Lead exposure in an urban population of free-ranging kaka (*Nestor meridionalis septentrionalis*)

A thesis presented in partial fulfilment of the requirements for the degree of

Master of Veterinary Science

in

Wildlife Health

at Massey University, Palmerston North, Manawatu, New Zealand.

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2017
Abstract

Anthropogenic lead use has resulted in widespread environmental lead contamination known to affect wildlife populations worldwide. Lead is a highly toxic, non-essential heavy metal recognised as a cause of morbidity and mortality in birds. Ecotoxicological investigations in wild birds have thus far prioritised waterfowl and raptor species and primarily addressed contamination in natural ecosystems. Urban areas are increasingly associated with high levels of heavy metal contamination, however the risk of lead exposure in urban wildlife is less well known.

This study aimed to identify the significance of lead exposure in a well-established urban population of kaka (*Nestor meridionalis septentrionalis*). Blood lead concentrations were assessed in adult and nestling birds to quantify exposure prevalence and magnitude. The impact of lead exposure on physiological and neurological function was assessed using behavioural and physiological parameters. Finally, lead stable isotope analysis was employed to identify the primary sources of lead in the urban environment.

Lead exposure is prevalent in this kaka population, with 43.2% of adults and 36.7% of nestlings with detectable blood lead concentrations. Blood lead concentrations in nestlings ranged from <3.3 to 42.9ug/dL, with no detectable neurological or physiological deficits. The pattern of exposure in chicks is suggestive of parental feeding of lead, however detection of lead in some eggshells suggests that maternal transfer is another route of exposure in this species. Blood lead concentrations in adult birds ranged between 3.4 to 50.7ug/dL. Although no acute clinical signs of toxicity were observed, lead exposure was associated with reduced body condition in adults. Behavioural changes were present in one individual with the highest recorded blood lead concentration. Lead isotope ratios in kaka blood samples overlap with isotope values of roof-collected rainwater, suggesting this to be an important source of exposure in this population.

The prevalence of lead exposure observed in this study suggests that lead is a threat to kaka interacting with urban areas. Wildlife intoxications largely result from anthropogenic lead sources and this study identifies a previously undescribed urban source of lead in wildlife. The well-described subclinical and persistent effects of lead highlight the need for abatement strategies to reduce lead exposure and its effects in this population.
Acknowledgements

Completing a research project during a demanding clinical residency requires a team effort, and I have many people to thank for helping me see out this project. Firstly I would like to thank my two supervisors, Brett Gartrell and Wendi Roe, for their patience, unwavering support and guidance through the last three years. Thank you for being approachable, for tolerating my insecurities and for your optimism at times when it really counted. It would have been a tough innings without your support and friendship.

This project would not have been possible without the help and support of the staff and volunteers at Zealandia Ecosanctuary, in particular, Raewyn Empson and Matu Booth. Thank you for your help and input in designing and setting up this project. Thank you for sharing your wisdom and knowledge on all things kaka. Matu, thank you for the many hours you contributed to help with fieldwork and for your extraordinary kaka capturing skills. Thanks must also go to Judi and Linton Miller, for their enthusiasm, knowledge and exceptional organisational skills. Thank you for repeatedly rescuing me when I found myself wandering aimlessly trying to locate nest boxes!

Many thanks to all the volunteers who helped with fieldwork and contributed their weekends or days off to help with this project. Sarah Van Herpt, I must thank you especially for spending many weekends walking tracks, finding nest boxes and wrangling kaka.

I was fortunate to have the help of Dr Nick Kim and Dr Carol Stewart from Massey University, Wellington, at a crucial point during my research. Thank you both for reaching out and sharing your knowledge and expertise. Your assistance was timely, extremely useful and helped to broaden the scope of this project.

Thank you to my friends and colleagues for your moral support and for making the last three years truly memorable. The trials and tribulations of a residency are much easier to cope with when you have a good bunch of co-residents and top-notch colleagues! Stuart Hunter, you are an excellent teacher and a better than average friend, thank you for the banter, laughs and the encouragement. Thank you Zoe Grange
for setting the scene, always saying yes and making the most of every moment. Gillian
Dennis, your comforting words and logic were always what I needed, thank you for
listening and for your support. Carina Svensson, thank you for your kindness and
friendship, I will treasure it always. Thank you Sarah Michael for the coffees, for your
willingness to help with all thesis related things and for the many educational feline
documentaries.

Thank you to my family for your support throughout this project. It was a sprint to the
end, and the many coffees, teas and words of encouragement helped get me to the
finish line. And finally, thank you to Dirk Steenbergen, for your patience, relentless
optimism and unwavering faith in my capabilities. You inspire me always and I can’t
thank you enough for your love and support through the last 3 years.

Funding for this project was provided in part by the Institute of veterinary, animal and
biomedical sciences (IVABS) postgraduate fund, the IVABS Avian health fund, the
Karori Sanctuary Trust, the New Zealand Department of Conservation (DOC) and the
New Zealand Veterinary Association (Marion Cunningham Memorial Fund). All work
was carried out with permission from the New Zealand DOC and approved by the
Massey University Animal Ethics Committee (MUAEC 14/76).
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