European Commission

Science for Environment Policy

Switching to LED street lighting could alter urban bat behaviour

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The effect on bats of the replacement of mercury lamps with light-emitting diodes (LEDs) in street lighting has been investigated in a recent study. Artificial light affects bat species differently and the activity of species normally more sensitive to light were affected less by the new LED street lamps than by traditional mercury lamps. Use of LEDs may, therefore, help to reduce the impacts of outdoor lighting on light-sensitive bats, if used at an appropriate level.

The use of artificial lighting is increasing by around 6% per year globally. In urban environments around one third of light is emitted from street lights. Light pollution can have negative effects on biodiversity, particularly affecting nocturnal species, such as bats, which forage for insects within a dark environment. Lighting can affect bats' orientation and light-sensitive species may, therefore, avoid urban areas. For example, slow-flying bats, such as Natterer's bat (*Myotis nattereri*), which often forage for prey close to vegetation, catching insects hanging or flying close to leaves and usually dwell in cluttered forest habitats, only emerge after dark and avoid street lights. In contrast faster, higher flying species, such as noctule bats (*Nyctalus* species), are more tolerant of lights, and certain species, such as the common pipistrelle (*Pipistrellus pipistrellus*), will forage for insects around street lights.

High-pressure mercury vapour (MV) lamps, which currently make up 30% of all outdoor lighting, are no longer available in the EU as they do not meet minimum performance and efficiency standards in relation to the Ecodesign Directive[1]. As a result, light-emitting diodes (LEDs) are expected to become the main form of street lighting within the next few years. Understanding the ecological impacts of LEDs is, therefore, important.

This study examined how the replacement of conventional MV streetlights with LEDs affects urban bats. Bat activity was recorded at 46 MV street lights in six urban regions in Germany. Bat activity was measured in relation to the total time bats spent within the vicinity of each light. Bat echolocation calls were recorded and used to identify the bat species present. The surveys were repeated following replacement of 25 of the MV bulbs with LEDs. In total, bat activity around each light was recorded for 12 days. The luminance of each lamp was also measured to account for any differences in brightness of lamps due to lamp age or model.

The common pipistrelle was the most frequently recorded bat species around lights and was 45% less active at LED lights compared to MV street lamps. The activity of certain bat species, including nathusius's pipistrelle (*Pipistrellus nathusii*), the soprano pipistrelle (*Pipistrellus pygmaeus*), noctule bats, house bats (*Eptesicus* species) and vesper bats (*Vespertilio* species) were not influenced by light type. Species of mouse-eared bats (*Myotis*) were around four-and-a-half times more active at LED lights.

Continued on next page.

Source: Lewanzik, D. & Voigt, C.C. (2016). Transition from conventional to light-emitting diode street lighting changes activity of urban bats. *Journal of Applied Ecology*, 12(8): 105-119. DOI:10.1111/1365-2664.12758. This study is free to view at: http://rsbl.royalsocietypublishing.org/content/12/8/20160024?rss=1.

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1. Ecodesign Directive 2009/125/EC: http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32009L0125

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The researchers say this is the first study to look at the effects on bats of replacement of conventional MV street lights with LEDs in an urban environment. The fact that lighting changes affected different species in different ways suggests the switch to LED lighting could change the make-up of urban bat communities. As insects are less attracted to the light wavelengths emitted by LEDs, this may reduce the foraging advantages for more light-tolerant bats. For example, pipistrelles, which were most affected by the change of lighting, often hunt for insects along fixed routes under street lights. In contrast, species of noctule, house and vesper bats forage in less well-defined areas and generally fly in straight lines above street lamps, so were less affected by the change in lighting. In addition, light-sensitive species may be less sensitive to LED than MV street lighting; for example, mouse-eared bats are considered sensitive to lights and the results of this study suggest they may be more tolerant of LEDs, which emit less ultraviolet light than MV lamps.

The researchers caution that the potential benefits of LEDs may be reduced if the cheaper energy cost of LED lighting means the amount of artificial lighting increases. Artificial lighting should, therefore, be kept to a minimum to reduce the interference with the behaviour of bats and other nocturnal species. For example, unlike traditional lighting, the intensity of LEDs can be adjusted and minimum light levels could, therefore, be defined and used depending on specific lighting needs, e.g. for walking or driving. Other mitigation measures could include ensuring lights are only directed to certain areas, dimming lights during periods of low human activity and the use of motion sensors. The researchers consider the replacement of traditional MV outdoor lighting with LEDs over the coming decades as a potential opportunity to reduce the ecological impacts of street lights.

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