

SUMMARY ARTICLE BirdsNZ Research Grant

Are tītī undertaking a range retraction within New Zealand?

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Marine heatwaves and climate change are having recognisable impacts on seabirds both here in New Zealand and on a global scale. Even with predator control, bird survey data shows tītī/sooty shearwater (*Puffinus griseus*) numbers to be in decline at the northern boundaries of their distribution suggesting a range retraction to the south. This species is highly sensitive to temperature increases and anecdotal evidence suggests that warming seas throughout the waters of New Zealand (and beyond) may be driving this observed pattern of decline locally. Furthermore, at their northern colonies (Auckland) tītī appear to be getting slowly replaced by the more temperate Flesh-footed shearwaters (*Puffinus carneipes*). In a pilot study, we compared physiological stress of tītī adults and chicks from northern, central, and southern New Zealand to see if we could detect the effects of elevated water temperatures on these birds during the 2019/20, 2020/21 and 2021 and 22 breeding seasons. Our study had two aims.

Aim 1: Compare stress levels of tītī across their range.

Weights and feather samples of chicks were taken at four sites across New Zealand during 2022 i.e., Kauwahaia Island (Auckland), Mana Island, (Wellington), Sandfly Bay, (Otago) and Seal Bay (Southland). We found that weights of tītī chicks at Kauwahaia Island was 25% lower than other sites suggesting that decline in numbers of this species may be brought about by decreased provisioning and nutritional stress (lower food). Interestingly, this difference in weights was not reflected in feather corticosterone levels, which may reflect differences in timing of when feathers are grown among sites. This is being investigated further.

Aim 2: Compare stress levels of tītī adults with sympatric flesh-footed shearwaters, a warm water species, breeding at the same site.

Tītī adults had higher haemoglobin levels than Flesh footed shearwaters revealing a greater capacity for oxygen delivery, likely reflecting the differences in foraging dive depth between species. Stress biomarkers (red blood cell volume, mean corpuscular haemoglobin) within whole blood of adults of both species are correlated to weight fluctuations i.e. seasons where birds weigh less (2022) and thus produce more red blood cells and increase haemoglobin content within them. Whether this fascinating result is an adaptive weight loss response by birds to decrease flight costs during tough foraging conditions now needs to be ascertained.

Lastly, there was a reduction in average adult weight of both species across the study i.e. 2020, 2021, 2022 breeding seasons resulting increased blood stress biomarkers. Such losses in weight also correlate with a warming of nearshore waters of west coast of North Island during the months of December/January i.e. mean SST = 19.1 °C (2020), 20.7 °C (2022). Such a finding indicates that the physiology of these two procellariiformes are responding to increased sea surface temperatures, even in a species we thought was more 'warm adapted'. Key now is identifying tipping points where the birds can no longer successfully raise chicks. Time is of the essence as marine heatwaves are increasingly common, thus the findings in this study are worrying and need to be expanded to include other species.