

Response of urban birds to Covid-19 lockdown: evidence from surveys reporting complete checklists in Catalonia

Oscar Gordo ¹, Lluís Brotons ^{1,2,3}, Sergi Herrando ^{1,2} and Gabriel Gargallo ¹

¹Catalan Ornithological Institute (ICO), ES-08019, Barcelona, Spain

²Centre of Ecological Research and Forestry Applications (CREAF), ES-08193, Bellaterra, Spain

³Consejo Superior de Investigaciones Científicas (CSIC), ES-08193, Cerdanyola del Vallès, Spain

Corresponding author Oscar Gordo: ogvilloslada@gmail.com

After two dramatic years, Europeans are just recovering their life style previous to the Covid-19 outbreak and getting over the severe social restrictions imposed during the pandemic. When the World Health Organization officially declared the Covid-19 pandemic in March 2020, all countries took measures to stop virus spread. One of the most drastic of these measure was confining people to their homes. Spain applied one of the strictest and longest lockdowns in Europe, starting on 14 March and lasting until the end of June 2020. During this period, people could not leave their homes, except for purchasing basic consumer goods. Only the most essential services, such as markets, groceries or hospitals, remained open.

This unprecedented situation provided an exceptional opportunity to study urban wildlife responses to less crowded, noisy and polluted cities and gain unprecedented mechanistic insights into how human activities affect wildlife. For this reason, on 15 March 2020, the Catalan Ornithological Institute launched the project *#JoEmQuedoACasa* (I stay at home) using *ornitho.cat*, the reference website for birders in Catalonia. The aim was to collect information about bird responses to the new environmental conditions in urban areas resulting from people's confinement. In addition, the project was important to keep engaged *ornitho.cat* users and boost data submission, despite of constrained outdoor activities.

During the first month of the strictest lockdown, project participants recorded 1,290 complete checklists of birds observed from balconies, rooftops or yards at their homes, representing 1,248 hours of surveys in 149 sites spread across Catalonia. Then, we gathered the 6,911 complete checklists submitted to *ornitho.cat* during the same period between 2015 and 2019. This historical data was classified into urban and non-urban checklists according to the environment

where surveys were conducted. Historical urban data represented baseline data, while historical non-urban data were included as control data without human disturbances. Finally, we selected the 16 most common sedentary urban species in Catalonia. Our final dataset contained more than 131,000 bird observations and allowed us to test specifically: 1) Did urban birds occur more frequently in response to human-empty cities? and 2) Were urban birds more detectable as a consequence of quieter cities? We used hierarchical occupancy models to disentangle the effects of individuals' presence (first question) and detection (second question) in our bird data, while controlling for survey duration and time.

The prevalent impression at the beginning of the pandemic was that nature was getting back its space into our empty cities. However, the overwhelming majority of the studied species did not change their probability of occurrence during the lockdown compared to the period 2015–2019. Only three species, Feral Pigeons *Columba livia*, Collared Doves *Streptopelia decaocto* and Monk Parakeets *Myiopsitta monachus*, were more prevalent in 2020 bird surveys. Interestingly, they represent the most city dwelling birds and consequently their population increase could hardly rely on non-urban populations that moved into urban areas during the lockdown period. Their higher prevalence in the recorded checklists during the lockdown was probably due to the constraints of observers to survey birds only from their homes and thus, to predominantly observe the most urbanite birds.

Interestingly, detection probability increased in most species during lockdown surveys. Such increase was especially remarkable in early morning with an average estimated increase of 27% of bird detectability at sunrise compared to the previous years (Fig. 1). In fact, most species shifted their daily pattern of detectability during the

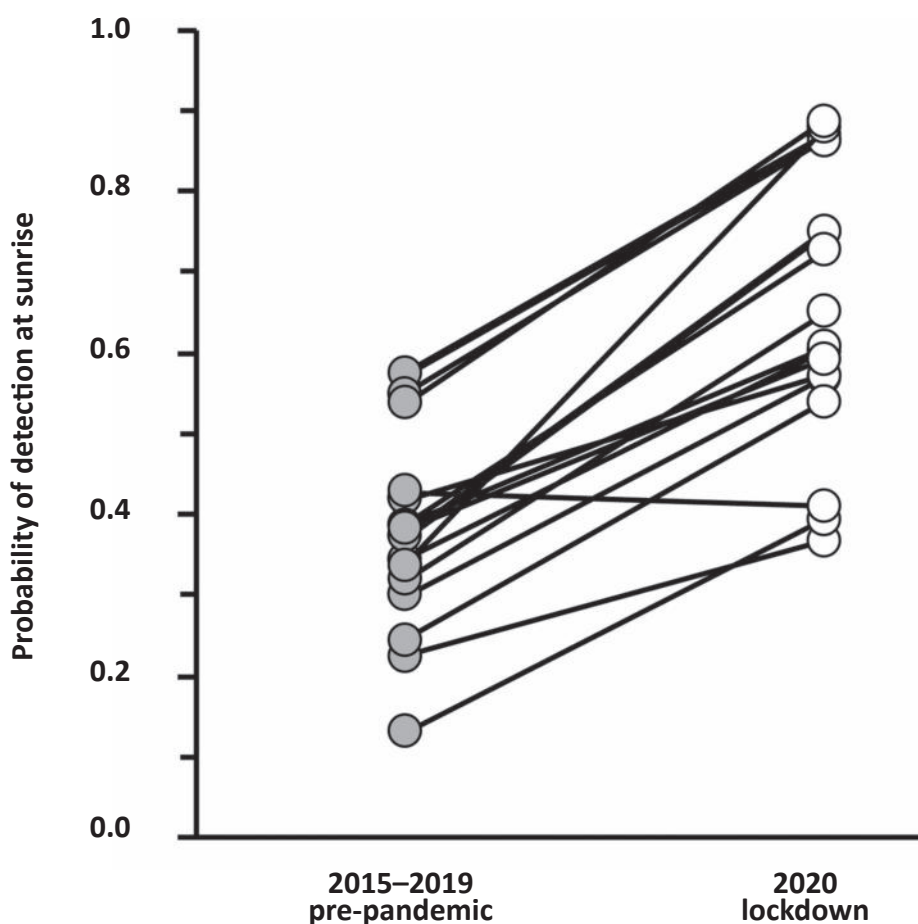


Fig. 1. Probability of bird detection in urban areas at sunrise before (2015–2019) and during (2020) the Covid-19 lockdown. Each dot represents a studied species.

lockdown. In 2020, detectability peaked at dawn and decreased until midday in most species, while in the historical urban checklists the peak of detectability was around mid-morning. Interestingly, the new lockdown pattern of detectability resembled more the pattern found in non-urban environments than that observed in urban areas in many species (Fig. 2).

The spring 2020 lockdown decreased drastically human presence and activities in urban environments, this being especially obvious during rush hours. In the case of morning rush hours, the released early morning acoustic space could be recovered by the dawn chorus. Therefore, urban birds quickly shifted their daily activity to match their maximum singing activity with dawn, as observed in natural conditions. This adaptive behavioural response to the exceptional conditions caused by people lockdown was mediated by phenotypic plasticity, as the environmental scenario in urban areas changed radically from one day to the next. Urban birds are already used to some extent to notable changes in our human routines, as those happening between working

and weekend days. Therefore, the observed behavioural response demonstrates the ability of urban birds to take the maximum profit of our cities by an extraordinary behavioural flexibility. Another important lesson from our study was that daily patterns of bird detectability were somewhat different between urban and non-urban populations. Most census protocols assume that the best moment to detect birds is early morning. We found that this happens only under natural conditions without human disturbance. If the detectability peak in urban populations is reached later (Fig. 2), their abundance would be systematically underestimated by the sampling time recommended in most bird census protocols.

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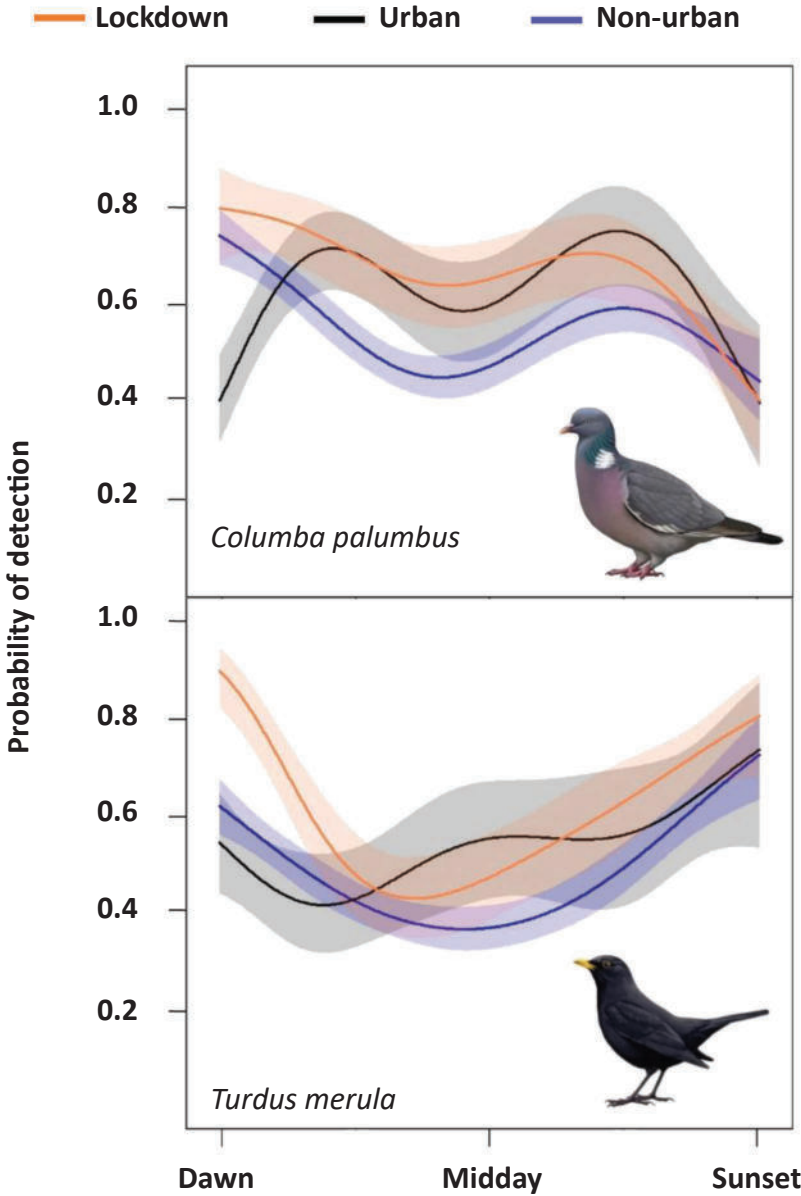


Fig. 2. Examples of daily patterns of detectability observed in the studied species for each group of checklists (orange: recorded during the 2020 lockdown; black: recorded in urban sites between 2015 and 2019; blue: recorded in non-urban environments). Shaded areas represent the 95% confidence intervals. Illustrations © Martí Franch/Catalan Ornithological Institute