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Introduction

Bat research in Australasia – in memory of Les Hall

Brad Law [A,D], *Justin Welbergen* [B] *and Paul Cooper* [C]

[A]Forest Science Unit, New South Wales Department of Primary Industries, Locked Bag 5022, Parramatta, NSW 2124, Australia.
[B]The Hawkesbury Institute for the Environment, Western Sydney University, Richmond, NSW 2753, Australia.
[C]School of Botany and Zoology, Australian National University, Canberra, ACT 0200, Australia.
[D]Corresponding author. Email: brad.law@dpi.nsw.gov.au

This Special Issue of the *Australian Journal of Zoology* is in honour of Dr Leslie Hall who passed away early in 2019. Les was a true-blue legend and his legacy of pioneering research on Australasian bats did much to increase our understanding of the biology of these fascinating native mammals. He was also a passionate campaigner for bat conservation and an inspirational mentor to so many of us around Australasia who followed in his path. Les' interests included all bats: flying foxes, blossom bats and the smaller echolocating species. He was equally at home exploring the depths of caves with a hand net or tropical forests with bat detectors and traps. He was instrumental in ensuring that bat studies became an important component of biological science in Australasia, and helped advertise the work that was occurring in this region to scientists around the world.

Four aspects of bat biology are dealt with in this first part of a two-issue speciality topic in the *Australian Journal of Zoology* on bats in Australasia: environment, roosting, energetics and thermoregulation, and viral ecology.

General habitat and environment and their influence on bats in northern Australia are examined by McKenzie *et al*. (2019) and Broken-Brow *et al*. (2019). The first paper indicates that in north-western Australia, bats tend to either be associated with mangrove forests or with more landward-based locations. However, only a few species specialise in these two locations, with overlapping use by most species. The paper on how fire affects bat activity (Broken-Brow *et al*. 2019) is concerned with how recent changes in fire intensity on Cape York may affect bat habitat use, and whether closed-guild, edge-open guild and open-guild bats differed in their responses. The responses of the various guilds differed and the authors suggest that the varying responses may indicate that their results could support the 'pyrodiversity begets biodiversity' hypothesis.

The next set of papers investigate roosting aspects of bat behaviour. The first paper (Godinho *et al*. 2019) examines how bat boxes were used by Gould's wattled bat (*Chalinolobus gouldii*) in human-disturbed landscapes near Melbourne, Victoria. The bats were not very specific in their choice of box design, but a variety of other attributes may play a role that requires further research. Trawling bats (*Myotis macropus*) have been able to co-exist with humans by using high culverts, especially those with lift crevices, as shown by the study of Gorecki *et al*. (2019) in the Brisbane area. They suggest that increasing the numbers of high culverts with crevices could improve the roosting habitat for these riparian-associated bats. Taking advantage of chocolate wattle bats (*Chalinolobus morio*) roosting in buildings, Thomson (2019) describes the behaviour of the bats at their roosts. A notable social activity of the bats was male allogrooming, and the way that this roosting permitted bats from several different summer groups coming together in one location. In the paper by Williams (2019), the use of mine adits by three species of bats (*Chalinolobus dwyeri*, *Miniopterus orianae oceanensis* and *Rhinolophus megaphyllus*) in the western Blue Mountains of New South Wales was documented using ultrasonic recorders, thermal cameras and visual counts of emerging bats. The study suggests this location may constitute a previously unknown small maternity roost for the threatened *M.o. oceanensis*. Ghost bats (*Macroderma gigas*) were shown to use vocal signals (chirp-trill, squabble and ultrasonic social calls) throughout the year, month and day, with notable activity both in the middle of the night and during diurnal periods (Hanrahan *et al*. 2019). The use of recordings that do not disturb bat activity are shown to be very useful in understanding the social activity of these bats in their roosts.

The third group of papers in this issue deal with a variety of thermoregulation and/or energetics of bats. Geiser *et al*. (2019) review the importance of hibernation and daily torpor that bats in Australia and New Zealand use for surviving varying conditions of temperature, rain and food availability. Walker *et al*. (2019) report that following a meal, Gould's wattled bats had a significant increase in metabolic rate, but that meal size (10–20% of fasting mass) had only a slight effect on the increase, suggesting that meal size is not a limitation on these bats to process their food and therefore they are not limited in taking larger meals. The authors suggest that these bats may be limited by food availability and not food processing in their environments. Turbill *et al*. (2019) used temperature-sensitive radio-transmitters to study the importance of roosting habitats of pregnant and lactating females of two *Nyctophilus* species. Their work supports the importance of tree cavities allowing group roosting to limit torpor in these females to ensure that young grow and develop as quickly as possible.

The last paper in this issue by Peel *et al*. (2019) gives an overview of the limited previous work done on coronaviruses in bats of Australia. The authors suggest that further work is necessary to understand how changing environments may lead to transmission of viruses from bats to humans, but also caution that, conversely, increased contact can lead to human-to-bat transmission as well.

Conflicts of interest

The authors declare no conflicts of interest.

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