

The light fantastic...?

How artificial light affects our wildlife



Street lighting, by Robert Read/NPL

Urbanisation has a profound effect on the wildlife around us, primarily through the loss or alteration of natural habitats. While many plants and animals are able to adapt well to human-dominated landscapes, attention is now turning to the less tangible effects of artificial lighting on bird and wildlife populations. The **Early Bird Survey**, which ran in January 2014, looked into some of these questions, and the results were analysed by **Gary Clewley**.

Artificial lighting has been shown to affect bird behaviour in various studies around the world. Many have focused on Blackbirds and Robins, which both sing and even forage at night, especially in areas with street lighting.

In one experimental study, Robins placed in artificially-lit aviaries started singing and feeding much earlier than birds without artificial light. American Robins in areas with large amounts of artificial light often start to sing well before dawn, while those in areas with little artificial light usually wait until dawn before starting their morning chorus. Other species that have been shown to sing for longer in the presence of artificial lights include Great Tit, Blackbird and Song Thrush.

Some studies have found that it's not just singing that is affected; there can also be an effect on the timing of reproductive behaviour. In one, female Blue Tits breeding closer to street lights started laying eggs an average of 1.5 days earlier than those further away. Males were also affected, being twice as likely to obtain extra-pair mates than those further away from artificial lighting. It could be that the artificially-extended day length 'tricks' birds into behaving as if it is a different time of year.

There is much we still do not understand about the effect of artificial light on bird behaviour and ecology. It has been suggested that the increased noise and temperature that come with urbanisation could also be a factor in changes in behaviour.

THE EARLY BIRD SURVEY

During January 2014 the BTO ran a large-scale citizen science project, the **Early Bird Survey**, with the aim of studying the effect of artificial lighting on the foraging habits of garden birds in winter.

Starting before dawn, participants were asked to record the first arrival time of each species that came into their garden to feed. Time of first light was defined as the time at which participants could first see their garden feeding station from their observation point, and arrival time for each species was calculated relative to this. On average, the time of first light reported by the participants was 28 minutes before sunrise, but this varied between gardens, as expected, because local light levels are influenced by cloud cover, the local topography, and other factors. Participants were asked to record the number of artificial lights within a 50m radius of their garden, and each garden was given a measure of urbanisation using national land cover data.

Temperature and rainfall from the nearest weather station were linked with each garden, and the mean minimum temperature recorded during the survey was 3.9°C.

A total of 3,460 participants took part across the UK, from 4–12 January, including 13 cases where no birds were observed. Only the ten commonest species were included in the final analysis, and the final dataset included 20,204 observations.



▲ Robins are known to sing all night under street lights.

NOT-SO-EARLY BIRDS?

Surprisingly, the Early Bird Survey did *not* find that any species in either urban or non-urban environments arrived into gardens earlier where there were more artificial lights; if anything, birds tended to arrive later. Furthermore, the response to artificial lights was *not* stronger in non-urban areas, where additional light sources are more novel. These results contradict previous assumptions that artificial light would result in a shift towards earlier arrivals in gardens during winter by allowing foraging in reduced daylight. To understand these findings, we looked at some other factors that could be influencing foraging behaviour in winter.

TEMPERATURE, FOOD AND PREDATION

Foraging behaviour is determined by a multitude of factors, and the relationship between arrival time into gardens and artificial lights could be dependent on other environmental conditions. Both recent minimum temperature and rainfall are thought to be important for determining when birds start to forage, and it's important to note that temperatures recorded over the survey period were relatively mild. Birds actively foraging are likely to be exposed to predators – more so than roosting birds – so individuals need to weigh up the risk of starvation against the risk of predation. Mild temperatures, such as those seen during the survey period, could mean that birds were not as driven by the risk of starvation as might be the case in colder weather, and they did not need to take advantage of artificial light sources to feed early. There are likely to be thresholds of temperature and day length below which different species may use artificial light sources to forage.

The onset of foraging may also be determined by the regularity and quality of food in the surrounding area. In a poor foraging area, birds are more likely to be constrained by day length and need to begin foraging earlier, whereas in good foraging areas sufficient body mass can be gained in a shorter period so more time can be spent avoiding predators. It has been suggested that food availability in urban areas is more predictable than non-urban areas, which could allow birds to begin foraging later and still meet their energetic requirements. Since aggregations of artificial lights are mostly connected with human presence, even in rural areas, if food resources are more predictable closer to humans this may help explain why birds arrived later into gardens with more artificial lights nearby.

Many of the previous studies that have found an effect of artificial light on bird behaviour have focused on behaviour during the breeding season, such as singing, or have been carried out in areas with very short day length or very low temperatures, when starvation may have been a more relevant risk to birds than predation.

A MISSED OPPORTUNITY FOR BIRDS?

The findings of this study, carried out with a variety of species surveyed at a national scale, do not suggest that garden birds arrive earlier to begin foraging in areas with more artificial lighting, but in fact tend to arrive later. It is not clear whether this represents a missed opportunity for garden birds to meet their daily energetic requirements earlier, or that artificial light is simply not a driving factor during winter compared with other environmental conditions.

We would like to thank all the participants who took part in the survey. This research has been carried out by BTO Research Ecologists Gary Clewley, Rob Robinson and Kate Plummer, together with Clare Simm and Mike Toms, and a manuscript has been submitted for publication.

Case studies: Blackbird

Blackbirds have been shown to vary the mass gained throughout the day at different times of year in order to balance the risks of starvation and predation.

Blackbirds fitted with light-loggers in Germany appear to avoid artificial lights such as street lights.

Blackbirds are active before sunrise during the Norwegian winter in order to maximise the time available for feeding.

Blackbirds have been shown to sing earlier in the morning during the breeding season in areas with artificial lights.



Blackbird, by John Harding