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Habitat loss, nutritional stress, and the decline of the Australasian bittern in New Zealand

Summary Report – 30 April 2024

The Matuku-hūrepo or Australasian bittern (*Botaurus poiciloptilus*) is a native New Zealand species which has undergone dramatic population declines, the cause of which is not fully understood. One theory is that prey has become less available to bittern due to the depletion and destruction of their wetland habitats. My research investigates whether the levels of nutritional stress in bittern have changed over time by using ptilochronology (the study of changes in growth bars in feathers) and stable isotope analysis (the study in changes of carbon and nitrogen isotopes related to diet). My aim is to compare historical (sourced from museum skins) and contemporary (sourced from live or recently deceased bittern) feather samples to understand whether the quality of remaining wetlands may be affecting the availability of prey for bittern. I am also directly assessing changes in vegetation coverage, land usage and water quality in wetlands across the New Zealand range of bitterns. Together, these studies will allow me to understand whether bitterns have undergone changes in their levels of nutritional stress over the past century and whether changes in wetland quality may be correlated to these changes.

Over the duration of the Marj Davis Scholarship (2023/2024), I obtained breast feathers from a total of 84 bitterns, ranging from samples collected in Auckland/Northland (n=13), Bay of Plenty (n=21), Canterbury/Marlborough (n=16), Waikato (n=25), and West Coast (n=9) regions to perform ptilochronology and stable isotope analysis. The Auckland and Northland birds and the Canterbury and Marlborough birds were combined as previous research have suggested bitterns within these areas form a single population. Feathers samples ranged in dates from 1886 to 2023, thus providing me with a unique opportunity to assess any changes in bittern diet and nutritional stress over this time period. Using ptilochronology, I found that the distances between growth bars have become more variable over time, suggesting that contemporary bitterns are experiencing more inconsistent diets compared to their historical counterparts. Similarly, stable isotope analysis identified differences in nitrogen levels between bittern populations across the various regions. Most notably, Auckland/Northland, Bay of Plenty, Canterbury/Marlborough, and Waikato regions exhibited high levels of variability in nitrogen, whereas the West Coast region had little variability in nitrogen. There are a number of factors that can affect nitrogen values. For example, these differences could be due to regional differences in diet, levels of starvation, or levels of nitrogen pollution from agriculture. To understand the influence of environmental baselines of nitrogen on the bittern stable isotope results I am currently awaiting on results from compound specific isotope analysis (CSIA) of nitrogen amino acids. This will allow me to pinpoint the exact cause of the differing isotope levels across the different populations.

I still have another year left in my PhD and I will be using this time to finish field sampling of wetlands throughout the Canterbury region. With the use of the current and two previously published New Zealand Bird Atlases, and DOC observational records, I have now identified a series of sites in which bittern are no longer present or have not been sighted within the last 10 years, but which were known to be previously present. as well as sites in which bittern continue to inhabit. Alongside evaluating the quality of water in these sites, I am using a mix of aerial photography and satellite imagery and on site ground truthing to compare changes in vegetation coverage and composition over time, focusing on key plants species which bitterns use for nesting such as raupō (*Typha orientalis*). Any differences I find in water quality and habitat structure between sites that still support bittern and those from which they have been lost will help identify the causes of bittern decline in New Zealand and what we may need to do in terms of habitat restoration to reverse this trend.

I thank the Marj Davis Scholarship for their generous support of my project over the last year. This support has been greatly appreciated and allowed me to focus on my project and to provide some of the evidence we will need to conserve this endangered species.

