990, Dvorak 1996). The most prominent difference is the absence of very large cliff-nesting colonies in Slovenia. In both countries mentioned above some of these qualify among the largest on a national level, with several tens of pairs

(two or three in Austria with > 100 pairs). Regarding building-nesters, the situation is more similar in general, with our largest colonies comparable in size (e.g. largest in Austria c. 120 pairs, Switzerland in recent times 43, formerly c. 100 pairs). The proportion of solitary-pair sites was substantially lower (Dvorak 1996, Brader & Samhaber 2005, Maumary *et al.* 2007), but the difference can probably be at least partly explained by the higher number of undetected solitary pairs in forests of NE Slovenia. In Vienna, a similarly low proportion of solitary pairs was partly explained by sufficient possibilities for colonial nesting on buildings (Hoi-Leitner *et al.* 2016). However, small average colony size on buildings, well below values considered as optimal colony size by Antikainen (1987), does not corroborate this assertion for Slovenia. Low number of colonies with > 30 pairs as found in Slovenia seems typical of the majority of Central Europe (Vogel 1990, Dwenger 1995, Samwald 1996, Salvati *et al.* 2002, Westermann *et al.* 2006). Jackdaw colony size is mainly influenced by the availability of nest sites, but also foraging sites, and evidence exists that other factors such as predator interference might be important, too (Glutz von Blotzheim & Bauer 1993, Salvati *et al.* 2002). Highest numbers tend to occur in places where many potential nest sites are adjacent to favourable foraging sites (Fraissinet *et al.* 1997), as was the case for the majority of the largest colonies found during this study. Therefore, small size of tree-nesting colonies is characteristic, resulting in low breeding densities in regions with a predominance of tree-nesters (Rudolph 2000, *this study*) and consequences affecting breeding success such as increased predation (Johnsson 1994). However, some notable exceptions to this rule can be found in Central Europe, e.g. with tree-nesting colonies of 30–60 pairs in Upper Austria (Brader & Samhaber 2005) and > 200 pairs in NE Poland (Chmielewski 2015).

All Jackdaws recorded used cavities for nesting. No open-nesting in abandoned nests of other crows or dense canopies of conifers as occasionally reported was observed. The former is hardly surprising owing to the scarcity of Rook *Corvus frugilegus* colonies in Slovenia (NOAGS database) with which Jackdaws most often associate (Röel 1978, Glutz von Blotzheim & Bauer 1993, Gorman 1996, Westermann *et al.* 2006). Furthermore, Jackdaws were not found nesting in quarries, bridges and various technical facilities frequently described elsewhere (e.g. Dvorak 1996, Westermann *et al.* 2006, Kostin 2009). Although multi-storey residential buildings were the most important by proportion of nesting pairs, tower blocks and churches hosted a higher number of pairs per building on average. The former was most evident in Kranj where two large colonies were centred around a few 9–11 storey tower blocks. However, the highest number of pairs on a single building (19 and 17) was recorded for multi-storey residential buildings with large footprints, thus offering numerous nest sites along the outer walls. Nevertheless, most of the largest colonies extended over large areas (≥ 1 km^2), where pairs nested on numerous nearby buildings, often interspersed with unused sections of the built-up area, as observed for example in Vienna (Hoi-Leitner *et al.* 2016) and rural settlement in the Netherlands (Röel 1978). The proportion of pairs using one- and two-storey residential buildings was rather low as these are smaller and obviously have fewer (potential) nest sites. This is especially true for one-storey buildings, exclusively represented in this study by single-family houses, where single pairs per house were almost the rule as found by Röel (1978). Here, nesting was exclusively associated with chimney pots. Overall, fewer than 40% of chimney-nesting pairs occurred on buildings other than one- and two-storey, most notably a colony of nine pairs in a single large chimney of a hotel at Bled. On the whole, both these nest site subtypes and nesting in chimney pots were rare outside Dravsko polje in the Podravje region. Such restricted utilisation of chimney pots appears unusual given their widespread use in Austria (registered in most districts, prevailing in two and Vienna) as well as many other areas in Europe (Röel 1978, Dvorak 1996, Samwald 1996, Fraissinet *et al.* 1997, Brader & Samhaber 2005, Westermann *et al.* 2006, Vasilev *et al.* 2007, Hoi-Leitner *et al.* 2016). One conceivable explanation for such a situation is that chimney pots in Slovenia are generally unfavourable for nesting as c. 75% of dwellings use sources of heating that require functional chimneys (Statistical Office RS 2002). As a matter of fact, several authors report Jackdaws only use chimneys that are abandoned or seldom used (Antikainen 1999, Hoi-Leitner *et al.* 2016). At Dravsko polje, however, Jackdaws mostly nested in functional chimney pots. The reason for their predominance and obviously long tradition here, i.e. 72% of pairs nested in chimney pots already years ago (Vogrin 1998), could possibly arise from a combination of high breeding site-fidelity/natal philopatry of the species (Schmidt 1999a) and a lack of other potential nest sites in the area. Contrary to these assertions, Vogrin (1998) observed that Jackdaws supposedly favoured chimney pots, as these were occupied earlier than attics, possibly due to their inaccessibility to predators. Among nest hole placements, roofs and other structures situated in the uppermost parts of buildings predominated. Thus,

height of nests above ground varied greatly, largely reflecting features of building subtypes and supposedly also the preference of Jackdaws for selecting the highest holes, the fact often attributed to competition for nest sites with other species (e.g. Feral Pigeon *Columba livia* f. *domestica* that tends to occupy lower holes), predation pressure and human disturbance (Antikainen 1987, Salvati 2002a, Bauer *et al.* 2005). It seems that the proportion of potentially available nest holes is highest along different edges of roofs and roof/outer wall junctions, as these sections are probably more prone to damage.

The majority of nests on trees were placed in holes, the only exception being a few pairs nesting in cavities in plane trees, formed on the spot where a branch was broken or cut off, either vertically or horizontally to the ground. Several forest colonies (up to 5 pairs) were situated in single beech trees with multiple holes at different heights, as observed also in Germany (Rudolph 2000). It was judged that nearly all holes in beech trees used by Jackdaws were excavated by Black Woodpecker and the range of heights above ground (6–15 m) found corresponded to value given for this species (Glutz von Blotzheim & Bauer 1994). A similar predominance of plane trees in pairs nesting in urban parks/avenues was reported for Vienna, for which several possible explanations were offered. These include effective predator protection enabled by its smooth bark and their effective reaction to damage, keeping the entrance to the nest hole small. Nevertheless, the fact that some plane species rank among the most widespread large ornamental trees that often have large number of suitable nesting holes should not be neglected (Torelli 2004, Hoi-Leitner *et al.* 2016). During this study, nesting was not recorded in traditional orchards, occasionally used by solitary pairs and small colonies in the 1980s. Tree species reported there were apple tree *Malus domestica* and Common Walnut *Juglans regia* (Vogrin 1998, F. Bračko *in litt.*).

The altitudinal distribution confirmed the Jackdaw's status of a typical lowland species. In the years prior to this study it was found higher at a handful of sites in the Upper Sava Valley (e.g. Belca at c. 690 m a.s.l.) and on the Bloke Plateau (720 m a.s.l.), but breeding was not confirmed. The highest breeding season record is from a mountain pasture above Tolmin at c. 800 m a.s.l. (Perušek 1994) where actual nesting is unlikely. This is broadly in line with the findings in Austria where > 90% of nest sites lie below 700 m and only few can be found higher than 900 m a.s.l. (Dvorak 1996). In Italy, Jackdaw is widespread up to 700–800 m, less frequent up to 1000 m and very locally up to 1500 m a.s.l. or even higher (Brichetti & Fracasso 2011), while in Germany the highest nest sites are situated at c. 800 m a.s.l. (Gedeon *et al.* 2014). Most of the nest sites in Switzerland are under 800 m, but the species penetrates deep into the Alps along the valleys with favourable climate, reaching over 1400 m a.s.l. (Maumary *et al.* 2007).

Despite the lack of comprehensive data on the species' past numbers and trends, there is little doubt that the population declined significantly over the previous two or three decades. Firm evidence of the disappearance of the species and its colonies a few dozen of sites, together with the depletion of several formerly large colonies, support this assertion. If only sites with known numbers are taken into consideration that would constitute a decline of 24% in c. 10–20 years to reach the situation presented in this study. Given the known distribution in the 1980s (Geister 1995), with numerous nowadays unoccupied 10 km UTM squares for which no exact past records were obtained in this study (e.g. western border area, eastern part of Podravje region etc.) and a fairly high number of past colonies with unknown size, the magnitude of the decline must have been substantially larger. Still, some care is needed in the interpretation of these figures as it is unknown to what extent pairs from abandoned colonies might move to new sites, recorded during this study. Circumstantial evidence for such events exists for few sites (i.e. number of pairs in existing colonies increased/new ones appeared immediately after the abandonment of nearby sites). It is known that Jackdaws can readily occupy alternative nest sites if available close enough and at a suitable distance to foraging sites, regardless of high breeding site-fidelity (Töpfer 1999, Eisermann & Börner 2006, Hoi-Leitner *et al.* 2016). However, for certain regions with good datasets from different periods like Dravsko and Ptujsko polje, a population decline of at least 40% is certain, with the majority occurring during the first half of the 1990s. A similar rate of decline over the past 20 years is suspected for (parts) of Austrian Styria (Albegger *et al.* 2015). With large declines also reported in Hungary (BirdLife International 2015), this indicates an unfavourable population status in the wider region. Some local/regional increases beyond the time period covered in this study (e.g. breeding population in Slovene Istria was in the range of 50–60 pairs in 2014–2016, NOAGS database; population of Goričko in far NE Slovenia was estimated at very high 100–200 pairs, although underlying data hardly support this, Denac & Kmecl 2014) were probably offset by local declines/extinctions on the other hand (c. 20–30 pairs lost in NE Slovenia in the last few years, *own data*), without major impact

on overall long-term negative trend. According to the IUCN criteria (IUCN 2012a, 2012b, IUCN 2016), Jackdaw would qualify as Vulnerable (VU) on the Red List of Slovenia based on A2 criteria (An estimated population size reduction of ≥30% over the last three generations, where the reduction or its causes may not have ceased, based on direct observation/a decline in area of occupancy, and influence of immigration being unknown).

The commonest known cause of decline is renovation of buildings that affected some sizeable colonies, notably on churches. Despite their relative importance, separate studies found most churches in Slovenia unsuitable for nesting of birds (including Jackdaw) due to closing of their openings and human disturbance (Tome 1986, Denac *et al.* 2002). Random post-2011 observations demonstrate a further aggravation: recently two colonies (Črenšovci, Kotlje) became extinct after renovation of the nave's roof and installation of window protection grids on the bell tower (Ž. Šalamun, M. Podgorelec *pers. comm.*). Restoration works on buildings are regularly referred to as the main cause of extinction of colonies, often leading to abrupt, catastrophic regional/local population declines (Eisermann & Börner 2006, Westermann *et al.* 2006). One of the most alarming potential threats for building-nesting Jackdaws in Slovenia is the dependence of many colonies (including some of the largest in country) on the old socialist-style tower blocks and multi-storey buildings constructed in the 1960s and 1970s with an abundance of suitable nest holes. The quality of living in such densely populated residential neighbourhoods has become an important issue in modern urban planning and calls for their complete renovation have emerged (e.g. the Planina housing district of Kranj, holding colony of 40 pairs). Consequently, massive losses/reductions of these nest sites can be predicted in the near future. Installation of nest boxes is often suggested as an appropriate conservation measure, with examples of several-fold population increases available (e.g. Börner & Eisermann 1999). In Slovenia, however, recent attempts gave rather mixed results, ranging from local increase to complete non-acceptance of nest boxes despite destruction of former nest sites nearby and an obvious lack of alternatives. Little is known about threats affecting tree-nesting pairs, but modern forestry practices are generally not in favour of large hole-nesting birds. One of the current concerns is increased annual timber harvest in Slovene forests, especially in deciduous forests (Denac & Mihelič 2015), probably reducing the proportion of mature beech trees suitable for nesting of Jackdaws, too. The proportion of extinct cliff-nesting colonies is striking. Apart from the Sava gorge where causes seem straightforward, their extinction from karst limestone walls of SW Slovenia is more obscure. The following explanations seem plausible: (1) Lack of suitable foraging areas at appropriate distance due to progressive overgrowing of grasslands, recognized as a major conservation issue in the region (Ivajnšič *et al.* 2013) (see above). This phenomenon might be responsible also for disappearance of the species from the entire Karst plateau (cf. Geister 1995). (2) Human disturbance due to expansion of rock climbing in the cliffs with nesting Jackdaws, as often mentioned among threats in literature although with little tangible evidence (Vogel 1990, Wagner 1994, Bauer *et al.* 2005). In the study of cliff-nesting birds of Kraški rob escarpment, Jackdaw was considered an adaptable species, less affected by this activity compared to some other specialised cliff-nesters (Marčeta 1994). (3) Competition with other species using cliffs for nesting in the area given like Eagle Owl *Bubo bubo* and Peregrine Falcon *Falco peregrinus* (cf. Wagner 2006). Populations of both species increased substantially in Slovenia in the last two decades (Birdlife international 2004, Denac *et al.* 2011). Quality of foraging sites is considered an important factor influencing breeding success of Jackdaws (Strebel 1991, Kneubühl 1998), while conversion of high-quality meadows and pastures into arable fields can presumably lead to food shortage, resulting in extinction of colonies (Samwald 1996). Given the widespread overall decline of grassland areas in Slovenia (Kmecl *et al.* 2014), this threat is likely to be important for Jackdaw, among others. Finally, the attitude of the general public towards the species is mostly negative for reasons such as allegedly untidy nesting in buildings, clogging of chimney pots with nesting material, noisy behaviour and damage in agriculture (e.g. on crops and round bale silage). Without targeted conservation of existing nest sites/nest holes and restoration of most important former sites, supported by a provision of suitable foraging sites and campaigns to raise awareness, the future prospects of the Jackdaw in Slovenia seems grim.

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5. Povzetek

Leta 2008 smo opravili koordiniran popis kavke *Corvus monedula*, da bi ocenili njeno gnezdečo populacijo, razširjenost in izbiro gnezditvenih mest v Sloveniji. Zbiranje podatkov za nepopisana območja smo nadaljevali še v obdobju 2009–2011, vključno s podatki o nekdanjih kolonijah in dejavnikih ogrožanja. Skupno smo zabeležili 663–794 parov kavk na 86 lokacijah, gnezdečo populacijo ocenjujemo na 700–900 parov. Več kot tretjina parov je bila ugotovljena v osrednji Sloveniji, posebno v Ljubljani (20,8 %), skoraj četrtina pa v Podravju. Večina kolonij je štela 2–5 parov, največja je bila za Bežigradom v Ljubljani z 82–87 pari. Gostota na večjih območjih je bila od 0,15 para/10 km^2 v goratih območjih v severni Sloveniji do 3,65 para/10 km^2 na Savski ravni. Večina kavk (82,2 % parov) je gnezdila na stavbah, medtem ko je bilo gnezdenje na drevesih redkejše (14,7 %) in skoraj izključno omejeno na vzhodno Slovenijo. Gnezdenje v skalnih stenah je bilo ugotovljeno le na dveh krajih v Slovenski Istri (3,1 %). Povprečna velikost kolonije se je pomembno razlikovala glede na tip gnezdišča: kolonije v skalnih stenah so bile v povprečju največje (mediana 9,5 para), sledile so jim kolonije na stavbah (6) in drevesih (3). Izmed parov, gnezdečih na stavbah, jih je bilo največ na večstanovanjskih stavbah (34,2 %), pomembni deleži pa tudi na cerkvah (14,4 %) in stanovanjskih blokih (13,5 %). Največ parov je gnezdilo v luknjah v strehah (26,9 %), pod napušči (18,0 %) in v dimnikih (14,7 %). Pari, gnezdeči na drevesih, so bili ugotovljeni predvsem v majhnih gozdovih v odprti kulturni krajini. Največ gozdnih kolonij, 14 od 16, je bilo na bukvah *Fagus sylvatica* (53,1 % parov). Kavke, ki so gnezdile v mestnih parkih in drevoredih, so uporabljale predvsem platane *Platanus* sp. (30,6 % parov). Velika večina kavk gnezdi v nižinah, 88,1 % parov je bilo popisanih na nadmorskih višinah pod 400 m n. v., najviše gnezdeča kolonija pa je bila zabeležena na 578 m n. v. V preteklosti so se kavke pojavljale na najmanj 54 dodatnih lokacijah, vendar je njihovo število tam močno upadlo ali pa so do obdobja raziskave celo izumrle. Populacijski upad na teh lokacijah ocenjujemo na 217–254 parov, kar pomeni 24-odstotni upad v 10–20 letih. Upoštevajoč kriterije IUCN bi kavko na Rdečem seznamu uvrstili med ranljive vrste (VU). Najpogostejši znani vzrok upada je obnova stavb – grožnja, ki se bo v prihodnje le še povečevala.

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