Old and novel methods for estimating Feral Pigeons (*Columba livia* f. *domestica*) population size: a reply to Amoruso et al. (2013)

Dimitri Giunchi[1]*, Lorenzo Vanni[1], Cecilia Soldatini[2], Yuri Albores-Barajas[3], N. Emilio Baldaccini[1]

[1] Department of Biology, Ethology Unit, University of Pisa, Via Volta 6, 56126 Pisa, Italy

[2] DAIS, University Ca'Foscari of Venice, Castello 2737/b, 30122 Venice, Italy

[3] Grupo de Ecologia y Conservacion de Islas, A.C. Moctezuma 836, 22800 Ensenada B.C., Mexico

* Corresponding author: e-mail dgiunchi@biologia.unipi.it, Phone +390502211364, Fax +390502211360

Abstract

In a recent paper Amoruso et al. (2013) proposed a novel method for estimating population size of Feral Pigeons, the Superimposed Urban Strata (SUS) method. In our reply we firstly comment on the lack of a complete review of the available literature. Secondly we point out that the SUS method does not account for birds detection probability and thus it is just a simple index of abundance as many others purposed in recent years. Thirdly, we questioned the approach used by the authors to evaluate the reliability of the method itself. To conclude, we believe that the SUS method is not truly innovative and that further investigations are needed before considering it as a reliable way for estimating Feral Pigeons populations size.

In several cities Feral Pigeons represent an important and often not well addressed problem (see Giunchi et al. 2012 for a recent review). So far, many of the approaches used to deal with this problem do not comply with the scientific requirements of a proper pest control program (see Hone 1994 for details) and often only produce a waste of resources. Any improvement of the techniques used in Feral Pigeon control programs is thus welcome and merits consideration. In a recent paper published online in this journal, Amoruso et al. (2013) proposed a novel method for estimating population size of Feral Pigeons, the Superimposed Urban Strata (SUS) method, which they tested in a medium sized Italian city (Padua). While we acknowledge that the problem of estimating Feral Pigeons populations size deserves further investigation, we argue that the SUS approach is not truly innovative and that the data presented by Amoruso et al. (2013) do not allow the reader to properly evaluate the reliability of the method itself. The major points of our criticism are listed below.

1. In 2007, our research group was the first to examine the use of distance sampling (Buckland et al. 2001) to estimate Feral Pigeon population size in Pisa, Italy (Giunchi et al. 2007b). In that paper we also discussed the pros and cons of the commonly used survey methods for Feral Pigeons, including the adoption of untested correction factors (see below). Further data regarding distance sampling were provided in a recent open access book (Giunchi et al. 2012), where we reported the results obtained in Pisa, Bolzano and Venice. We do not claim that distance sampling solves every problem in feral pigeons population estimate and, in fact, we discussed in detail the pros and cons of this method, clearly stating that further tests are needed to evaluate its reliability and applicability to other cities. We however consider this method as a true improvement with respect to the methods currently used, especially because it tries to estimate bird detectability in a rather inexpensive way (see Giunchi et al. 2007b for further details). Amoruso et al. (2013) failed to recognize these studies and subsequently did not compare the advantages of their proposed method to our proposed use of distance sampling to estimate Feral Pigeon population size.

2. The SUS method presented in Amoruso et al. (2013) has the same drawbacks detected in most of the methods used so far to estimate the population size of Feral Pigeons, i.e. it does not model bird detection probability, which is one of the main source of bias in all bird surveys (Thompson 2002). For this reason, while the technical details of the SUS method can be regarded as novel in the Feral Pigeon literature, the approach is quite old and extends the already long list of indexes of abundance designed to monitor bird populations (see Sutherland 2006 for a review). Indeed, in both the strata considered for the estimate, Amoruso et al. (2013) did not try to estimate bird detection probability; instead they corrected their estimates using two arbitrary correction factors (R). In the first stratum

the authors assumed that detection probability was = 1, because they fed pigeons in order to attract them before counting. Besides not being tested, this assumption is likely wrong. Pigeon flocks, even if attracted by a regular provision of food, are indeed not at all stable, as (1) birds did not frequent the same site daily and (2) a significant proportion of individuals behave like occasional visitors (Lefebvre and Giraldeau 1984; Lefebvre 1985). Indeed, Sacchi et al. (2002), which similarly fed pigeons in order to estimate the population size in Milan, still correct their results using R = 3.25 on the basis of preliminary capture-recapture data. Furthermore, Amoruso et al. (2013) report that pigeons were fed in the early afternoon, but several published papers indicate that the main foraging activity in early spring is concentrated during the morning (Janiga 1987; Johnston and Janiga 1995), with a noticeable inter-individual variability (Lefebvre and Giraldeau 1984). It is thus very likely that a significant proportion of pigeons were satiated in the early afternoon and thus probably ignored the new food sources. In the end, the authors reported that they performed their counts "...in early spring, before the peak of the Pigeon breeding season was reached (Hetmański 2004; Hetmanski and Barkowska 2007)"; this statement is also rather problematic. First of all, the phenological data reported by Hetmański (2004) (the paper by Hetmanski and Barkowska 2007 does not deal with the timing of breeding by Feral Pigeons) refer to Słupsk (NW Poland), about more than 9° of latitude north with respect to Padua. Actually the breeding season of Feral Pigeons shows a remarkable geographic variability (Johnston and Janiga 1995) and thus it could be misleading to refer to data collected from one distant locality. This is rather more strange as the authors completely ignored the phenological data reported for two closer Italian cities (Giunchi et al. 2007a). Moreover, Hetmański (2004) clearly stated that the peak months of breeding initiations were January, February and March. Therefore early spring is well within the peak of breeding activities in Poland and actually the same is more or less true for Venice, the nearest Italian city for which data on the timing of breeding activities are available (Giunchi et al. 2007a). Incubating birds are likely not to be attracted by the provided food. For all of these reasons the assumption that R = 1 for the first stratum is in our opinion rather unlikely.

In their second stratum, Amoruso et al. (2013) corrected their data by 3.25, assuming that about 70% of birds could pass undetected during counts. Again, this assumption was not tested, but it was considered reasonable in light of other papers reporting the use of similar proportions. We discussed in depth the problems related to the use of correction factors in our previous paper (Giunchi et al. 2007b). However, we would like to point out that adopting untested correction factors makes clear that what the authors obtained was not a population estimate, as they claim, but an educated guess of the population size, i.e. a population index. In this sense we find nothing really new in the approach Amoruso et al. (2013) proposed in their paper (see for instance Senar 1996).

3. Amoruso et al. (2013) did not actually test their method, e.g. by comparing SUS results with those obtained with other methods proved to be reliable and/or commonly used in the field, thus evidencing the pros and cons of the technique. Instead, they use a population model to project the 2007 population to 2010 and compare the results of the model with 2010 SUS results, claiming that the SUS approach was reliable as the difference between the two values were rather small. In our opinion this approach is flawed, because:

a. The fact that the SUS approach accurately caught the population trend, only suggests that this could be a reliable population index (but see below). It did not allow for the conclusion that the population estimates were unbiased. For example, if the SUS method systematically underestimated the population size (as discussed before), the results of the two surveys (2007 and 2010) and the 2010 population projection (which was based on 2007 SUS results) would be biased in the same direction.

b. The population model was based on demographic parameters not estimated for the study area, but derived from literature. Given the lack of local data, it would have been safer to simulate different scenarios in order to assess the robustness of the results. Indeed, several demographic parameters reported for pigeons show remarkable variability among populations: e.g. adult mortality was estimated 33.5% in Manchester (Murton et al. 1972), but only 10% in Basel (Haag 1988). Moreover other parameters were only simple guesses (e.g. the intrinsic rate of population increase) or plainly wrong (the fraction of reproductive birds reported by Murton et al. (1972), and confirmed by other data collected in Kansas (Johnston 1984) is no more than 30% instead of the adopted 65.9%). In the end, the manner in which carrying capacity (K) was set seems flawed. Amoruso et al. (2013) set K=4500 "... that is the maximum rounded number of Pigeons that a private pest control company could capture in 2006, upon request of the Padua Municipality...". From this claim and given the definition of carrying capacity, we infer that in 2006 the pest control company was able to capture all birds living in the study area. This is a rather strong statement which has to be validated, given the well-known difficulties in catching/killing a large fraction of a medium-sized population of Feral Pigeons within pest control programs (see Johnston and Janiga 1995 for references). It is important to notice that, if e.g. the pest control activities would have caught 70% of the population (quite a high percentage according to the published data, see Johnston and Janiga 1995) and if we assume that Padua population was actually near the carrying capacity of the urban environment, K had to be set at 6500, which, according to the model reported by Amoruso et al. (2013) and not changing the other parameters, produce an estimate of >5000 pigeons in 2010, i.e. about 50% higher than SUS estimate.

To conclude, our criticisms to the paper by Amoruso et al. (2013) are not aimed at discrediting the SUS approach *in toto*. Instead, some of its characteristics and in particular the integration of several sources of data in order to evaluate the abundance of pigeons is worth considering. However, we believe that further and rigorous investigations are needed before considering it as a reliable way for estimating Feral Pigeons populations size.

References

Amoruso I, Fabbris L, Mazza M, Caravello G (2013) Estimation of Feral Pigeon (Columba livia) population size using a novel Superimposed Urban Strata (SUS) method. Urban Ecosyst. doi: 10.1007/s11252-013-0323-2

Buckland ST, Anderson DR, Burnham KP, Laake JL, Borchers DL, Thomas L (2001) Introduction to Distance Sampling: Estimating Abundance of Biological Populations. Oxford University Press, New York

Giunchi D, Baldaccini NE, Sbragia G, Soldatini C (2007a) On the use of pharmacological sterilisation to control feral pigeon populations. Wildl Res 34:306–318.

Giunchi D, Gaggini V, Baldaccini NE (2007b) Distance sampling as an effective method for monitoring feral pigeon (*Columba livia* f. *domestica*) urban populations. Urban Ecosyst 10:397–412.

Giunchi D, Albores-Barajas Y, Baldaccini NE, Vanni L, Soldatini C (2012) Feral Pigeons: Problems, Dynamics and Control Methods. In: Soloneski S, Larramendy ML (eds) Integrated Pest Management and Pest Control - Current and Future Tactics. InTech, Rijeka, pp 215-240

Haag D (1988) Die dichteabhängige Regulation im Brutschwarm der. Strassentaube *Columba livia* forma domestica. Ornithol Beob 85:209–224.

Hetmański T (2004) Timing of breeding in the Feral Pigeon *Columba livia* f. *domestica* in Słupsk (NW Poland). Acta Ornithol 39:105–110.

Hetmański T, Barkowska M (2007) Density and age of breeding pairs influence feral pigeon, *Columba livia* reproduction. Folia Zool 56:71–83.

Hone J (1994) Analysis of Vertebrate Pest Control. Cambridge University Press, Cambridge

Janiga M (1987) Seasonal aspects of intensity and course of daily translocations of pigeons (*Columba livia* f. *domestica*) for food from Bratislava to its surroundings. Acta Fac Rerum Nat Univ Comen Zool 32:47–58.

Johnston RF (1984) Reproductive ecology of the feral pigeon, *Columba livia*. Occas Pap Mus Nat Hist Univ Kans 114:1–8.

Johnston RF, Janiga M (1995) The Feral Pigeons. Oxford University Press, London

Lefebvre L (1985) Stability of flock composition in urban pigeons. The Auk 102:886–888.

Lefebvre L, Giraldeau LA (1984) Daily feeding site use of urban pigeons. Can J Zool 62:1425–1428.

Murton RK, Thearle RJP, Thompson J (1972) Ecological studies of the feral pigeon *Columba livia* var. I. Population, breeding biology and methods of control. J Appl Ecol 9:835–874.

Sacchi R, Gentilli A, Razzetti E, Barbieri F (2002) Effects of building features on density and flock distribution of feral pigeons *Columba livia* var. *domestica* in an urban environment. Can J Zool 80:48–54.

Senar JC (1996) Bird census techniques for the urban habitat: a review. In: Controllo Delle Popolazioni Ornitiche Sinantropiche: Problemi e Prospettive. Istituto Superiore di Sanità, Roma, pp 36–44.

Sutherland WJ (2006) Ecological census techniques. Cambridge University Press, Cambridge.

Thompson WL (2002) Towards reliable bird surveys: Accounting for individuals present but not detected. Auk 119:18–25.