Corella, 2022, 46: 94-96

Progress Report for 2022 FAR Grant

Evolutionary drivers and thermal consequences of nest architecture in birds

Silvia Colombo

University of Melbourne
Email: scolombo@student.unimelb.edu.au

INTRODUCTION

Nests evolved in birds because they create a suitable environment in which to lay eggs and raise nestlings. Building an appropriate nest structure that can protect nest contents from environmental conditions, including harsh ambient temperatures, is a fundamental behaviour that increases offspring survival. To date, the evolution of nest types has been the subject of very few studies; the selection pressures underlying the evolution of nest architecture, as well as the variables driving the transition from domed to open nests, are not well understood. In this project, we aim to investigate whether nests with a roof (domed nests, Fig. 1) provide different thermal environments to open nests (Fig. 2) and have specific traits that make them better suited to extremely cold or hot, arid environments. The project is designed to increase our understanding of how nest architecture can protect eggs and nestlings under a future scenario of harsh temperatures caused by contemporary climate change.

We collected and are currently collecting data on the thermal environment of open and domed nests in the field in order to better understand if and how the two nest microclimates respond differently to the same ambient temperature and environmental conditions.

Figure 1. *Superb Fairy-wren nest. Photographed in Campbell Park, Canberra.* Photo: Jessica McLachlan

Figure 2. *Willie wagtail nest with nestlings, photographed in Campbell Park, Canberra.* Photo: Jessica McLachlan

Figure 3. *Open nest with copper eggs.* Photo: Helberth Peixoto

METHODS

In September 2022 at the beginning of the breeding season, we started collecting data on nest microenvironment in domed and open nests in Campbell Park, Canberra. We are including all the open and domed nests available of the following passerine species: Weebill *Smicrornis brevirostris*, Grey Fantail

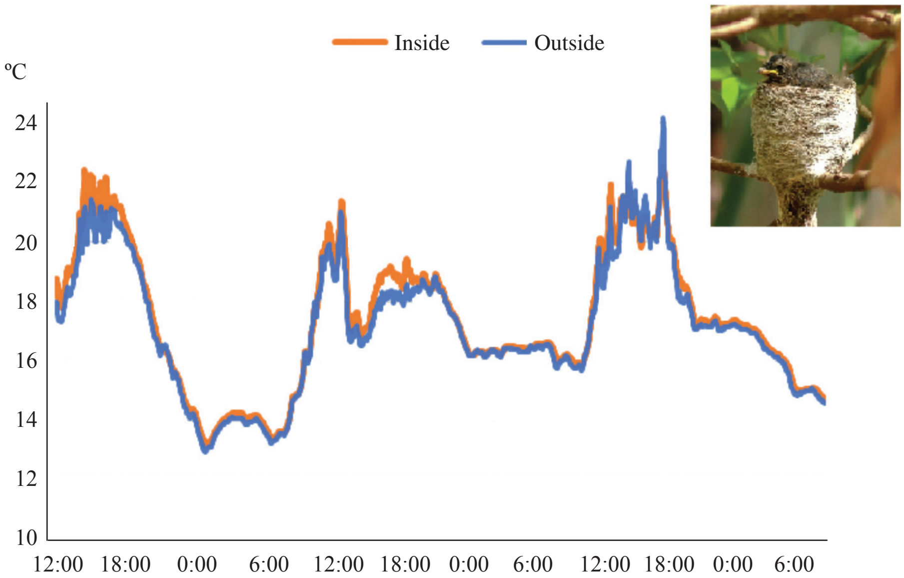

Figure 4. *Recorded temperature inside (orange line) and outside (blue line) a Grey Fantail nest (open nest)*

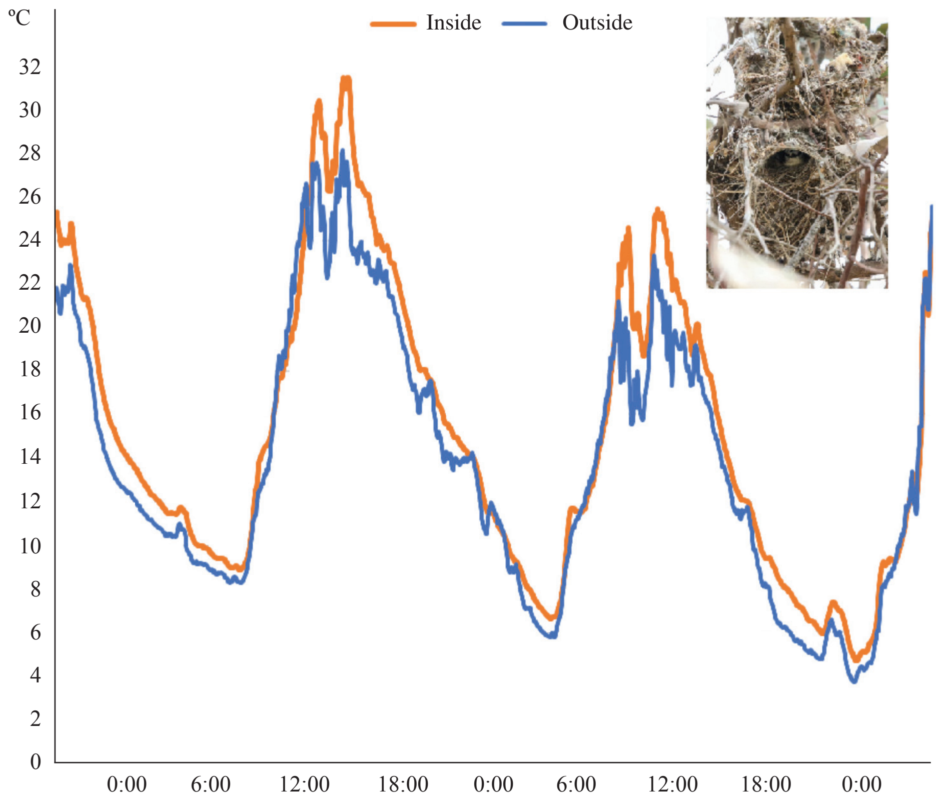

Figure 5. *Recorded temperature inside (orange line) and outside (blue line) a Yellow-rumped Thornbill nest (domed nest).*

Rhipidura albiscapa, Willie Wagtail *Rhipidura leucophrys*, Yellow-rumped Thornbill *Acanthiza chrysorrhoa* and Superb Fairy-wren *Malurus cyaneus*.

To record temperature, we are using data loggers (iButtons, Thermochron, Castle Hill, NSW, Australia), which we place inside customized white, copper eggs to collect data inside and outside nests (Fig. 3). Once nestlings have fledged and the nest is empty, we place one egg inside the nest and one egg outside in the immediately adjacent microenvironment to obtain precise measures of temperatures. We record temperature every 2 minutes for at least 48 consecutive hours. Immediately after the iButton recording we collect the nests. In the laboratory, at the end of the fieldwork season, we will measure several nest traits, such as cup depth, wall thickness, entrance diameter, nest diameter and floor thickness. Using the temperature data and the nest measurements, we will examine the relationship between the thermal properties of nests and their general structure. We will then test whether specific traits (e.g. larger entrances, thicker-walled nests) are linked with better insulation properties and relatively cooler nest temperatures on hot days. We are also collecting information on the type of vegetation surrounding the nest and light levels inside and outside the nest (using a light meter).

Lastly, we are collaborating with Dr. Brendan Lepschi, Curator of the Australian National Herbarium in Canberra, to study which plants Superb Fairy-wrens use to build their nests. During last year's field season, my supervisors observed that the amount of plant material and the number of plant species used vary widely among nests of this species. Surprisingly also, artificial materials, such as plastics, are sometimes added to the nest. After identifying the plant fragments used by the birds to build the nests, we will search for the plants in the nest surroundings and collect one fertile specimen per species. Specimens will be pressed and dried at the Centre for Australian National Biodiversity Research. After data analysis, we will donate all specimens to the Australian National Herbarium in Canberra.

RESULTS

During this year's field season, we will complete the data collection that we started during the 2021 breeding season (from September 2021 to February 2022). Last year, we collected temperature data from 10 Grey Fantail nests, 9 Willie Wagtail nests, 7 Weebill nests, 8 Yellow-rumped Thornbill nests and more than 60 Fairy-wren nests. All nests were collected and several nest traits (as mentioned above) have been measured in all specimens in the laboratory.

This year's field season will conclude in February 2023. A large number of nests of the same species is critical for our project, as we are interested in delving into intra-specific variation in nest physical structure and how specific nest traits influence the nest microclimate.

An example of the preliminary results we extrapolated from last year's data collection is depicted in Fig. 4 (open nest) and Fig. 5 (domed nest). Temperature inside open nests is similar to ambient temperature, and changes in ambient temperature are immediately observed inside the nest. Conversely, domed nests provide better insulation and retain heat inside the nest for a longer period. Temperature inside domed nests decreases more gradually than in open nests, and hence cooling rates of nest contents will be slower. Lastly, the microclimate inside domed nests is less affected by abrupt changes in ambient temperature.

The ABSA FAR grant enabled us to procure all the necessary equipment for this year's field season. We also aim to engage the public in order to encourage the conservation of Australian native birds; we will continue collecting videos and photographs of birds building nests and incubating, which we can use to stimulate interest in Australian birds. The supervisors of my PhD project are Dr. Iliana Medina Guzmán, University of Melbourne, Professor Naomi Langmore, Australian National University and Dr. Claire Taylor, University of Melbourne.