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# Feral pigeon (*Columba livia*) population management in Ljubljana

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**ABSTRACT**

Results and critical standpoints regarding the actions of the feral pigeon (*Columba livia*) population management in Ljubljana were studied. The objective of the study was to evaluate the efficiency of the methods used to manage and control the feral pigeon population in Ljubljana. The effectiveness of progesterone, ultrasound deterrent and artificial dovecots for egg collection was tested in order to evaluate different approaches to feral pigeon population management in Ljubljana. The most effective method of pigeon control was the use of contraceptives, since the number of pigeons in selected locations of the wider centre of Ljubljana decreased by 49.1% ($P>0.05$) in the period from 1999 to 2004. The method of ultrasound as a pigeon deterrent remains questionable, since no distinctive deterrent effects were established, even though pigeons in our experiment showed significant ($P<0.001$) signs of agitation when ultrasound was present in the tested area of the covered passage entrance to the urban landfill in Ljubljana. The method of pigeon nesting in 8 green plot and 2 house attic artificial dovecots, which we are investigating at present, seems to have great potential regarding the egg collecting and consequently the reduction of the number of feral pigeons, improving nesting hygiene and hobby feeding control. After a 10-month period, since the green plot dovecots were built, pigeons have already started to nest in 62% of the available nesting space, however eggs will not be collected until the dovecots are populated completely. The house attic dovecotes were only built recently, so they were still un-populated at the end of this study. We concluded that all the methods used may be only successful in the long term by implementing an integrated approach to pigeon control, specially supported by public information and education.

**Key words:** feral pigeon, pigeon birth control, progesterone, ultrasound

## Introduction

The feral pigeon (*Columba livia*) is a free living form of domestic pigeon, perfectly adapted to the urban environment (HAAG-WACKERNAGEL and GEIGENFEIND, 2008). Due to the almost ideal conditions for feral pigeons feeding, breeding and nesting in

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close contact with humans, the largest pigeon density is found mainly in city centres, where it is often more than twice the size it is on the city periphery, where the living conditions for feral pigeon are less favourable (CLERGEAU et al., 2004). For this reason pigeon populations in city centres are a major problem, since there they can exceed the acceptable density. However, they represent a problem almost everywhere where they find enough food and suitable living sites (SIMON et al., 2007). Feral pigeon populations in cities are constantly growing on account of the permanent and plentiful sources of food, as well as favourable nesting conditions in the absence of natural selection factors such as cold stress, lack of food predators and microorganisms. On the other hand, feral pigeons are constantly exposed to a lack of essential nutrients and to potential alimentary intoxications, all of which can affect the pigeons' immunity strength. However, pigeons can also catch infectious diseases - some of them may even be zoonoses - caused by various types of micro-organisms and parasites (DOBEIC, 2003; DOVČ et al., 2004). As a result, in European and many other cities all over the world, feral pigeon control has become one of the priority tasks of city councils. Many methods and experiments in feral pigeon control have been more or less successfully implemented (BARLOW et al., 1997; SPEAR, 1966). In addition, many problems also originate from the lack of appropriate public information (HAAG-WACKERNAGEL and GEIGENFEIND, 2008).

The general intent of pigeon control in the cities is to maintain the convenient and suitable size of feral pigeon populations. Primarily the measures that may be successfully maintained in general feral pigeon control are: comprehensive public information, enacting and enforcing bans on pigeon feeding, humane usage of pigeon mechanical barriers, birth control and artificial nesting, following the concern for hygiene and socio-cultural considerations (VATER, 1999).

The aim of the following article is to report about several activities in the period of 1999 - 2009 regarding feral pigeon management and control in the city of Ljubljana, with 350,000 residents and as many as 15,000 pigeons according to the last estimation (2005).

## Materials and methods

*Pigeon birth-control (contraception).* In Ljubljana pigeon birth-control was implemented in the period from 1999 to 2004 using hormone maize feeding contraception (Ornisteril®) as a project with the consent of the general public and the consensus of animal protection associations. Ornisteril® is a ready- to- use hormone maize fodder for pigeons, i.e. used for reducing female pigeon fertility. The main ingredient of the contraceptive was progesterone in maize at a concentration of 10 mg/100 g (0.01% of progesterone). In the project of pigeon birth control using hormone maize fodder in Ljubljana, pigeons were treated twice a year in the periods of most intensive pigeon mating. Those periods

were from February or March to July, and from late August until the first autumn frosts, when pigeon mating decreases. The total treatment amounted to at least 150 days per year. Pigeons were fed daily in the wider centre of Ljubljana between 8.00 a.m. to 2.00 p.m at 17 selected feeding locations (Fig. 1, Table 1). Pigeons were fed according to the Ornisteril® producer (Virbac®) instructions: targeting at least 30 g of hormone maize/ animal/day.

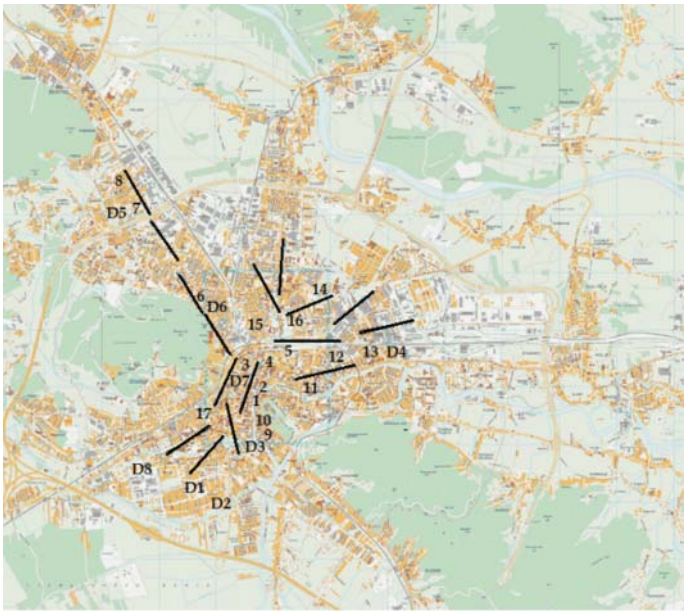


Fig. 1. Feeding locations (1-17), transect lines (------) and green plot dovecots (D1-D8) locations in Ljubljana

Regarding contraception, and so the reduction of the pigeon population, the number was estimated of pigeons in flocks during feeding. This was performed by the feeders throughout the feeding periods each year, at each feeding location and on each feeding day. This method was used from the beginning to the end of the experiment, and controlled by photo documentation. Since some feeding locations were added during the experiment, the pigeon census was determined only at locations where feeding was maintained constantly from 1999 to 2004. Of the 17 locations, 8 feeding locations for pigeon counting were chosen in the narrower and wider city centre, therefore feeding area A, in the strict city centre comprised 5 feeding locations (location numbers 1, 2, 3, 4, 5), whereas other feeding areas comprised single feeding locations: B (location number 6),

C (location number 7) and D (location number 9 (Fig. 1). Other locations (8 and 10-17) were added in the period from 2003 to 2004 (Fig. 1).

Moreover, an experiment was performed using the transect counts sampling method, since this method of stratified random sampling was recommended, as it was supposed to increase the precision of the estimate (EMLEN, 1971; GIUNCHI et al., 2007). Nevertheless this method showed several deficiencies. The distance sampling method was performed by counting pigeons in 16 line transects allocated proportionally to the wider city area, taking 1000 m as transect length and 50 m as minimum transect spacing in order to reduce the likelihood of double counts (Fig. 1). However this method, generally used for bird counting in forests and open areas showed some difficulties: several pigeons were virtually undetectable when attending to eggs or fledgings; the improbability of detection of pigeons resting on building roofs or façades in the vicinity of the line, and the difficulties of counting pigeons in a flock. This method showed some significant faults, especially because the transects followed the urban road network, and thus did not represent a random sample of various habitats of the city, moreover, linear paths were located along roadways where pigeon density is obviously low, which meant that population density was significantly underestimated.

*Ultrasonic bird deterring.* Ultrasound was used as an experimental method of deterring pigeons. Ultrasound presumably creates audio discomfort for pigeons and consequently excludes pigeons from sites where ultrasonic devices are installed. The reports of effectiveness span from exceptional to poor and short-term performance (HAAG-WACKERNAGEL, 2000). The reason for this is habituation - most bird pest species are highly intelligent and will quickly habituate to sonic noise, ultrasound and bio-acoustic scaring techniques (HAAG-WACKERNAGEL, 2000). In order to confirm or reject these reports, the effects of ultrasound on deterring pigeons were examined. The examination was performed in a space under a covered passage (15 m long, 8 m wide, 3,5 m high) at the heavy traffic entrance for garbage trucks at the urban landfill in Ljubljana (Fig. 2). The pigeons' behaviour was observed, comprising: the frequency of pigeons landing (a.) and rising in the air (b.) from the structures under the roof of the covered passage, the frequency of pigeon movements (c.) on the structures, and the frequency of pigeons flying under the covered passage with no attempt to land (d.) in response to ultrasound exposure. For observation four video cameras were used with a sequence recording system. The tested ultrasonic device was designed to operate in open environment covering an area of max. 350 $m^2$, using a frequency of 20 kHz with a volume from 95 to 102 dB, 24 hours/day. Ultrasound was emitted equally in the space, from four speakers installed at the same point in the central location under the covered passage used as the tested area, at a height of 3.5 m (Fig. 2). In the first 10 days of the test, prior to the operation of the ultrasound device, normal pigeon behaviour was monitored. In the next 15 days, when the ultrasound

was broadcast, he pigeons were observed in terms of the most significant changes in the frequency of their observed behaviour patterns.

*Artificial dovecots.* In the period from 2008 to 2009 the construction of artificial dovecots was initially started in Ljubljana. The aim of constructing pigeon dovecots in Ljubljana was to implement of dovecot units (green plot dovecots) at locations where pigeons already fed (selected city neighbourhoods) or roosted (house attic dovecots) for the sake of egg collecting, thereby reducing the number of pigeons and also to regulate and supervise pigeon hobby feeding (HAAG-WACKERNAGEL, 2000). For this reason 6 green plot dovecots with 6 nests (each nest with a surface area of 63.0 cm × 29.0 cm, height 27 cm), 1 green plot dovecot with 8, and 1 green plot dovecot with 9 nests (altogether 8 green plot dovecots (D1-D8) with 53 nests located on the three floors of the each dovecot) were set up in Ljubljana (Fig. 1). In addition, 2 house attic dovecots were placed under the rooftop of the Veterinary Faculty of Ljubljana, and on the roof of the one of Ljubljana's municipality buildings.

Green plot dovecots were set up at city sites suitable for the care and regular feeding of pigeons and located in green public recreation areas, mostly in areas where pigeons can be fed without disturbing nearby property owners. House attic dovecots were built onto the rooftops of public buildings.

The most suitable materials used for dovecots are wood and metal, both resistant to the climatic conditions, covered with an impermeable roof. The outer appearance of the green plot dovecots has to be considered, mainly owing to the general appearance of city design; hence the Municipality of Ljubljana created its own design for a green plot dovecot, and 1 of the 8 green plot dovecots built was designed by a Municipal city architect. This design differed from the design of the dovecot prototypes we had planned; but main properties of dovecote are the same.

In the experimental observation the number of young pigeons, nests and eggs found on each of the three floors of the 8 dovecots in the experiment was monitored over a 3 month period from June to August 2009. To attract pigeons to start nesting in the green plot dovecots, fodder (maize grain) was supplied daily.

**Results**

*Pigeon birth-control in Ljubljana.* Owing to hormone maize feeding, the number of pigeons in Ljubljana decreased by 49.1% ($P>0.05$) in the period from 1999 to 2004 at locations where the feeding was performed (Table 1, Fig. 1, Fig. 3). This result is favourable, particularly because these sites represent most of the central city area. The highest reductions, 81.4% and 51.9% of pigeons, was especially noted at some particular feeding areas (C, D), presumably owing to an agreement with the pigeon hobby feeders to stop feeding feral pigeons completely at these locations, so that the pigeons could be

fed with a sufficient daily dose of progesterone in hormonal maize, reaching the optimum daily blood concentration of progesterone (DOVČ et al., 2003), thus assuring female pigeon contraception. Nevertheless the conditions at the other feeding areas (A, B) were not as favourable. For that reason we have to compare pigeon counts, considering all the gathered data, to see the real situation regarding reduction of pigeon numbers at different sites and the entire "treated" area of the city in the period from 1999 to 2004.

Table 1. Average counts and differences (%) in pigeon population in the period 1999-2004 on feeding areas A, B, C, D in Ljubljana

| Year | | Feeding area/location | | | | Difference (%) 1999-2004 |
|---|---|---|---|---|---|---|
| | | A | B | C | D | |
| 1999 | average | 158.86 | 90.33 | 245.24 | 128.28 | 622.72 |
| | SD | 49.18 | 42.84 | 84.98 | 56.22 | |
| 2000 | average | 157.33 | 86.96 | 247.65 | 94.62 | |
| | SD | 38.56 | 45.88 | 100.87 | 46.96 | |
| 2001 | average | 180.34 | 93.80 | 71.90 | 135.36 | |
| | SD | 30.34 | 56.20 | 46.15 | 29.45 | |
| 2002 | average | 174.80 | 67.00 | 72.00 | 88.22 | |
| | SD | 36.38 | 25.49 | 43.93 | 44.95 | |
| 2003 | average | 101.85 | 107.22 | 80.04 | 61.24 | |
| | SD | 36.15 | 28.48 | 36.09 | 51.53 | |
| 2004 | average | 120.37 | 89.34 | 45.40 | 61.67 | 316.78 |
| | SD | 20.99 | 33.25 | 32.92 | 29.56 | |
| | difference (%) | -24.23 | -1.09 | -81.49 | -51.93 | -49.13 (P>0.05) |
| | SD | 41.71 | 45.28 | 103.31 | 113.98 | |

*Ultrasonic device test.* No significant differences in the number of pigeons in the tested area could be observed before and during ultrasound emission. However the number of pigeons landing on the structure (a.) and rising in the air (b.) from the structure under the roof of the covered passage was significantly ($P<0.001$) higher by (a.) 144% and (b.) 145% respectively when the ultrasound was being emitted (Fig. 4). The frequency of pigeon movements (c.) on the structures of the tested passage were significantly ($P<0.001$) more intense (by 195%) as well, while the ultrasound was being emitted (Fig. 4). The trend of 50% fewer pigeon flying under the covered passage with no attempt to land (d.) during the time when the ultrasound was activated, also indicated a change in the pigeons' behaviour (Fig. 4).

Table 2. Number (n) of young pigeons, nests and eggs found in the each of three floors of dovecotes (D1-D8) in the period from the June to August 2009

| Dovecote No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Young pigeons (n) 1st Floor | 0 | 2 | 2 | 2 | | 2 | 0 | 2 |
| 2nd Floor | 0 | 2 | 2 | 2 | 2 | 0 | 0 | 2 |
| 3rd Floor | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| Sum | 0 | 4 | 4 | 6 | 4 | 2 | 0 | 6 |
| Nest (n) | | | | | | | | |
| 1st Floor | 0 | 1 | 1 | 2 | 1 | 1 | 0 | 2 |
| 2nd Floor | 0 | 1 | 2 | 2 | 2 | 1 | 0 | 2 |
| 3rd Floor | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 2 |
| Sum | 1 | 3 | 4 | 5 | 4 | 2 | 0 | 6 |
| Eggs (n) | | | | | | | | |
| 1st Floor | 0 | 0 | 2 | 4 | 0 | 2 | 0 | 0 |
| 2nd Floor | 0 | 2 | 2 | 2 | 2 | 2 | 0 | 4 |
| 3rd Floor | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 |
| Sum | 0 | 4 | 4 | 8 | 2 | 4 | 0 | 4 |

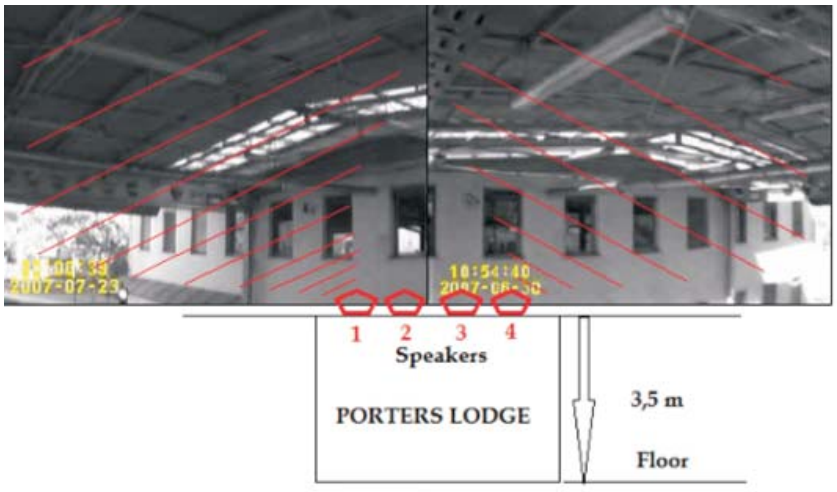


Fig. 2. Covered passage of the heavy traffic entrance for garbage trucks on the urban landfill in Ljubljana

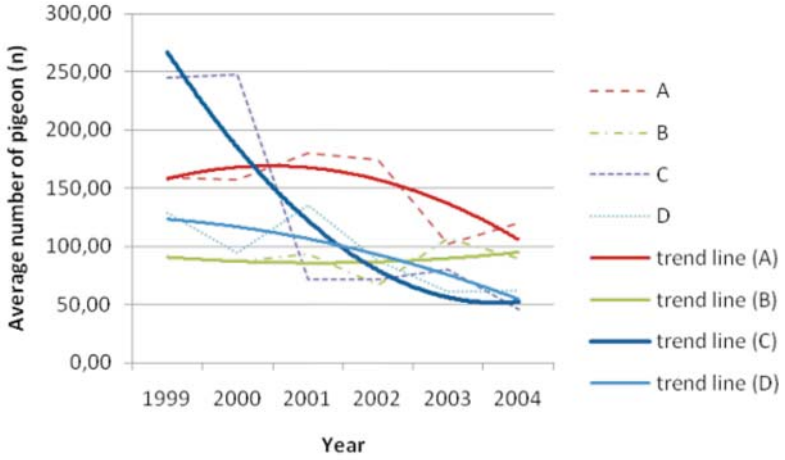


Fig. 3. Average number of pigeon in perood of 1999-2004 on feeding areas A (feeding locations 1, 2, 3, 4, 5 ), B (feeding location location 6), C (feeding location 7) and D (feeding location 9)

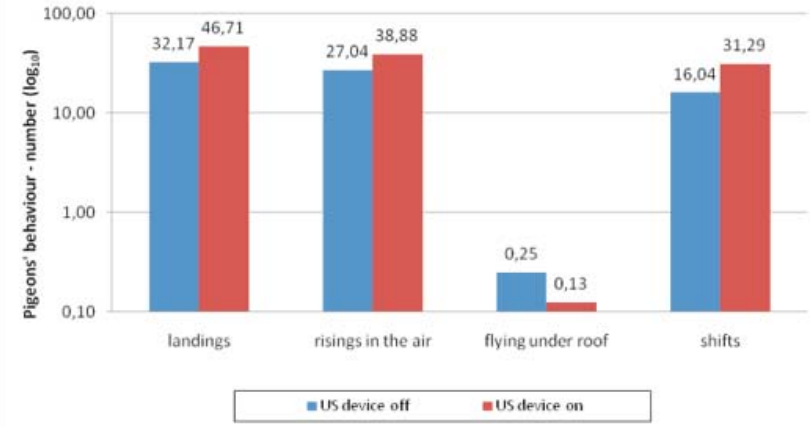


Fig. 4. Numbers* of pigeons' landings (a.), risings (b.) and shifts (c.) on/from structures, flyings under the roof of covered passage with no attempting to land (d.) when the ultrasound was broadening (US device on) and when ultrasound was not emitted (US device off). (*value on the top of each column)

*Artificial dovecots.* After the 10-month period, pigeons accepted the artificial dovecots, and they started to nest and lay eggs in 7 of 8 green plot dovecots located at 8 locations (D1-D8) in Ljubljana (Fig. 1). Pigeons started to nest in 7 of the 8 dovecots,

and settled 33of 53 nests (62%); however, at the time of the last observation in August, 2009, only one dovecot remained unpopulated (Table 2.). During the time of observation 24 eggs in 12 of 25 nests and 26 young pigeons were found; however the frequency of nesting changed all the time. In this period we did not yet start to collect the eggs.

The two house attic dovecots remained unsettled since they were built last, that is, at the end of this study, so the observation time was too short.

**Discussion**

Pigeon birth-control is the one of many solutions to the problem of how to control the excess feral pigeon population (VATER, 2000; AVERY et al., 2008). According to previous results of feral pigeon birth-control, the feral pigeon population can be reduced even up to 30% in the course of several years (DOBEIC, 2003). The hormonal pigeon birth control in Ljubljana showed good results, since the size of the feral pigeon population in Ljubljana decreased on average by as much as 49.1% in the six-year period. Beside this we noticed that the reduction of the pigeon population improved the general living conditions of pigeons in Ljubljana (KOS and DOBEIC, 2000), consequently manifested in an improvement of the general health status of pigeons (DOBEIC, 2003; DOVČ et al., 2004). However we should emphasise that the results gathered are only based on an evaluation of real data from the field, although at permanently treated locations, as we came across many problems throughout the 6 years especially due to requests from the municipality and citizens. These influences significantly obstructed the regularity of the pigeon contraception process, the study design and the main goal - a reduction of the number of pigeons. Moreover we were limited in the selection of the method of determining the pigeon population, since the method of transects lines was not useful owing to several faults. For this reason we estimated the number of pigeons at feeding locations when feeding with Ornisteril® at the beginning, during and at the end of the yearly contraception. Finally we should emphasise that the evaluation of the results was dependent on the very variable data gathered from the field which we mostly could not influence.

However, like any other intervention in the natural environment, the contraception method has certain side-effects. Given the fact that pigeons were migrating in search of food and emptied their nesting places, the feeding with hormone maize in the city centre attracted other feral pigeon flocks to move in from the peripheries to the city centre of Ljubljana, therefore the number of pigeons could gradually change at some city sites during the time of contraception. This was probably the essential reason why an even higher density of pigeons occasionally appeared in the city centre, compared to the periphery (Table 1, Fig. 3 - feeding areas A, B). Therefore, if we wish to achieve more reliable results from hormone maize feeding we should approach the treatment of pigeons at more locations throughout the entire city area.

The continuous treatment of pigeons by hormone maize is not successful for unlimited and continued pigeon reduction. However, it does prevent new upsurges in the pigeon population and the possible side effects of progesterone on pigeons and other birds. The special problem linked to hormone maize treatment pigeon control is pigeon hobby feeding (HAAG-WACKERNAGEL and GEIGENFEIND, 2008). This was a problem revealed by the hormone maize feeding in Ljubljana too, since pigeons had previously been fed by hobby feeders' fodder, so there may not be a sufficient level of daily progesterone consumption for that reason. This was obvious at feeding location B (Fig. 3) where no reduction in pigeon numbers was achieved. Nevertheless one of the main questions regarding hormone maize pigeon control was deciding on the appropriate daily hormonal feeding time, particularly in terms of the ratio of females and males who leave the nest and come to feed. Afterwards it was very difficult to find the most suitable feeding locations in the city, especially from the point of view of citizen acceptance, which did not overlap so that pigeons can come to feed from other feeding locations or even from distant city sites on the periphery. One technical problem of feeding was bad weather, when feeding was not possible or was aggravated, so the females could not receive daily quantities of progesterone.

Therefore, owing to these experiences, the use of the hormone on feral pigeons should be performed only in the short term, e.g. for some years at most to diminish the pigeon population in general, after that other measures should be taken. And finally, the permanent use of the hormone can be detrimental to the environment due to general health protection, wild animals and possible environmental residue.

Regarding the results of pigeon observation in testing the deterrent effects of ultrasound, we ascertained that ultrasound can disrupt and disturb the pigeons, however the nesting and habituation instincts were nevertheless predominant, thus no difference in pigeon numbers was seen in the tested area whether the ultrasound was being emitted or not. Apparently, pigeons showed a certain level of anxiety about flying in the tested area when ultrasound is present; however they were agitated presumably by the ultrasound. The significantly ($P<0.001$) higher frequency of pigeon shifting, landings on- and risings from the observed structure, and half the number of pigeons flying (50%) under the tested passage when ultrasound was being emitted indicate the supposed effects, but this should be investigated more accurately in the future. Perhaps the effects of the ultrasonic device tested in our experiment should be increased by lowering the frequency and increasing the volume, however this may also be annoying to humans. Since the location of the test was very noisy, the pigeons were more or less accustomed to the ambient noise, so the question of the deterrent effects of audible sound (>15 khH) remains questionable.

Since avian hearing is most sensitive to sounds from about 1 to 4 kHz, no bird species has shown sensitivity to ultrasonic devices (>20 kHz). Some species possess sensitivity to

infrasound (<20 kHz), e.g. pigeons and some other species, because of the close position of their ears, which are sensitive to lower frequencies, but they are not able to perceive ultrasound (BEASON, 2004). And, lastly HAAG-WACKERNAGEL (2000) reported that ultrasonic devices had no deterring effects on pigeons. For this reason the ultrasound deterrent effects are very questionable.

Recently an increasing emphasis has been placed on feral pigeon control using the method of constructing feral pigeon artificial dovecots and egg collecting (pigeon number reduction). This is one of the newest methods for reducing the number of pigeons in urban areas, especially when combined with anti-feeding measures (CASERTANO and ROBERTS, 2007). This method is suitable from many aspects. Firstly, using the method of egg collecting and replacing them with dummy eggs, the number of feral pigeons can be somewhat lowered, which seems to be one of the suitable solutions for feral pigeon control in Ljubljana. Secondly, the hygiene and maintenance of pigeon feeding areas can be improved. Another advantage is that artificial dovecots can be located outside of the congested urban centres with the aim of moving the pigeons from the city centres to the periphery. At the same time, such dovecot units become a place to confront the socio-cultural aspect of pigeon (hobby) feeding in the urban environment.

The artificial dovecots in Ljubljana were designed in appropriate sizes and shapes considering feral pigeon needs and habits and simultaneously the dovecot keepers' maintenance, egg collection and dummy egg replacement. It is necessary for the nests in the dovecots ti be located at least 2.5 m above ground level, opened by inlet holes and doorsteps on the front panels with removable nesting backs, from where access to the inside of the nest is provided. Green plot dovecots were placed mainly in city parks, close to nearby streets, main roads and pavements, and to pedestrian traffic. Pigeons were disrupted initially by the general noise of movement; however they very quickly adapted to the noise. They already got used to being in and around the dovecots in a month after the dovecots were built.

The proximity of human dwellings had an important influence on the locations where artificial green plot dovecots were implemented, since most people object to pigeon manipulating near their homes. Beside this, of it seemed to be almost unfeasible to install attic dovecots in private house attics, since the owners strongly resisted having dovecots placed around - and especially - on their dwellings. Mainly they pointed out the effect on hygiene and the increased risk of disease hazards; therefore we established that the attic dovecots could be installed mainly on buildings belonging to the City Council. A positive influence of daily feeding on pigeon nesting was ascertained, especially because they were fed inside the nests, as well as in the vicinity of the dovecots, which seemed to be attractive and stimulating for pigeons' nesting instincts.

During the time of our experiment female pigeons started to lay in at least 33 of the 53 nests in the 8 green plot dovecots, where 24 eggs and 26 chicks were evidenced at the time of observation, but we did not decide to start collecting eggs. We will start to run egg collection as soon as all the dovecots in Ljubljana have been occupied and completely adopted by feral pigeons. Regarding the egg collection, we expect at least a 20% decrease in the entire feral pigeon population in Ljubljana over the next 5 years.

The attic dovecots in Ljubljana were built only recently, therefore the nesting prevalence and the effectiveness of egg collection will be investigated in further research work.

Consequently we will proceed to inform the public about detrimental hobby feeding and will redirect hobby feeders to limited and controlled feeding, only around the artificial green plot dovecots. Our intention is to set up several more dovecots in the following years all over the city of Ljubljana. In addition, other measures, such as city hygiene maintenance and investment in systematic mechanical pigeon anti-roosting barriers should be simultaneously stimulated.

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## References

AVERY, L., M., K. L. KEACHER, E. A. TILLMAN (2008): Nicarbazin bait reduces reproduction by pigeons (*Columba livia*). Wildlife Res. 35, 80-85.

BARLOW, N. D., J. M. KEAN, C. J. BRIGGS (1997): Modelling the relative efficacy of culling and sterilisation for controlling populations. Wildlife Res. 24, 129-141.

BEASON, C. R. (2004): What can birds hear? Proceedings. 21st Vertebrebrate Pest Conference. University of California, Davis, 92-96.

CASERTANO, M., A. ROBERTS (2007): Curbing the Pigeon Conundrum. Hon. Simcha Felder Council member, 44th district New York, 2-14.

CLERGEAU, P., S. CROCI, J. JOKIMAKI, M. L. K. JOKIMAKI, M. DINETTI (2004): Avifauna homogenisation by urbanisation: Analysis at different European latitudes. Biol. Conserv. 127, 336-344.

DOBEIC, M. (2003): Regulation of population size of street pigeons in Ljubljana, Slovenia. Acta Vet-Beograd 53, 171-182.

DOVČ, A., J. RAČNIK, J. PIŠOT, V. CESTNIK, N. ČEBULJ-KADUNC, M. DOBEIC (2003): Progesterone concentration in the sera of pigeon treated with Ornisteril. In: 7th European AAV conference. 5th ECAMS scientific meeting: In cooperation with Loro Parque and Loro Parque foundation. Tenerife: European Committee of the Association of the Avian Veterinarians, pp. 373-374.

DOVČ, A., O. ZORMAN-ROJS, A. VERGLES RATAJ, V. BOLE-HRIBOVŠEK, U. KRAPEŽ, M. DOBEIC (2004): Health status of free-living pigeons (*Columba livia domestica*) in the city of Ljubljana. Act. Vet. Hung. 52, 219-226.

EMLEN, J. T. (1971): Population densities of birds derived from transect counts. The Auk 88, 323-342.

GIUNCHI, D., V. GAGGINI, N. E. BALADACCINI (2007): Distance sampling as an effective method for monitoring feral pigeon (*Columba livia* f. *domestica*) urban populations. Urban Ecosystems 10, 397-412.

HAAG-WACKERNAGEL, D., I. GEIGENFEIND (2008): Protecting buildings against feral pigeons. Eur. J. Wildlife. Res. 54, 715-721.

HAAG-WACKERNAGEL, D. (2000). Behavioural responses of the feral pigeon (Columbidae) to deterring systems. Fol. Zool. 49, 101-114.

KOS, U., M. DOBEIC (2000): The control of urban pigeon population in the city of Ljubljana with Emphasis laid on the Pigeons' welfare. Proceedings of 10th International Congress in Animal Hygiene. ISAH'2000, Maastricht, Netherlands, 796-802.

SIMON, U., S. KUBLER, J. BUHNER (2007): Analysis of breeding bird communities along an urban-rural gradient in Berlin, Germany, by Hase Diagram Technique. Urban Ecosyst. 10, 17-28.

SPEAR, J. S. (1966): Bird Control Methods and Devices - Comments to the National Pest Control. In: Wildlife damage Management, Internet Center for Bird Control Seminars proceedings. University of Nebraska - Lincoln, USA, 134 - 146.

VATER, G. (1999): Bestandsverminderung bei verwilderten Haustauben Teil 1 Bilanz mitteleuropaisher Stadtverwaltungen. Springer Berlin/Heidelberg. Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz 42, 911-921.

VATER, G. (2000): Bestandsverminderung bei verwilderten Haustauben Teil 2. Springer Berlin/ Heidelberg. Bundesgesuntheitsblatt - Gasundheitsforsch - Gesundheitsschutz 43, 41-46.

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**DOBEIC, M., Š. PINTARIČ, K. VLAHOVIĆ, A. DOVČ: Uređivanje populacije gradskih golubova (*Columba livia*) u Ljubljani. Vet. arhiv 81, 285-298, 2011.**

**SAŽETAK**

U ovome su radu prikazani rezultati kao i kritički osvrt na primjenu različitih metoda u uređivanju populacije golubova u Ljubljani. Ujedno, cilj ove studije bio je utvrditi učinkovitost postupaka poduzetih sa svrhom uređivanja populacije golubova u Ljubljani. Radi vrednovanja različitih pristupa u uređivanju populacije golubova provjeravana je djelotvornost progesterona, ultrazvuka i umjetnih golubinjaka. Najdjelotvornijom metodom u kontroli populacije golubova pokazala se upotreba kontraceptiva budući da se broj golubova u Ljubljani smanjio za 49,1% (P>0,05) u razdoblju od godine 1999. do 2004. Metoda zastrašivanja ultrazvukom vrlo je upitna, iako su golubovi u našem istraživanju pokazali određeni strah od letenja u prostoru u kojem je bio

uključen ultrazvuk te značajne (P<0,001) promjene u brojnosti slijetanja, polijetanja i kretanja na građi potkrovlja vratarnice komunalne sprave. Metoda gniježđenja u osam parkovnih i dva tavanska umjetna golubinjaka, koje trenutačno istražujemo, čini se vrlo učinkovitom budući da se nakon desetomjesečnog razdoblja u njima počelo gnijezditi 62% golubova. Ta metoda ujedno omogućuje unaprjeđenje higijenskih uvjeta držanja, hranjenje iz razonode kao i sakupljanje jaja radi smanjenja broja golubova u Ljubljani. Međutim, sve navedene metode učinkovite su tek nakon cjelovite primjene različitih pristupa kontrole populacije golubova tijekom duljeg razdoblja, a pritom moraju biti popraćene informiranjem te edukacijom javnosti.

**Ključne riječi:** gradski golubovi, kontracepcija, progesteron, ultrazvuk