

BEFORE THE INDEPENDENT HEARING PANEL

IN THE MATTER of the Resource Management Act 1991

AND the proposed Timaru District Plan

Evidence of Simon James Kynaston Waugh
on behalf of the Director-General of Conservation *Tumuaki Ahurei*
Hearing F: Hazards and Risks (Natural Hazards only) – Other District-wide Matters
Submitter No. 166 Further Submitter No.166
Dated: 9th April 2025

Department of Conservation | *Te Papa Atawhai*

Solicitor rōia: Alice McCubbin-Howell

Phone waea: 022 012 6647

Email Īmera: amccubbinhowell@doc.govt.nz

Introduction

1. My full name is Simon James Kynaston Waugh.
2. I have been asked by the Director-General of Conservation Tumuaki Ahurei (the D-G) to provide expert evidence on the proposed Timaru District Plan (the PTDP).
3. This evidence relates to Hearing F which includes District Wide Matters, including the Light Chapter.

Qualifications and experience

4. I am employed by the Department of Conservation (DOC) as a Biodiversity Ranger in the Geraldine Office. I have worked for DOC since December 2021.
5. I have experience in monitoring long-tailed bats, including catching, handling, radio tracking and roost tree finding.
6. My qualifications are a Bachelor of Environmental Science, Auckland University of Technology, 2014.

Code of Conduct

7. Although this is a Council hearing, I have read the code of conduct for expert witnesses as contained in the Environment Court's Practice Note 2023 (the Code). I have complied with the Code when preparing my written statement of evidence.
8. The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for the opinions expressed are also set out in the evidence to follow.
9. Unless I state otherwise, this evidence is within my sphere of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.
10. For the avoidance of doubt, in providing this evidence as an expert witness in accordance with the Environment Court Code of Conduct, I acknowledge that I have an overriding duty to impartially assist the Panel on matters within my area of

expertise. The views expressed are my own expert opinion, and I do not speak on the D-G's behalf.

Scope

11. I have been asked to provide evidence in relation to the notified PTDP, the D-G's submission (submitter number 166), and the D-G's further submission, and further submissions lodged on the D-G's submission. This evidence specifically addresses effects of artificial lighting on long tailed bats / pekapeka.
12. My evidence addresses the following matters:
 - a. Effects on long-tailed bats from artificial light; and
 - b. Best practice for reducing effects on long-tailed bats when using artificial light in bat habitat areas.
13. I provided expert evidence in relation to long-tailed bats / pekapeka at Hearing D of the PTDP.¹ My evidence for Hearing D covered some general topics that are relevant to this hearing, including: long tailed bat threat classification (paragraph 14) and long tailed bat distribution in the Timaru District (paragraph 15 and Figures 1, 2 and 3). I have not repeated these paragraphs but for ease of reference I have attached my Hearing D evidence as Appendix 2.
14. I also provided evidence about effects of artificial light on bats (paragraphs 21 – 23). In my evidence below, I will provide some additional information about the effects of artificial lighting on bats that are relevant to this hearing.

Material Considered

15. In preparing my evidence I have read and relied upon the following documents:
 - (a) Proposed Timaru District Plan 2022
 - (b) The Section 32 Evaluation Report:
 - (i) Light dated May 2022.

¹ Evidence of Simon Waugh, Hearing D: Natural Environment, Hazards and Open Space Zone, Dated 28 October 2024.

- (c) The D-G's submission dated 15 December 2022 and further submissions dated 4th August 2023 and 18 March 2024.
- (d) The s42a Report:
 - (i) Light and Noise dated 24 March 2025.

Effects of artificial light on bats

16. Bats are nocturnal mammals that are active during darkness – i.e. in the period from dusk until dawn. Naturally, when they are active, bats are only exposed to low levels of light, including moonlight, starlight, and low light levels at twilight.² The levels of light that bats are exposed to from natural sources are lower than artificial light levels. This means that even at low levels of artificial lighting, bats can be negatively affected.³
17. Artificial light at night is increasing both in Aotearoa New Zealand and worldwide.⁴ Artificial light is known to affect bats world-wide: preferred flight paths and commuting routes have been severed; access to profitable foraging (feeding) areas cut; and the areas themselves reduced – all by the addition of light to a once dark place. Roosts (where bats shelter during the day) can be isolated from flight paths and foraging areas by light and their use can be reduced.⁵
18. Both of Aotearoa New Zealand's pekapeka – long-tailed bats and lesser short-tailed bats – are negatively affected by artificial light.⁶
19. Research into the effect of light on long-tailed bats in Hamilton found that as light levels increased, bat activity decreased.⁷ A PhD thesis from 2022 found that when lamps were introduced to forested bat habitat in the North Island, bat activity levels were measurably lower when the lamps were lit than when they were unlit.⁸ The same researcher established that reducing the amount of blue wavelength light reduces the effect of lighting on long-tailed bats. At sites that were illuminated by bulbs that had

² [WEB_EUROBATS_08_ENGL_NVK_19092018.pdf](#)

³ Long-tailed bats are detected less often on nights when moonlight intensity is high [Page-Corney, 2024](#)

⁴ [Cieraad and Farnworth, 2023](#)

⁵ See [WEB_EUROBATS_08_ENGL_NVK_19092018.pdf](#) for a summary

⁶ For a summary: [long-tailed bats, Cieraad and Farnworth, 2023](#); lesser short-tailed bats avoid light (DOC report: DOC-CM7406799)

⁷ Wildland Consultants 2018a: Baseline acoustic monitoring of long-tailed bats for the Southern Links roading project, Hamilton: 2017 and 2018. *Wildland Consultants Ltd Contract Report No. 4192d*. Prepared for Aecom, New Zealand. 37 pp.

⁸ Schamhart T, Tempero G, Browne C, Borkin K, Ling N, Pattemore D. 2022. Artificial light at night: does it affect long-tailed bat activity? [abstract]. In: NZ Ecological Society; 28 November – 2 December 2022, Dunedin, New Zealand.

blue wavelength light filtered out, bat activity was similar to sites which were unlit completely.⁹

20. Where there are more streetlights, long-tailed bats are less likely to be detected.¹⁰ By comparison, long-tailed bats are more likely to be detected using sites where lux is less than 0.5.¹¹ Long-tailed bats use lit sites less often than unlit sites and arrive at them later in the night.¹²
21. Light also affects winged insects, which are the food of long-tailed bats. Winged insects are often attracted to artificial light, which results in a vacuum effect of reduced prey densities in areas still dark enough for bats to forage.¹³

Best practice for reducing effects on long-tailed bats when using artificial light in bat habitat areas

22. Relevant international guidelines¹⁴ identify four key ways to reduce the effects of light on bats:
 - a) Avoid any lighting on key habitats (e.g. roosting areas and important foraging areas)
 - b) In supporting habitats, use the least amount of light possible (lowest possible illuminance or intensity) and implement sensitive lighting methods such as downward facing lights and dimmer switches and sensor lights.
 - c) If light is required, then using use light sources with low, no, or filtered UV and blue wavelength light i.e., with 2700K¹⁵ or warmer colour temperature.
 - d) Increase distances of lights from the areas bats use, including roosts and places used for breeding, foraging, and commuting.

⁹ Schamhart T, Tempero G, Browne C, Borkin K, Ling N, Pattermore D. 2022. Does white and blue wavelength filtered light influence the activity of rural long-tailed bats? [abstract]. In: NZ Ecological Society; 28 November – 2 December 2022, Dunedin, New Zealand.

¹⁰ [Dekrout, Clarkson and Parson 2014](#)

¹¹ Summarised in [Cieraad and Farnworth, 2023](#)

¹² [Schamhart et al 2023](#)

¹³ [Lighting - Threats to bats - Bat Conservation Trust](#)

¹⁴ [EUROBATS Publication Series No.8 – Guidelines for consideration of bats in lighting projects](#); [Guidance Note 8 Bats and Artificial Lighting | Institution of Lighting Professionals](#); [International Light Pollution Guidelines for Migratory Species](#); [National Light Pollution Guidelines for Wildlife Australia](#)

¹⁵ [International Light Pollution Guidelines for Migratory Species](#), pg 115; [EUROBATS Publication Series No.8 – Guidelines for consideration of bats in lighting projects](#), pg 39

Light colour temperature and Light Intensity (Lux Levels)

23. While I am not an expert in relation to light and lighting matters generally, I am familiar with the ways in which light can be measured, as relevant to effects on bats and measures to reduce effects on bats.
24. The research referred to above describes effects on bats by reference to both the colour or “colour temperature” and intensity of light. Kelvin is a unit of measurement for the colour temperature of light, with higher numbers indicating cooler, bluer light, and low numbers indicating warmer, yellower light. Daylight measures about 5000K on this scale. Lux is a measurement of illumination over a given surface area and takes into account the distance from a light source.
25. In terms of light colour/colour temperature, bats avoid blue wavelength light, which is similar to daylight. Warm wavelengths of light (yellow or amber in colour) have been shown to have less impact on bat behaviour.¹⁶
26. In terms of light intensity, long-tailed bats are detected less often on nights when moonlight intensity is high¹⁷. Based on current understanding of the effects of light intensity, we can infer that, to avoid adverse effects on bats, artificial light should not exceed average-intensity moonlight (0.1 lux).¹⁸

Shading

27. In addition to light intensity and colour, light spill can be controlled to reduce effects on bats by shielding light sources and angling lights straight down to direct light only

¹⁶ Voigt CC, Kingston T. 2015. Bats in the anthropocene: conservation of bats in a changing world. Berlin: Springer Nature

¹⁷ [Page-Corney, 2024](#)

¹⁸ [Kyba et al, 2017](#)

into areas where it is needed. Figure 1 illustrates how light spill can be controlled.

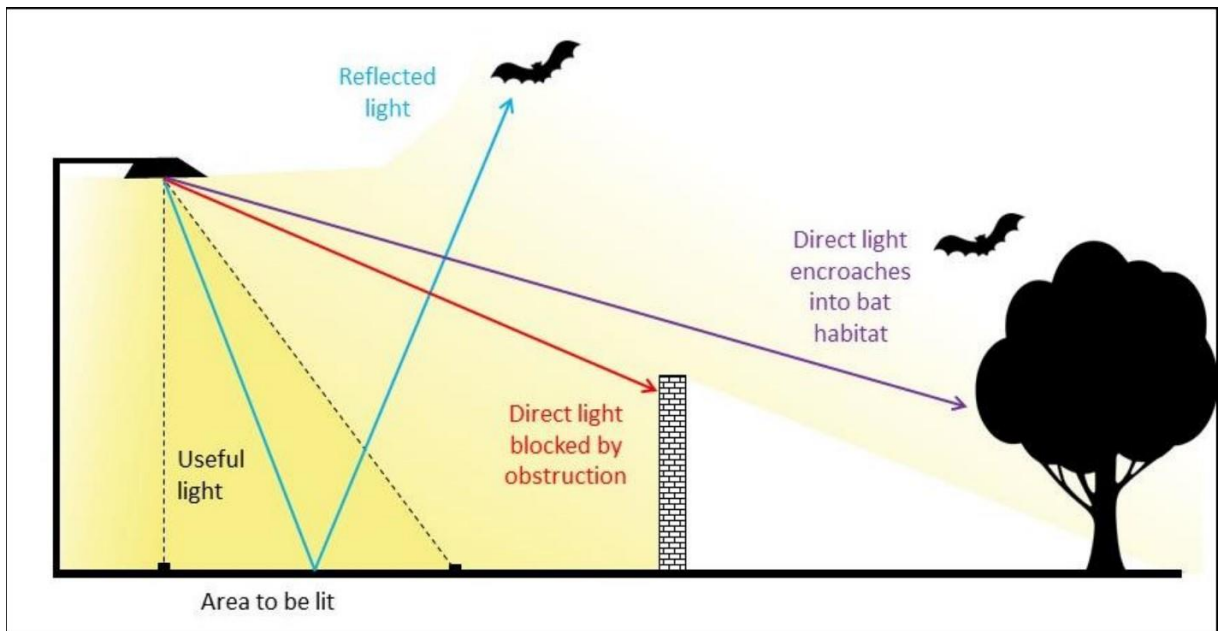


Figure 1

This diagram shows how light may encroach unintentionally into bat habitat, either through surface reflection or direct illumination projecting laterally from a light source. Appropriate shielding may be achieved by installing a deeper set light shade.

Section 42A report

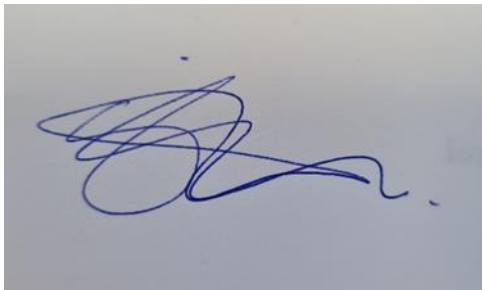
28. I understand that the author of the s42a report recommends that the Light Sensitive Areas (LSA) are disestablished but that specific lighting controls will apply in certain areas within the Bat Protection Area (BPA) instead.
29. In terms of the proposed lighting controls in the s42A report:
 - Controls of light shielding and colour corrected temperature (at 2700K) that would apply to the Rural Zone, Open Space and Recreation Zone within the BPA are likely to limit adverse effects on bats from artificial lighting within these areas. Ideally there would be an additional requirement for lights to point downwards.
 - I note that lux limits of 10 lux from 7am – 10pm and 5 lux from 10pm – 7am would apply in the General Rural Zone and there does not appear to be different limits set for the BPA. I have concerns about these lighting levels applying within the BPA for two reasons:
 - (1) As set out above, research demonstrates that bats avoid higher intensity light levels. The proposed lux levels that would apply to the zones within the BPA are higher than the levels at which

research demonstrates an adverse effect on bats. I understand the stated lux levels would apply as measured at a property boundary, meaning that even higher light levels could be used within the site (and therefore within the BPA).

- (2) Bats are active between dusk and dawn. Therefore the timeframes proposed (noting that the lower light level will apply from 10pm) do not correlate with bat activity periods. Controls that applied a lower lighting intensity from dusk until dawn would be more effective for reducing effects on bats.

Conclusion

29. The long-tailed bat population in the Timaru District is vulnerable to habitat and behavioural changes brought about by the introduction of artificial light. Imposing lighting controls in the Bat Protection Area will help manage the adverse effects on bats.



Simon Waugh

DATED 9 April 2025

Appendix 1: References

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International guidelines (footnote 14)

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National Light Pollution Guidelines for Wildlife 2023. Department of Climate Change, Energy, the Environment and Water. Australian Government (Pages 86-100 specific for bats)