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SHORT NOTE

Artificial light at night potentially alters feeding behaviour of the native southern black-backed gull (*Larus dominicanus*)

ANDREW R. PUGH*
Scion, Forest Protection, 49 Sala Street, Rotorua, New Zealand

STEPHEN M. PAWSON
Scion, Forest Protection, Forestry Rd, Ilam, Christchurch, New Zealand

Artificial light at night (ALAN) is increasingly recognised as having ecological impacts. In fact, artificial light has been identified as one of the most serious emerging threats to urban ecosystems (Stanley *et al.* 2015). Rich (2005) documents some of the first observations of the impact of artificial lights, beginning over 150 years ago. Since then, light pollution has continued to grow in scale and in the number of known impacts on wildlife. It was estimated that 18.7% of the world's global land area is now affected to some extent by ALAN (Cinzano *et al.* 2001), and is increasing by approximately 6% annually (Hölker *et al.* 2010), due in part to new energy efficient lighting technologies, such as light emitting diodes (LEDs). These new technologies may exacerbate some of these problems further because of the larger proportion of blue light emitted compared to older lighting technology (Davies *et al.* 2013; Gaston *et al.* 2014). LEDs have a peak of blue-green light not present in other lighting technologies such as high pressure sodium or metal halide lighting (Davies *et al.* 2013; Pawson & Bader 2014). The blue light part of the spectra is highly visible across a wide range of animal groups (Davies *et al.* 2013).

Artificial light is known to cause behavioural changes in birds. There are periodic reports of mass death of migrating birds from impact or exhaustion as a result of specific point source lights, the most famous example being the death of approximately 50,000 birds due to exhaustion over 2 nights at an air force base in the United States (Johnston 1955). However, additional, more subtle, effects on birds include inducing activity earlier in the day (Kempenaers *et al*. 2010; Dominoni *et al*. 2014), and altering the timing of breeding (Kempenaers *et al*. 2010). Attention is now being drawn to the multitude of problems arising across ecosystems (*e.g.*, Davies *et al.* 2014; Gaston *et al.* 2014) caused by ALAN. To date there are few studies that record the impact of ALAN on avian feeding behaviour.

The southern black-backed gull (*Larus dominicanus*) inhabits both marine and terrestrial environments in New Zealand (Powlesland & Powlesland 1994; Maloney 1999). It has adapted to the significant anthropogenic changes throughout the landscape, and now inhabits a number of

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*Correspondence: *andrew.pugh@scionresearch.com*

modified areas, including farms and rubbish dumps (Powlesland & Powlesland 1994). The southern black-backed gull has been recorded foraging at night under lights in a marine environment before, but "… only one or two…" (Leopold *et al.* 2010). However, during night time visits to multiple wood processing sites that have ALAN, the authors and sawmill workers have observed significant changes in the natural behaviour of this native bird that suggest they are using ALAN to increase the time spent foraging.

The authors have observed southern black-backed gulls congregating on the roofs of buildings when adult burnt pine longhorn beetle (Cerambycidae: *Arhopalus ferus*) and huhu beetle (Cerambycidae: *Prionoplus reticularis*) are flying at night during summer. These observations are corroborated by sawmill owners in Nelson and the Hawke's Bay who confirm that there are regular annual congregations that coincide with peak insect emergence periods. These beetle species, like many Cerambycidae, are highly attracted to artificial light, particularly the white lighting (which has a blue wavelength peak) used to illuminate log yards at saw mills (Pawson & Watt 2009; Pawson *et al.* 2009). Approximately 1 hour prior to sunset the gulls can be seen circling above sawmills and adjacent forest stands. Prior to sunset, as beetles take flight, the gulls can be seen chasing the flying insects. The most common insect at sawmills is the smaller burnt pine longhorn beetle and they can be clearly seen with gulls in pursuit. As night falls the gulls begin to fly in concentrated clusters (estimated number 5-20) around the lights, probably taking various insects on the wing. This behaviour was observed on at least 15 separate occasions and was consistent, occurring on each night the sites were visited. In addition, multiple gulls (estimated number of 10-50 on differing nights) were observed by entomologists and mill workers during February of 2014 and 2015 eating live and squashed adult huhu beetles, on the ground at night between the hours of 9 pm-1 am under lights (when observations were halted).

The impact of this unusual nocturnal feeding behaviour by the southern black-backed gull is unknown and needs further study at the individual, population, community, and landscape level. For diurnal birds, their sight at night is improved by all high pressure sodium, metal halide, and LED lighting, which all emit a wide range of light wavelengths absorbed by avian photoreceptors (Davies *et al*. 2013), and allow for greater colour differentiation (Gaston *et al*. 2013). This improves the bird's visual performance at night and their ability to conduct activities that require visual guidance, such as feeding (Davies *et al.* 2013).

Understanding how birds react to ALAN is important given the plans for major urban centres in New Zealand to adopt LED technology. For example, it is reported in the media that Auckland City plans to change 44% of its 100,000 street lights from high pressure sodium lighting to LED lighting (Anonymous 2014a). Wellington city is also in the process of adopting LED technology (Anonymous 2014b). While we acknowledge the importance of seeking more energy efficient lighting solutions, this change may increase the ecological impacts of ALAN by changing the spectral composition of street lighting. Given the scope of such change in municipal lighting, it is important that consideration is given to the potential ecological impacts from this substantial change to artificial night lighting. To minimise the impacts of ALAN, 3 methods have been proposed: use of light shields to direct light downwards, reduction in number of lights used, and use of light sources that avoid emitting light from the blue part of spectrum (Navara & Nelson 2007). It is imperative that the impacts of increasing the area affected by ALAN and a change in the spectral composition is carefully considered and examined before wide-scale adoption of new lighting technologies occurs.

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