

## **Faithfulness and deceit in tits of the Anthropocene: from life in a primeval forest to life in a city**

For a long time bird mating systems have been considered as model examples to justify that monogamy is rule rather than the exception in the animal kingdom. Bird alleged fidelity was a source of convenient and picturesque metaphors to praise eternal love in ethics, literature and art. However, only 25 years ago, science shattered this reassuring picture. Molecular genetic techniques revealed that birds are in fact rarely monogamous, and extra-pair offspring were found in 90% of avian species. Among socially monogamous species over 11% of offspring, on average, have an extra-pair father. An inquiry to understand the causes of extra-pair paternity (EPP) has been undertaken since. We now know that such behaviour can be beneficial not only for males but also for females, who can then transmit better genes to their offspring. But there is still much to learn about the causal factors underlying extra-pair copulations (EPC). Much of what we know about this phenomenon comes from studies on small passerine birds: great tits (*Parus major*) and blue tits (*Cyanistes caeruleus*). However, until now all of these studies are based on birds breeding in nestboxes, and not in natural tree cavities in which they originally evolved. This is potentially a serious problem, since as a result we do not know whether currently collected data on bird reproductive decisions are affected by artificial, “non-natural” breeding sites such as nestboxes, or ecological habitat such as cities. Our study offers a unique opportunity to look into the natural rates of EPP in birds breeding in natural cavities of Białowieża primeval forest, one of the last remaining habitats of this kind in Europe.

Our main objective is to establish levels of EPP in great tits and blue tits breeding in natural cavities in a primeval forest in order to compare it to levels of EPP in nest-box breeding populations. We expect that birds breeding in nest-boxes will indeed be more prone to engage in EPC since the density of breeding pairs, and the opportunity to engage in EPC, is greater in such study sites. Moreover, we also expect that rates of EPP can be altered by factors associated with urbanisation levels, such as light and noise pollution. That is why we will also look into EPP variation in a gradient of urbanisation. Altogether, our project offers the chance to disentangle the effects of breeding cavity type (nest-box vs. natural cavity) and environmental characteristics (gradient of urbanisation) on EPP rates. We will use data on blue tits and great tits already collected in Białowieża National Park in the past few years. In parallel, we will also collect material in a woodland with natural cavities in Warsaw to test whether rates of EPP in 7 populations breeding in nest-boxes in Warsaw covary with the city’s gradient of urbanisation. Parents and offspring will be genotyped, and extra-pair offspring as well as extra-pair fathers will be identified. Finally, we will perform a comparative study of EPP variation in blue tits and great tits based on published data to assess the magnitude of human influence on reported promiscuity levels.

All in all, we will confront current knowledge on EPP, and reassess its natural variation in a primeval environment. We hope that our research will contribute to a better understanding of the footprint of cities on the ecology and behaviour of wild animal species, which is particularly important in an era of rapidly expanding urban areas. Moreover, our project will also contribute to a better understanding of variation in promiscuity and resulting levels of EPP within and between populations. Who knows, it may even repair birds’ reputation as serial cheaters.