The triumphs, challenges and failures of young North Island brown kiwi (*Apteryx mantelli*): a study of behaviour, growth, dispersal and mortality

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Alexandra Louise Wilson

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Abstract

North Island brown kiwi (NIBK, *Apteryx mantelli*), an endemic New Zealand species, are estimated to have declined by 90% from pre-human colonisation numbers. Currently, at least 60% of mortality is attributed to introduced mammalian predators, namely stoats (*Mustela erminea*) preying on chicks. Therefore, conservation effort focuses on predator trapping/killing, and hatching and rearing NIBK chicks in captivity and releasing them back into the wild. These efforts are resulting in increased recruitment of chicks into populations. However, little is known about the biology and behaviour of NIBK chicks in the wild and how this may affect management of these populations. Consequently, the aim of this study was to examine the ecology of young wild NIBK in a natural high density population with reduced predator diversity on Ponui Island. More specifically, the goal was to determine their growth rates, behaviour around the natal nest, dispersal and mortality, and how these factors may be influenced by environmental variables. During the 2010 - 2011 and 2011 - 2012 breeding seasons 29 young NIBK were observed from hatching until mortality or the end of 2012. Remote video cameras were set up outside nests to record behaviour. Juveniles were located daily as often as possible and location, habitat type, roost type and visibility were recorded. Growth measurements of weight, bill and tarsus lengths were taken monthly in the first season and weekly in the second. Invertebrate abundance and availability were also measured using pitfall traps and soil penetrability. Lastly, young NIBK found dead were preserved in formalin and sent for autopsy to accurately determine the cause of death.

NIBK on Ponui Island were found to grow slower K_g = 0.0052 than a NIBK population measured previously at Lake Waikaremoana (K_g = 0.006) and 296 other bird species measured to date using the Gompertz growth curve. Females grew faster than males for the first 90 days after hatching. Sample size was too small to do further comparisons after this age. The rate of growth for body mass increased with age whereas the rate of growth for bill length and tarsus length decreased with increasing age, until at least 90 days of age. On a monthly scale, with increasing temperature food abundance significantly increased and soil penetrability declined; on a weekly scale temperature significantly affected growth rates with NIBK growing fastest between 19 - 22°C. I hypothesised that this was because with

increasing temperature, food abundance increased, until a point where the soil became too hard for NIBK to probe for food resulting in the optimum growth rate between 19 - 22°C.

In 161 nights of nest observation I observed seven interactions between a chick and the adults at the nest. These observations are interesting because NIBK were not previously known to interact with their young outside the nest. The behaviours are ambiguous and therefore I was unable to be sure of the context. Juveniles changed roost location most days and the movements between roost sites of individuals were highly variable. Daily dispersal distance was significantly affected by temperature and season, juveniles moved further in the warmer seasons and there was a positive relationship between dispersal distance and temperatures.

Lastly, the mortality rate of NIBK in this population was high at 87.5% with most young NIBK dying from natural causes such as starvation and disease before 90 days of age. Cat predation was found to be higher at 30% relative to mainland populations where cat predation contributes to 5 - 9% of mortalities.

This study highlights that population density, temperature, food availability and causes of mortality other than predation are important factors to consider when researching, conserving and translocating NIBK.

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