



RESEARCH

An ecological survey of Kuranui (Penguin Island) and Waikaia (Rabbit Island), western Bay of Plenty

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Published online: 28 February 2025

Abstract: Kuranui and Waikaia are iwi-owned islands in the Slipper group off the east coast of the Coromandel peninsula that have not been surveyed for 50 years. We visited both islands for one day and night each in April 2024 and undertook rodent trapping and species surveys of birds, reptiles, and vascular plants. The islands have changed little in 50 years. The avifauna remains similar and shared between both islands while the vegetation has continued to recover on a successional trajectory to a native state following burning. Some new weed species have colonised both islands. Kiore are the sole introduced mammal species on both islands and are abundant, though smaller than elsewhere in New Zealand. Ōi (grey-faced petrel) are abundant on both islands, with a historical estimate on Kuranui from the early 2000s of 5500 burrows. Due to their general inaccessibility the islands have retained their natural character from the lack of human disturbance.

Keywords: bird, coastal forest, island, kiore, Pacific rat, *Rattus*, reptile, seabird

Introduction

New Zealand has 345 offshore islands larger than five hectares and they have been a major focus for conservation and restoration (Towns et al. 1990). Islands are often only subjected to a subset of ecological threats, and management of those threats alongside restorative actions has helped conserve important elements of New Zealand's flora and fauna (Bellingham et al. 2010). However, only a fraction of New Zealand's offshore islands have received substantive attention. Many islands, particularly those outside the government conservation estate, have unrealised conservation potential. In working towards a Predator Free New Zealand, islands outside the government conservation estate are a natural priority with regards to adding predator-free land area, and there is an urgency to eradicate predators from offshore islands on which they remain (Carter et al. 2021). Alongside predator management, it is important to assess other threats to islands such as weed invasion and habitat recovery (Towns et al. 1990). Unfortunately, long-term monitoring data are absent from many islands making it difficult to assess change over time.

Many islands off the Coromandel peninsula are vested in iwi ownership and are irregularly visited (Esler 1978). Contemporary surveys of these islands would better guide their conservation management. Located off the eastern coast of the Coromandel peninsula, Kuranui and Waikaia are part of the Slipper Island (Whakahau) group, and the ownership of both has

always been retained by Ngāti Hei. Although Whakahau is in private ownership and has been heavily modified and managed as farmland on its accessible slopes (Russell & Russell 2018), nearby Kuranui and Waikaia were only burnt in the distant past and have since regenerated to native-dominated vegetation. The Slipper Island group was last systematically surveyed in August 1973 by the Auckland University Field Club (Hayward & Moore 1974). Their team of 25 members surveyed most aspects of the biota. From 2000 to 2010, ōi | grey-faced petrel (*Pterodroma gouldi*) monitoring also took place on Kuranui (Wills 2010), from 2003 using 45 systematically located 10 × 10 metre quadrats. In December 2016 the terrestrial fauna of Whakahau was re-surveyed (Russell & Russell 2018) with additional study of the resident kiore (*Rattus exulans*) population in March 2017 (Ricardo et al. 2020). The 45-year vegetation change on a rock stack near Whakahau has also been documented (Clarkson et al. 2014). However, repeat surveys of Kuranui and Waikaia have not been undertaken.

We visited Kuranui and Waikaia to document the extant terrestrial fauna and flora and document any change in the 50 years since the last systematic survey of both islands. We focused on documenting which invasive rodents were currently present in order to inform eradication planning across the Whakahau group. We also documented the flora in order to understand how forest regeneration and weed invasion trajectories have changed over the past 50 years.

Methods

Kuranui (Penguin Island; 37.065°S, 175.932°E) lies 3.3 kilometres east off the coast of Coromandel and 500 metres south-west of Whakahau (Slipper Island). Waikaia (Rabbit Island; 37.071°S, 175.927°E) lies 2.9 kilometres east off the coast of Coromandel and 400 metres south-west of Kuranui (Fig. 1). Both islands are about nine hectares, forested, and generally surrounded by cliffs, rocky boulders, and gravel beaches. On the south of Kuranui is a boulder beach which provides a reasonable landing. Kiore (*Rattus exulans*) have previously been recorded on both islands, and rabbits (*Oryctolagus cuniculus*) were still present on Kuranui in 1973 (Hayward & Moore 1974), although since 2000 they have not been recorded (Wills 2010).

We spent one day and night on each island: 25 April 2024 on Waikaia and 26 April 2024 on Kuranui. On each island we set a single line of 30 paired rat and mouse snap traps (Victor) under a single corflute cover at 20 metre spacing along the longest axis of the island. Five additional rat snap traps were set around each camp site. All bird species seen and heard were recorded (Appendix S1 in Supplementary Material). During the day each island was searched around the coastal margins, steep cliffs, and across the tops to identify vascular plant species (Appendix S2). Low incidence invasive exotic shrub and tree species were controlled via cut and paste when located. In the evening *ōi* were captured and banded. During both day and night additional searches for reptiles and invertebrates of note were made.



Figure 1. Kuranui and Waikaia with rat trapping lines indicated (dark red lines). Inset map shows location of Slipper group in New Zealand (black arrow).

Results

Both islands have changed little since the last survey 50 years earlier. Kiore are now the only introduced mammals present on both islands. Kiore were occasionally observed during daylight hours and then regularly throughout the evening. On Kuranui we caught eight kiore and on Waikaia we caught 23 kiore (Table 1). Eight native or endemic forest birds and four introduced land birds were recorded across both islands (Appendix S1). Notably, ruru (*Ninox novaeseelandiae*) were not recorded on either island. Seven seabird species were observed around the islands. Large seabird burrows suitable for *ōi* and kororā (*Eudyptula minor*) are abundant across most land area of both islands, and in some locations are so densely placed that they must be avoided. A single large, shed gecko skin was observed in a pōhutukawa (*Metrosideros excelsa*) tree crevice on Waikaia. This was probably from a Duvaucel's gecko (*Hoplodactylus duvaucelii*), as it is the only gecko species recorded in the past on this island (Towns 1974). Shore skink (*Oligosoma smithi*) were noted on the rocky beach of Kuranui. Kekenō | New Zealand fur seals (*Arctocephalus forsteri*) were observed hauling out on the coast around Kuranui and Waikaia.

Pōhutukawa dominates the canopy of the forests on both islands. The subcanopy and understorey on each island were variously dominated by a range of broadleaved species with many common to both islands (Appendix S2); these included coastal māhoe (*Melicactus novae-zelandiae* subsp. *novae-zelandiae*), māhoe (*Melicactus ramiflorus* subsp. *ramiflorus*), and kawakawa (*Piper excelsum* subsp. *excelsum*). Although the rabbits formerly recorded on Kuranui were not noted during this visit and appear to have died out by the end of the 20th century, the grasslands they maintained are still evident. However, shrubs are now regenerating through these grasslands in parts. On Waikaia the forest in the southern third of the island has abundant kohekohe (*Didymocheton spectabilis*), flowering profusely during our visit, in all tiers of the forest. Other shrub and tree species that were noted on Waikaia but not Kuranui included whārangi (*Melicope ternata*), tawāpou (*Planchonella costata*), karaka (*Corynocarpus laevigatus*), houpara (*Pseudopanax lessonii*), nīkau (*Rhopalostylis sapida*), and rangiora (*Brachyglottis repanda*). A single large clump of kakahaka (*Astelia hastata*) was seen in the fork of a tall pōhutukawa, and is quite likely to be the same one noted in 1973 (Court et al. 1974).

Early successional species like mānuka (*Leptospermum scoparium*) and bracken (*Pteridium esculentum*) that would have established post burning and were noted in 1973 (Court et al. 1974) are now largely absent on both islands. The whisk fern (*Psilotum nudum*), not seen on this trip, may also be absent or less common now that fewer open areas remain. The number of exotic vascular plant species present on both islands has increased over 50 years (Table 2). Most of these species are either bird or wind dispersed, with seed sources likely to be on nearby Whakahau or the adjacent mainland. However, some may have reached the island via adhesion to birds or as contaminants from previous visitors, e.g. Onehunga weed (*Soliva sessilis*). Infestations of inkweed (*Phytolacca octandra*) and pampas (*Cortaderia sellosana*) are present on both islands, with woolly nightshade (*Solanum mauritianum*) stands on Kuranui.

Table 1. Morphological measurements of adult kiore from Kuranui and Waikaia (combined). Measurements are given as a mean, with the range in brackets.

Sex	<i>n</i>	Mass (g)	Head-body length (mm)	Tail length (mm)
Male	17	64.9 (42.2–77.9)	133.1 (118.0–148.0)	137.1 (122.0–147.0)
Female	11	62.7 (48.1–76.7)	125.6 (113.0–134.0)	135.4 (125.0–152.0)

Table 2. Vascular plant species recorded on Kuranui and Waikaia in August 1973 (Auckland University Field Club; Court et al. 1974) and April 2024 (this study).

	Kuranui		Waikaia	
	1973	2024	1973	2024
Exotic vascular plant species	7	11	11	16
Native vascular plant species	62	60	47	51
Total vascular plant species	69	71	58	67

Discussion

Our surveys of the flora and fauna of Kuranui and Waikaia documented remarkably little change over 50 years (Court et al. 1974). Given the intensity of anthropogenic change on many other islands over the past 50 years (Russell & Keuffer 2019) this provides testament to the biodiversity benefits of minimising human visitation and disturbance to islands. Left alone, islands can be resilient and can return to natural vegetation states following periods of disturbance such as burning and land clearance, especially in the absence of common introduced mammals (Atkinson 2004) and problem weeds (Atkinson 1997). The vegetation has, however, changed somewhat in the last 50 years, particularly in the extent of pōhutukawa canopy cover and in the diversity of broadleaved species. The vegetation has moved to a secondary successional state with the loss of some primary successional species (e.g. mānuka) and establishment of later successional species (e.g. pūriri (*Vitex lucens*) and kohekohe). This succession has occurred alongside colonisation by some new exotic species, likely reflecting an increased seed source pool on nearby Whakahau and the adjacent mainland in the intervening 50 years. New exotic species include Chinese windmill palm (*Trachycarpus fortunei*), Chinese privet (*Ligustrum sinense*), Japanese spindleberry (*Euonymus japonicus*), and woolly nightshade. Control of those considered problem weed species on both islands is recommended.

Kiore on Kuranui and Waikaia were similar in body size, and notably smaller than other kiore in New Zealand (Wilmshurst & Ruscoe 2021), including those on nearby Whakahau (Ricardo et al. 2020). Although our trap success differed between the islands, kiore numbers appear similar and the difference in capture rates more likely reflects differences in catchability at the time of our study (Sagar et al. 2022). Such differences in catchability are notorious in kiore both between islands and over time. For example, on Whakahau at the start of summer 2016/17 Russell and Russell (2018) caught only one kiore, whereas at the end of summer a few months later Ricardo et al. (2020) caught many. Of the introduced rodents, the Slipper group apparently has only ever had kiore established, although a Norway rat (*Rattus norvegicus*) trapped during the 1973 Field Club expedition (Hayward &

Moore 1974) highlights that incursions from other rodent species are possible. The connectivity of the kiore populations among all three islands remains unknown, but it would be prudent to treat all three islands as one eradication meta-unit should rat eradication take place in the group (Roberston & Gemmell 2004). Although the islands are not visited regularly, biosecurity on Kuranui and Waikaia will be critical to reduce the threat of introduced species colonising from nearby source pools, especially Argentine ants (*Linepithema humile*) from Whakahau (Russell & Russell 2018).

The forest bird avifauna is essentially shared between both islands due to the short distance between them and has changed little in the past 50 years (Douglas & Gubb 1974). For burrowing seabirds, the timing of our survey predisposed us to only detect ōi, which were commencing their breeding season, but other petrel and shearwater species are likely to breed on the islands. The number of ōi burrows on Kuranui was systemically surveyed annually between 2003 and 2010 using quadrats (Wills 2010). Extrapolating results of those surveys to the entirety of the island provides an average estimate of approximately 5500 burrows (variance not straightforward to derive) with a reasonably consistent 20% occupancy rate by chicks towards the end of the breeding season. This estimate appears unchanged from surveys in 1973 of over ten burrows per 100 m² (Douglas & Gubb 1974). However, this estimate should be treated with caution given challenges in estimating ōi colony sizes (Russell et al. 2017). This estimate should be updated through resampling the same quadrats which remain marked in place.

Acknowledgements

For facilitating this visit thanks to Ngāti Hei (Tania Dixon and Joe Davis) and harbourmasters (Hayden Coburn and Lee Samphier). Thanks to Chris Niebuhr for kiore measurements, Mark Smale for additional plant identifications, Katherine Russell for the map, and Ewen Cameron and an anonymous reviewer for feedback on the draft manuscript.

Additional information and declarations

Author contributions: Data collection, JCR, PC, KO'T, BG, CB; writing, JCR; all authors have read and agreed to the published version of the manuscript.

Funding: None.

Data and code availability: Species lists for birds and plants are available in the supplementary material.

Ethics: This work was undertaken under University of Auckland animal ethics 22610 and DOC Wildlife Act Authority 38573-FAU.

Conflicts of interest: The authors declare no conflicts of interest.

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Received: 12 September 2024; accepted: 27 November 2024
Editorial board member: Matt McGlone

Supplementary Material

Additional supporting information may be found in the online version of this article.

Appendix S1. Bird species list

Appendix S2. Vascular plant species list

The New Zealand Journal of Ecology provides online supporting information supplied by the authors where this may assist readers. Such materials are peer-reviewed and copy-edited but any issues relating to this information (other than missing files) should be addressed to the authors.