

Ornithology from the Lakeshore

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Ornithology from the lakeshore

According to a publication of the Department of Economic and Social Affairs of the United Nations (World Urbanization Prospects), more than half of the human population lived in cities in 2014, and the trend is rising. Recently, ornithologists have discovered cities as an inspiration to work on the effects of noise and light pollution (Ortega 2012, Gill & Brumm 2013, Gaston *et al.* 2015), and studying effects of light pollution has become the focus of large collaborative initiatives in the Netherlands (LichtOpNatuur, www.lichtopnatuur.org/en) and in Germany (Verlust der Nacht, www.verlustdernacht.de). So is this a chance for blue sky research to meet applied research in the form of advice to policy makers? After all, emphasizing societal relevance of scientific work helps to gain acceptance and funding for basic research. Perhaps, but most studies on the effects of noise and light pollution seem more interesting (from a basic science perspective) than they are relevant (when it comes to application).

Songbirds sing and singing is a form of communication. So, what happens in a noisy environment where the message may not get across to the receiver? There is now evidence that birds avoid the masking effect of noise by changing the amplitude of their song (sing louder), or the structure of their song (sing at frequencies that are masked less by background noise), or the timing of singing (avoid the noisy times, e.g. associated with rush-hour traffic). This is indeed interesting in a communication context; it allows determining the extent of plasticity in timing of behaviour, in choice of song elements, and in singing performance. It can also be used to study the consequences of less effective communication, both at the intraspecific level (what if competitors or potential mates do not hear you?) and at the predator-prey level (what if predators have a hard time finding their prey, or conversely, what if the prey does not hear the approaching predators?). As a recent review (Ortega 2012) points out, noise pollution may have many effects on individuals, but despite more than a decade of research, we still know relatively little

about the fitness consequences of living in a noisy environment, let alone about its population-level consequences. Ortega (2012) provides a long list of “research needs” and concludes that what is required is “sound scientific research to better understand the complicated... effects of noise pollution.” Nevertheless, the paper also concludes, echoing the alarming message of Barber *et al.* (2010), that “management of noise will be necessary to maintain or restore the integrity of natural ecosystems.”

So what about light pollution? Biological effects of artificial night lighting are expected, because light is the most important *Zeitgeber*, and disturbances of the natural day-night cycle may thus affect both the daily and seasonal timing of activities. Indeed, we now know, for example, that some songbirds respond to artificial night lighting by producing a dawn chorus earlier in the season. Under the influence of night lighting, some species also start singing earlier in the morning and finish their dusk chorus later in the evening. Light pollution may lead to a shift in the timing of reproduction, such that ‘enlightened’ females lay eggs somewhat earlier in the season. Studying such – relatively subtle – effects of artificial night lighting on bird behaviour and reproduction is certainly interesting, and there are many questions that remain unanswered. For example, why are some species more affected by artificial night lighting than others? Is the response to light immediate, a matter of opportunity to be active earlier, or is an individual’s biological rhythm affected, with longer-term consequences? More importantly, perhaps, how do these subtle effects on behaviour affect an individual’s fitness? Few if any studies have reported clear effects on fitness-related traits such as survival or seasonal reproductive success. Are there costs associated with the changes in behaviour? Are there perhaps also fitness benefits of living in a territory that is exposed to artificial night lighting, for example related to an increased time-window to forage or higher food availability when insects are attracted to the light? In their introduction to a theme issue of the *Philosophical Transactions of the Royal Society B* on “The biological

impacts of artificial light at night: from molecules to communities”, Gaston *et al.* (2015) lay out a general research agenda, and write “understanding the genuine severity of the problem is challenging”. Indeed, the consequences of artificial night lighting for individual fitness, population dynamics and ecosystem health remain poorly understood. Initiatives such as LichtOpNatuur allow the study of the impact of light pollution under a broader ecological perspective, encompassing effects on plant phenology (e.g. timing of budburst), and on predators and prey.

There is little doubt that noise and light affect bird behaviour, and studying these effects can be fascinating and insightful. However, with few exceptions, it is much less clear how these results should be translated into sound advice to policy makers. Referring to noise and artificial night light as environmental ‘pollution’, and emphasizing the link with increasing urbanization may help create a misdirected hype. It is all too easy to state that artificial night lighting is a big problem, but are we crying wolf? No, if one considers the obvious: birds that migrate at night are attracted by light and many die after crashing into lighted structures. But what about the more subtle effects on the timing of

behaviour? From an applied perspective, the focus should be on reducing the impact where it is most obvious (e.g. death through collisions with lighted structures). However, we should avoid investing too many resources in solving non-existing (or minor) problems. Indeed, isn’t habitat loss related to population growth and urbanization the real threat to biodiversity? Then why bark at the lights?

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