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SELECTED BREEDING PARAMETERS OF JACKDAW *CORVUS MONEDULA* IN NESTING BOXES IN SULECHÓW (WESTERN POLAND)

ABSTRACT

The paper presents selected parameters such as the number of eggs, egg size, number of fledglings and nesting success of Jackdaw *Corvus monedula* in nesting boxes. In February 2005, 35 nest boxes were hung on trees in a park in Sulechów, a town in Western Poland. Observations were conducted over the period 2005-2009. In each of the years the boxes were inhabited by 8, 15, 22, 11 and 6 pairs of Jackdaws, respectively. In the first three years the number of boxes occupied increased by 20% per year (maximum 62.9%), then dropped in the following two years to 17.1%. The number of eggs ranged from 2-6 with the average 4.8. The average egg length was 34.4 mm, width 24.7 mm and volume 10.6 cm^3. Nesting success in individual years ranged from 16.7% in 2009 to 60.0% in 2006. The average number of fledglings was 0.8 individuals, while for successful nests it was 2.3. The obtained reproduction parameters were similar (egg number) or lower (nest success, the number of fledges) in comparison to results obtained in other studies in Europe, including from Poland. The decrease in the number of boxes occupied in the study period was probably due to low nest success. The observed nest boxes in Sulechów, which were willingly occupied by Jackdaws, are a good solution in a time of a decline in natural breeding sites. However, they need to be properly located, well-manufactured and maintained, and – preferably – equipped with some kind of protection against predators.

Key words: Jackdaw, *Corvus monedula*, breeding biology, nesting boxes, Sulechów, Poland

INTRODUCTION

The Jackdaw is a medium-abundant species in Poland, with a population estimated at 230-310 thousand pairs (Chodkiewicz et al. 2015). As a synanthropic species, most of its populations are associated with human settlements. Its breeding sites involve natural cavities and all kinds of openings, including gaps in buildings, especially ventilation ducts and chimneys (Luniak 2005, Dolata et al. 2005). Since the 1980s and 1990s its populations have been declining in size in many areas of Europe (Cramp and Perrins

1994, Tucker and Heath 1995), including Poland (Tomiałojć and Stawarczyk 2003, Dolata et al. 2005, Luniak 2005, Kuczyński and Chylarecki 2012). The main reason is a loss of breeding sites caused by renovation and thermomodernization, resulting in the disappearance of crevices and openings in many buildings (Dolata et al. 2005, Kuczyński and Chylarecki 2012, Bocheński et al. 2013, Walasz and Misielak 2014). The decrease in population size is also attributed to the deteriorating feeding conditions for chicks due to the reduced richness of feeding grounds (Luniak 2005, Kuczyński and Chylarecki 2012, Bocheński et al. 2013). One of the solutions proposed to address the situation of Jackdaws is active protection involving the manufacture and hanging of nest boxes (Luniak 2005 and the literature quoted there, Dolata et al. 2005).

The reproduction parameters of Jackdaw have been described in Poland in detail on the basis of data collected from colonies in natural hollows in the Narew valley (Kamiński and Konarzewski 1984, Kamiński 1991). Additional data are contained in the works of Antikainen (1987) and Michocki (1974), who studied a population occupying nest boxes

The aim of this study was to present selected breeding parameters of an urban population of Jackdaws nesting in nest boxes mounted as part of the active protection of the species.

STUDY AREA

The research was carried out in a small city park located at the State Higher Vocational School in Sulechów (currently the Faculty of Economics of the University of Zielona Góra). Sulechów is a town in Zielona Góra County in Lubuskie Voivodeship, with a population of over 15,700 and an area of 6.8 km^2. The park where the nest boxes for the jackdaws were located and observations were carried out, covers an area of 2.5 ha and can be classified as a ring park. It contains a main road which runs around the perimeter of the park and also divides it into three sections. The park is home to mature deciduous trees, mainly Oaks *Querqus* sp., Lime trees *Tilia* sp. and Maples *Acer* sp.

In February 2005, 35 nest boxes with shapes and dimensions recommended for jackdaws were hung in the park. The boxes were mounted on the main trunks of trees in the park near the university buildings, at a height of about 6 meters.

MATERIAL AND METHODS

Observations in nest boxes were carried out in the breeding seasons over the period 2005-2009. Checks were performed on all the boxes with the number of occupied nests and their contents. Observations were carried out from the beginning of April to the end of May, with 4 to 7 inspections per year. In 2007 only two inspections were carried out at the beginning of the breeding season, so only data on the egg number are presented for that year. During the inspection of the nest boxes, the presence of

a nest, the number of eggs, the number of chicks and the number of fledglings in the final phase of the breeding period were recorded. The observations were carried out at relatively constant times of the day, between 11:00 and 13:00, on days with good weather conditions (rain-free days).

In the years 2007-2009 egg measurements were carried out with the consent of the Minister of Environment, No: DLOPiK-op/ogiz-4200/III-45,1/1344,1889/06/07/aj of 06 April 2007. Eggs were measured with a digital caliper to an accuracy of 0.1 mm. The results show three dimensions of eggs – length, width and volume calculated based on the formula: $V = 0.5 \times \text{length} \times (\text{width})^2$ (Hoyt 1979).

The following terms were used in this paper: egg-laying rate – number of eggs in a completed clutch; number of fledglings – number of live chicks before leaving the nest; successful nest – a nest which at least one fledge left; nest success – the ratio of the number of successful nests to the number of all nests in which the eggs were laid.

Statistica 12 software (StatSoft, Inc. 2014) was used for statistical calculations.

RESULTS

Occupation of nest boxes

In each year from 2005-2009, the nest boxes were occupied by 8, 15, 22, 11 and 6 pairs of Jackdaws, respectively (Fig. 1), showing an occupancy of 22.9%, 42.9%, 62.9%, 31.4% and 17.1%, respectively. In each of the first three years increase in the number of boxes occupied was observed. However, in the fourth year the number of occupied boxes decreased to 31.4% and in the fifth year only 17.1%.

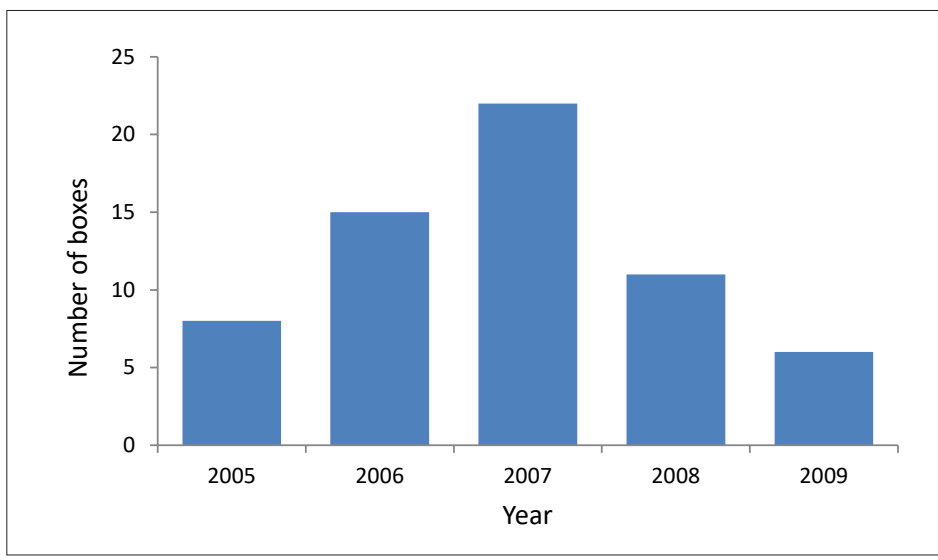

Fig. 1. Number of occupied nest boxes by Jackdows *Corvus monedula* in 2005-2009 y

Egg-laying rate and dimensions of the eggs

A total of 273 eggs were laid in 61 complete clutches. Most often clutches comprised 5 eggs (mode = 27), with a range from 2 to 6 eggs (Fig. 2). In total, for the five years of the study, the mean laying rate was 4.48 eggs (SD = 0.92; N = 61). The average number of eggs in a clutch did not differ statistically significantly between seasons (ANOVA test, $F_{3.36} = 1.60$; $p > 0.05$).

On average, eggs were 34.4 mm long (SD = 1.8; range 29.0-39.8 mm; N = 168), 24.7 mm wide (SD = 0.7; range 22.4-26.9 mm; N = 168) and with a volume of 10.6 cm^3 (SD = 0.9; range 8.3-13.2 cm^3).

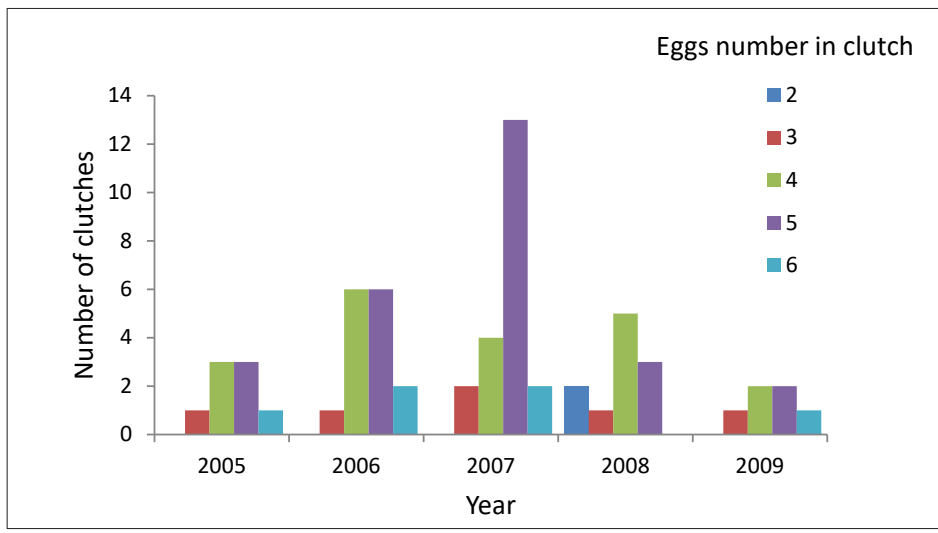

Fig. 2. Eggs number in the cluchtes of Jackdaw *Corvus menedula* in 2005-2009 y

Nest success and number of fledglings

In the years 2005-2006 and 2008-2009 at least one young Jackdaw fledgling flew from 14 of the 40 clutches (35% of clutches). Nest success in individual years ranged from 16.7% in 2009 to 60.0% in 2006 (Fig. 3). Nest success (percentage of successful pairs in the entire breeding population) did not differ between years (chi square test, $\chi 2 = 3.99$; $df = 3$; $p > 0.05$)

Successful clutches contained a total of 69 eggs, with 32 fledglings leaving the nest (43.4%). Statistically significant between-year differences were found (chi square test, $\chi 2 = 15.19$; $df = 3$; $p<0.05$) in the ratio of fledglings to the total number of eggs in the population (2005-11%, 2006-36%, 2008-7%, 2009-4%).

The average number of fledglings in the nest was 0.8 (SD = 1.2; range 0-4; N = 40), while for an average successful nest it was 2.3 (SD = 1.0; range 1-4; N = 14; Fig. 4).

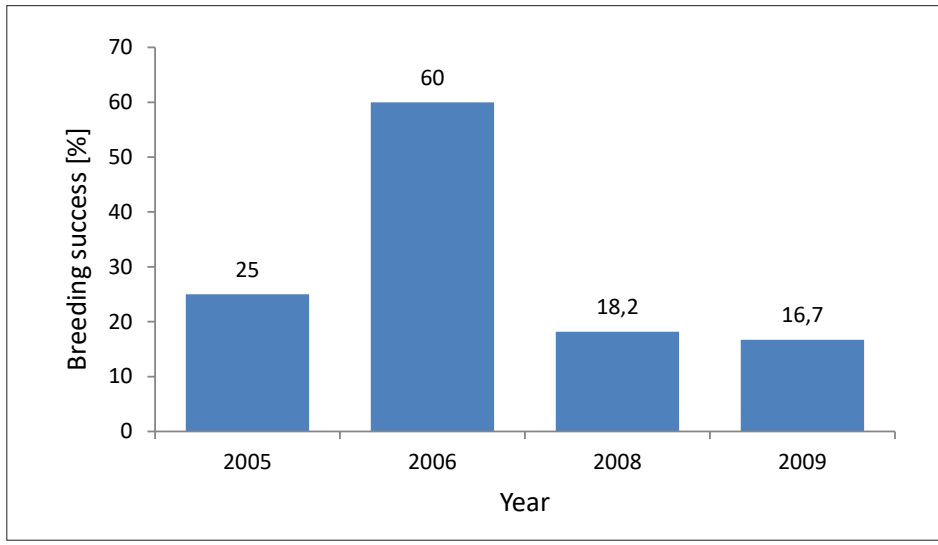

Fig. 3. Breeding success of the Jackdaws *Corvus monedula* in 2005-2006 and 2008-2009 y

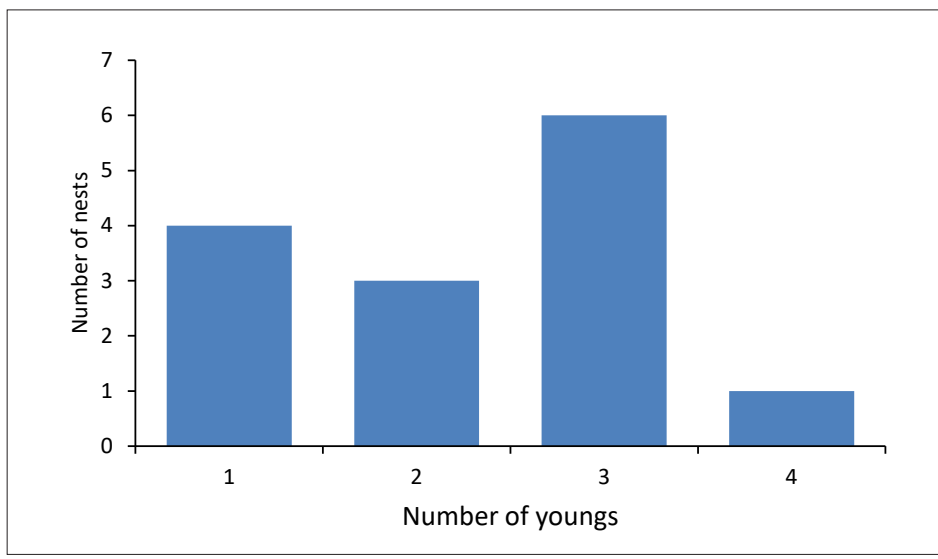

Fig. 4. Number of youngs of the Jackdaw *Corvus monedula* in the nests with breeding success

Between-year differences in the average number of fledglings from all nests (ANOVA test, $F_{3.36} = 4.25$; $p < 0.05$) were found only for 2006 and 2008.

DISCUSSION

The nest boxes became occupied in the year they were mounted (February 2015). During the first three years the number of occupied booths grew, but in the following two seasons the number of pairs nesting in boxes decreased, which may have been caused by a very low nest success in the study period. The decrease in the number of occupied boxes may also be associated with the deteriorating quality of the boxes, e.g. deformations and cracks in their walls, the opening wall falling off and dropping water tightness. This shows the importance of the quality of the boxes, first of all the material from which they are made and the proper drying of wood. The research did not determine the exact causes of breeding losses, but such a high loss of eggs and chicks may have been caused by a predator (e.g. marten) plundering the nests. The size of the hole in the nest box for Jackdaws probably allows some predators to penetrate, although there is no indisputable evidence of this. The mortality of young jackdaws is also strongly influenced by bad weather conditions – high humidity or low temperatures (Kamiński 1991).

In Poland, the range of egg numbers in a clutch has been reported to range from 2 to 6 eggs (Busse 1963, Kamiński 1991, this study). The mean egg-laying rate of 4.5 eggs (N = 61) found in this study Sulechów was lower than 5.1 (N = 80) found in the nests in nest boxes in a rural park in Siemianice (Michocki 1974) and compared to 4.9 (N = 484) observed in a colony near Białystok (Kamiński 1991). In European populations, this number shows considerable variation. Parameters similar to our study (4.5 eggs, range 1-7) were obtained in Scotland (Chesney 1986). Lower results were generally obtained in Great Britain, where the average was 4.3 eggs (N = 431) with a range of 2-7 eggs, with the highest parameters obtained in Wales (mean 5.3; N = 18) and the lowest in southern Scotland (4.2; N = 20). In other parts of Great Britain (northern England, southern England, and Ireland) the average was 4.3-4.4 eggs (Holyoak 1967). In other parts of Europe, e.g. in north-eastern Slovakia (museum collection) the average number of eggs was 4.14 (N = 125) with a range of 2-9 eggs (Tryjanowski et al. 2001). Higher parameters were obtained in Spain, with 5.1 eggs on average (N = 173) (Soler and Soler 1991), or in north-eastern Bulgaria, where the average was 4.8 eggs and the range was 2-7 eggs (Vasilew and Marinov 2017).

The recorded egg dimensions (length 34.4 mm; width 24.7 mm; volume 10.6 cm^3) were similar to those obtained in other populations. In a study in Poland, the average size of 464 eggs (length and width) in the colony near Białystok was 464: 35.2 mm and 24.9 mm (Kamiński 1991). In Ostrów Wielkopolski, in a study based on 22 eggs the average length was 34.9 mm and width was 24.2 mm (Dolata et al. 2005). In the Przemyśl area (34 eggs) these were 35.1 mm and 25.3 mm, respectively (Hordowski

1998). In the north-eastern Slovakia (museum collection of 518 eggs) the average egg dimensions were (length, width, volume): 34.92 mm; 25.01 mm and 11.0 cm^3 (Tryjanowski et al. 2001). The dimensions of eggs in 228 nests in five Spanish colonies (814 eggs) ranged from 34.08 to 35.07 mm in length; 24.16-24.72 mm in width and 10.10-10.55 cm^3 in volume (Soler 1988). In south-western Finland, the average dimensions of 682 eggs (length and width) were 34.1 mm and 324.4 mm (Antikainen 1978), in Brno in the Czech Republic (678 eggs) 34.6 and 24.2 mm (Folk 1968) and in Zurich in Switzerland (332 eggs) 34.4 and 24.4 mm (Zimmermann 1951), respectively. All the aforementioned discrepancies in egg size, although not very large, may result from different local and temporary atmospheric conditions or different access to food resources (Tryjanowski et al. 2001).

The breeding success of jackdaws is most influenced by environmental conditions and predator density (Dolata et al. 2005). The observed nest success in Sulechów was similar to that achieved by a population nesting in nest boxes in Siemianice, which was also quite low at only 31.4% (Michocki 1974). In both cases this parameter was lower than in the population nesting in natural hollows in the Narew valley near Białystok, where, depending on the year, it ranged from 36-95% (Kamiński 1991). The author of that paper stated that breeding success depended on favorable weather conditions, such as temperature, air humidity, and heavy rainfall. In addition, he observed that breeding success depended on the number of eggs in a clutch, where the more eggs are laid, the lower the success rate (Kamiński 1991).

In Spain, the breeding success, measured as the ratio of young birds leaving the nest to all eggs in a clutch, was 25.5% on average. Depending on the year and the location of the population, the success observed there ranged from 4.5% to 34.8% (Soler 1990). Using the same definition, the nest success in Sulechów ranged from 3.7% to 34.8%, 18.4% on average and so was lower than in Spain (Soler 1990).

In Sulechów, the average number of fledglings per nest (0.8 individuals) was lower than in other studies in Europe (Switzerland, Czech Republic, Great Britain), where from 0.7 to 2.4 fledglings were recorded (Zimmermann 1951, Folk 1968, Richford 1978, Riggenbach 1979). On the other hand, the average number of fledglings per successful nest was 2.3 individuals – higher than in a population nesting in nest boxes in Cambridge, UK, with 1.9 fledglings (Greggor 2017). In Perthshire, Scotland, the average number of fledglings was 0.9 individuals in 1983 and 2.3 individuals in 1984. The low parameter in 1983 was due to the poisoning of many young birds with alpha-chloralose in the food brought by adult birds (Chesney 1986). The author states that the poison was probably deliberately put by farmers in barley fields, where jackdaws were feeding. However, as dead chicks are rarely examined by researchers, this may often go undetected as a factor causing low breeding success.

To sum up, the reproductive parameters of the studied population of jackdaws in Sulechów are similar (number of eggs in a clutch) or lower (breeding success, number of fledges) in comparison to the results of the aforementioned European studies,

including Poland. The decrease in the number of boxes occupied in the consecutive years was probably due to low breeding success. Although some authors point out that clutches in nest boxes (and in hollows of trees) have better reproduction parameters than in other types of nests (Börner and Eisermann 1999 and the literature quoted there), the comparison of our results with those for populations studied in buildings and hollows (the literature cited above) shows a rather different situation. However, breeding success strongly depends on many factors (e.g. predation, weather conditions), which may differ significantly between years of research and depending on the location of the studied population (e.g. Soler 1990). In general, it seems that the nest boxes inspected in this study, which in Sulechów were willingly occupied by jackdaws, are a good alternative to the decline in natural breeding sites. However, it is important to properly locate the boxes, ensure the durability of the boxes and adequate maintenance, and perhaps some kind of protection against predators.

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