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NCCARF

NCCARF Report

RE: PhD Short Collaborative Visit Funding from

I received funding support from the NCCARF to visit Professor Warren Porter (University of Wisconsin, USA) and Professor Bas Kooijman (Vrije Universiteit, Amsterdam). The work completed while visiting these two professors marks an important step towards the completion of both the NicheMapper™ and Dynamic Energy Budget models for kangaroos (and therefore for other mammals). I am incredibly grateful for the funding I received from this award which made such an invaluable opportunity and incredible progress with my work possible.

The visit with Professor Warren Porter focused on refining the NicheMapper ™ so that it better incorporated solar radiation when calculating the energy and water balance of an endotherm. This mechanistic model, which calculates heat and water balance using biophysics, has recently been applied to nocturnal endothermic species, but it has required some refining before applying it for crepuscular and diurnal species. Specifically, we were working to determine how solar radiation affects the temperature profile through fur, thus affecting skin temperature and heat loss through the body. We made incredible progress while I was in Madison, Wisconsin, both in deriving and implementing the equations into the NicheMapper code.

The visit with Professor Bas Kooijman focused on implementing a Dynamic Energy Budget model for kangaroo species. We were collaborating to incorporate costs of pregnancy and lactation into the standard model, thus applying this general metabolic theory for mammals. During my visit, we determined the most appropriate way to adjust the structure of the standard model to incorporate such reproductive costs. We also estimated the parameters for the eastern grey kangaroo (*Macropus giganteus*), which is one of the most difficult stages for implementing the model for a new species. The generality of this metabolic theory means that once parameters have been identified for a species, we can predict its growth, reproductive output, energy and water demands, time to starvation, and other such traits in populations across a wide range of environmental gradients.

The development and implementation of these two models will result in useful and robust predictions for kangaroo populations, based on mechanisms and linked with nutritional and climatic variability. Such predictions are of interest to land managers (including those in commercial harvesting regions of New South Wales). In doing this research, I am also testing the potential for such models to be used for other endothermic species. Indeed, these models may be applied for endangered or less-well studied species which may already be suffering from and/or buffering impacts of climate change by altering their behavior. The work from these collaborative visits has been instrumental in progressing towards the completion of these two models, which together will be used to generate useful predictions of kangaroo abundance, providing important groundwork for future management-driven studies.