

The impact of population management on urban and rural Hooded Crow populations

Petra Paládi^{1,3,*} – Isma Benmazouz^{1,3} – Szabolcs Lengyel² – László Kövér³

¹University of Debrecen, Doctoral School of Animal Science, Debrecen, Hungary

²Centre for Ecological Research, Institute of Aquatic Ecology, Debrecen, Hungary

³University of Debrecen, Department of Nature Conservation, Zoology and Game Management, Debrecen, Hungary

*Correspondence: paladi.petra@agr.unideb.hu

SUMMARY

Hooded Crow (Corvus cornix), originally native to agricultural areas, has become widespread in urban areas in recent decades. However, this process has negative consequences on urban animals and humans. Due to these problems, the control of urban crow populations is needed. Crows also cause significant damage to wildlife management, and are constantly being controlled in rural areas as well. In this study, we compare rural and urban populations to find out whether hunting activities have a population reduction effect. In the rural population, the reduction is carried out by weapons and traps, while the urban crows are controlled using traps only. In both sample areas, crow nests were surveyed during the nesting period. 29 active nests were monitored in the rural area in 2021, and 39 in 2022. In the urban area, 44 nests were recorded in 2021 and 35 nests in 2022. In 2021, 30 individuals were removed in the rural area, and 84 in 2022. In the urban area, 223 individuals were removed in 2021 and 144 in 2022. Results show that the number of crows removed follows the number of active nests, so that the reduction of a given year is likely to have an effect on the following year's nesting population. Because traps mostly capture juvenile birds, reducing the breeding population in the city can only be achieved in the long-term. Considering this, it is likely that increased attention to population control can effectively maintain crow populations and reduce the problems they cause.

Keywords: crow control; population reduction; urban wildlife management

INTRODUCTION

Hooded Crow is a widespread bird species in Hungary. The size of the Hungarian population is around 50.000 pairs. The number of breeding pairs is slightly increasing over the last decades (Szép et al., 2022). The Hooded Crow is a game species in Hungary with a hunting season lasting from 1 July to 29 February. They are viewed as pests and considered undesirable by most hunters and nature conservationists. This corvid is originating from rural, agricultural areas, however in recent decades it has successfully colonized urbanized environments (Vrezec, 2010) and has settled in several Hungarian cities as well. Debrecen is one of these cities, since Hooded Crows can be found in great numbers in the city. Corvids are essentially very intelligent and ecologically flexible birds, so they can utilize the wide range of conditions that the urban areas possess (Emery & Clayton, 2004; Kabadayi and Osvath, 2017; Kurosawa et al., 2003; Taylor, 2014). Crows find suitable nesting places in urban parks, tree rows or forests (Kövért et al., 2015), and have access to a wide range of food sources. Crows often feed on the animals of urban parks or ponds, such as arthropods, amphibians, reptiles, other birds, or even small mammals. They can also find food in trashcans or landfill sites, or steal the food of pets or zoo animals. Cities also lack predators which threaten them in their natural rural habitats (Vuorisalo et al., 2003), which is another positive aspect of urbanized areas. Their great number in cities, however, can have negative consequences not just for the urban fauna, but for the human population as well (Pokorný et al., 2014; Vuorisalo et al., 2003). Inhabitants often complain about their annoying, or sometimes scary cawing, or

their littering while going through trash in search of food (Spur et al., 2016). Crows are also often reported to attack pets or even humans, especially during the nesting and chick-rearing period (Kövért et al., 2022). Another, local problem in Debrecen occurs at the Nagyerdei Stadium, where the roofing is made of a fairly thin tarp material, where crows often gather before roosting. By pecking at the tarp, crows cause substantial damage in the roofing material, which is rather costly to repair. Being aware of these diverse problems caused by them, the population control of urban Hooded Crows has become a necessity in the city.

At the same time, crows still can be found in great numbers in rural areas (McIvor & Healy, 2017). They do not reach densities as high as those in the cities, however they can be an issue for humans in rural areas (Ahmed et al., 2018; Tsachalidis et al., 2006). In Hungary, the Hooded crows cause significant problems for the wildlife management. They are omnivorous, but food of animal origin is a very important part of their diet. They are very good hunters, and often depredate other birds' nests (Zduniak, 2006), or nestlings (Amar and Burthe, 2001), and can cause problems for wildlife management as they reduce the numbers of ground nesting game species, such as the Common Pheasant (*Phasianus colchicus*) (Kallioniemi et al., 2015) or Grey Partridge (*Perdix perdix*) which are among the most important game bird species in Hungary (Faragó et al., 2017). Crows can prey other game species as well, for example, they are often reported hunting on young European Hares (*Lepus europaeus*). Because of these issues, Hooded Crows are considered undesirable in game management areas, and are constantly being controlled in rural environments (Faragó et al., 2017). Apart from wildlife management, crows can cause

problems to nature conservation as well. They can reduce the numbers of not just game species, but protected, endangered species as well. They often predate the nests of the Great Bustard (*Otis tarda*) which is a specially protected bird species in Hungary. They can also predate on a specially protected reptile, the Hungarian meadow viper (*Vipera ursinii rakosiensis*), of which only fragmented populations can be found in Hungary, thus its protection is a priority.

Hooded Crows are relatively well examined in urban areas; several studies have been carried out regarding their nesting and breeding characteristics, movement patterns, survival, trappability and their public perception (Kövért and Juhász, 2012; Kövért et al., 2015; Kövért et al., 2018; Kövért et al., 2022; Paládi et al., 2017). Although their urban ecology is fairly well known, we know very little about their rural populations, thus it is important to study their rural communities as well. Better knowledge of their ecology, breeding characteristics, and behavior in rural areas is essential in understanding their success in urban environments and can also make it easier to design and implement the control of their urban populations.

The aim of this study was to compare urban and rural Hooded Crow populations in relation to the effect of different control activities have on them, and determine if these interventions have a significant population reduction effect. The results of a study like this can be beneficial from several points of view; wildlife management, nature conservation, and the urban human population can all take advantage of a well-planned, effective crow control.

MATERIALS AND METHODS

The urban research area was Debrecen, a city in eastern Hungary, with more than 200.000 inhabitants and with a significant number of Hooded Crows. The first breeding was observed in the 1970s, and by the 1990s, Hooded Crows became a permanent member of the urban avifauna. Due to the problems the crows cause, a population reduction project started in March 2019 as a cooperation between the City Council of Debrecen and the Department of Nature Conservation, Zoology and Game Management of the University of Debrecen. Five Australian crow traps were operated continuously, changing between several trapping sites: the Debrecen Zoo, the Botanical Garden, the Nagyerdő Open Air Theatre, the Agricultural Campus of the University of Debrecen, the Nagyerdő Stadium, the Aquaticum Spa, the Clinical Center, and the Hotel Nagyerdő. Every trap contained at least one decoy bird and was supplied with different kinds of food (dry and wet cat food, pastries). These foods were important from two aspects: it provided food to the decoy birds, and served as bait to attract other crows into the trap. Since Hooded Crows are very observant and intelligent birds, the trapping needs to be carried out with due care. Traps were checked only after dark, so that the crows do not connect the sight of the traps with human presence. During these checks we removed the trapped

birds and gave food and fresh water to the decoy birds. The birds captured were given to persons authorized to hunt for culling, or to the Veterinary Medical Research Institute for studies of the role of crows as infection vectors, thus, the crows captured in either the rural or the urban area were not released back into the wild. The trapping project took place in the northern part of the city because the density of crows here is the highest. The trapping was efficient nevertheless and affected the most part of Debrecen's crow population. The goal of trapping and removal of the crows in the urban area is to reduce the number of breeding pairs by half and to maintain this level over the long term.

The rural research area was the Egyek-Pusztakócs marsh system, around 60 km far from Debrecen, in western Hortobágy. This area consists of different grasslands, astatic and permanent marshes, forests, and arable lands. This mosaic structure is perfect for the Hooded Crows, since the ideal habitat for them is agricultural lands patched with tree groups where they can find both food and suitable nesting places. The marsh system is a spatially isolated unit (c. 4000 ha) of Hortobágy National Park. The area is shared by two game management regions: the Nagykunsági Game Management Region (106), and the Hajdúsági Lőszhát-Hortobágy Game Management Region (108). These regions are responsible for the population management of all game species in the area. Since Hooded Crows reduce the numbers of economically important game species, it is very important for hunters to manage their numbers in this area. Crow hunting in rural environments is conducted mainly with the use of weapons, and with different kinds of selective, live-catching traps. The most commonly used traps are Larsen-traps and Australian crow traps. Since crow reduction in this area is carried out by professional hunters, we did not take part in this trapping and in other reduction activities. Data on the number of Hooded Crows culled in the rural site were provided by Imre Csirmaz, the chief hunter of Hortobágy National Park. Hunting and trapping were conducted in the entire area of the marsh system (c. 4000 ha), thus, the entire crow population was affected within this area. The goal of the hunting in the rural area is to reduce the number of breeding pairs, but there are no explicit goals because the Egyek-Pusztakócs population cannot be delimited properly and its size fluctuates due to emigration to and immigration from nearby areas.

We surveyed the breeding characteristics of Hooded Crows in both the urban and rural areas between March and July. From early March, we searched for active nests or nests in construction for the upcoming breeding season. We looked for newly built nests, birds with nest material in their beaks, and later in the season, nests with incubating females sitting on their eggs. After we localized the active nests, we monitored them to determine their fate by counting the eggs or chicks in the nest. For the monitoring, we used an Unmanned Aerial System (UAS), a small, foldable and lightweight (weight: 249 g) drone (model DJI Mavic Mini). The resolution of the camera of the drone is 12 megapixels, with which good quality photos and

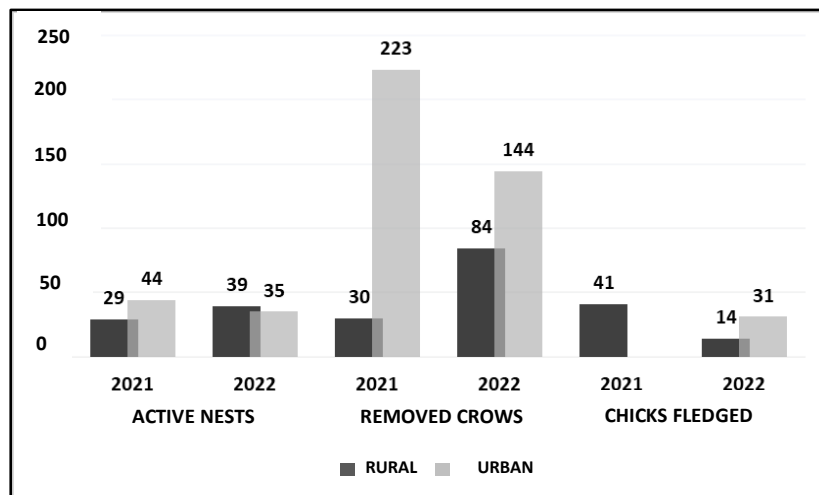
videos can be made of the content of the crow nests. The nests were approached by car or by foot, and then the content was checked with the camera of the drone. We recorded the number of eggs and/or chicks and left the area of the nest shortly after, in order to reduce the time of disturbance. Most of the time the parents returned to their nests soon and continued the incubation.

RESULTS AND DISCUSSION

In 2021, we monitored 29 active nests in the rural area. In 2022, 39 active nests were found in the same

area. In the urban research site 44 nests were found in 2021, and 35 in 2022. The number of removed individuals in 2021 was 30 at the rural site, and 84 in 2022. At the urban area 223 crows were removed in 2021 and 144 in 2022. With regard to the number of fledged chicks, 41 chicks left the rural nests successfully in 2021, and 14 in 2022. Unfortunately, we do not have data about the number of fledglings in urban nests in 2021, but 31 chicks fledged from the monitored urban nests in 2022 (Figure 1).

Figure 1. The number of active nests, removed crows and fledged chicks in the rural and urban area, in 2021 and 2022



In the city, the number of removed crows was higher than in the rural area. This can be explained with several hypotheses. It is possible that the trapping intensity was higher in the urban area than the hunting intensity in the rural area. This research is partly based on an official crow-control project in the city, so trapping was carried out with very high time investment. On the other hand, hunting in rural environments was carried out by professional hunters, and it is possible that they did not have enough time for Hooded Crows. They must cover large areas with many other game species not just crows, and the number of other predators is needed to be reduced as well. Trapping crows is very time consuming and requires a lot of commitment, so it is possible that they did not spend enough time on it, which could result in a lower number of hunted crows in the rural places.

In the city, most of the removed birds were young-of-the-year juveniles: 89.6% in 2021 (n = 223), and 86.1% in 2022 (n = 144), while the rest were two-year-old birds or older. This can be expected because juveniles are more inexperienced, less cautious, and therefore are easier to trap. This also means that breeding adults were not removed from the population, since they are more experienced, and usually do not fall for traps. In contrast, mostly adults were removed by hunting and trapping in rural areas, which could not

breed in the next year, which may explain why the nesting population remained relatively low. In urban areas mostly young birds were caught, which would not have breed for 2–3 more years. This means that the breeding population did not decrease, even though 200+ urban birds were removed in 2021. The urban breeding population possibly will not grow further, since the nesting density is already really high, the nests are much closer to each other than in rural areas. The areas suitable for nesting appear to be saturated with breeding pairs, so the further growth of the breeding population is not likely in the future. The long-term reduction of the population requires maintenance of the relatively high reduction rate. For example, assuming 200 breeding pairs and three fledglings per nest or a total of 500 individuals in the urban population, the reduction rate was 45% in 2021 and 29% in 2022. We do not have similar estimates for the rural population size and reduction rate because the rural population cannot be delimited properly and its size fluctuates due to emigration to and immigration from nearby areas.

More crows were removed in the rural areas in 2022 than in 2021. Concurrently, the number of fledged chicks was very low in 2022 compared to 2021. This also can be explained by several mechanisms. One possibility is simply that the parents were removed, which lead to a strong reduction in the fledged



nestlings. Another factor could be the exceptional drought which occurred in the spring of 2022. It is possible that adults could not rear the young as effectively, possibly very little food were available. Since crow chicks need high protein food in the early times to grow healthily, the drought could have led to lower survival among the nestlings (this also raises an interesting question: is it possible that nestlings fledged in the dry spring of 2022 will be less healthy and have lower survival?). It is also possible that drought affected the risks of being shot by hunters as well. Under bad conditions, adults may be in an overall poorer body condition, which may make them less cautious or less able to flee from hunters. Another possibility is that the shortage of natural food forces them to go for the bait in the traps.

Unfortunately, we do not have data about the fledged urban nestlings in 2021, since monitoring with the drone did not start in the city yet. However, the breeding success of birds is usually lower in urban environments (Marzluff et al., 2016; Rodewald et al., 2013). More years of research is necessary to examine this hypothesis in our case. However, in 2022, breeding success was higher in the urban area (number of fledglings per nest: 0.89) than in the rural area (0.36), which does not support this hypothesis. This again can be explained by the drought in the spring-early summer period; the urban crows are not that dependent of natural food, since anthropogenic food sources are present all year long, independently from the weather. Urban areas also offer more water sources by artificial lakes or irrigation in public parks, or even private gardens, which can make it easier to survive and raise the offsprings in the city in case of a heavy drought.

Results show that if the reduction is conducted with proper attention, numerous individuals can be culled from the Hooded Crow population both in urban and rural environments. In rural areas mostly adult birds are hunted which is effective because they will probably not be breeding in the upcoming years, so the nesting population can be reduced effectively. In contrast, in urban areas mostly young, nonbreeding birds are captured, but in larger numbers, which do not have an immediate effect on the breeding population, rather can reduce the population on longer terms, since crows start breeding after 2–3 years of age. It is also not well known yet if there is migration of individuals between the rural areas and the city, which can be another interesting topic to examine.

CONCLUSIONS

Population management of Hooded Crows is an important activity in both rural and urban habitats, since crows can cause several problems in both areas. Our

preliminary results suggest that the reduction activities used in our study areas were effective for reducing the population of crows. However, more years of research is needed to draw reliable conclusions on the efficiency of control methods in the reduction of population sizes. In rural areas, hunting mostly influences adult individuals, so the reduction directly affects the breeding population. However, in the city, nearly always young birds in their first year are captured probably because they are inexperienced. Because only young, non-breeding birds are removed, older breeding pairs can continue to breed and produce offspring, so the number of breeding pairs can remain relatively high. However, the reduction of young individuals will probably lead to a long-term population decrease.

Based on our results it is also possible that bad weather conditions are more dangerous for the nesting success of rural crows, since they are more exposed to the impact of nature and the weather, whereas conditions in the cities are more balanced, and resources are available all year round.

It is also worth mentioning that using a UAS is an effective way of monitoring Hooded Crow nests. The equipment is lightweight, and easy to move and set up between nests. The checking of the nests is quick, so the time of disturbance is reduced significantly, in contrast to using other methods such as climbing to the nests or lifting the researchers to the nest by a mobile crane.

Our results can be beneficial for wildlife management, nature conservation, and the urban human population as well. Hooded Crows cause a lot of economic problems to game management (Faragó et al., 2017), since they reduce the numbers of important game species by depredate their nests or offspring. Nature conservation is facing the same problem, since crows can reduce the number of protected species as well. Hooded Crows also cause several problems in case of the inhabitants of a city. They can be noisy, aggressive, they can also litter, steal food from pets or zoo animals, or even cause serious damages in buildings. Based on all these problems, all three mentioned fields can take advantage of a well-planned, effective crow control, since reducing the number of crows in each of these areas is highly beneficial.

ACKNOWLEDGEMENTS

This study was funded by the New National Excellence Programme by the Development and Innovation Office, the Ministry for Innovation and Technology, funded from the National Research, Development and Innovation Fund, and by a grant from the National Research, Development and Innovation Office of Hungary (NKFIH-OTKA K134391).

REFERENCES

- Ahmed, H.A.A.–Issa, M.A.–Eisa, Y.A. (2018): determination of Hooded Crow (*Corvus Corone* L.) population and methods of control in sheep farm at Ras Sedr, South Sinai, Egypt. *J. Agric. Res.*, 96(4), pp. 1351–1359. <http://dx.doi.org/10.21608/ejar.2018.142667>

- Amar, A.–Burthe, S. (2001): Observations of predation of Hen Harrier nestling by Hooded Crows in Orkney. *Scott. Birds*, 22, 65–66.
- Emery, N.J.–Clayton, N. (2004): The Mentality of Crows: Convergent Evolution of Intelligence in Corvids and Apes. *Science*, 306, pp. 1903–1907. <https://psycnet.apa.org/doi/10.1126/science.1098410>
- Faragó, S.–Kovács, Gy.–Hajas, P.P. (2017): Management plan for Hooded Crow (*Corvus cornix*) in Hungary. *Hungarian Small Game Bulletin*, 13, pp. 15–48. <http://dx.doi.org/10.17243/mavk.2017.015>
- Kabadiyi, C.–Osvath, M. (2017): Ravens parallel great apes in flexible planning for tool-use and bartering. *Science*, 357, pp. 202–204. <https://doi.org/10.1126/science.aam8138>
- Kallioniemi, H.–Väänänen, V.M.–Nummi P.–Virtanen J. (2015): Bird quality, origin and predation level affect survival and reproduction of translocated common pheasants *Phasianus colchicus*. *Wildlife Biology*, 21(5), pp. 269–276. <https://doi.org/10.2981/wlb.00052>
- Kövér, L.–Gyüre, P.–Balogh, P.–Huettmann, F.–Lengyel, Sz.–Juhász, L. (2015): Recent colonization and nest site selection of the Hooded Crow (*Corvus corone cornix* L.) in an urban environment. *Landscape Urban Planning*, 133, pp. 78–86. <https://dx.doi.org/10.1016/j.landurbplan.2014.09.008>
- Kövér, L.–Juhász, L. (2012): A dolmányos varjú (*Corvus cornix* L.) színes gyűrűs jelölésének módszertana és az előzetes eredmények. *Agrártudományi közlemények*, 48, pp. 43–48. <https://doi.org/10.34101/actaagrar/48/2451>
- Kövér, L.–Tóth, N.–Lengyel, Sz.–Juhász, L. (2018): Corvid control in urban environments: a comparison of trap types. *North-Western Journal Of Zoology*, 14(1), pp. 85–90.
- Kövér, L.–Paládi, P.–Benmazouz, I.–Šorgo, A.–Špur, N.–Juhász, L.–Czine, P.–Balogh, P.–Lengyel, Sz. (2022): Is the Hitchcock Story Really True? Public Opinion on Hooded Crows in Cities as Input to Management *ANIMALS*, 12(9), 1207, 18 p. <https://doi.org/10.3390/ani12091207>
- Kurosawa, R.–Kono, R.–Kondo, T.–Kanai, Y. (2003): Diet of jungle crows in an urban landscape. *Global Environmental Research*, 7, pp. 193–198.
- Marzluff, J.M.–Clucas, B.–Oleyar, M.D.–DeLap, J. (2016): The causal response of avian communities to suburban development: a quasi-experimental, longitudinal study. *Urban Ecosyst*, 19, pp. 1597–1621. DOI 10.1007/s11252-015-0483-3
- McIvor, G.E.–Healy, S.D. (2017): Nest site selection and patterns of nest re-use in the Hooded Crow *Corvus cornix*. *Bird Study*, 64(3), pp. 374–386. <https://doi.org/10.1080/00063657.2017.1364220>
- Paládi, P.–Tóth, D.–Lengyel, Sz.–Juhász, L.–Kövér, L. (2017): Dolmányos varjak (*Corvus cornix* Linnaeus, 1758) szárnybilétás jelölése Debrecenben. *Természetvédelmi Közlemények*, 23, pp. 68–79. <https://dx.doi.org/10.20332/tvk-jnatconserv.2017.23.68>
- Pokorny, B.–Flajšman, K.–Jelenko, I. (2014): The importance and impacts of crows, with emphasis on Hooded Crow (*Corvus cornix*), in the (sub)urban environment. *Acta Silvae et Ligni* 103(2014), pp. 47–60.
- Rodewald, A.D.–Kearns, L.J.–Shustack, D.P. (2013): Consequences of urbanizing landscapes to reproductive performance of birds in remnant forests. *Biological Conservation*, 160, pp. 32–39. <https://doi.org/10.1016/j.biocon.2012.12.034>
- Špur, N.–Pokorny, B.–Šorgo, A. (2016): Attitudes toward and Acceptability of Management Strategies for a Population of Hooded Crows (*Corvus cornix*) in Slovenia, *Anthrozoös*, 29(4), pp. 669–682. <http://dx.doi.org/10.1080/08927936.2016.1228766>
- Szép, T.–Csörgő, T.–Halmos, G.–Lovászi, P.–Nagy, K.–Schmidt, A. (2022): Magyarország madáratlasza, 2. javított és kiegészített kiadás, Agrárminisztérium, Magyar Madártani és Természetvédelmi Egyesület, Budapest
- Taylor, A.H. (2014): Corvid cognition. *WIREs Cognitive Science*, 5, pp. 361–372. <https://doi.org/10.1002/wcs.1286>
- Tsachalidis, E.–Sokos, C.–Birtsas, P.–Patsikas, N. (2006): The Australian Crow Trap and the Larsen Trap: Their capture success in Greece. Proceedings of the 2006 Naxos International Conference on Sustainable Management and Development of Mountainous and Island Areas. Vol. II., pp. 325–329.
- Vrezec, A. (2010): Historical occurrence of the Hooded/Carrion Crow (*Corvus cornix/corone*) in urban areas of Europe with emphasis on Slovenia. *Annales Ser. Hist. Nat.*, 20(2), pp. 131–140.
- Vuorisalo, T.–Andersson, H.–Hugg, T.–Lahtinen, R.–Laaksonen, H.–Lehikonen, E. (2003): Urban development from an avian perspective: Causes of hooded crow (*Corvus corone cornix*) urbanisation in two Finnish cities. *Landscape Urban Planning*. 62(2), pp. 69–87. [https://doi.org/10.1016/S0169-2046\(02\)00124-X](https://doi.org/10.1016/S0169-2046(02)00124-X)
- Zduniak, P. (2006): The prey of Hooded Crow (*Corvus cornix* L.) in wetland: study of damaged egg shells of birds. *Polish Journal of Ecology*, 54(3), pp. 491–498.

