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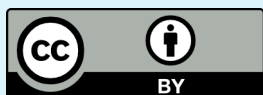
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Phillip Island, Norfolk Island National Park

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ABSTRACT. The Australian Museum Research Institute Terrestrial Vertebrates team was on the Norfolk Island Group from 23 to 30 October 2022. The aims were to improve the Museum's specimen and tissue collection of native and introduced birds, mammals and reptiles from the Island Group and to search for evidence of the presence of microbats. Samples were collected from 97 individuals of 28 species of birds from the Norfolk Island Group. Blood and/or feather samples were collected from 32 individuals of eight native bird species that were subsequently released, including representatives of six endemic taxa. An additional 65 specimens of 20 bird species (10 native, 10 introduced), mostly either found dead by Island residents or obtained from pest management operations, were transported back to the Museum for curation as skins, skeletons and tissues. Samples were collected from 39 individuals of six species of reptiles and amphibians, including representatives of the two endemic taxa. A survey of Phillip Island resulted in tail-tip samples being collected from 29 individuals of the native skink, *Oligosoma lichenigerum* and gecko, *Christinus guentheri*. Two voucher specimens with genetic samples of each species were retained. No evidence of native lizards was found on Norfolk Island itself. Vouchers and tissue samples from three species of introduced herpetofauna were collected: Asian House Gecko, *Hemidactylus frenatus* (n = 3), Beach Scaly-toed Gecko, *Lepidodactylus pantai* (n = 1), and a Green Tree Frog, *Litoria caerulea* (n = 1). Significantly, the *Lepidodactylus* specimen is a new species record for Australia and its territories. A rehabilitating Green Sea Turtle, *Chelonia mydas* (n = 1) was also sampled. No acoustic evidence for the presence of any microbat species on Norfolk or Phillip Islands was detected during the survey, suggesting that the endemic population of Gould's Wattled Bat, *Chalinolobus cf. gouldii* is now extinct. Specimens and tissue samples were collected from all four of the island's introduced mammal species; House Mouse, *Mus musculus* (n = 1), Pacific Rat, *Rattus exulans* (n = 5), Black Rat, *Rattus rattus* (n = 3) and feral Cat, *Felis catus* (n = 7). These specimens and samples will provide a valuable record of the introduced mammals of Norfolk Island and enable future genetic studies. Tissue samples were also

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obtained from a Blainville's Beaked Whale, *Mesoplodon densirostris* that stranded at Kingston in April 2016, the first recorded stranding of that species on Norfolk Island. Overall, these new specimens and tissue samples will significantly enhance the Australian Museum's collection and provide documentation of the contemporary bird, reptile and mammal fauna of Norfolk Island, as well as supporting current and future research projects.

Background

The subtropical Norfolk Island (NI) Group (29° 02' S, 167° 57' E) is situated on the Norfolk Ridge between New Zealand and New Caledonia, in the south-west Pacific Ocean. Lying ~1400 km from the eastern Australia coast, NI and the surrounding islets are the eroded remnants of a much larger island formed by volcanic activity approximately 2.5 million years ago (Mortimer *et al.*, 2021). With a long history of isolation, and a terrestrial biota initially derived by dispersal from surrounding landmasses, the NI Group has long been of scientific interest and conservation concern (DNP, 2010, 2018; CoA, 2025). The three largest islands in the group, Norfolk (3,455 ha), Phillip (190 ha) and Nepean (10 ha) Islands (Fig 1), were all originally forested but have been significantly impacted by anthropogenic vegetation clearing, degradation, and the introduction of pest species. On NI most (90%) native vegetation has been cleared, primarily for agriculture, with the largest remaining remnant of native forest now occurring in the north of the Island and protected as a National Park (460 ha) (DNP, 2018; CoA, 2025). Nepean Island, lying ~1 km south of NI (Fig. 1), originally supported over 200 Norfolk Island Pines, *Araucaria heterophylla* and a wide variety of native vegetation. However, it underwent major degradation following British settlement in 1788 through deforestation and calcarenite quarrying. Nepean Island now supports a grassland/shrubland habitat with the dominant flora including invasive Kikuyu and Buffalo grasses (Cogger *et al.*, 1983; Norfolk Island Parks and Forestry Service, 2003). Phillip Island, 6.5 km south of the main island (Fig. 1), was heavily impacted by introduced herbivores and became an eroded moonscape, almost completely devoid of vegetation (Cogger *et al.*, 1983). Eradication of these herbivores by the 1980s has led to significant and ongoing revegetation of the Island, which is now part of the Norfolk Island National Park (Coyne, 2009, 2010; CoA, 2025). The NI Group's high levels of endemism, ongoing conservation initiatives, and unique biogeographical relationships have made it a research focus for Australian Museum (AMS) staff for many decades (Millington *et al.*, 1888; North, 1889; Hedley & Basset Hull, 1912; Troughton, 1922; Iredale, 1929, 1945; Smithers & Disney, 1969; Cogger *et al.*, 1979, 1983, 2006; Hyman *et al.*, 2023).

Norfolk Island Group birds

The NI Group is famous for its unique and abundant birdlife, and their diversity and natural history since 1788 has been well reviewed (North, 1889; Basset Hull, 1909; de Ravin, 1975; Smithers & Disney, 1969; Schodde *et al.*, 1983; Hermes *et al.*, 1986; Christian, 2005; Priddel *et al.*, 2010). Less well known is the history of the NI Group's avifauna prior to the first European settlement in 1788 and the impact of the prior Polynesian settlement during the 13-14th centuries (Schodde *et al.*, 1983; Holdaway & Anderson, 2001; Christian, 2005). The bones of sea and land birds, including some now extinct species, have been detected in archaeological and natural deposits (Schodde *et al.*, 1983; Holdaway & Anderson, 2001). Since 1788, over fifteen species of seabirds have been recorded breeding in

the NI Group and at least another 15 species are regular non-breeding migrants (Christian, 2005). Of the native land birds, at least 29 species have been recorded breeding, and a further three species are regular non-breeding migrants or visitors (Christian, 2005). Habitat modification, especially clearing of forest to produce pasture, has created new open habitats that have enabled some relatively recently arrived species to become established, including the Nankeen Kestrel, *Falco cenchroides*, Masked Woodswallow, *Artamus personatus* and Welcome Swallow, *Hirundo neoxena*. Of the land birds, 15 are endemic species or subspecies, seven of which have become extinct since 1788: Norfolk Ground Dove, *Pampusana norfolkensis* (~1800), Norfolk Pigeon, *Hemiphaga novaeseelandiae spadicea* (~1900), Norfolk Kaka, *Nestor productus* (~1850s), Norfolk Starling, *Aplonis fusca fusca* (~1920s), Norfolk Island Thrush, *Turdus poliocephalus poliocephalus* (1970s), Long-tailed Triller, *Lalage leucopyga leucopyga* (1970s), and the White-breasted White-eye, *Zosterops albogularis* (~2000s) (Schodde *et al.*, 1983; Christian, 2005). Four endemic taxa are currently listed as threatened: Norfolk Parakeet, *Cyanoramphus cookii*, Norfolk Robin, *Petroica multicolor*, Norfolk Golden Whistler, *Pachycephala pectoralis xanthoprocta* and the Norfolk Morepork, *Ninox novaeseelandiae undulata* (EPBC, 1999). Eleven introduced species are now established on the NI Group including the Crimson Rosella, *Platycercus elegans*, California Quail, *Callipepla californica*, House Sparrow, *Passer domesticus* and Common Blackbird, *Turdus merula* (Christian, 2005). Additionally, over 78 species have been reported as vagrants or rare visitors to the NI Group (Christian, 2005).

Comparative DNA analyses of some NI Group bird populations have already significantly clarified their taxonomy, evolutionary history and informed management. This includes the Norfolk Robin by Kearns *et al.* (2015), white-eyes, *Zosterops* sp. by Clegg *et al.* (2002), Norfolk Golden Whistler by Jönsson *et al.* (2014), Norfolk Parakeet by Boon *et al.* (2001) and Providence Petrel, *Pterodroma solandri* by Lombal *et al.* (2017). However, many questions remain unaddressed and taxa unstudied. The collection and long-term storage of tissue and DNA samples of NI's endemic taxa (and introduced species) is important research infrastructure that the Australian Museum can provide to facilitate future studies to determining the evolutionary relationships, population history and genetic diversity of NI's avifauna. Unfortunately, the Australian Museum's historic collecting on the NI Group was prior to the establishment of the Museum's frozen tissue collection.

Australian Museum holdings of Norfolk Island Group birds

Prior to the recent Expedition, the Australian Museum Ornithology Collection held over 700 specimens of 41 bird species from the NI Group, collected between 1838 and 1978 (Table 1). This includes specimens of 12 of the endemic species/subspecies of land bird and five of the seven recently extinct species. The extinct Norfolk Ground Dove is only known from a ~1790 drawing by then-Captain (later Governor) John Hunter (1737–1821) and a few subfossil



Figure 1. Map of the Norfolk Island Group, showing locations mentioned in the text. Basemap: Google Satellite (obtained through QuickMapServices QGIS plugin), map data ©2015 Google.

bones (Forshaw, 2015). The majority of the Ornithology Collection's holdings are eggs (610) mostly collected in the late 1880s and early 1900s. Most of these eggs, as well as some nests and skins, were collected by Dr Peter Herbert Metcalfe (1853–1913) who was a medical officer on NI between 1879 and 1912 and was a keen natural historian and collector (ANH, 2022). Other substantial egg collections were obtained by the naturalist Arthur Francis Basset Hull (1862–1945) in 1908 and by John Simeon Pierson Ramsay (1884–1981), son of Edward Pierson Ramsay (1842–1916) the Museum's Curator, in 1915/1916. The AMS collection also contains over 100 study skins of 28 NI Group bird species, many collected during 1968/1969 when the Bird Curator Henry John de Suffren Disney (1919–2014) visited the island (Smithers & Disney, 1969). Most poorly represented in the AMS bird collection were frozen tissues for genetic studies ($n = 0$) and skeletal material ($n = 1$) for morphological and comparative studies (Table 1).

Of the threatened NI endemic bird species, the Australian Museum holds specimens of the Norfolk Parakeet (skins and eggs), Norfolk Golden Whistler (skins, eggs and nests) and Norfolk Robin (skins, eggs and nests) (Table 1). For extinct NI endemic bird species, the Australian Museum holds specimens of Norfolk Kaka (1 skin), Norfolk Starling (eggs), Norfolk Island Thrush (eggs), Long-tailed Triller (eggs and nests) and White-breasted White-eye (skins, eggs and nests) (Table 1). These provide not just important documentation of NI's historic biodiversity but a valuable resource for research.

In the European history of NI and the discovery and decline of its birds, two species feature prominently, the Norfolk Kaka and the Providence Petrel, although both species are poorly represented in museum collections.

Norfolk Kaka, *Nestor productus* (Gould, 1836)

Although a relatively large bird, the Norfolk Kaka appears not to have been heavily exploited for food by Polynesian settlers on NI during the 13–14th centuries (Holdaway & Anderson, 2001). However, it fared less well following the first European settlement of NI in 1788 and was driven to extinction. Of all the extinct endemic birds of the NI Group, the Norfolk Kaka is perhaps the most widely known and recognised (Forshaw, 2017). During our fieldwork on NI, the species was frequently raised in conversation by members of the local community, who expressed considerable interest in how many specimens are known to survive in natural history collections worldwide.

The Norfolk Kaka, *Nestor productus*, was first described by the English ornithologist John Gould (1804–1881) as *Ptyctolophus productus* Gould, 1836, based on a specimen from an unknown locality. Gould (1848: 6) later elaborated on the species, referring to it as the “Phillip Island Parrot” (Fig. 2) and noting that “*many persons who have resided in Norfolk Island for years, have assured me its occurrence there is never known, although the distance from one island to the other is not more than three or four miles*”. This account suggests the Norfolk Kaka had already undergone early local extinction on the main island, and that the specimen upon which Gould based his original description was most likely sourced from Phillip Island.

Subsequently, the Austrian ornithologist August von Pelzeln (1825–1911) described *Nestor norfolcensis*, proposing that the NI and Phillip Island populations in fact represented distinct species (von Pelzeln, 1860). However, von Pelzeln did not have access to any specimens from NI and instead based his description on the features depicted in a drawing of a living specimen made by Austrian botanical

illustrator Ferdinand Lucas Bauer (1760–1826) on 19 January 1805. Bauer had come to Australia as an artist on Captain Matthew Flinders' (1774–1814) surveys, but remained behind in Sydney when Flinders left in 1803 to return to London to try to obtain a replacement ship. Unfortunately, Flinders was detained in Mauritius en route, and Bauer stayed in Australia for several years, visiting Norfolk Island between August 1804 and March 1805 (Vallance *et al.*, 2001).

Von Pelzeln's taxonomic interpretation was supported by the ornithologist Adelardo Tommaso Salvadori Paleotti (1835–1923), who confirmed that the species was extinct and noted that, aside from the “very curious shape of the bill, the absence of any bars on the tail distinguishes this species from the others” (Salvadori, 1891). The following year, the parson-naturalist Henry Baker Tristram (1822–1906) also lent support to this view, identifying within his own collection a specimen corresponding to the description of *N. norfolcensis*. He further suggested (Tristram, 1892) that his specimen may have been the individual previously in the possession of then-Captain (later Governor) John Hunter. The zoologist Walter Rothschild (1868–1937) sowed further confusion by stating that all known specimens of *N. productus* had originated from Phillip Island, proposing that “it lingered some years longer than on the main island, while the specimens of Ferdinand Bauer and Governor Hunter, and possibly the supposed *N. norfolcensis* of Canon Tristram's collection, now in Liverpool, had been brought from Lord Howe's Island in cages and were kept as pets in Norfolk Island” (Rothschild, 1907).

While Rothschild (1907) represents one of the earliest suggestions that the Norfolk Kaka may also have occurred on Lord Howe Island, an earlier work by the ornithologist, and Curator of the Australian Museum Edward Pierson Ramsay had already listed *N. productus* as occurring there (Ramsay, 1888). Hindwood (1932) similarly noted that early accounts from Lord Howe Island do reference “parrots and parroquets,” raising the possibility that another parrot species was present alongside the now-extinct Lord Howe Parakeet, *Cyanoramphus cookii subflavescens*. However, Hindwood (1940) later revised this position, concluding that any such parrot was unlikely to have been *N. productus*. Subsequent work by Greenway (1967) synonymised *N. norfolcensis* under *N. productus*, while Hume (2017) concurred, arguing that the plumage of *N. productus* is known to be highly variable, as are bill deformities in captive parrots. No solid evidence for the existence of the Norfolk Kaka on Lord Howe Island has ever emerged (Hume, 2017) and the most recent comprehensive treatment of parrots by Forshaw (2010, 2017) recognises only the single species *N. productus*, with its former range restricted to Norfolk, Nepean, and Phillip Islands.

Prior to the Norfolk Kaka's formal scientific description, there are few early observations which describe both *parrots* and *paroquets* from the NI Group which are interpreted as the observers noting both the Kaka and the Norfolk Parakeet (Hume, 2017; Forshaw, 2017). The first of these observations occurred soon after the European discovery of Norfolk Island in 1774 and the establishment of the first British penal colony in 1788 (Forshaw, 2017; Hume, 2017). Of these early accounts, Philip Gidley King (1758–1808), who set up the colony on NI, wrote in his journal (which was published as part of Hunter's account) that

“*The Parrots are numerous, and the ugliest bird of the kind I ever heard of, this, added to the harshness of their note, makes them a very disagreeable bird. The parroquets are entirely green, except a red tuft on their head*” (Hunter, 1793: 315).

Table 1. Summary of registered Australian Museum bird specimens from the Norfolk Island Group prior to current survey.

Scientific name	Common name	Number	Form of specimens of specimens
<i>Anas superciliosa</i>	Pacific Black Duck	2	eggs
<i>Anous minutus</i>	Black Noddy	51	skins (2), eggs (49)
<i>Anous stolidus</i>	Common Noddy	17	eggs
<i>Aplonis fusca fusca</i> †	Norfolk Starling	8	eggs
<i>Ardea alba</i>	Great Egret	1	skin
<i>Callipepla californica</i> *	California Quail	3	skin (1), eggs (2)
<i>Carduelis carduelis</i> *	European Goldfinch	1	skin
<i>Chalcophaps longirostris</i>	Pacific Emerald Dove	4	skins (2), eggs (2)
<i>Chalcites lucidus</i>	Shining Bronze-cuckoo	1	eggs
<i>Cyanoramphus cookii</i>	Norfolk Parrakeet	5	skins (4), eggs (1)
<i>Gallirallus philippensis</i>	Buff-banded Rail	5	skins (4), eggs (1)
<i>Gerygone modesta</i>	Norfolk Gerygone	20	skins (8), eggs (10), nests (2)
<i>Gygis alba</i>	White Tern	116	skins (7), eggs (109)
<i>Hirundo neoxena</i>	Welcome Swallow	3	skins
<i>Lalage leucopyga leucopyga</i> †	Long-tailed Triller	13	eggs (12), nest (1)
<i>Lorius chlorocercus</i> #*	Yellow-bibbed Lory	2	eggs (1), x (1)
<i>Nestor productus</i> †	Norfolk Kaka	1	skin
<i>Pachycephala pectoralis xanthoprocta</i>	Norfolk Golden Whistler	29	skins (9), eggs (19), nest & eggs (1)
<i>Passer domesticus</i> *	House Sparrow	1	skin
<i>Petroica multicolor</i>	Norfolk Robin	16	skins (5), eggs (10), nest (1)
<i>Phaethon rubricauda</i>	Red-tailed Tropicbird	12	eggs
<i>Platycercus elegans</i> *	Crimson Rosella	11	skins (4), eggs (7)
<i>Porphyrio melanotus</i>	Australasian Swamphehen	1	eggs
<i>Zapornia tabuensis</i>	Spotless Crane	5	eggs
<i>Anous albivitta</i>	Grey Noddy	16	skin (1), eggs (15)
<i>Pterodroma nigripennis</i>	Black-winged Petrel	5	skins (4), skeleton (1)
<i>Pterodroma solandri</i> #	Providence Petrel	1	eggs
<i>Puffinus assimilis assimilis</i>	Little Shearwater	12	skin (1), eggs (11)
<i>Ardenna grisea</i> #	Sooty Shearwater	3	eggs
<i>Ardenna pacifica</i>	Wedge-tailed Shearwater	5	skins (3), eggs (2)
<i>Rhipidura albiscapa pelzelni</i>	Norfolk Fantail	19	skins (5), eggs (13), nest (1)
<i>Onychoprion fuscatus</i>	Sooty Tern	227	skins (2), eggs (223), tissue (1), skin & wing (1)
<i>Sturnus vulgaris</i> *	Common Starling	3	skins
<i>Sula dactylatra</i>	Masked Booby	22	eggs
<i>Todiramphus sanctus</i>	Norfolk Kingfisher	14	skins (2), eggs (12)
<i>Turdus merula</i> *	Common Blackbird	5	skins (4), egg (1)
<i>Turdus philomelos</i> *	Song Thrush	2	skins
<i>Turdus poliocephalus</i>	Norfolk Island Thrush	21	eggs
<i>poliocephalus</i> †			
<i>Zosterops albogularis</i> †	White-chested White-eye	11	skin (1), eggs (9), nest (1)
<i>Zosterops lateralis</i>	Silveryeye	21	skins (19), eggs (2)
<i>Zosterops tenuirostris</i>	Slender-billed White-eye	17	skins (5), eggs (11), nest (1)

† extinct; * introduced; # species ID of specimens requires confirmation.

Unsurprisingly, John Gould was very keen to obtain specimens of the kaka, and in 1839, had a series of correspondence with Major Thomas Ryan (1790 – death unknown) who served as the Acting Commandant of the second penal settlement on Norfolk Island from July 1839 to March 1840. In a letter dated 15 December 1839 to Major Thomas Ryan Gould states (Sauer, 1998: 133-134)

“I am presumptuous enough to request the favour of your still favouring me with your acceptance and if not impose too much on your time I shall be happy to receive any remarks on the various creatures, inhabitants of your interesting Island (Norfolk Island), particularly any information respecting the Philip Island cockatoo. You say it is nocturnal, pray inquire more particularly into this matter and everything relative

to its history how it climbs rocks broken its long bill and I could not procure its egg and in what situation. I should also feel obliged for 3 or 4 skins of that bird as from its local habitats I have not been able to procure good skins of it. It is a most interesting species. You say you have not had full compliments of some of the eggs, perhaps an opportunity will appear to send me a duplicate collection of such as one sent P. It would be a mark of considerable interest if you could send me a perfect list of all the Birds of Norfolk Island”.

Major Thomas Ryan replied in a letter dated 10 January 1840 (Sauer, 1998: 140-141)

“My dear Sir, I have received your letter from the Hunter, and I wish it was in my power to forward you the Phillip Island Cockatoo or its eggs. I shall however do all in my



Figure 2. Reproduction of Plate 6 featuring the ‘Phillip Island Parrot’, *Nestor productus* from Gould (1848). *Birds of Australia. Volume 5.* The plate represents an old and a nearly adult bird, exhibiting traces of the immature plumaged on the chest.

power yet to obtain either the birds, eggs, or nests. I believe there is a bird of this kind belonging to Major Anderson 50th Regiment, it is certainly a very curious bird, and as its species is rare, its value is therefore more enhance. I shall forward you a few more nests, and eggs.”

In subsequent letters (Sauer, 1998), Major Thomas Ryan appears to have sent John Gould some specimens, but there is no further mention of the Phillip Island Cockatoo.

John Gould went on to publish the *Birds of Australia* in parts between 1840 and 1848. In Volume 5, Gould (1848: 6) published the following details which included the observations of a live bird held by Joseph Anderson (1790–1877) who was the Commandant of NI from 1834–1839. This appears to be the same captive bird mentioned by Major Thomas Ryan.

“The *N. productus* has a very limited habitat, the entire race, as I am credibly informed, being confined to Phillip Island, whose whole circumference is not more than five miles in extent; so strictly in fact is it confined to this isolated spot, that many persons who have resided in Norfolk Island for years, have assured me its occurrence there is never known, although the distance from one island to the other is not more than three or four miles. I regret to stated, that, in consequence of the settlement of Norfolk Island, the native haunts of this fine bird have been so intruded upon, and such a war of extermination been carried on against it, that if such be not the case already, the time is not far distant when the species will be completely extirpated, and, like the Dodo, its skin and bones become the only mementos of its existence.

During my stay at Sydney, I had an opportunity of seeing a living example in the possession of Major Anderson, and was much interested with many of its actions, which were so different from those of every other member of its family, that I felt convinced they were equally different and curious in a state of nature. This bird was not confined to a cage, but permitted to range over the house, along the floors of which it passed, not with the awkward waddling gait of a Parrot, but in a succession of leaps, precisely after the manner of the Corvidae. Mrs. Anderson, to whom I am indebted for the little I could learn respecting it, informed me that it is found among the rocks and upon the loftiest trees of the island, that it is so tame as to be readily taken alive with a noose, and that it feeds upon the blossoms of the white-wood tree, or white Hibiscus, sucking the honey of the flowers: the mention of this latter circumstance induced me to examine the tongue of the bird, which presented a very peculiar structure, not, like that of the true honey-feeding Parrakeets (the *Trichoglossi*), furnished with a brush-like termination, but with a narrow horny scoop on the under side, which, together with the extremity of the tongue, resembled the end of a finger with the nail beneath instead of above: this peculiarity in the structure of the organ is doubtless indicative of a corresponding peculiarity in the nature of the food upon which the bird subsists. I may mention that Sir J. P. Millbank, Bart., informed me that a living example of this species in his possession evinced a strong partiality to the leaves of the common lettuce and other soft vegetables, and that it was also very fond of the juice of fruits, of cream and butter. Mrs. Anderson told me that it lays four eggs in the hollow part of a tree, but beyond this I was unable to ascertain anything respecting its nidification. Its voice is a hoarse, quacking, inharmonious noise, sometimes resembling the barking of a dog. It would appear from the numerous specimens I have examined that the sexes scarcely differ from each other in colour; the young, on the contrary, have but little of the rich yellow and red markings of the breast, that part being olive-brown like the back.

The general colour of the upper surface brown; head and back of the neck tinged with grey, the feathers of these parts as well as of the back margined with a deeper tint; rump, belly, and under tail-coverts deep red; cheeks, throat, and chest yellow, the former tinged with red; shoulders on their inner surface yellow tinged with rufous olive; tail-feathers banded at the base with orange-yellow and brown; the inner webs of the quill-feathers at the base and beneath, with dusky red and brown; irides very dark brown; bill brown; nostrils, bare skin round the eye, and feet dark olive-brown.”

Gould was in Sydney between 1839–1840. The Sir J. P. Millbank he refers to is likely to be Sir John Peniston Milbanke, Bt. (1776–1850), seventh Baronet, based in England, so this bird would have been alive in England.

In 1837, Dr. George Bennett (1804–1893), Secretary and Curator of the Australian Museum from 1835–1841, published “A Catalogue of the Specimens of Natural History and Miscellaneous Curiosities Deposited in the Australian Museum”, in which both a male and female specimen are listed (Fig. 3) (Bennett, 1837), indicating that the collection held two specimens at that time. A newspaper notice from 1843 confirms that the Australian Museum had numerous parrot specimens in its collection, including at least one *N. productus* (Anonymous, 1843), though the precise number is not stated. It has only recently come to light that on 29 September 1915, a specimen was exhibited at the Ordinary Monthly Meeting of the Linnean Society of New South Wales (Hamilton, 1916: 488):

“Mr. North, by permission of the Curator of the Australian Museum, exhibited an example of the now extinct Phillip Island Parrot, *Nestor productus* Gould, its then restricted habitat being about five miles away from Norfolk Island. The specimen forms part of the “Old Collection” and nothing is known of its history beyond that recorded in the Register for 1875, No.2933, “*Nestor productus* (extinct) Phillip Island.”. It was at that time a mounted specimen in the Exhibit Collection, but has since been reduced to a skin, and placed in a glass jar. Formerly it was in spirits, which cause the dull yellow and red plumage of the underparts to fade so much as to render the specimen almost a uniform brown. This species is the smaller of the genus *Nestor*, the wing-measurement of the present being only 9-6 inches. For comparison, the skin of an adult male of *Nestor meridionalis*, its nearest living ally, obtained at Titirangi, ten miles north-west of Auckland, North Island, New Zealand, on the 27th April 1877, was shown. One of the best life-histories of the Phillip Island Parrot will be found in the folio edition of the “*Birds of Australia*,” written by Gould, who originally described it, in 1836 (*Proc. Zool. Soc. London*), under the name of *Plyctolophus productus*. According to the late Professor A. Newton, M. A., of Cambridge, the last Phillip Island Parrot known to have lived, Gould saw in a cage in London, about the year 1851. The species became extinct about the middle of last century, and not more than a dozen specimens are believed to exist in collections. So far as is known, the present specimen is the only one in Australia.”

Thus by 1916, a single specimen remained in the Australian Museum collection, described only as a “faded brown skin in a glass jar” (Cammaray, 1916). The Australian Museum currently holds only one Norfolk Kaka specimen (AMS O.22287; Fig. 4), which is in poor condition and corresponds closely to the descriptions provided by Hamilton (1916) and Cammaray (1916). According to the current Ornithology Register, it was accessioned into the O. series on 13 July 1915 from the “Old Collection,” having been located in a glass jar in the Bird Gallery. It was previously registered in the Palmer Register (PA.2933) (Table 2). Although the

No. 139.—NESTOR PRODUCTUS—Gould.

Ptyctolophus productus—Gould.

The Phillip Island Parrot.

Habitat, Phillip Island.

MALE AND FEMALE.

The habitat of this bird has been erroneously supposed to be Norfolk Island, instead of Phillip Island; and although the latter island is only five miles distant from the former, the power of flight of this bird is so limited, that it has not been found on Norfolk Island. It is now said not to be found on Phillip Island; if so, this species may be considered extinct.

140.—TRICHOGLOSSUS HÆMATODUS—Vig. and Horsf.

Psittacus hæmatodus—Linn.

Red breasted Parrot—Lath. Gen. Hist. ii. p. 122, No. 26.

The Blue Mountain Parrot of the Colonists.

Habitat, Port Jackson.

MALE.

141.—TRICHOGLOSSUS PUSILLUS—Vig. and Horsf.

Small Parrakeet—White's Journ. pl. in p. 262.

The Red-faced or Small Parrakeet.

Habitat, Moreton Bay.

MALE AND FEMALE.

142.—TRICHOGLOSSUS CONCINNUS—Vig. and Horsf.

Psittacus australis—Lath. Ind. Orn. p. 104, No. 66.

Crimson-fronted Parrakeet—Lath. Gen. Hist. ii. p. 181, No. 97.

Habitat, Port Jackson.

MALE AND FEMALE.

143.—TRICHOGLOSSUS

—Vig. and Horsf.

The Red-shouldered Parrakeet.

Habitat, Moreton Bay.

MALE AND FEMALE.

144.—TRICHOGLOSSUS

—Vig. and Horsf.

The Red-headed Parrakeet.

Habitat, Moreton Bay.

MALE.

D

Figure 3. Reproduction of pg. 22 from Bennett's (1837) *A Catalogue of the Specimens of Natural History and Miscellaneous Curiosities Deposited in the Australian Museum*. showing details of the AMs two Norfolk Kaka, *Nestor productus* specimens. Only one specimen is now in the collection: PA.2933 which was subsequently re-registered as AMS O.22287.

specimen is considerably faded, it is unquestionably among the older natural history specimens held in the Australian Museum collection, given that few of the specimens listed in Bennett's (1837) catalogue are still extant. It is also one of only two specimens held in Australian natural history museums, the other being housed at Museum Victoria (Table 2).

Given the species' early extinction, relatively few specimens were acquired by natural history institutions worldwide. Gouraud and Jansen (2024) estimate that fewer than 30 specimens are known to exist in collections globally, with their survey yielding 28 specimens. An independent database and literature search conducted for the present study identified 27 *N. productus* specimens held in natural history museums in 10 countries, with the UK, USA, and the Netherlands among the best-represented, alongside holdings in Australia, Germany, Austria, Italy, France, and the Czech Republic (Table 2). The difference in total number of specimens is due to Gouraud and Jansen (2024) assuming the AM still has two specimens, whereas we can confirm that there is only one (Table 2).

Nearly all specimens are labelled as originating from Phillip Island rather than NI itself, with the notable exception of the NMW Vienna specimen collected in 1805 and purchased from the estate of naturalist Ferdinand Bauer in 1826 (Table 2). However, it is known that while Bauer did spend most of his time on NI itself during his visit between Aug 1804 and March 1805, he is known to have visited Phillip Island in October 1804, so even this specimen could also have been obtained from Phillip Island. Regardless, the Vienna specimen is both the earliest precisely dated example and the holotype of *Nestor norfolcensis*, while the holotype of *Ptyctolophus productus* Gould, 1836, is held at ANSP Philadelphia. Collection dates cluster broadly in the 1830s–1860s, consistent with the species' extinction around the mid-19th century, though the earliest specimen in the dataset was collected as early as 1788 on Phillip Island — the same year the First British Settlement was established on NI — and is now held at the World Museum Liverpool (Table 2). Many of these specimens passed through the hands of prominent 19th-century collectors and dealers before reaching their current institutions, including the XIIIth Earl of Derby, naturalist George Bennett, and the Amsterdam dealer Gustav Adolph Frank (1809–1880), with recorded sale prices ranging from £10 to US\$75, already reflecting the bird's growing rarity at the time. Interestingly, a specimen in the NHMUK (1837.9.26.12) was received from George Bennett from the Australian Museum (Table 2) and could possibly be the other specimen listed in the Bennett Catalogue, or an additional specimen from that collection event. Notably, new Norfolk Kaka specimens continue to be identified in collections, most recently in Abbeville, France, as well as in Göttingen and Kiel (Gouraud & Jansen, 2024) (Table 2), suggesting that further examples may yet come to light in insufficiently catalogued European natural history collections.

From these limited observations and specimens, it appears that *N. productus* was originally numerous and inhabited both Norfolk (Holdaway & Anderson, 2001) and Phillip Islands. It became extinct first on NI (sometime after 1788), with a population persisting somewhat longer on Phillip Island. However, this remnant population also then became extinct around the mid-19th century as a result of habitat loss and hunting.

Sadly, a few years after the final publication of the *Bird of Australia*, Gould received a written request on the 27 March 1851 from the Belgian politician, palaeontologist,

and ornithologist Bernard du Bus de Gisignies (1808–1874) asking if they could please acquire a *Nestor productus* for the Brussels Museum" (Sauer, 2001). Gould replied on the 10 April 1851 (Sauer, 2001: 519):

"*Nestor productus* has been extirpated from its natural habitat and i know not where a specimen is to be procured."

Mr. John Henry Gurney (1819–1890) an English banker and amateur ornithologist published the following details which he had heard second hand from Mr. F. Strange of Sydney (Gurney, 1854: 4298) in a letter dated 7 December 1853. "I have seen the man who exterminated the *Nestor productus* from Phillip Island, he having shot the last of that species left on the island; he informs me that they rarely made use of their wings, except when closely pressed: there mode of progression was by the upper mandible; and whenever he used to go to the island to shoot, he would invariably find them on the ground, except one, which used to be sentry on one of the lower branches of the *Araucaria excelsa*, and the instant any person landed, they would run to those trees and haul themselves up by the bill, and, as a matter of course, they would there remain till there were shot, or the intruder had left the island. He likewise informed me that there was a large species of hawk that used to commit great havoc amongst them, but what species it was he could not tell me."

This is Frederick Strange (1818–1854), a well-known natural history collector living in Sydney, first arriving there about 1840. It is not clear who Strange's contact was, or when that contact was on Phillip Island. The "large species of hawk" mentioned may have been the Swamp Harrier, *Circus approximans*, the largest diurnal raptor recorded from the island group today (Schodde *et al.*, 1983).

Providence Petrel, *Pterodroma solandri* (Gould, 1844)

One of the most famous birds associated with the early European history (post-1788) of the NI Group is the Providence Petrel. The enormous numbers of Providence Petrels that historically nested on the mountain slopes of NI were heavily harvested for food by the early colonists from 1790 (Medway, 2002). This human predation combined with the impact of feral Pigs, *Sus scrofa* and Cats, *Felis catus* resulted in the petrels being regarded as locally extinct by the early 1800s (Medway, 2002). A small number of Providence Petrels were subsequently rediscovered nesting on Phillip Island in 1985 (Priddel *et al.*, 2010). It appears that no historical specimens of Providence Petrels from NI exist in museum collections but there are some late 18th century illustrations of adults and young (Phillip, 1789; Bonyhady, 2000; Olsen, 2007). However, in the Australian Museum Ornithology Collection there is a broken egg specimen from NI originally labelled as *Estrelata phillipii* (an early name for the Providence Petrel) that was registered in 1901 (AMS O.12359) (Fig. 5). Although no date of collection is recorded, the specimen was collected by Dr P.H. Metcalfe who was resident on NI from 1879 to 1912. This is likely the egg specimen that North (1889) noted was sent to him by Metcalfe.

Under the heading *Oestrelata phillipii* (a synonym for the Providence Petrel), North (1889: 416) states that "during a period of ten years [i.e., 1879–1889] he [Metcalfe] has only obtained two birds and three eggs, one of the latter of which he has kindly forwarded".

While the species identification of the egg needs confirmation, it is perhaps an indication that Providence Petrels were not entirely locally extinct as had been assumed. Interestingly, Christian (2005) noted that Providence Petrel

Table 2. Norfolk Kaka, *Nestor productus* specimens in world natural history museums.

Institution	Registration number	Collection date	Listed collection locality	Notes
Academy of Natural Sciences of Drexel University (ANSP), Philadelphia, USA	22082	—	Phillip Island	The holotype of <i>Ptyctolophus productus</i> Gould, 1836.
American Museum of Natural History (AMNH), New York, USA	300597 616718	Dec 1839	New Zealand?	Collected by (presumably the Austrian ornithologist Johann Natterer 1787–1843), but specimen received from Dr. Leonard Cutler Sanford (1869–1950). Acquired from the Distington Museum.
Australian Museum (AMS), Sydney, Australia	O.22287 (original number PA.2933)	pre-1837	Phillip Island	This specimen is likely one of the two mentioned in Bennett's (1837) Catalogue (See Fig. 3).
Beffroi Musée Boucher de Perthes-Manessier, Abbeville, France	2021.0.1334	—	—	A recently documented mounted specimen (Gouraud & Jansen, 2024).
Birmingham Museum and Art Gallery (BMAG), Birmingham, UK	1912Z108	pre-1912	Australia	Aston Hall Collection.
Museo Zoologico de 'La Specola' (MZUF), Florence University, Italy	—	pre-1857	—	This specimen was acquired by Carlo Passerini (1793–1857), the curator between 1820 and 1857 (Violani & Barbagali, 2003; Barbagali & Violani, 2010).
Museum Heineanum (MHH), Halberstadt, Germany	—	—	Phillip Island	Formerly the property of the Heine family. Mr. Jürgen Otto Heine donated it to the museum in 1992. This specimen has a label of "G.A. Frank Amsterdam" and Phillip Island (Nicolai, 1993).
Museum Victoria (NMV), Melbourne, Australia	14050	pre-1843	Phillip Island	Acquired from William Sheridan Wall (1815–1876) in November 1863 for £10. Wall, previously the Collector and Preserver of Specimens at the Australian Museum, had previously offered to sell the specimen to the Australian Museum, but they declined.
National Museum Prague (NMP), Czech Republic	P6V-004385	pre-1843	—	Obtained from the collection of Baron Christopher Freiherr Rellner von Feldegg (1779–1845) (Mlikovsky, 2012).
Naturhistorisches Museum (NMW), Vienna, Austria	NMW 1826.V.26	1805	Norfolk Island	Purchased in 1826 from the estate of Ferdinand Lucas Bauer. The holotype of <i>Nestor norfolcensis</i> von Pelzeln, 1860 (Schifter <i>et al.</i> , 2007).
Natural History Museum (NHMUK), London, UK	1837.9.26.12 1955.6.N.19.3	—	Phillip Island Phillip Island	Obtained from George Bennett, Australian Museum. From the old collection, previously registered as VEL.25.282B (Knox & Walters, 1994). Obtained from W. Wright (Knox & Walters, 1994).

Table 2. Continued...

Table 2. *Continued.*

Institution	Registration number	Collection date	Listed collection locality	Notes
	VEL.25.282a	—	Phillip Island	Obtained from from Bell, Hardwicke Collection (Knox & Walters, 1994). Possibly the British naturalist-collector Thomas Bell (1792–1880); Hardwicke is Major-General Thomas Hardwicke (1756–1835).
	2000.1.79	—	Phillip Island	Possibly individual listed as “Mount in the South Kensington Gallery” (Knox & Walters, 1994).
Naturalis Biodiversity Center Leiden (NL), Netherlands	RMNH.AVES.110061	pre-1865	Phillip Island	Adult male
	RMNH.AVES.110068	—	Phillip Island	Adult female
	ZMA 3164	pre-1860	Phillip Island	Specimen was received in 1863, possibly from the same batch as the adult male and female in the RMNH. Specimen transferred to Naturalis, Leiden in 2011 from Universiteit van Amsterdam, Zoologisch Museum (ZMA), Netherlands when the collections were merged (Gouraud & Jansen, 2024).
Senckenberg Museum Frankfurt (SMF), Germany	SMF 17346	1836	Phillip Island	From the collection of Eduard Rüppell (1794–1884).
Smithsonian National Museum of Natural History (USNM), Washington DC, USA	151991	pre-1866	Phillip Island	Donated 2 March 1896 by Dr. William LeGrange Ralph (1851–1907). Dr. Ralph bought the specimen for US\$50.00 from Bernard Adolphus Hoopes (ca 1827–1897) of Organ, New Mexico, who had secured it from William Paterson Turnbull (1830–1871) in Philadelphia about 30 years before.
	176991	pre-1865	Phillip Island?	Purchased 12 June 1901 from Annie P. Cope for US\$75.00. Annie Cope (likely Annie Pim Cope, 1841–1933, wife of the palaeontologist Edward Drinker Cope, 1840–1897, who she married in 1865) bought it in 1865.
Staatliches Museum für Tierkunde (SMTD), Dresden (now Senckenberg Museum Dresden)	—	1836	Phillip Island	Cited in Gouraud & Jansen (2024). Purchased from Eduard Rüppell (Hartert, 1891).
University Museum of Zoology (UMZC), Cambridge University, Cambridge, UK	—	pre-1852	—	<i>Nestor meridionalis productus</i> bought in Edinburgh in 1852. From the Hugh Edwin Strickland (1811–1853) Collection (Benson, 1972).
World Museum (WML or NML), Liverpool, UK	—	1788	Phillip Island	Specimen was collected on Phillip Island in 1788. It was then bought by Governor Phillip in 1788 and then passed to Dr. William Elford Leach (1791–1836). The specimen was subsequently bought by the XIIIth Earl of Derby (Edward Smith-Stanley, 1775–1851) at Christie’s sale of 1811. Canon Henry Baker Tristram then obtained the specimen by exchange in 1873. It has been previously mounted (Fisher, 1981).

Table 2. *Continued...*

Table 2. Continued.

Institution	Registration number	Collection date	Listed collection locality	Notes
	—	1833	Phillip Island	Specimen was collected on Phillip Island in 1833 by Tucker. It was transported to England by Captain Sturt for possibly John Gould. It had a very long beak and was in the collection of the XIIIth Earl of Derby (Fisher, 1981).
Zoologisches Museum (ZIMG), Göttingen, Germany	—	—	—	Cited in Gouraud & Jansen (2024).
Zoologisches Museum der Christian-Albrechts-Universität (ZMK), Kiel, Germany	—	—	—	Cited in Gouraud & Jansen (2024).

*An additional specimen in the Museo Civico di Storia Naturale di Milano, Italy was destroyed during World War II (Violani *et al.*, 1984).

specimens were collected from around NI in 1892.

Several other bird specimens in the Australian Museum Ornithology Collection also require additional research or verification. The first is a series of eggs labelled as Sooty Shearwater, *Ardenna grisea*, a species that has not been otherwise recorded as breeding in the NI Group and is regarded as an occasional vagrant (Schodde *et al.*, 1983; Marchant & Higgins, 1990; Christian, 2005). Two eggs, as noted in Bassett Hull (1909) were collected in December 1908 by J. Jacobs from Bumboras Bay, NI (AMS O.49999, O.50000), while a third was collected in December 1915 by J.S.P. Ramsay from Nepean Island (AMS O.61755). Although the species identification of these eggs should be tested, confusion with the common NI breeding species the Wedge-tailed Shearwater, *Ardenna pacifica* (which has a dark morph) is a potential explanation. The second, is a clutch of eggs and other material (AMS O.13107–13108) recorded in the Ornithology Collection database as Yellow-bibbed Lory, *Lorius chlorocercus* a parrot species endemic to the east Solomon Islands (Dunston, 2011). These specimens are listed as having been collected by Dr P. H. Metcalfe on 6 January 1903 from Steels Point, NI. Although the species identity requires confirmation (and currently the specimens cannot be located in the collection), the presence of large numbers of staff from the Melanesian Mission on NI Island from 1866–1920 (Hoare, 2008) and the fact that *L. chlorocercus* is a common cage-bird in the Solomon Islands (Dunston, 2011) raises the intriguing possibility that some birds were brought to NI and became free-flying but did not establish, or that Metcalfe collected the eggs from a captive bird.

Norfolk Island Group herpetofauna

Unlike the diverse avifauna, the diversity of the native herpetological (reptiles and amphibians) fauna of the NI Group is incredibly low. Only two native terrestrial lizards, the Lord Howe Island Gecko, *Christinus guentheri* and the Lord Howe Island Skink, *Oligosoma lichenigerum* have been recorded from the NI Group, with all known records of living animals being from the offshore islands. As their common name suggests, these two species also occur on the Lord Howe Island Group (895 km to the west), however further research is required on both species to determine the true taxonomic status of the Lord Howe and Norfolk Island populations.

The earliest European accounts of NI Group reptile fauna come from Philip Gidley King who led the establishment of the first British settlement on NI in 1788. He mentions only that “lizards and centipedes” were common on Phillip Island (Cogger *et al.*, 1983), but the species being referred to is unclear. In 1830, the botanist Alan Cunningham (1791–1839), spent four months on NI and stated that “no snakes have been found on any part of the Island, but frogs inhabit its waters, and a small black lizard has been observed, with a broad flat triangular tail much like *L. laticauda* [= *Laticauda laticaudata*]” (Mills, 2012). These observations are unique as there have never been any historical records of frogs from these islands and is most likely an error (Mills, 2012). However, since endemic frog species do occur in New Zealand (Gill & Whitaker, 1996) and Fiji (Morrison, 2003), there is a small possibility that there might have been a native frog on NI that become extinct soon after European settlement. The small black lizard and another description of a beach-washed snake will be discussed subsequently (see Introduced Reptiles below). Later observations by Downing (1859) noted that NI was “free also from lizards



Figure 4. The Australian Museum specimen of the Norfolk Kaka, *Nestor productus*, AMS O.22287 (PA.2933) collected prior to 1837. (Photography: Emily Cave, AMRI).



Figure 5. A single broken egg AMS O.12359 in the Australian Museum collection, collected prior to 1901, labelled as *Estrelata phillipii* an early name for the Providence Petrel, *Pterodroma solandri*. Accompanying the specimen is a handwritten note from the collector Dr P.H. Metcalfe stating, “This is the only one I have...”. (Photography: Emily Cave, AMRI).

and centipedes, both of which are to be found in a certain small portion of Phillip Island”.

In 1885, George Albert Boulenger (1858–1937) from the British Museum’s Department of Zoology (now Natural History Museum, London -NHMUK), documented specimens of two gecko species from the NI Group; *Phyllodactylus guentheri* [= *Christinus guentheri*] and *Gehyra vorax* (Boulenger, 1885). It is presumed the *G. vorax* specimens (NHMUK 1861.1.6.27–28) are an error of identification or collection location, as had also been noted for *G. oceanica* records from Lord Howe Island (Cogger, 1971), and for other herpetological specimens collected by F. M. Rayner (Shea & Scanlon, 2007). However, these specimens in the NHMUK have not been examined recently and should be reassessed. Additional information on the distribution of NI Group lizards, was noted by Ogilby (1887: 990) who describes two “*Phyllodactylus guentheri* [= *Christinus guentheri*] that have been brought back by a Mr. Millington, who states that it is not found on Norfolk Island proper, but that it is common on Phillip and Nepean Islands.” Almost a century later Cogger *et al.* (1979, 1983, 2006), provided the most comprehensive reptile survey of the NI Group. They concluded that *Christinus guentheri* and *Oligosoma lichenigerum* were the only native terrestrial reptiles present in the NI Group, and that these species were effectively extinct on the main island, most likely as a result of predation by introduced rats. Further, Cogger *et al.* (2006) provided the first documentation for an established population of the introduced Asian House Gecko, *Hemidactylus frenatus* on NI. This invasive species is widespread in south and southeast Asia, New Guinea, northern Australia and many Pacific Islands (Cogger, 2014).

Lord Howe Island Gecko, *Christinus guentheri* (Boulenger, 1885)

The Lord Howe Island Gecko was first described by George Albert Boulenger as *Phyllodactylus guentheri* Boulenger 1885, based on a series of specimens from the NI Group (NHMUK 1862.1.6.29–31), Lord Howe Island (NHMUK 1856.7.7.19), and Champion Bay (NHMUK 1867.2.19.18), northwest coast of Australia (Fig. 6). The NI Group and Lord Howe Island specimens are respectively listed as being collected by Frederick Matthew Rayner (1817–1872) (Surgeon) and John Denis MacDonald (1830–1908) (Assistant Surgeon) of H.M.S. *Herald* who were employed on Surveying Service on the South Pacific under the command of Captain Henry Mangles Denham R.N. F.R.S. (1800–1887) (David, 1995). During this voyage H.M.S. *Herald* visited Norfolk Island in June 1855 and June of 1856. In June of 1855, there appears to be no mention of geckos, or any reptiles collected (Rayner & Macdonald, 1855) and they appear to have only surveyed the main island. However, in June of 1856, parties were landed on Phillip Island (David, 1995). It is presumed this is when the “Norfolk Island” specimens were collected as the species was not present on the main island by this time. In May and September of 1853, H.M.S. *Herald* was joined by the *Torch* for a survey of Lord Howe Island. In September of 1853, John MacGillivray (1821–1867) (zoologist), William Grant Milne (1829–1866) (botanist) and Frederick Rayner did land and collect on Lord Howe Island, so it is presumed this is when that specimen was collected. The specimen from Champion Bay, northwest Australia was reviewed by Cogger (1971) and, while confirmed as conspecific with the other syntypes, was presumed to be an error as no specimens of this species have ever been recorded from mainland Australia. The donor

of this specimen, the entomologist Francis Houssemayne DuBoulay (1837–1914) resided near Champion Bay and is not known to have travelled to either NI or Lord Howe Island, or even to the eastern states prior to the receipt of the specimen by the then British Museum in 1867 (Musgrave, 1932). Hence, we presume that this specimen mistakenly became associated with that registration number, locality and donor prior to the description of the species nearly two decades later. Wells and Wellington (1985) designated the specimen NHMUK 62.1.6.29 as lectotype, fixing the name to the population from the NI Group (although they incorrectly gave the locality for this specimen as Lord Howe Island). Cogger (1971) also provides an extended redescription of the species based on a much larger series of specimens and lists its occurrence as only the NI and Lord Howe Island Groups. In the NI Group, Cogger *et al.* (1979, 1983) found *C. guentheri* to be extremely abundant on Phillip and Nepean Islands. It was also found to be present on the smaller offshore islands of Bird Rock (= Red Stone) and Moo’oo Stone. A further survey in 2005 found *C. guentheri* to be abundant on Phillip Island and Nepean Island, but with few individuals found during short day searches on Moo’oo Stone and Bird Rock (Cogger *et al.*, 2006). The species has also been reported on Green Pool Stone and Cathedral Rock and may occur on other small rock stacks off the north coast (Colgan *et al.*, 2006). To date there have been no confirmed records of this species on NI as a living animal, but skeletal remains have been recovered as subfossils in sand dune deposits (Schodde *et al.*, 1983). Cogger *et al.* (1979) concluded that *C. guentheri* was functionally extinct on the main NI, as a result of introduced rat predation, and that its disappearance possibly pre-dates European settlement (Cogger *et al.*, 1979; 1983). *Christinus guentheri* is currently listed as Vulnerable by the International Union for Conservation of Nature (IUCN) and the Australian Government’s *Environmental Protection and Biodiversity Conservation (EPBC) Act*. Threats include the impact of invasive species, human disturbance, as well as habitat loss and degradation (Chapple & Cogger, 2018).

Lord Howe Island Skink, *Oligosoma lichenigerum* (O’Shaughnessy, 1874)

The Lord Howe Island Skink was first described by Arthur O’Shaughnessy (1844–1881) as *Mococa lichenigera* O’Shaughnessy 1874 based on a single specimen (NHMUK 1946.8.16.27) collected on Lord Howe Island (Fig. 7) by John MacGillivray of H.M.S. *Herald*. MacGillivray did collect on Lord Howe Island in September 1853, but did not collect on NI as he had been dismissed by Captain Henry Mangles in early 1855, prior to the first visit to NI in June 1855 (David, 1995). Interestingly, a few years later Boulenger (1887) also lists a second specimen (NHMUK 1856.7.7.26) as “Probable same locality” and being from H.M.S. *Herald*. Cogger (1971) provided an extended redescription of the species based on a much larger series of specimens from the Lord Howe Island Group and concluded that it only occurred in that group. However, in March of 1978, a single *O. lichenigerum* specimen (AMS R.74889) was discovered on Phillip Island, NI Group by Beryl Evans (1927–2016) and Owen Evans (1928–2010). This specimen had been found while Beryl and Owen were staying on Phillip Island studying the nesting seabirds (Coyne, 2009). A second specimen (AMS R.77118) was found later in the year, and both were forwarded to the Australian Museum for identification. Cogger *et al.* (1979), stated that although there were differences in scalation between the Phillip Island



Figure 6. Reproduction of Plate 7 from Boulenger (1885) *Catalogue of the Lizards in the British Museum (Natural History) Volume I.* featuring a specimen of *Phyllodactylus guentheri* [= *Christinus guentheri*] (lower centre).

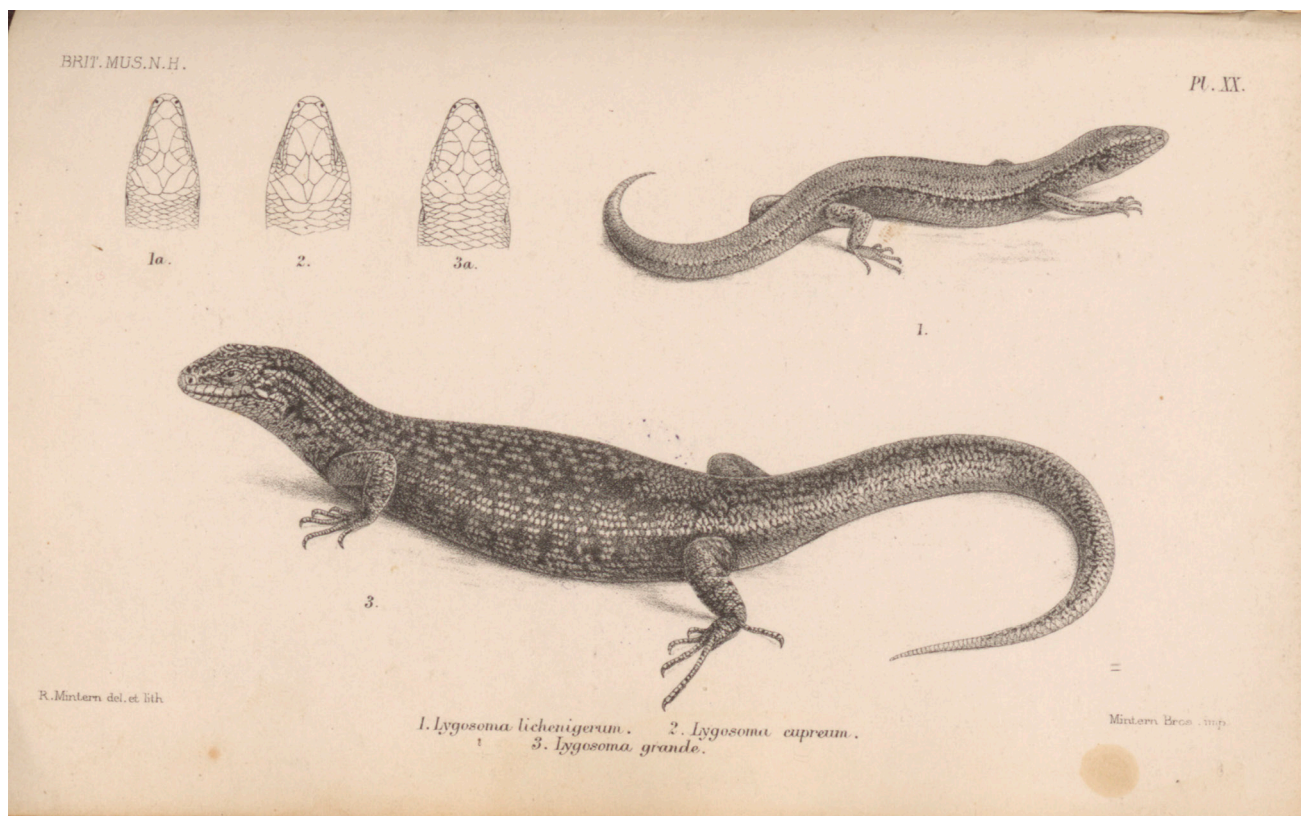


Figure 7. Reproduction of Plate 20 from Boulenger (1887) *Catalogue of the Lizards in the British Museum (Natural History) Volume III*, featuring a specimen of *Lygosoma lichenigerum* [= *Oligosoma lichenigerum*] (top right).

and Lord Howe Island specimens, they should be treated as the same species pending further taxonomic studies. After searching the islands of the NI Group, Cogger *et al.* (1979, 1983, 2006) concluded that *O. lichenigerum* was only found on Phillip Island and unlike *C. guentheri*, no evidence has been found that *O. lichenigerum* ever lived on the main island. However, during a community engagement session, Arthur Evans (pers. comm.) informed us that his parents (Owen and Beryl Evans) had sighted a skink on Moo'oo Stone in the late 1980s while out on an overnight fishing trip. As Owen and Beryl were skilled naturalists who first discovered *O. lichenigerum* on Phillip Island, the physical difference between the gecko and skink and the overnight trip which allowed for sighting of nocturnal species, it is possible that *O. lichenigerum* was present on the northern islets in the late 1980s. *Oligosoma lichenigerum* is currently listed as Vulnerable by the IUCN and under the Australian Government's *EPBC Act*. Threats include the impact of invasive species, human disturbance, as well as habitat loss and degradation (Chapple *et al.*, 2018).

Marine Turtles

Available evidence suggests that marine turtles were at low density in the NI Group during the period of Polynesian settlement, based on a low abundance of turtle bones found in excavations of settlements on NI (Smith *et al.*, 2001). Marine turtles were first recorded by Europeans basking and being captured in 'Turtle Bay' (= Emily Bay) on NI, by Philip Gidley King in early 1788 (Fidlon & Ryan, 1980; Pendoley & Christian, 2012). Captain John Hunter (1737–1821) also detailed accounts of numerous turtles at NI, including onshore at 'Turtle Bay' (Hunter, 1793, summary in Pendoley & Christian, 2012). Turner *et al.* (1968) suggested marine turtles breed at Anson Bay, but there is no evidence, historical

or modern that marine turtles have ever bred on the main island (Pendoley & Christian, 2012). A review of marine turtle records by Pendoley and Christian (2012) notes that healthy juvenile and adult Green Turtles, *Chelonia mydas* are frequently present in NI waters. Adult Hawksbill Turtles, *Eretmochelys imbricata* are also noted, but all records of juvenile *E. imbricata* have been of dead and dying animals found as strandings. This suggests that adult *E. imbricata* may only visit the waters of NI to feed. There appear to be no marine turtle specimens from the NI Group in natural history museum collections.

Sea snakes

Norfolk Island residents have recorded sea snakes in the waters surrounding the NI Group (Cogger *et al.*, 1979, 1983), but no verified specimens are known to exist in natural history museum collections. However, while on NI, we were alerted by staff from the Norfolk Island Museum to an historical account in the *Sydney Gazette and New South Wales Advertiser* on 30 October 1830. In this account, a prisoner found a live snake coiled under a rock. The "colour down the belly was a dull yellow down the back a greenish blue, until within about six inches of the trails, where the colours ceased to be longitudinal, became circular, and distinctly marked in rings alternately black and yellow within about an inch of the extremity of the trail, which was obtuse and flattened like the common eel, two antennae [sic], or rather hooker nippers, were placed, measuring about one inch from their insertion to the point. ... The reptile measured 2 feet 6 inches, and we understand is now in the possession of the Hon. The Colonial Secretary, to whom it was forwarded" (Anonymous, 1830: 3).

Based on the detail in this description, this snake is most certainly a Yellow-bellied Sea Snake, *Hydrophis platurus*. As

this species is the most widely distributed reptile, living in the Indian and Pacific Oceans (Cogger, 2014), it is not surprising that it would occur around the NI Group. In addition, the Australian Museum has specimens of this species from Lord Howe Island (AMS R.3291, R.7016, R.7200, R.8138 and R.131999). At the time of the observation, the Colonial Secretary was Alexander Macleay (1767–1848), who was a natural history collector, so it's not surprising that it was forwarded to him for inclusion in his private collections. His scientific collections were passed to his son William Sharp Macleay (1792–1865), likewise a natural history collector, and were then passed to his nephew William John Macleay (1820–1891) who eventually gave the collection to the University of Sydney where it is still held today (Stanbury & Holland, 1988). Currently the Macleay Museum Collection does hold historical specimens of *H. platurus* from Australia (NHR.689, 690, and 806), Indonesia (NHR.691), Sri Lanka (NHR.692), Vanuatu (NHR.688), and one specimen of an unknown locality (NHR.687). Unfortunately, the specimen from an unknown locality is a juvenile so is unlikely to be the specimen that was “2 feet 6 inches” as reported in 1830. Considering this, it must be assumed that the 1830 specimen is not in the current Macleay or Australian Museum Herpetology Collection and therefore is either lost or was passed onto other collectors at the time.

Introduced reptiles and amphibians

In contrast to multiple bird and mammal introductions, there appear to have been no successful introductions of reptiles or frogs by either the Polynesian or early European settlers in the NI Group. However, several exotic reptile species may have been recorded on NI but failed to establish. The botanist Allan Cunningham (1791–1839), who visited NI in May–September 1830, noted on NI a “small black lizard with a broad flat triangular tail”. Mills (2012) believed this to be a specimen of the native gecko, *C. guentheri*. However, this species does not have a “broad flat triangular tail”, and thus we believe this description possibly relates to a translocated Leaf-tailed Gecko, *Phyllurus* sp., most likely the Broad-tailed Gecko, *Phyllurus platurus*, a common gecko widely distributed on sandstone within the Sydney region, but also regularly found in nearby buildings and infrastructure (Cogger, 2014). Given the regular flow of shipping coming from Sydney to NI, it would be unsurprising for this species to be accidentally transported. However, due to its reliance on specialised sandstone habitats, it would not have easily established on NI. Mills (2012) also noted Allan Cunningham's historical account of a terrestrial snake arriving on Norfolk Island inside a floating log, originating from islands to the north and east. Based on a sketch illustrating two claw-like appendages at the tip of the tail, Mills (2012) hypothesized that the animal was a Pacific Boa (*Candoia* sp.), a genus known for its cloacal spurs. While *Candoia* species are widely distributed across Melanesia and the southwest Pacific, including the Loyalty Islands, Vanuatu, Fiji, and Samoa (Reynolds & Henderson, 2018) this assessment remains problematic. Given the substantial size of the illustrated tail appendages, the specimen is much more likely a sea snake with everted hemipenes. We also believe that this observation is possibly the same one as reported in the *Sydney Gazette and New South Wales Advertiser* on 30 October 1830 (Anonymous, 1830) (see above), as both occurred at the time Allan Cunningham was on NI.

The first detailed herpetological survey of the NI Group by Cogger *et al.* (1979, 1983) documented no introduced reptiles or frogs on NI or its surrounding smaller islands.

Covacevich *et al.* (2001) provided the first review of introduced reptiles and frogs to NI recording a Cane Toad, *Rhinella marina* (QM J.74062), Green Tree Frogs, *Litoria caerulea* (QM J.74064–74065) and an Asian House Gecko, *Hemidactylus frenatus* (QM J.74060). While these species had been recorded as arrivals on NI, they had not become established at that time. Later, Cogger *et al.* (2006) noted the discovery of free-ranging colonies of *H. frenatus* on NI. Further investigation by Whitaker and Whitaker (2007) found a substantial population of *H. frenatus* around the South Pacific Hotel, Burnt Pine in 2006. By 2008, this population was still at the same extent and population density as recorded in 2006 (Whitaker & Whitaker, 2008). Whitaker and Whitaker (2007) also recorded a single Garden Skink, *Lampropholis delicata* at Burnt Pine in November 2005.

Australian Museum holdings of Norfolk Island Group herpetofauna

Specimens from the NI Group in the Australian Museum Herpetology Collection date from the 1800s with a few specimens added at irregular intervals over the next 100 years, prior to the large-scale collections during the surveys of Cogger *et al.* (1979). Prior to the current survey, the collection contained 132 herpetological specimens from the NI Group, comprising only two terrestrial lizard species (Table 3). Frozen tissue samples (n = 26) for genetic studies from the Cogger *et al.* 2008 survey are also in the collection, but none are associated with any of the voucher specimens (Table 3).

Lord Howe Island Gecko *Christinus guentheri* (Boulenger, 1885)

The Australian Museum Herpetology Collection holds a total of 122 voucher specimens and 16 tissues (not associated with vouchers) from NI Group *C. guentheri* (Table 3).

The oldest NI specimen in the Herpetology Collection appears to be AMS R.5594 (Fig. 8). Though the specimen was registered in the current R. numbering series on the 22 April 1912, it is likely much older as it is listed as coming from the “old collection” on the electronic database with a locality of “Norfolk Island” in the 1912 hard copy register. Over time, specimens that were in the earlier series of the Palmer (c.1877–1888), A. (1875–1883) & B. (1883–1886) registers at the Australian Museum have been reregistered in the current R. series (Shea & Sadlier, 1999), however not all the specimens recorded in these old registers have been located in the current collection. Unfortunately, AMS R.5594 does not have an earlier registration number (A, B or P.) suggesting either it is quite old or was donated around 1912. However, details of specimens acquired by the AM can be obtained from two other sources: the annual reports of the Australian Museum and the monthly lists of donations published in the local press at the time (Kehlmaier *et al.*, 2024). The current hard copy register states that AMS R.5594 was “Collected by Sir W Macleay,” and we have located a corresponding newspaper record listing a donation to the Australian Museum in June 1862 of “Three lizards (*Naultinus pacificus*) from Norfolk Island, By William Macleay, Esq., M.P.” (Anonymous, 1862: 5). We believe these *Naultinus pacificus* specimens are most likely examples of *Christinus guentheri*, which had yet to be described as a species. The reference in 1912 to the “old collection” suggests these specimens had not previously been registered, supporting the conclusion that AMS R.5594 was received by the AM in June 1862 from William Macleay, Esq., M.P.

Table 3. Summary of registered Australian Museum reptile specimens and samples from Norfolk Island Group prior to current survey.

Scientific name	Common name	Number of specimens	Form of specimens
<i>Oligosoma lichenigerum</i>	Lord Howe Island Skink	10	Bodies in ethanol
	—	10	Frozen tissues
<i>Christinus guentheri</i>	Lord Howe Island Gecko	121	Bodies in ethanol
	—	1	Skull
	—	16	Frozen tissues

William John Macleay was the cousin of William Sharp Macleay, the son of Alexander Macleay, a Scottish born member of the Linnean Society and from 1825 to 1836 was the Colonial Secretary for New South Wales who had a passion for collecting natural history objects (Stanbury & Holland, 1988). Upon his death, his entire collection was passed to his son William Sharp Macleay who also had a fondness for natural history. In 1865, William Sharp died, and the entire collection was passed onto William John Macleay. William John first landed in Australia in 1839 and became a squatter. Over time his economic position became more secure, and by the 1850s he had entered politics and was elected to the first Legislative Assembly for the self-government of the Colony of New South Wales. It was during these later years, with the encouragement of his cousin William Sharp, that he began a keen interest in the collection of natural history objects (Stanbury & Holland, 1988). He soon met other local naturalists such as Rev. Robert Lethbridge King (1823–1897) (Stanbury & Holland, 1988), the son of Phillip Parker King (1791–1856), naval officer, born on 13 December 1791 at Norfolk Island, the son of Philip Gidley King who documented the first account of herpetofauna on NI. In addition, he also knew Lieutenant Arthur Onslow (1833–1882), of H.M.S. *Herald*, a grandson of Alexander Macleay (Stanbury & Holland, 1988). It is through this contact that he also met Dr Frederick Rayner of H.M.S. *Herald* (Stanbury & Holland, 1988; Ville *et al.*, 2020) who collected the first NI Group *C. guentheri* specimens in the NHMUK's collection. It is unknown if William John ever collected in the NI Group, but it appears that through his contacts he would have easily been able to source specimens. Based on this, we hypothesise that AMS R.5594, was possibly acquired by Frederick Rayner during the 1856 trip where parties from H.M.S. *Herald* landed on Phillip Island (David, 1995). However, given the Macleay's extensive access to natural history items from throughout the world, and NI, this specimen may have been acquired much earlier. Either way, this makes AMS R.5594 one of the oldest known herpetological specimens in the current Australian Museum Collection. Interestingly, this species is not represented in the current Macleay Collection.

On 2 December 1908, the AMS received a series of *C. guentheri* (AMS R.4270–4277) collected from Nepean Island on the 15 October 1908 by A. F. Basset Hull during his studies on the birds of Lord Howe and Norfolk Islands (Basset Hull, 1909). His archival notes states:

“that the majority of these seen had short tails covered with blackish skin, while some were apparently casting the black skin and the tail was growing to the normal length and of the greenish colour of the body” (Basset Hull, 1908). (It is presumed he was noting the occurrence of regenerated tails for this species).

On 27 September 1910, the AMS was given a single *C. guentheri* (AMS R.4919) specimen from Phillip Island, by a Miss Mitchell. On 16 March 1963, the AMS was presented by J. Booth, a single *C. guentheri* (AMS R.19301) that had been collected on Nepean Island by L. Marsh. It is presumed this was Loiset Matilda Marsh (1928–2021), a marine biologist who lived on NI from 1960–1963 and later became Curator of Marine Invertebrates at the Western Australian Museum. On the 5 December 1977, the Herpetology Collection received another single *C. guentheri* specimen (AMS R.66242) collected on the 9 February 1963 from Norfolk Island by B. Marsh. It is likely this is Brian Marsh, the husband of Loiset Matilda Marsh, who was also present on Norfolk from 1960–1963 (Gregson, 2021; Wikipedia, 2022). It is likely this specimen is also from Nepean Island.



Figure 8. The oldest Australian Museum specimen of *Christinus guentheri* (AMS R.5594) donated in June 1862 by William John Macleay. See text page 18. (Photography: Dane Trembath, AMRI).

Three more *C. guentheri* (AMS R.29192–29194) were collected on Phillip Island on 26 November 1968 by Australian Museum Entomology Curator and Deputy Director Courtenay Neville Smithers (1925–2011) and Ornithology Curator H.J. Disney, during a trip to determine the present distribution of the terrestrial and freshwater birds of NI (Smithers & Disney, 1969). In March 1969, Disney returned to Norfolk Island and appears to have made it to Nepean Island where he collected an additional six *C. guentheri* (AMS R.71119–71123).

In the late 1970s, the then Australian National Parks and Wildlife Service commissioned the Australian Museum to undertake a survey to assess the present status of the two native terrestrial lizards in the NI Group (Cogger *et al.*, 1979). This was initiated by the finding of a single *O. lichenigerum* specimen (AMS R.74889) on Phillip Island by Beryl and Owen Evans in March of 1978, and the strong evidence that neither *C. guentheri* nor *O. lichenigerum* were present on the main island. Fieldwork was undertaken in November of 1978, and included a general search of NI, combined with trying to access all the offshore islands. Despite the often-changing weather and ocean conditions, the survey team was able to access Phillip Island, Nepean Island, Moo'oo Stone and Bird Rock. During the twelve days more than 800 individual lizards (geckos and skinks) were observed, with about 450 captured, weighed measured and released. In addition, a very important series of voucher specimens were taken on Phillip (AMS R.80386–80429; R.80451–80452; R.80570–80572; R.80913; R.81394; R.95642) and Nepean (AMS R.80430–80445; R.80574; R.80660; 105414) Islands, Moo'oo Stone (AMS R.80446–80448) and Bird Rock (AMS R.80449–80450). However, no frozen tissues suitable for genetic studies were collected at this time. A small series of

live *C. guentheri* (AMS R.90199–90202) were also brought back to the Australian Museum for karyotyping studies by cytogeneticist Dr Max King (King, 1987).

In February 2005, the Australian Museum was once again contracted to undertake a field survey of the native reptiles in the NI Group. This survey was to gather more up to date information, as at the time, all available information was based on the 1978 survey. In addition, this new survey sought to gather genetic material (tail-tip biopsies) to undertake a study on genetic variation and gene flow amongst the populations (Colgan *et al.*, 2006). This survey gathered the first tissues from Phillip (AMS R.193155.001; R.193157.001–193158.001; R.193160.001; R.193165.001; R.193167.001) and Nepean (AMS R.193168.001–193172.001; R.193174.001) Islands, Moo'oo Stone (AMS R.193173.001; 193175.001; 193177.001), and Bird Rock (AMS R.193178.001). However, no whole specimen vouchers were taken.

Lord Howe Island Skink, *Oligosoma lichenigerum* (O'Shaughnessy, 1874)

The Australian Museum Herpetology Collection holds a total of 10 voucher specimens and 10 tissues (not associated with vouchers) from NI group *O. lichenigerum* (Table 3). The earliest specimens are the two collected by Beryl and Owen Evans on Phillip Island in 1978 (AMS R.74889; R.77118). Due to the discovery of a new skink species in the NI Group, the Australian Museum collected further specimens (but no frozen tissues) during a November 1978 trip to Phillip Island (AMS R.80453–80457; R.99299). A juvenile (AMS R.80573) is also listed, that was hatched from an “egg found on Phillip Island”. Some eggshells (AMS R.93400) are also present in the collection and are presumed to have come from

two gravid females that were brought back to the Australian Museum laboratory (Cogger *et al.*, 1979). Frozen tissues (tail-tip biopsies), but no specimens, were collected in March 2005, when the Australian Museum again undertook field surveys (AMS R.193153.001–193154.001; R.193156.001; R.193159.001; R.193161.001–193164.001; R.193166.001; R.193176.001).

Introduced reptiles

Prior to this Expedition, the Australian Museum Herpetology Collection had no holding of introduced reptiles or frogs from the NI Group.

Norfolk Island Group mammals

In contrast to the diverse avifauna, the native terrestrial mammal fauna of the NI Group is depauperate, reflecting the superior over-water dispersal ability of birds compared to most mammals. Only two native species of terrestrial mammals, both microbats, have been recorded from Norfolk Island: the Eastern Free-tail bat, *Micronomus norfolkensis* (Molossidae) and Gould's Wattled Bat, *Chalinolobus gouldii* (Vespertilionidae). An additional seven terrestrial mammal species have been introduced to the NI Group and established wild populations, although three of these have now been eradicated. As noted above, while vagrant bird species are regularly reported from NI (Christian, 2005) and other oceanic islands (McAllan *et al.*, 2004; James & McAllan, 2014), we are not aware of any verified records of vagrant bats from NI. This most likely reflects the greater difficulty in both the detection and identification of microbats compounding the rarity of vagrancy.

Microbats

Eastern Free-tail bat *Micronomus norfolkensis* (Gray, 1839)

The only NI record of *Micronomus norfolkensis* (previously *Mormopterus norfolkensis*) is one specimen obtained at an unknown date prior to 1838, but its attribution to NI remains uncertain. The presence of *M. norfolkensis* on NI remains problematic due to uncertainty about the origin of the NI specimen (Strahan, 1980), taxonomic confusion about the specimen's identity, and taxonomic confusion surrounding the small species of Australasian free-tail bats more generally (Reardon *et al.*, 2008). The English taxonomist and Keeper of Zoology at the British Museum, John Edward Gray (1800–1875) first published the name in 1839 in a species identification key, later indicating that the specimen was from NI (Gray, 1843). The specimen (NHMUK 38.10.11.56) was registered in the collection in October 1838 as being from NI, but no other details were entered in the register other than that it was obtained from "Mr I T Warwick". The year of collection and the collector remain unknown. It is possible that the name associated with the specimen as "I. T." Warwick is a misreading of "J. E." and refers to the known natural history dealer John Edington Warwick (1793–1874), who sold natural history specimens to the then British Museum (Ackery & Goodger, 2004; Khandal *et al.*, 2022), but this possibility requires further investigation.

The species-level identification of the type specimen also needs to be re-examined, including if possible, using molecular genetics (Bi *et al.*, 2013) in the broader context reflected by current understanding of molossid systematics.



Figure 9. Holotype skin of *Micronomus norfolkensis* (Gray, 1839) NHMUK 38.10.11.56, indeterminate sex: a) dorsal view of skin; b) ventral view of skin, scale bar applies to a) and b); c), closeup of throat area where a gular sac, if present, would be located. (Photography: Phaedra Kokkini. From the collections of the Natural History Museum, London.).

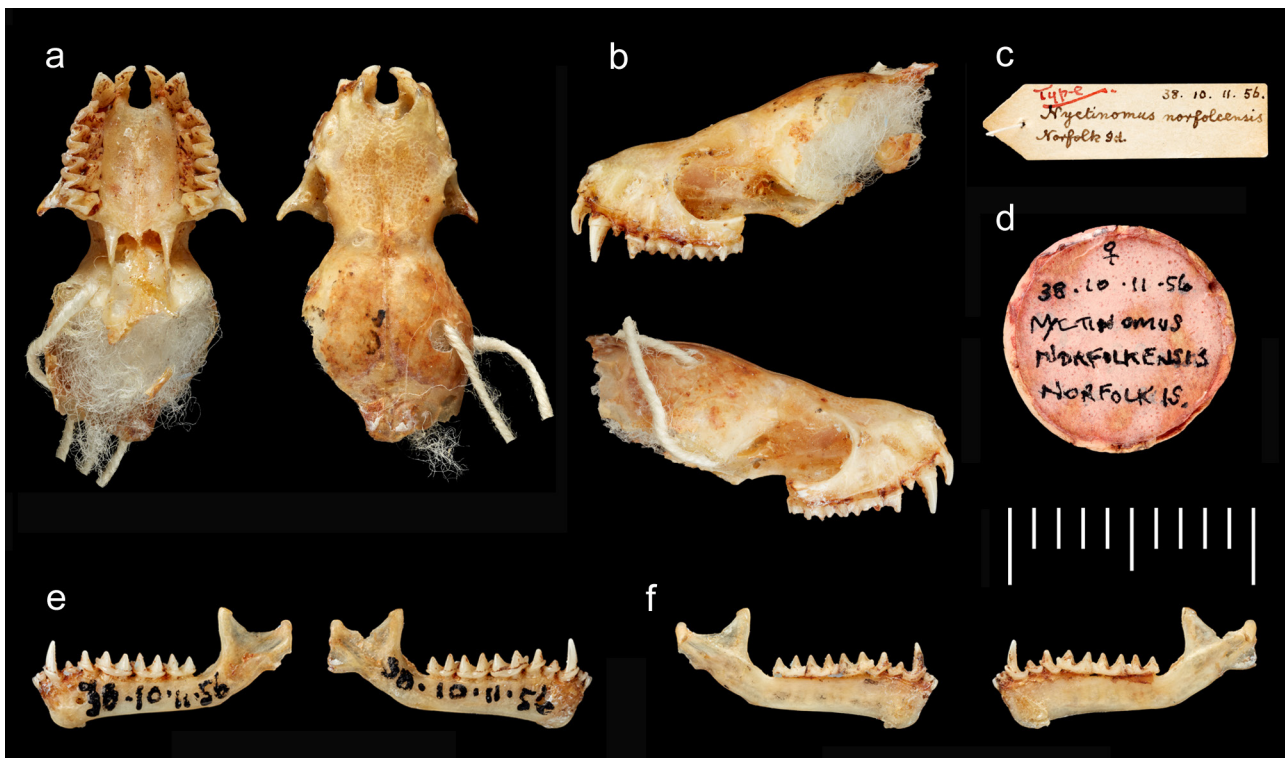


Figure 10. Holotype skull of *Micronomus norfolkensis* (Gray, 1839) NHMUK 38.10.11.56, indeterminate sex: a) ventral (left) and dorsal cranium; b) cranium lateral views; c), skull tag; d), skull vial label; e), labial views of left and right dentaries, and f) lingual views of left and right dentaries. Scale = 10 mm. (Photography: Phaedra Kokkini. From the collections of the Natural History Museum, London.)

Previously, it has been regarded as indistinguishable from continental Australian populations referred to *M. norfolkensis*, which is currently envisioned as a species with a narrow subcoastal distribution in northern NSW and southern Qld. Reardon *et al.* (2008) provided the first detailed description of eastern Australian *M. norfolkensis* and concluded that the holotype of *M. norfolkensis* was the same species as that found in eastern continental Australia. They examined the holotype and could not find evidence for the presence of a small throat sac (gular sac), a diagnostic feature previously thought to distinguish the holotype from all eastern Australian *M. norfolkensis* and a character not found in any species from the Australian region. They concluded that all previous authorities who had examined the holotype had incorrectly reported the presence of a gular sac. Species with a gular sac occur in Madagascar, central and South America, and Sumatra. We examined images of the holotype skin (Fig. 9) but could not confirm the presence of a gular sac. Here we also provide images of the holotype skull and dentaries (Fig. 10), given limited published illustrations of the holotype to date. It is evident that the original skin tags, if any, are no longer associated with the skin and skull.

Although Gray (1839) provided the first valid publication of the name *norfolkensis* under current rules governing zoological nomenclature, Gray never published measurements or an adequate description of this species. Subsequently, Gray (1844–1875) included the species as “Norfolk Island bulldog-bat *Molossus norfolkensis*” in a list of ‘Miscellanea’ but provided no further details beyond an illustration (Plate 22 of Gray 1844–1875) of a ventral view of a non-descript, small molossid without-stretched wings (Fig. 11). Dobson (1878) provided the first detailed description of the species but based it on material that included an unrelated continental Australian species (*Ozimops planiceps*). This confusion led Dobson to conclude that the holotype was the same species

as bats from eastern Australia. The adoption of Dobson’s assessment resulted in confusion that persisted throughout the 20th century, leading to the view that the holotype of *M. norfolkensis* was identical to an eastern Australian species. Given that *norfolkensis* was the earliest available name, it was uncritically adopted for the mainland Australian species. This view was supported by the most recent taxonomic assessment by Reardon *et al.* (2008).

No other specimens or records of *M. norfolkensis* have ever been recorded from NI, leading most authors since Iredale and Troughton (1934) to believe that the type locality given for the type specimen was erroneous and that the specimen was more likely to have come from eastern Australia. This is plausible given that the holotype was registered in the NHMUK with a batch of specimens from continental Australia. This is similar to the situation for the Squirrel Glider, *Petaurus norfolcensis* (Petauridae) named in 1792 by the Scottish naturalist Robert Kerr (1757–1813) based on the mistaken belief that the type locality was Norfolk Island. The Squirrel Glider has never occurred on Norfolk Island (nor has any other marsupial) but the species is widespread in eastern Australia, and the type specimen is more likely to have come from near Sydney (McKay, 1988). In the late 1700s the only British settlements in the region were the fledgling colonies at Sydney Cove and Norfolk Island, although by the 1830s British settlements and influence were more widespread.

Thus, four possibilities exist for the origin of the type specimen of *M. norfolkensis*:

1. The species was a resident of NI but became extinct after the first, and only, specimen was collected;
2. The type specimen was collected from NI, but the individual was a vagrant from eastern Australia, and the species was not established on NI;
3. The species has never occurred on NI and the original



Figure 11. Reproduction of Plate 22 featuring “*Molossus norfolkensis*” (= *Micronomus norfolkensis*) (lower centre) from Gray (1844–1875). *The Zoology of the Voyage of the H.M.S. Erebus & Terror; Under the Command of Captain Sir James Clark Ross, During the Years 1839 to 1843. By Authority of the Lords Commissioners of the Admiralty.*

collection locality is erroneous with the type specimen actually coming from eastern Australia;

4. The species has never occurred on NI, the collection locality is erroneous, and the type specimen is of a species from outside the region.

Resolving these possibilities is a high priority for Australian mammal taxonomy, given that the taxonomic name *norfolkensis* is currently applied to a widespread species of Australian bat that is classified as “Near Threatened” by the IUCN (McConville & Pennay, 2020) and listed as “Vulnerable” under the NSW *Biodiversity Conservation Act* 2016. Further, if this record of a molossid from NI is genuine, it likely represents a recently extinct population or taxon in need of clearer documentation in the context of broader patterns of historical and ongoing extinctions within the Australian mammal fauna (Woinarski *et al.*, 2015).

Gould’s Wattled Bat, *Chalinolobus* cf. *gouldii* (Gray, 1841)

Gould’s Wattled Bat, *Chalinolobus gouldii*, is found across continental Australia and was first described in 1841 by J. E. Gray. Gray based his description of *C. gouldii* on specimens collected in south-eastern mainland Australia and Tasmania. This species was first reported from NI (Troughton, 1922) on the basis of a 1915 museum specimen

(AMS M.4991), although the relationship between the NI population and that in continental Australia ~ 1400 km to the east remains uncertain, thus we refer to the NI population here as *Chalinolobus* cf. *gouldii*. Endemic island species of *Chalinolobus* occur elsewhere in the south-west Pacific in New Caledonia 675 km to the north (*C. neocaledonicus*), and in New Zealand, 772 km to the southeast (*C. tuberculatus*) of NI (Parnaby *et al.*, 2020).

Until the 1960s, *Chalinolobus* cf. *gouldii* was apparently common and reported regularly on NI (Turner *et al.*, 1968; Hoyer, 2011). However, it apparently declined subsequently, and by the early 1980s it could not be located during a dedicated survey (Gordon, 1983) and was feared extinct (Tidemann, 1986). There have been no validated records of the species from NI in the past four decades despite dedicated searches in 1983, 1986, and 2003 (Gordon, 1983; Hoyer, 2011). The last well-documented museum specimens were collected in the period between 1 March 1944 and 10 April 1945 (see below). The species is now considered to be extinct on NI (Flannery, 1995; Jackson & Groves, 2015), although sightings of microbats of unknown identification continue to be reported occasionally by NI residents (Tidemann, 1987; Hoyer, 2011).

Until recently, most authorities adopted the taxonomic assessment by Troughton (1922) that NI populations of *Chalinolobus* were indistinguishable from Australian *C. gouldii*. Tidemann (1986) found statistically significant

differences in measurements between specimens from NI and those from mainland Australia but attributed this to geographic variation, regarding *C. gouldii* as a variable species without clear justification for taxonomic recognition of subspecies. Nevertheless, compared to current arrangements of *Chalinolobus* taxonomy, Tidemann's taxonomic concept of *C. gouldii* encompassed a wide range of morphological variation and a sweeping insular geographic range, also including *C. neocaledonicus* (endemic to New Caledonia), now recognized as a full species. Koopman (1994) treated New Caledonian *Chalinolobus* as a subspecies (*C. gouldii neocaledonicus*), within which he tentatively included the NI population. Flannery (1995) rejected Tidemann's conclusions and believed the taxonomic status of the NI population was uncertain, implying that it was a distinct taxon. His view has subsequently been adopted by some authors (e.g. Simmons, 2005).

In a review of the taxonomic status of *C. neocaledonicus*, Parnaby *et al.* (2020) emphasised the taxonomic importance of the presence and relative size of a skin flap on the rear margin of the lips in delineating species of *Chalinolobus*, a key diagnostic feature not considered in recent taxonomic studies of *C. gouldii* and related species. Although Parnaby *et al.* (2020) did not discuss the status of NI populations, subsequent investigations have revealed that this structure is moderately developed in all four AMS specimens from NI (Fig. 12), though not as well developed as usually found in mainland *C. gouldii*. The absence of this structure in *C. neocaledonicus* is a significant difference from NI populations of *Chalinolobus*. Thus, the taxonomic status of NI *Chalinolobus* cf. *gouldii* requires further investigation. This isolated (but now apparently extinct) NI population may represent an undescribed endemic taxon (Jackson &

Groves, 2015; Burgin, 2019).

The first record of *Chalinolobus* from NI in the zoological literature is often attributed to Troughton (1922), who reported on a NI specimen collected in December 1915 by J.S.P. Ramsay (AMS M.4991). However, two previously overlooked watercolour paintings located during this study provide a much earlier record. The paintings by Dr James Stuart (1802–1842), one of which is dated 1840, depict specimens of NI *Chalinolobus* (Figs 13 and 14). Stuart, a keen natural historian, was the colonial assistant surgeon on NI from 1838 to 1840, and also completed many fine paintings of NI birds and fishes (Musgrave, 1955; Iredale, 1955; Whitley, 1955). His paintings were bequeathed to W.S. Macleay, subsequently given to the Linnean Society of NSW (Musgrave, 1955), and are now housed in the Mitchell Library, State Library of New South Wales in Sydney.

Several features seen in the illustrations (Figs 13 and 14) indicate that the subject was a species of *Chalinolobus* (and categorically not a molossid, the only other kind of bat reported from NI). The domed head and shape of the tragus and shape and relative size of the ears are characteristic of the genus, and the wing digits also indicate that it is not a bent-wing bat (*Miniopterus* spp.), a genus sometimes confused with *Chalinolobus* on external appearance.

Stuart indicates that his painting of a bat that died in resting position (Fig. 13) was drawn at life size and our measurements of the original painting reveal a forearm length of 43 mm, consistent with forearm lengths of existing NI specimens (Tidemann, 1986). Although Stuart does not indicate the scale in the painting of the bat in flight (Fig. 14), this painting appears also to be drawn at life size given that forearm length measured on the original painting is 44 mm.

The more uniformly dark, chocolate-brown fur colour



Figure 12. Wet specimen of *Chalinolobus* cf. *gouldii* collected on Norfolk Island in 1944–45. Showing lateral view of head of AMS M.12758, adult male (Photography: Ron Lovatt, AM DigiVol).



Figure 13. Watercolour painting of Norfolk Island *Chalinolobus* by James Stuart (1802–1842). Dated 1840; labelled “(*Vespertilio murinus* *norfolkica*). A dead bat swinging by his hind legs from a wall in the position it which he died. James Stuart depicted at natural size, 15 May 1840. Norfolk Island”. LE3399744. Vol 5. Natural history drawings of marsupials, reptiles and rodents, ca. 1831-1841 by James Stuart. Held in Mitchell Library, State Library of New South Wales, Sydney. FL3399797.



Figure 14. Watercolour painting of Norfolk Island *Chalinolobus* in flight by James Stuart (1802–1842). Undated, labelled “Norfolk Island”. LE3368120. Vol 5. Natural history drawings of marine plant and animals, ca. 1831-1841 by James Stuart. FL3368179. Held in Mitchell Library, State Library of New South Wales, Sydney.

M12759 SKIN DORSAL



Figure 15. Wet specimen of *Chalinolobus* cf. *gouldii* collected on Norfolk Island in 1944–45 showing dorsal view of AMS M.12759 adult male. (Photography: Ron Lovatt, AM DigiVol).

on the dorsum shown in the illustration (Fig. 13) is a contrast to the dorsal fur colour typical of *C. gouldii* from the southern half of continental Australia, in which the dark brown shoulders grade to pale brown fur on the rump. Fur colour in the four NI specimens in the AMS also lack a strong contrast between shoulders and rump (Fig. 15). NI bird species illustrated by Stuart reveal an accurate rendition of colours (Iredale, 1955), suggesting that Stuart's bat illustration provides a reliable indication of fur colour in the bat illustrated.

Stuart's bat painting depicted in Figure 13 bears the label “(*Vespertilio murinus* / *norfolkica*)”, presumably representing an impression that the bat was distinctive at some level and perhaps an intent to apply the taxonomic name *norfolkica* to it by Stuart or others. However, at this early date no species currently classified in the genus *Chalinolobus* had been named by taxonomists, preventing any comparison to the diverse vespertilionid component of the Australian fauna, which was largely unknown at the time. Consequently, the comparison is apparently with *Vespertilio murinus*, a Eurasian species and one of the first vespertilionid bats to be given a modern scientific name, by Linnaeus in 1758. In the hand-written caption of Stuart's original painting, an extra comment appears to be more lightly pencilled in (presumably at a later date) after the name: “This cannot be *V. murinus*”. The comparison to *V. murinus* in this case probably indicates little other than that the bat was correctly identified as a vespertilionid. This trinomial name (*norfolkica*) has never been published to our knowledge, and our mention of it here is not intended to activate its usage as a valid name. Rather we use it here as a *nomen nudum* in calling attention to it as a *nomen manuscriptum* of interest.

Establishing a firmer understanding of the taxonomic

status of *Chalinolobus* from the NI Group remains an important priority in Australian mammalogy, as it represents a recently extinct population and perhaps even a distinct taxon, and is important in the context of broader patterns of historical and ongoing extinctions within the Australian mammal fauna (Woinarski *et al.*, 2015).

Introduced mammals

Over the last ~800 years an additional seven terrestrial mammal species have been introduced to the NI Group and established wild populations; these include the Polynesian Rat, *Rattus exulans*, Black Rat, *Rattus rattus*, European House Mouse, *Mus musculus*, Pig, Goat, *Capra hircus*, European Rabbit, *Oryctolagus cuniculus* and Domestic Cat. All had significant detrimental impacts on the biodiversity of the NI Group, but the feral Goat, Pig and Rabbit populations have now been eliminated (Medway, 2002; DNP, 2010; Coyne, 2009; DNP, 2018). Fortunately, the three rodent species and Cats only became established on the main island (Norfolk) in the NI Group, allowing some native species to survive on offshore islands and islets (Cogger *et al.*, 1983; Christian, 2005; Coyne, 2010; DNP, 2010; CoA, 2025) despite being eliminated from the main island. On NI, rodent and cat control for biodiversity benefit is ongoing (DNP, 2010, 2018; CoA, 2025).

The introduction of *Rattus exulans* to the NI Group likely coincided with a period of Polynesian settlement of NI around the 13th-14th centuries (Anderson & White, 2001). The remains of *R. exulans* have been found in the Polynesian archaeological site (Smith *et al.*, 2001) and as subfossils in sand dune deposits (Schodde *et al.*, 1983). Genetic analysis of the remains from the Emily Bay settlement site revealed a population with high diversity that showed links to *R.*

exulans populations in East Polynesian and New Zealand (Matisoo-Smith *et al.*, 2001). The rats were still present on the main island at the time of the first European settlement in 1788 (Hoare, 2008) and remain so (CoA, 2025).

Mus musculus, was likely introduced to NI during the period of the first European settlement from 1788 to 1814 (Hoare, 2008). When the second European settlement was established in 1825 mice were reported to be very numerous (Medway, 2002). By around 1860 NI was regarded as the source population for the mice introduced to Lord Howe Island (Etheridge, 1889). Hermes (1986) documented a record of *M. musculus* from Nepean Island as well as on the main island.

The timing of the arrival *Rattus rattus* on NI remains less certain. Most suggest they arrived during World War II (Christian, 2005; TSSC, 2006; DNP, 2010; Mills, 2012), while some suggest they established at an earlier date. “Predation by exotic rats on Australian offshore islands of less than 1000 km² (100,000 ha)” is listed as a Key Threatening Process under the *EPBC Act 1999* (TSSC, 2006).

Pigs were released onto Phillip Island in 1793 and by 1830 had been joined by populations of Goats and European Rabbits (Coyne, 2009; Mills, 2012). During this period, Phillip Island was regularly visited by shooting parties from the nearby settlement on NI (Moore, 1985; Mills, 2012). The populations of these introduced species on Phillip Island increased rapidly and they began to destroy the island’s vegetation and expose the soil to erosion. The degradation of the island was noted in 1830 (Mills, 2012), well advanced by 1856 and by 1900 the pigs and goats had died out, but rabbits persisted until a targeted eradication program commenced in the 1970s, with the last rabbit removed in 1988 (Coyne, 2009, 2010). Fortunately,

rabbits did not become established on other islands in the NI Group. Feral goats and pigs also became established on NI and greatly increased in abundance during 1814–1825, when the European settlement was temporarily abandoned (Medway, 2002; Hoare, 2008). However, both species were subsequently eliminated following the establishment of the second European settlement in 1825 (Medway, 2002). Interestingly, about a dozen domestic Dogs, *Canis familiaris* were left on the island in 1814 but they failed to establish a feral population (Medway, 2002; Hoare, 2008).

Domestic cats appear to have become feral on NI soon after the establishment of the first European settlement in 1788, with reports of wild cats as early as 1795 (Medway, 2002). Feral cats appear to have proliferated between the first and second European settlements (1814–1825) (Medway, 2002) and by 1838 were regarded as a serious pest and were hunted with dogs (Moore, 1985). Unfortunately, feral cats remain well established across the main island and continue to negatively impact both native land birds and nesting sea birds (Hermes *et al.*, 1986; Medway, 2002; Christian, 2005). “Predation by feral cats” is listed as a Key Threatening Process under the *EPBC Act 1999* (DAWE, 2000).

Marine mammals

Over 30 marine mammal species may be found in the waters around the NI Group (Wilson & Mittermeier, 2014), and while there are confirmed species records in NI waters (Norfolk Island Province – IMCRA Bioregion) for at least 15 species (Table 4), there are very few marine mammal specimens from this region in natural history museums.

Vagrant seals have been occasionally reported from the NI Group (Shaughnessy & Christian, 2016). An unidentified seal was present at Cascade Bay during the 1950s or 1960s,

Table 4. Records and sightings of marine mammals around the Norfolk Island Group (Norfolk Island Province).

Scientific name	Common name	Nature of record	Reference
Pinnipeds			
<i>Arctocephalus forsteri</i>	Long-nosed Fur Seal	Stranding & sightings	Shaughnessy & Christian, 2016
<i>Hydrurga leptonyx</i>	Leopard Seal	Sighting	Matthews, 2024a
<i>Mirounga leonina</i>	Southern Elephant Seal	Bone fragments	Smith <i>et al.</i> , 2001
Cetaceans			
Mysticeti			
<i>Balaenoptera</i> spp.	Minke Whales	Sightings	Oosterman <i>et al.</i> , 2010
<i>Balaenoptera borealis</i>	Sei Whale	Sightings	NWDSSD, 2020
<i>Eubalaena australis</i>	Southern Right Whale	Harvest & sightings	Richards, 2009; NWDSSD, 2020
<i>Megaptera novaeangliae</i>	Humpback Whale	Harvest & sightings	Clapham <i>et al.</i> , 2009; Oosterman <i>et al.</i> , 2010; NWDSSD, 2020
Odontoceti			
<i>Globicephala melas</i>	Long-finned Pilot Whale	Sightings	NWDSSD, 2020
<i>Orcinus orca</i>	Killer Whale	Sightings	Ross, 2006; NWDSSD, 2020
<i>Physeter macrocephalus</i>	Sperm Whale	Sightings	Oosterman <i>et al.</i> , 2010
<i>Pseudorca crassidens</i>	False Killer Whale	Sightings	NWDSSD, 2020
<i>Tursiops truncatus</i>	Bottlenose Dolphin	Sightings	Bannister <i>et al.</i> , 1996; Oosterman <i>et al.</i> , 2010
<i>Mesoplodon densirostris</i>	Blainville’s Beaked Whale	Stranding & sightings	Bachara & Matthews, 2016
<i>Mesoplodon ginkgodens</i> or <i>M. hotaula</i>	Ginkgo-toothed or Deraniyagala’s Beaked Whale	Sighting	Bachara & Matthews, 2016
<i>Indopacetus pacificus</i>	Longman’s Beaked Whale	Potential sighting	Bachara & Matthews, 2016

while another five seals were reported between 2000 and 2013. Two of these were identified as Long-nosed Fur Seals, *Arctocephalus forsteri* by Shaughnessy and Christian (2016). Another likely fur seal was reported on rocks at Kingston in August 2023 (Matthews, 2023a), while a juvenile Leopard Seal, *Hydrurga leptonyx* was present at Cemetery Bay, Kingston on 2–3 October 2024 (Matthews, 2024a). In addition, cranial fragments of a Southern Elephant Seal, *Mirounga leonina* were recovered from the excavation of a Polynesian settlement site at Emily Bay (Smith *et al.*, 2001), although whether this skeletal material represents a natural vagrant elephant seal or the material was transported to the Island by the Polynesians remains unclear.

From the 1850s, NI supported a whaling industry hunting mainly Humpback Whales, *Megaptera novaeangliae* until the scarcity of whales ended harvesting in the early 1960s (Clapham *et al.*, 2009; Hoare, 2008). With the global cessation of hunting, Humpback Whale numbers have steadily recovered, and the species is now regularly sighted near NI on their regular migrations from Antarctic waters to the tropical southwest Pacific (Constantine *et al.*, 2007; Garrigue *et al.*, 2010; Oosterman *et al.*, 2010; NWDSSD, 2020).

A well-documented recent marine mammal record for Norfolk Island occurred on 26 April 2016, when a female Blainville’s Beaked Whale, *Mesoplodon densirostris* stranded alive at Slaughter Bay, Kingston (Bachara & Matthews, 2016). Despite attempts to return it to the ocean, the whale died and the following day was buried nearby (Bachara & Matthews, 2016). Sightings of beaked whales are uncommon in the vicinity of the NI Group, with *M. densirostris* having been reported on a limited number of previous occasions (Bachara & Matthews, 2016). The marine mammal fauna of the NI Group requires additional investigation.

Australian Museum holdings of Norfolk Island Group mammals

Specimens from the NI Group in the Australian Museum Mammal Collection date from 1915 with specimens added at irregular intervals over the next 70 years. Prior to the current survey, the collection contained 29 mammal specimens from NI comprising only four terrestrial mammal species (Table 5). Frozen tissue samples for genetic studies were not available for any species (Table 5).

Significantly, the AMS holds four specimens of *Chalinolobus* cf. *gouldii* from NI (Table 6). These appear to be the only known specimens of this taxon from NI held in any natural history museum collection. The first specimen (AMS M.4991) was collected by J.S.P. Ramsay in December 1915, “from the hollow spout of a small tree which was about five feet high and several inches in diameter and situated in the scrub” (Troughton, 1922). It has not previously been noted that this specimen was in the late stages of pregnancy, with two large fetuses. The specimen appeared due to give birth in late December or early January, corresponding to the time of birth for *C. gouldii* and many other Australian insectivorous bats (Van Dyck & Strahan, 2008).

A series of three specimens (AMS M.12758–12760), two adult males and an adult female, were collected by ‘LAC Marwick, H.’ on NI, but no date of collection was recorded. These three specimens had been found unregistered in the Mammal Collection in November 1983. Additional historical research undertaken has determined that LAC H. Marwick was Leading Aircraft Man (LAC) Hugh Marwick (1922–1995) who was the son of John Marwick

Table 5. Summary of registered Australian Museum mammal specimens from Norfolk Island prior to current survey.

Scientific name	Common name	Number of specimens	Form of specimens
<i>Chalinolobus</i> cf. <i>gouldii</i>	Gould’s Wattled Bat	4	bodies in alcohol (n = 4), skulls (n = 4)
<i>Rattus rattus</i> *	Black Rat	18	bodies in ethanol
<i>Rattus exulans</i> *	Polynesian Rat	6	bodies in ethanol
<i>Mus musculus</i> *	House Mouse	1	body in ethanol

* introduced

Table 6. Summary of Gould's Wattled Bat, *Chalinolobus* cf. *gouldii* specimens from Norfolk Island held by the Australian Museum (AMS).

Registration number	Sex	Specimen type	Date Collected	Date Registered	Collector	Remarks
M.4991	F	Adult, body in ethanol, skull removed and dry	December 1915	15 April 1930	J.S.P. Ramsay	Collection details given by Troughton (1922). Pregnant with two late-stage foetuses.
M.12758	M	Adult, body in ethanol, skull removed and dry	Between 1 March 1944 and 10 April 1945*	24 Nov 1983	H. Marwick	Penis intact.
M.12759	M	Adult, body in ethanol, skull removed and dry	Between 1 March 1944 and 10 April-1945*	24 Nov 1983	H. Marwick	Penis intact.
M.12760	F	Adult, body in ethanol, skull removed and dry	Between 1 March 1944 and 10 April-1945*	24 Nov 1983	H. Marwick	—

*see text for details.

(1891–1978), a New Zealand palaeontologist and geologist. During the Second World War Hugh was stationed on NI, with the Meteorological Section of the Royal New Zealand Air Force, when he also collected specimens of molluscs (TM3119), insects (AI.017794), crustacea (CR.015979), birds (OR.002326, OR.002732–002736, OR.002738, OR.013554) and a gecko (RE.000782) for Museum of New Zealand Te Papa Tongarewa, Wellington (collection dates 1944, mostly October and November). The period he was stationed on NI, according to his Armed Services statement of Service, was between 1 March 1944 and 10 January 1945. (MacAlpine, 2022). With this additional information we can now confidently place the collection date for the three NI *C. cf. gouldii* specimens to between 1 March 1944 and 10 April 1945 (Table 6).

A fifth potential *C. cf. gouldii* specimen from NI, AMS M.25830, was received in September 1984 and not registered until 1991. Its history is poorly documented with the donor, collector and date of collection being currently unknown, although an associated note indicates it came via Lismore, NSW. Further research is required to establish this specimen's provenance and collection locality.

Of the seven introduced mammal species, the AMS holds specimens of only three species, all rodents (Table 5). This includes six specimens of *R. exulans* (AMS M.25612–25617) collected in the 1980s, 18 specimens of *R. rattus* (AMS M.25580–25583, M.25619–25621, M.25828–25829, M.26026–26033) mostly collected in the 1970s–1980s and a single specimen of *M. musculus* (AMS M.12110) collected in the 1970s. The AMS does not hold any specimens of the other four introduced mammal species (Pig, Goat, Cat, Rabbit) and specimens of these species from the NI Group are poorly represented in other natural history collections – apart from a fine series (n = 17) of European Rabbit in the Australian National Wildlife Collection, Canberra which were collected in the 1970s from Phillip Island (CM15254–15264, CM15271–15276).

Aims of 2022 Expedition

The aim of the Australian Museum Terrestrial Vertebrates team's 2022 Expedition to the NI Group was to improve the Museum's specimen and frozen tissue collection of native and introduced terrestrial vertebrates from the NI Group. This included focusing on poorly sampled introduced and native bird species, especially the endemic land bird taxa. For the herpetofauna, we aimed to complete the first survey of native reptiles since 2005, to collect voucher specimens linked to frozen tissue samples (the first for these species from the NI Group) and collect additional tissue samples from the wider native lizard population. For introduced reptiles and amphibians we aimed to collect specimens and tissue samples to document the presence of any introduced species on the NI Group. For mammals, we aimed to document any evidence of the continued existence of microbats in the NI Group and collect specimens and frozen tissue of the remaining introduced species: the rodents (*R. exulans*, *R. rattus*, *M. musculus*) and feral Cat.

Methods

From 23 to 30 October 2022 up to six Australian Museum Research Institute (AMRI) staff (ME, EC, KH, SI, RM, DT) and a staff member from Tāmaki Paenga Hira Auckland War Memorial Museum (RB) were in the NI Group. Surveys, scientific collecting and export was conducted under

permit from the Norfolk Regional Council (Permit No. 31 of 2022: public reserves; 21 October – 6 November 2022); Australian Government, Director of National Parks (Permit No. Australian Museum AM/2022/01; Norfolk Is. National Park & Botanic Garden; 27 September – 30 November 2022); Australian Government, Department of Climate Change, Energy, the Environment and Water (Permit No. E2022-2023; Norfolk Island Region 20 October 2022 – 31 December 2027); Australian Government, Department of Climate Change, Energy, the Environment and Water (Cetacean Permit No. 2022-007; 20 October 2022 – 20 October 2025). Terrestrial Vertebrate research was conducted under animal ethics research authorities approved by the Australian Museum Animal Ethics Committee: 20-01 (reptiles and amphibians), 20-03 (mammals) and 21-04 (birds).

Birds

Capture and tissue sampling

Between three and five 18 m mist-nets were deployed in four different sites over four days of fieldwork to capture land birds in the National Park (Table 7). Nets were open for four hours at each site and checked every 15 min to minimise the stress to birds caught in the nets. Call playback was used occasionally during quiet periods of bird activity, to target the Norfolk Golden Whistler, Slender-billed White-eye, *Zosterops tenuirostris*, Norfolk Gerygone, *Gerygone modesta* and Norfolk Robin.

Unlike mammals, birds have nucleated red blood cells, so blood is an excellent source of avian DNA. Large amounts of DNA can therefore be obtained from small blood samples, allowing DNA samples to be collected from birds that can be released alive. Accordingly, blood samples were collected by pricking the brachial vein and collecting the blood droplet in a capillary tube, prior to aspiration into pre-filled vials of 100% ethanol. Between 10 and 130 µl of blood was collected from each captured bird, and up to a maximum of 10 samples per species which was allowed under permit. Additional DNA was sampled by collecting approximately 10 small feathers plucked from the breast or belly area of each bird. All birds were photographed and measured, recording the weight and the lengths of the wing, tail, tarsus, bill (culmen) and total head (tip of bill to back of skull) (Table 8). Blood was not collected from the one Norfolk Parakeet that was captured incidentally, but feathers were collected under permit.

Whole specimens and tissue (muscle and/or liver) samples were obtained from salvaged birds, stored in freezers on NI, that had been found dead by Islanders or were the result of pest control and air traffic safety programs. Two additional specimens were collected as roadkill by members of the NI Expedition team. To preserve these specimens and allow import into Australia in accordance with quarantine requirements, small to medium sized birds (i.e., Crimson Rosella or smaller) were fixed in 75% ethanol, after making an incision in the body cavity. Larger birds such as feral Chicken, *Gallus gallus* and Australasian Swamphen, *Porphyrio melanotus* were skinned, the bodies flensed, and the resulting skeletons fixed in 75% ethanol for subsequent preparation as skeletal specimen vouchers. The skins from some feral Chicken and Australasian Swamphen specimens were preserved in 10% formalin for subsequent preparation as study skins.

Table 7. Location of sites and trapping details of mist-netting to target endemic forest birds.

Date	Site	Location	Latitude	Longitude	No. nets	Time open	Time close	Individuals captured
25/10/2022	1	Hollow Pine	-29.0191	167.9417	3	0600	1000	1 Slender-billed White-eye; 1 Common Blackbird
26/10/2022	2	McLachlan's Lane	-29.0136	167.9521	5	0600	1000	2 Norfolk Fantail; 4 Norfolk Gerygone; 1 Silvereye; 6 Slender-billed White-eye
27/10/2022	3	Mt Pitt South	-29.0164	167.9368	3	0600	1000	3 Common Blackbird; 1 Pacific Emerald Dove; 1 Norfolk Gerygone; 1 Norfolk Golden Whistler; 1 Norfolk Parakeet; 1 Norfolk Robin; 1 Silvereye; 1 Song-Thrush
28/10/2022	4	Bridle Track	-29.0115	167.9494	4	0600	1000	4 Norfolk Gerygone; 1 Norfolk Robin; 4 Norfolk Golden Whistler; 3 Slender-billed White-eye

Table 8. Summary of morphometrics of bird specimens that were DNA sampled and released on Norfolk Island in October 2022.

Common name	Scientific name	n	Weight (g) mean ± sd	Wing (mm) mean ± sd	Tail (mm) mean ± sd	Head (mm) mean ± sd	Bill (mm) mean ± sd	Tarsus (mm) mean ± sd
Pacific Emerald Dove	<i>Chalcophaps longirostris</i>	1	115.7	149.5	91.0	46.8	20.1	27.7
Norfolk Fantail	<i>Rhipidura albiscapa pelzelni</i>	2	7.25 ± 0.35	69.75 ± 2.47	83.0 ± 2.83	25.60 ± 0.42	6.75 ± 0.35	19.60 ± 0.42
Norfolk Gerygone	<i>Gerygone modesta</i>	9	7.30 ± 0.36	53.82 ± 2.31	45.75 ± 3.62	28.82 ± 0.59	8.99 ± 0.31	20.56 ± 0.99
Norfolk Golden Whistler	<i>Pachycephala pectoralis</i>	5	31.58 ± 2.58	95.4 ± 1.52	78.75 ± 6.13	41.9 ± 0.58	12.54 ± 0.23	25.6 ± 0.77
	<i>xanthoprocta</i>							
Norfolk Robin	<i>Petroica multicolor</i>	2	13.50 ± 0.85	66.50 ± 0.71	44.50 ± 0.71	34.35 ± 0.21	11.25 ± 0.21	23.80 ± 0.85
Silvereye	<i>Zosterops lateralis</i>	2	10.90 ± 0.42	61.0 ± 1.41	41.50 ± 0.71	29.30 ± 0.28	11.0 ± 0.14	17.60 ± 0.14
Slender-billed White-eye	<i>Zosterops tenuirostris</i>	10	16.79 ± 1.67	66.80 ± 1.74	48.85 ± 1.92	34.81 ± 0.62	14.27 ± 0.55	21.55 ± 0.61
Common Blackbird	<i>Turdus merula</i>	3	78.73 ± 8.37	126.33 ± 2.89	107.67 ± 9.02	50.47 ± 2.31	18.17 ± 1.14	33.13 ± 1.29
Song Thrush	<i>Turdus philomelos</i>	2	67.45 ± 8.27	117.5 ± 0.71	103.0 ± 0.0	47.85 ± 0.78	16.1 ± 0.57	31.85 ± 0.21

Reptiles and amphibians

Survey, capture and sampling

We conducted presence/absence surveys across NI and on Phillip Island. Survey methods included nocturnal and diurnal visual, hand searching and auditory surveys, as well as pitfall trapping. Visual surveys were conducted by the herpetology team at locations across NI, focussing on the settlement areas, National Park and on Phillip Island. Surveys involved opportunistically searching bare rock, grass areas, scrubs, trees and slopes, and the turning of natural and artificial ground cover (e.g. building material). Data on observations and captures were recorded including habitat type, behaviour and GPS location. All individuals were caught by hand.

During the Expedition we undertook extensive consultation with NI residents about known reptile and amphibian species and possibly unknown ones. Whole specimens were also obtained from NI residents that were found dead or were the result of pest control activities.

Norfolk Island

Two pitfall trapping lines were established in the NI National Park in locations not surveyed in the previous two herpetological expeditions (Cogger *et al.*, 1979, 2006). Two sites were selected to cover different habitat types within the pest management trapping and baiting grids. The first line (-29.01725, 167.93807) was installed beside a track off the road to the Mount Pitt summit in relatively undisturbed palm forest with soft-loamy soil and light fern understorey, on 24 October. The second line (-29.01594, 167.95246) was established on 25 October beside the start of Red Road track in forest of NI Pines with a weedy understorey, in soil with more root layers present. Each herpetology trapping site incorporated five 5 m transects each with a 30 cm high fence and one bucket (20 L) and 2 funnel traps. Pitfall traps were unbaited and checked daily. Pitfall trap lines were removed on October 28 and holes filled.

Diurnal survey locations included; Burnt Pine, Mt Pitt, bottom of JE Rd near creek and Headstone Point. Nocturnal survey locations included: Burnt Pine (2 nights), Mt Pitt, Captain Cook's Lookout/start of the Bridle Track, Anson Bay Reserve, Kingston, and the Airport. Additional spotlighting, i.e. road cruising, was also undertaken throughout the entire island by way of the road network. During all nocturnal and diurnal surveys, team members listened for frog and introduced gecko calls.

For the introduced species, liver and muscle samples preserved in 99% ethanol, were taken from all intact individuals and standard body measurements were recorded. All herpetology specimens were fixed in 10% formalin and transferred to 75% ethanol after 7–10 days.

In addition, we were able to obtain tissue biopsy samples from 'Doris', a subadult female Green Turtle (Fig. 16) that had been found very ill in August 2022. This turtle was being rehabilitated, and Parks Australia staff were interested in what might be learned from its genetics. 'Doris' subsequently spent four months on Norfolk Island, undergoing treatment and rehabilitation before being released near the Captain Cook Memorial in January 2023 (Matthews, 2023b).

Phillip Island

Landing on Phillip Island requires favourable weather and sea conditions. Only a single afternoon and overnight visit on 26–27 October 2022 was possible due to swell. The survey



Figure 16. Subadult female Green Sea Turtle, *Chelonia mydas* 'Doris' (AMS R.192842.001) undergoing rehabilitation on Norfolk Island. (Photography: Dane Trembath, AMRI).

area was limited to the Parks Hut surrounds and a loop track from Park Hut to the Peak, via Evans' camp, returning via Long Valley. Nocturnal survey areas included the Park Hut surrounds and Long Valley, including the old Aviary. Diurnal and nocturnal surveys covered a variety of habitats and focussed on locations where both *O. lichenigerum* and *C. guentheri* had been previously recorded.

All captured lizards were photographed (dorsal and ventral), and measured recording snout-vent length, tail length, interlimb length, head length and head width. Sex, reproductive status, patterning and colouration were also recorded. Tail tip samples were collected and preserved in 95% ethanol. Sex was determined by eversion of the hemipenes in *O. lichenigerum* males and the presence of a swollen post-cloacal region containing hemipenes in *C. guentheri*. Female reproductive status of *O. lichenigerum* was determined through palpation of the abdomen and visual presence of eggs in *C. guentheri*. Following processing, lizards were released at the site of capture. Two voucher specimens from each lizard species were retained from Phillip Island and accessioned into the Australian Museum collection. Photography, measurements and life-history characteristics were recorded as above, and following death, samples of liver tissue were taken via a small ventral incision and preserved in 90% ethanol. These represent the first voucher specimens of both species from the NI Group with accompanying frozen tissue samples and photographs in life.

Analysis of size distribution in native reptiles

All analyses were performed on R Statistical Software (v4.1.2; R Core Team, 2021) with the packages *ggplot2* (Wickham, 2016) for figures and *tidyverse* for data manipulation (Wickham *et al.*, 2019). Snout-vent length

(SVL) data from the three native lizard surveys were used to investigate the distribution of size (SVL) within the native lizard populations and to compare them across survey periods. All captured individuals (including juveniles) were included in the analysis. Violin plots were used to visualise and compare the probability density distribution of SVL by survey year for both skinks and geckos. Data for all lizards measured during the 1978 survey was extracted from Cogger *et al.* (1979). Measurements from the 2005 survey were inferred from Figures 10-12 in Cogger *et al.* (2006), where data points were limited to 15 of 31 skinks and 149 of 345 geckos captured during that survey. For both surveys, data was limited to geckos captured on Phillip Island. A standard box plot was also overlaid on the density plot to illustrate the median, interquartile range and the full data range.

Genetic analysis of reptiles and amphibians

To investigate the genetic affinities of the Green Turtle 'Doris' (AMS R.192842.001), total genomic DNA was extracted from a tissue biopsy using the Animal Tissue protocol of the ISOLATE II Genomic DNA Kit (Meridian Biosciences), following manufactures instructions. To place 'Doris' within the global Green Turtle population, an 887 base pair (bp) region of the mitochondrial DNA (mtDNA) control region was sequenced using the primers LCM-15382 (5' GCT TAA CCC TAA AGC ATTGG 3') and H950g (5' GTC TCG GAT TTA GGG GTT TG 3') (Abreu-Grobois *et al.*, 2006) and compared to control region haplotypes collected from global Green Turtle nesting populations (Dutton *et al.*, 2014; Read *et al.*, 2015) in consultation with Dr Michael Jensen, co-author of the aforementioned publications.

PCRs were conducted in 25 µl reactions using 100–200

ng of genomic DNA, 1 x Reaction Buffer (MyTaqRed Reagent Buffer; Meridian Biosciences), 2 pmol primers and MyTaqRed DNA polymerase (0.5 unit) (Meridian Biosciences). Thermocycling was performed on an Eppendorf Mastercycler Pro S (Eppendorf, Hamburg, Germany) under the following touchdown conditions: initial denaturation 94°C (3 min), 1x cycle each of denaturation at 94°C (50 s), annealing at 56–50°C (50 s) [1°C decrements per cycle], and extension at 72°C (1 min) and 35 cycles of denaturation at 94°C (50 s), annealing at 50°C (50 s) and extension at 72°C (1 min) with a final extension step of 72°C for 5 min. PCR products were visualised on a 2% E-gel (Thermo Fisher Scientific), then purified using ExoSAP-IT reagent (Thermo Fisher Scientific) and sequenced at the Australian Genome Research Facility (AGRF), Sydney on a AB 3730xl. Resultant chromatograms were quality checked and edited using Sequencher v5.4 (Gene Codes Corporation, Ann Arbor, USA).

For the introduced lizards and frog, to confirm morphological species identifications and to place the individuals sampled on NI into a broader phylogeographic context, additional frozen tissue samples were sourced from Australian natural history museum collections for *Hemidactylus frenatus* (n = 13), *Lepidodactylus* sp. (n = 4), and *Litoria caerulea* (n = 6) (see Appendix 1 for sample details). Genomic DNA was extracted using the Bioline Isolate II Genomic DNA Kit (Meridian Biosciences, Eveleigh, Australia) following the manufacturer's protocols for 'purifying genomic DNA from cultured cells and human or animal tissue'. Amplification of a ~390 bp region of the mitochondrial 12S rRNA gene, an ~658 bp region of the mitochondrial Cytochrome Oxidase 1 (CO1) gene, and a ~720 bp region of the mitochondrial NADH-ubiquinone oxidoreductase chain 4 (ND4) gene was accomplished for the *H. frenatus*, *Lepidodactylus*, and *L. caerulea* specimens respectively, using the following primer sets: L1091 - AAAAAGCTTCAAACCTGGGATTAGATACCCCACTAT-3') and H1478 (5'-TGACTGCAGAGGGTGACGGGCGGTG TGT- 3') (Kocher *et al.*, 1989), BAK1490 (5'-CTCAACCAACCACAAAGACATCGG- 3') and BAK2198 (5'-TAGACTTCTGGGTGGCCGAAGAATCA-3') (Neaves *et al.*, 2018), and Limno2 (5'-GGTYAC G AGYAATTAGCAGTTCT- 3') and ND4 (5'-TG ACTACCAAAAGCTCATGTAGAAGC- 3') (Arèvalo *et al.*, 1994; Schauble *et al.*, 2000).

All PCRs were performed in volumes of 25 µl, which consisted of 5 µl of 1 × Bioline MyTaq Red Reagent Buffer, 0.5U of Bioline MyTaq Red DNA polymerase (Meridian Biosciences, Eveleigh, Australia), 2 pmol of each primer, 16.8 µl of UltraPure H₂O, and 100–500 ng of template DNA. For the 12S PCR, an initial denaturation step of 94°C for 3 min preceded 35 cycles of 94°C for 30 s, 56°C for 40 s, and 72°C for 40 s. This was followed by a final extension at 72°C for 5 min. Amplification of the CO1 fragment was accomplished using a touchdown PCR protocol. An initial denaturation step of 94°C for 3 min preceded 5 cycles of 94°C for 20 s, variable annealing temperatures for 40 s, and 72°C for 40 s. For the first cycle, the annealing temperature was set to 55°C and, over the four subsequent cycles, the annealing temperature was decreased by 1°C (i.e., 55–50°C). This was followed by 36 cycles of 94°C for 20 s, 50°C for 40 s, 72°C for 40 s, and a final extension at 72°C for 5 min. Finally, the ND4 PCR consisted of an initial denaturation step of 94°C for 3 min, followed by 35 cycles of 94°C for 45 s, 55°C for 45 s, and 72°C for 60 s. This was followed by a final extension at 72°C for 7 min. The PCR products were visualised by electrophoresis on 2% agarose gels and

purified using an enzymatic hydrolysis method (Thermo Fisher Scientific ExoSAP-IT™). Sequencing was performed on an AB 3730xl Sequencer at the Australian Genome Research Facility, Sydney.

The resultant chromatograms were viewed and edited using Sequencher v5.4 (Gene Codes Corporation, Ann Arbor, USA) and aligned using ClustalW in MEGA X (Kumar *et al.*, 2018). To provide broader, global phylogenetic context, DNA sequences from the sampled *H. frenatus*, *Lepidodactylus*, and *L. caerulea* specimens were compared to additional published sequences from these and related species from GenBank. Phylogenetic analysis was performed using the maximum-likelihood method and general time reversal (GTR) model (+ G + I) of best fit, also in the program MEGA X (Kumar *et al.*, 2018). Support for the branching topology was evaluated with 1000 bootstrap replicates.

Mammals

Microbats

Microbat call detection

Seven Anabat Express bat call detectors were set up at 34 sites throughout NI (one night per site) and at two sites on Phillip Island (six nights per site) (Fig. 17, Table 9). Recorders were in operation for eight nights in total and operated continuously for 12 hr per night. Detectors were programmed to start recording 30 min before sunset and stop 30 min after sunrise. The Anabat Express bat detection system was considered appropriate to address the two main objectives of the bat call survey: a) to detect the presence of bats; b) to inventory bat species. Bat calls were analysed using AnalookW software which produced a frequency versus time display of bat call sequences. All the ~90,000 sound files (which included all sounds such as wind and insects) were manually inspected for bat call sequences or fragments of call sequences.

Community survey of bat sightings

A series of community engagement events were held from 23–29 October. These were: a "meet the community" function on 23 October; an introduction to staff from the Department of Climate Change, Energy the Environment and Water on 25 October; daily informal meetings at local cafes and at the Seventh Day Adventist Hall; and a farewell function with community members on 28 October. During each event mammal staff questioned people about possible sightings of bats over the last few decades.

Rodents

Rodents were trapped using both Elliott and cage traps set at eight sites across the island for between two and five nights (Table 10) with a total of 329 Elliott trap and 46 cage trap nights. Dead specimens were also received as donations from NI residents. Freshly dead or previously frozen rodent specimens were fixed in 10% formalin and transferred to 75% ethanol after 7–10 days. Desiccated specimens were prepared as skulls and/or skeletons. Liver and muscle samples preserved in 90% ethanol, were taken from all intact individuals and standard body measurements were recorded.

Genetic analysis of rodents

To investigate the genetic relationships of NI *Rattus rattus*,

Table 9. Location of Anabat Express detectors deployed on Norfolk and Phillip Islands in October 2022 and number of sound files recorded per night (total = 90,808 files, none of which contained bat calls).

Site number	Date at site	Nights at site	Detector number	Total sound files/night	Location	Latitude	Longitude	Alt (m)
1	23	1	SN637012	1250	Bucks Point House, Martins Road	-29.04485	167.9879	110
2	23	1	SN637011	28	Ball Bay Reserve near Bucks Point House	-29.04468	167.9877	121
3	24	1	SN637011	0	Marsh's Road, Ball Bay Reserve	-29.04753	167.9801	66
4	24	1	SN636998	3046	Mount Pitt, on Mount Bates track	-29.01594	167.9379	105
5	24	1	SN636997	11067	Red Road track at NP entrance	-29.01584	167.9522	207
6	24	1	SN636996	1976	Creek on JE Road	-29.02673	167.957	105
7	24	1	SN637012	6774	Mount Pitt Road (W side)	-29.01727	167.9378	268
8	24	1	SN382096	10	Community Hall, Burnt Pine	-29.03185	167.9505	99
9	24	1	SN382198	3306	Eucalypt plantation near Selwyn Reserve	-29.01581	167.9243	105
10	25	1	SN637012	26	SDA church, New Cascade Road	-29.03179	167.9562	119
11	25	1	SN382096	18	Creek on New Cascade Road	-29.02926	167.9637	72
12	25	1	SN636998	1110	Selwyn Pine Road in National Park	-29.01633	167.9471	194
13	25	1	SN636997	25	Nursery on Bishop Patterson Road	-29.02412	167.9272	105
14	25	1	SN636996	24	Dam on Bishop Patterson Road	-29.02397	167.9246	85
15	26	1	SN382096	1458	End of Collins Head Road	-29.05424	167.978	77
16	26	1	SN636998	15	Christian Road - Quality Row	-29.05574	167.971	15
17	26	1	SN637012	14089	Botanic Gardens boardwalk	-29.02565	167.9409	189
18	26	1	SN636996	4	Bullocks Hut Road near eucalyptus plantation and Banyan tree	-29.01058	167.929	172
19	26	1	SN636997	1	Anson Bay Reserve, near cliff at end of Anson Bay Road	-29.00809	167.9249	128
20	25	6	SN637011	0	Phillip Island western site	-29.11933	167.9494	91
20	26	—	—	9686	Phillip Island western site	—	—	—
20	27	—	—	8298	Phillip Island western site	—	—	—
20	28	—	—	11700	Phillip Island western site	—	—	—
20	29	—	—	7528	Phillip Island western site	—	—	—
20	30	—	—	6030	Phillip Island western site	—	—	—
21	25	6	SN382198	0	Phillip Island central site	-29.11891	167.9535	103
21	26	—	—	6	Phillip Island central site	—	—	—
21	27	—	—	20	Phillip Island central site	—	—	—
21	28	—	—	8	Phillip Island central site	—	—	—
21	29	—	—	2	Phillip Island central site	—	—	—
21	30	—	—	11	Phillip Island central site	—	—	—
22	27	1	SN382096	1748	Creek on Douglas Road	-29.03497	167.9318	186
23	27	1	SN636997	0	Headstone Reserve, in clearing near cliff	-29.04238	167.9215	90

Table 9. Continued...

Table 9. *Continued.*

Site number	Date at site	Nights at site	Detector number	Total sound files/night	Location	Latitude	Longitude	Alt (m)
24	27	1	SN636996	4	Rocky Point Reserve at Banyan tree	-29.04741	167.9255	90
25	27	1	SN636998	0	Rocky Point Reserve near Farm Road	-29.04725	167.9244	136
26	27	1	SN637012	18	Bombora Reserve picnic area	-29.05746	167.9407	51
27	28	1	SN637012	44	Ferry Lane near airport	-29.04074	167.9427	138
28	28	1	SN636997	38	Cascade Reserve, creek on Prince Phillip Drive near Harper Rd junction	-29.02308	167.9657	49
29	28	1	SN636998	0	Cascade Reserve on creek near boardwalk	-29.02171	167.9676	50
30	28	1	SN636996	105	Dam on Cascade Road	-29.02788	167.9701	107
31	28	1	SN382096	10	Dry creek bed off Ephraim Christian Road	-29.03181	167.9723	111
32	29	1	SN636997	424	Buffets Road	-29.03229	167.9889	99
33	29	1	SN636998	0	Two Chimney Reserve near cliff in clearing	-29.03948	167.9927	64
34	29	1	SN636996	1	John Quintal Rd/Stockyard Road corner	-29.02703	167.9872	104
35	29	1	SN382096	653	Watermill Dam	-29.04859	167.9523	24
36	29	1	SN637012	247	Middlegate School oval	-29.0411	167.9695	147

Table 10. Location of trapping sites for introduced rodents on Norfolk Island.

Date opened	Location	Latitude	Longitude	No. nights	No. Traps	Date closed	Individuals captured
23/10/2022	Site 1. Bucks Point House, Martins Rd	-29.0446	167.9877	4	8 Elliott	27/10/2022	—
24/10/2022	Site 2. Mount Pitt Rd	-29.0173	167.9378	5	25 Elliott, 4 cages	29/10/2022	<i>Rattus rattus</i>
25/10/2022	Site 3 Marsh's Rd (lower)	-29.0475	167.9813	2	11 Elliott, 4 cages	27/10/2022	—
25/10/2022	Site 4 Marsh's Rd (upper)	-29.0478	167.9787	2	6 Elliott, 1 cage	26/10/2022	<i>Rattus exulans</i>
27/10/2022	Site 4. Marsh's Rd (upper extended)	-29.0478	167.9787	2	10 Elliott, 1 cage	28/10/2022	—
25/10/2022	Site 5. Martins Rd, Ball Bay Reserve	-29.0446	167.9878	3	20 Elliott	28/10/2022	<i>Rattus exulans</i>
26/10/2022	Site 6. SDA Church, New Cascade Rd	-29.0318	167.9562	2	10 Elliott, 2 cages	28/10/2022	<i>Mus musculus</i>
27/10/2022	Site 7. Garden, Holman Christian Lane	-29.0294	167.9733	2	16 Elliott, 4 cages	29/10/2022	—
27/10/2022	Site 8. Garden behind shed, Mill Rd	-29.0306	167.9745	2	8 Elliott, 2 cages	29/10/2022	<i>Rattus rattus</i>

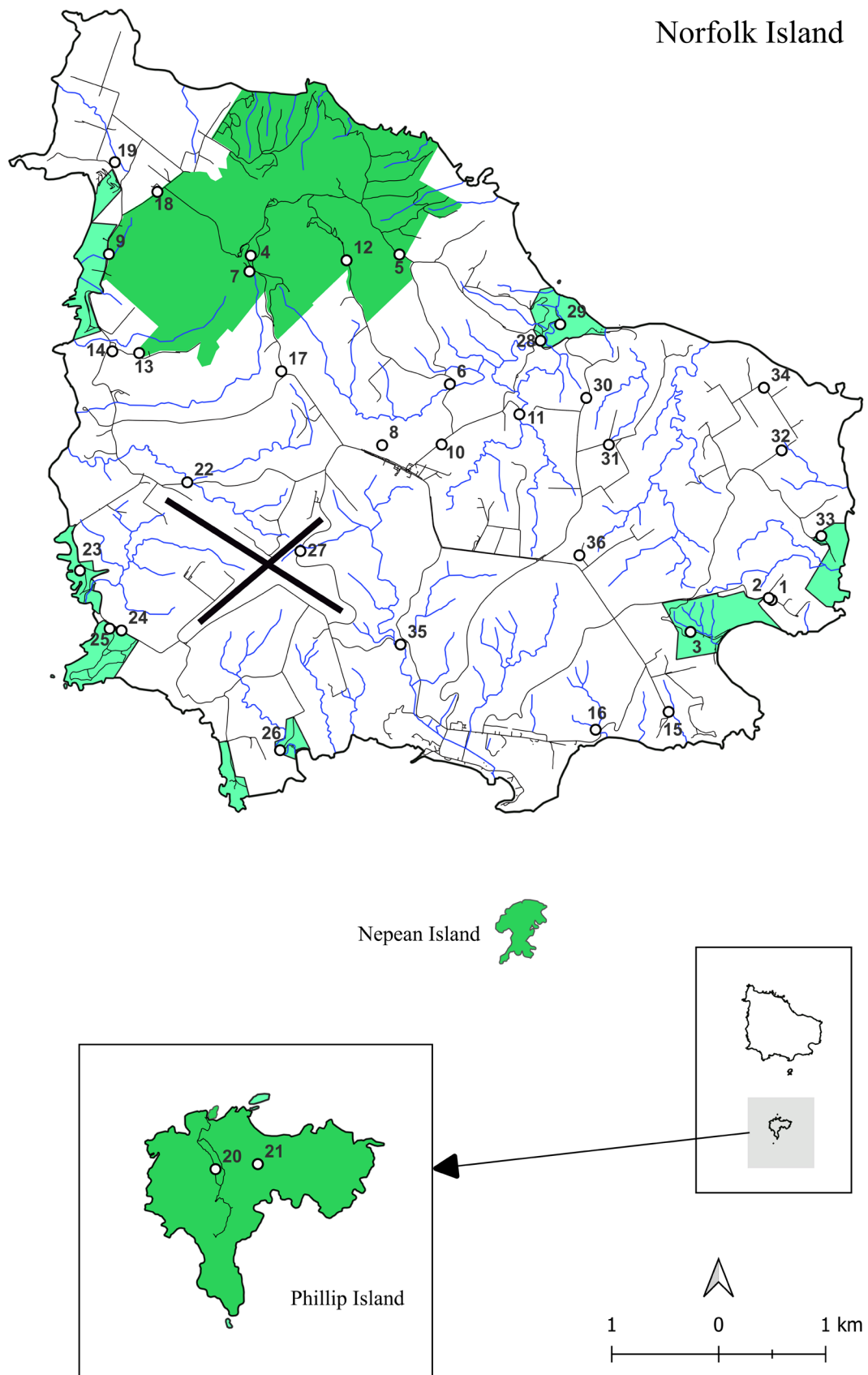


Figure 17. Sites where Anabat Express bat detectors were deployed on Norfolk and Phillip Islands in October 2022.

total genomic DNA was extracted from the two tissue samples collected (AMS M.53926–53927) using the Animal Tissue protocol of the ISOLATE II Genomic DNA Kit (Meridian Biosciences), following manufactures instructions. A 307 bp region of the mtDNA Cytochrome b gene (CytB) was amplified using the following primers: L14841 (F), AAAAAGCTTCCATCCAACATCT CAG CATGATGAAA, H15149 (R) TGCAGCCCCCTCAGAATGATAT TTGTCCTCA (Kocher *et al.*, 1989); PCRs were conducted in 25 µl reactions using 100–200 ng of genomic DNA, 1 x Reaction Buffer (MytaqRed Reagent Buffer; Meridian Biosciences), 2 pmol primers and MyTaqRed DNA polymerase (0.5 unit) (Meridian Biosciences). Thermocycling was performed on an Eppendorf Mastercycler Pro S (Eppendorf, Hamburg, Germany) under the following conditions: initial denaturation 94°C (3 min), 38 cycles of denaturation at 94°C (20 s), annealing at 54°C (40 s) and extension at 72°C (40 s) with a final extension step of 72°C for 5 min. PCR products were visualised on a 2% E-gel (ThermoFisher Scientific), then purified using ExoSAP-IT reagent (Thermo Fisher Scientific) and sequenced at the Australian Genome Research Facility (AGRF), Sydney on a AB 3730xl. Resultant chromatograms were quality checked and edited using Sequencher v5.4 (Gene Codes Corporation, Ann Arbor, USA) and aligned using ClustalW in Mega 7.0.21 (Kumar *et al.*, 2016). DNA sequences from the NI specimens were compared to those generated from other *R. rattus* specimens from the Australian Museum Mammal Collection (see Appendix 1 for specimen details), as well as those available from previously published studies on GenBank (e.g., Aplin *et al.*, 2011). Mega 7.0.21 was used to determine the most appropriate model of evolution for phylogenetic reconstruction, TN92+I and to carry out Maximum Likelihood analysis using 1000 bootstrap replicates.

Feral cats

Feral cats were donated as freshly dead, frozen or desiccated specimens by National Parks staff or island residents. Stomachs were removed from six cats and the contents examined before the bodies were preserved. Three cats were fixed in 10% formalin and transferred to 75% ethanol after 2–3 weeks, two were preserved in 75% ethanol and later prepared as skins and skulls, one additional specimen was prepared as a full skeleton and another as a skull only. Liver and muscle samples preserved in 90% ethanol, were taken from all intact individuals and standard body measurements were recorded.

Beaked whales

Genetic analysis

A frozen tissue sample (AMS M.53928) taken from the female Blainville's Beaked Whale that stranded alive at Slaughter Bay, Kingston on 26 April 2016 (and subsequently died) was donated by Margaret Christian. At the time it was identified as *M. densirostris* based on the shape of the lower jaw and as a female due to its relatively small size ~350 cm (Bachara & Matthews, 2016) and lack of tusk.

As beaked whales are poorly known and can be difficult to identify to species and to sex (MacLeod, 2014), we sought to confirm the morphological species identification and sex of the stranded beaked whale using a molecular approach (Eldridge *et al.*, 2017). Total genomic DNA was extracted from the tissue sample of AMS M.53928.001 using the Animal Tissue protocol of the ISOLATE II Genomic DNA Kit (Meridian Biosciences), following manufactures

instructions. Sex determination was conducted as described by Jayasankar *et al.* (2008). This method amplifies the homologous *ZFX/ZFY* gene on the X chromosome in females and on the X and Y chromosomes in males, as well as the male sex determining gene *SRY*, also found on the Y chromosome in males. In female cetaceans only one PCR product is expected (amplification of the *ZFX/ZFY* gene) whereas in males two PCR products are expected (amplification of *ZFX/ZFY* and *SRY*). A multiplex PCR was carried out using the primers *ZFX/ZFY*-F (5' ATAATCACATGGAGAGCCACAAGCT 3') and *ZFX/ZFY*-R (5' GCACTTCTTTGGTATCTGAGAAAGT) and *SRY*-F (5' CCCATGAACGCATTTCATTGTGTGG 3'') and *SRY*-R (5' ATTTTAGCCTTCCGACGAGGT CGATA 3'). PCRs were conducted in 25 µl reactions using 100–500 ng of genomic DNA, 1x Reaction Buffer (MytaqRed Reagent Buffer; Meridian Biosciences), 2 pmol primers and MyTaqRed DNA polymerase (0.5 unit) (Meridian Biosciences). Thermocycling was performed on an Eppendorf Mastercycler EpS (Eppendorf, Hamburg, Germany) under the following conditions: initial denaturation 94°C (3 min), 35 cycles of denaturation at 94°C (45 s), annealing at 58°C (45 s) and extension at 72°C (1 min) with a final extension step of 72°C for 7 min. PCR products were visualized on a 2% E-Gel Precast Agarose Gel (ThermoFisher Scientific) and sex was determined where one band represented a female and two bands represented a male. Two previously identified males, AMS M.51338 (*M. densirostris*) and AMS M.51305 (*M. ginkgodens*) were used as positive controls to confirm sex.

Species identification of the beaked whale was carried out by amplifying a partial region of 357 bp the mtDNA CytB gene. Amplification was carried out using the primers mcb398 'TACCATGAGGACAAATATCATTCTG' and mcb869 'CCTCCTAGTTTGTAGGGATTG' (Verma & Singh, 2003). PCRs were conducted in 25 µl reactions using 100–500 ng of genomic DNA, 1x Reaction Buffer (MytaqRed Reagent Buffer; Meridian Biosciences), 2 pmol primers and MyTaqRed DNA polymerase (0.5 unit) (Meridian Biosciences). Thermocycling was performed on an Eppendorf Mastercycler EpS (Eppendorf, Hamburg, Germany) under the following touchdown PCR conditions: initial denaturation 94°C (5 min), 1x cycle each of denaturation at 94°C (45s), annealing at 55–50°C (1 min) [1°C decrements per cycle], and extension at 72°C (1 min) and 35 cycles of denaturation at 94°C (45 s), annealing at 50°C (1 min) and extension at 72°C (1 min) with a final extension step of 72°C for 5 min. PCR products were visualized on a 2% E-Gel Precast Agarose Gel (ThermoFisher Scientific). Amplified products were purified using ExoSAP-IT reagent (Thermo Fisher Scientific) and sequenced at the Australian Genome Research Facility (AGRF), Sydney on a AB 3730xl. Resultant chromatograms were quality checked and edited using Sequencher v5.4 (Gene Codes Corporation, Ann Arbor, USA) and aligned using ClustalW in MEGA 7.0.21 (Kumar *et al.*, 2016). Species identification was carried out using comparative published reference data for beaked whales obtained from GenBank in a Maximum Likelihood analysis using 1000 bootstrap replicates.

Results and discussion

Birds

A total of 32 individuals of eight native species were captured

in mist-nets before being sampled and measured (Table 8). Native species sampled were the Norfolk Golden Whistler, Norfolk Robin, Norfolk Parakeet, Slender-billed White-eye, Norfolk Fantail, *Rhipidura albiscapa pelzelni*, Norfolk Gerygone, Silvereye, *Zosterops lateralis* and Pacific Emerald Dove, *Chalcophaps longirostris*. Exotic species captured and euthanized from mist-net sampling comprised five individuals of two species: Song Thrush, *Turdus philomelos* and Common Blackbird, *Turdus merula*.

Sixty birds were obtained as salvaged individuals. These included exotic species such as Common Starling, *Sturnus vulgaris*, California Quail and House Sparrow. The native species obtained included NI Sacred Kingfisher, *Todiramphus sanctus norfolkiensis*, Welcome Swallow, *Hirundo neoxena*, Masked Woodswallow and Pacific Golden Plover, *Pluvialis fulva*.

The substantial quantity of new bird material collected during the 2022 Expedition (Appendix 2), significantly broadens the taxonomic representation and fills major gaps in the AMS collection, providing a rich resource for current and future studies. Of particular importance is a significant increase in the holding of high-quality tissue (previously $n = 1$) suitable for molecular studies, and an increase in skeletal material (previously $n = 1$) for comparative studies of evolution, adaption and the identification of NI Group subfossil and fossil bird remains. Indeed, some tissue samples from this Expedition have already been subsampled and loaned to national and international researchers.

Reptiles and amphibians

Samples and/or specimens were collected from a total of 39 individuals of six species of reptiles and amphibians, including representatives of the two endemic lizard taxa and four introduced reptile and frog species (Appendix 3).

Native lizard fauna

This survey builds on the knowledge of the NI Group herpetofauna from the 1978 and 2005 Australian Museum surveys. No evidence of the native lizards was found on NI further supporting the absence of these two species from the main island, although our current surveys were not extensive.

Lord Howe Island Gecko

Fifteen individuals were caught, sampled and released, and two were retained as specimens (Table 11, Fig 18).

Distribution and abundance. On Phillip Island, geckos were located in all surveyed habitats in high abundance. During nocturnal surveys, abundance was so high that caution was required when walking over bare rock to ensure that individuals were not crushed. During the day, geckos utilised shared retreat sites, such as underneath rocks and building materials. Many individuals were found in single retreat sites. The geckos also use tree roots, hollows, and Flax, *Phormium tenax* clumps for shelter as they were seen emerging from these during nocturnal searches. Very high numbers (100s), with variation in ages, were found during the day between canvas and tarp layers at the Evans' Camp site. Lizard tracks were recorded in the sandy substrate around Flax in Long Valley. During nocturnal surveys in the same area, geckos were observed actively foraging on the nectar of Flax flowers. In contrast to the 1978 survey, we found geckos easier to locate and catch in less vegetated areas than on the twisted White Oaks, *Lagunaria patersonia*. This was likely due to the complexity of the habitat around them or that gecko populations were more dispersed throughout a

Table 11. Summary of morphometrics of lizards captured and sampled on Norfolk Island Group in October 2022.

Common name	Scientific name	n	Snout-vent length (mm) mean $\pm$ sd	Inter-limb length (mm) mean $\pm$ sd	Head length (mm) mean $\pm$ sd	Head width (mm) mean $\pm$ sd	Tail length (mm) mean $\pm$ sd	Regenerated tails %	Adult sex ratio M:F
Asian House Gecko	<i>Hemidactylus frenatus</i>	2	63.5 $\pm$ 2.12	—	—	—	41.5 $\pm$ 27.58	100	male only
Beach Scaly-toed Gecko	<i>Lepidodactylus pantai</i>	1	46.0	—	—	—	48.0	0	—
Lord Howe Island Gecko	<i>Christinus guentheri</i>	17	87.0 $\pm$ 8.29	37.24 $\pm$ 3.57	22.31 $\pm$ 2.04	16.0 $\pm$ 1.98	67.17 $\pm$ 11.87	88.2	8:9
Lord Howe Island Skink	<i>Oligosoma lichenigerum</i>	16	72.0 $\pm$ 8.02	38.41 $\pm$ 5.48	13.88 $\pm$ 1.77	8.41 $\pm$ 2.37	56.44 $\pm$ 17.35	93.8	8:7

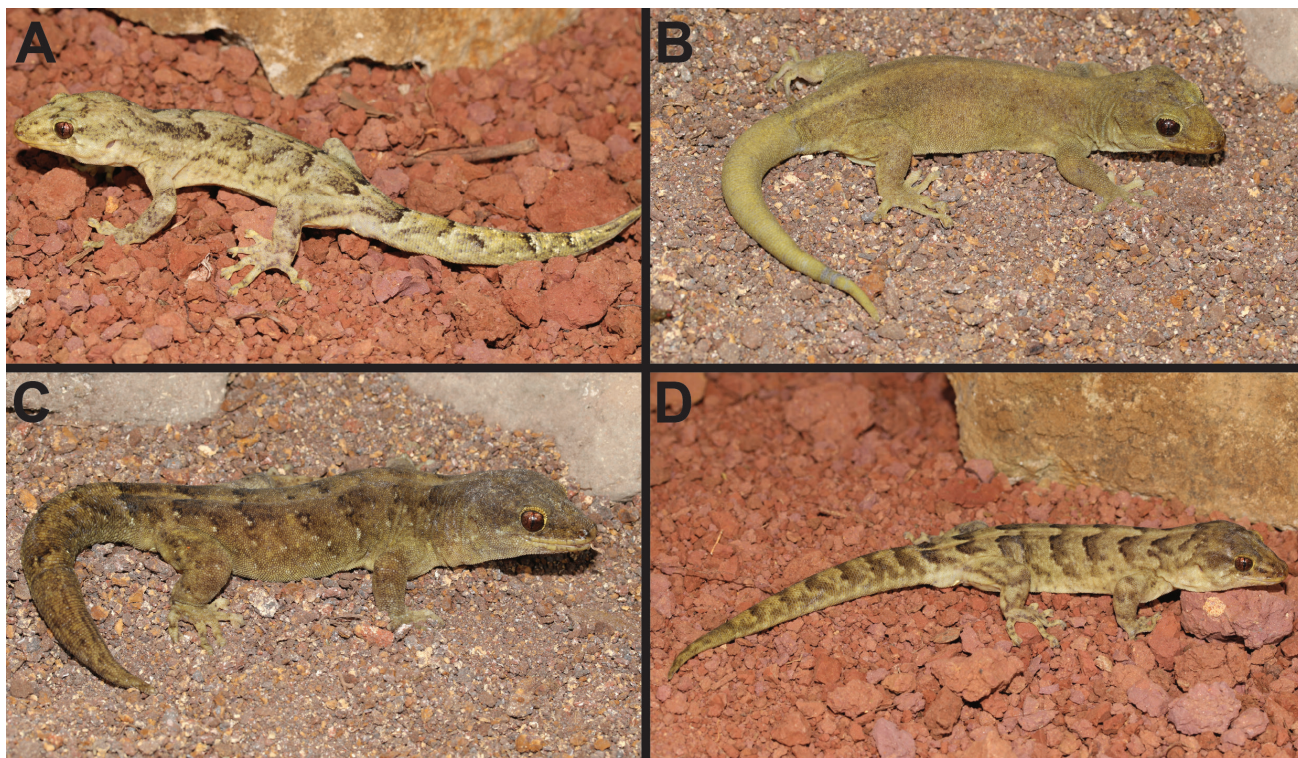


Figure 18. Variation in colouration and patterning of endemic *Christinus guentheri* on Phillip Island, Norfolk Island Group; a) (AMS R.189040), b) (AMS R.192815.001), c) (AMS R.192818.001) and d) (AMS R.189039). (Photography: Dane Trembath, AMRI).

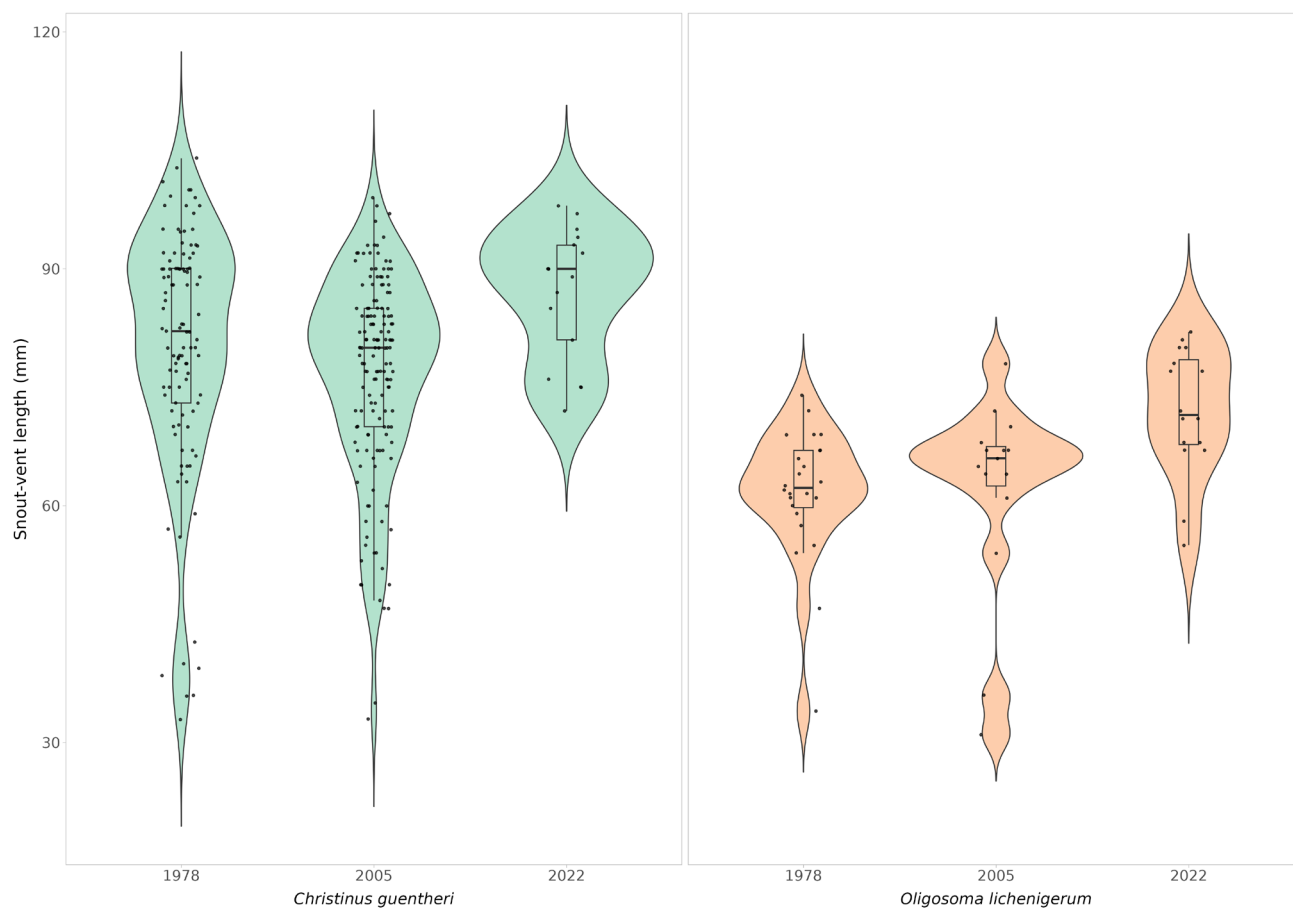


Figure 19. Density distribution of snout vent length (SVL) of all measured individuals by survey year for *Oligosoma lichenigerum*, 1978 $n = 24$, 2005 $n = 15$, 2022 $n = 16$ and *Christinus guentheri*; 1978 $n = 107$, 2005 $n = 149$, 2022 $n = 17$ captured on Phillip Island, Norfolk Island Group. *2005 data limited as not all measurements included in survey reports.

wider range of habitats. We found no variation in distribution from previous surveys.

Reproduction. Two females (25% of those measured and sampled) were gravid with one and two eggs respectively. Large calcium-filled endolymphatic sacs were present on all females. Hard-shelled eggs were found underneath rocks and most building materials, and in walls of the old aviary building. All eggs located were laid individually rather than in communal nests.

Size distribution within the population. The probability density distribution of gecko sizes is shown in Fig. 19. Note that due to very restricted survey time, the mark-recapture analyses performed in previous surveys were unable to be repeated, and only a small number of geckos were measured during the 2022 survey limiting comparisons in snout-vent length (SVL) between surveys. Analysis of adult SVL data across the three surveys (1978, 2005 and 2022) shows a small decrease in maximum SVL and changes in mean SVL over time (1978, max SVL = 104 mm, mean SVL = 82.5 mm; 2005, max SVL = 99 mm, mean SVL = 78.3 mm; 2022, max SVL = 98 mm, mean SVL = 87.0 mm). The increase in mean SVL in our survey (2022) is most likely an artifact of the combination of one or more factors: (i) lower sampling effort for geckos, (ii) differing survey methods between years, and/or (iii) increasing complexity of habitat contributing to lower juvenile counts rather than a true lack of juveniles and smaller individuals in the population.

Ancillary data. A variety of dorsal colouration was observed with no difference between males and females. (Fig. 18). Pattern variation included a light vertebral stripe, dark transverse bands or a combination of the two. Only two individuals measured had intact tails; both were female (25% of females measured). During the diurnal survey two dead geckos were found on the track to the peak, one with large amounts of body tissue removed which is suggestive of centipede predation. Three Phillip Island Centipedes, *Cormocephalus coynei* were encountered active at night within the distribution of the skink and gecko in Long Valley. All individual geckos sighted and measured were in good body condition. A single female had orange gecko mites present on feet and dorsal surface. Digit loss was observed in one female with digits missing from three feet (four digits total).

Lord Howe Island Skink

Fourteen individuals were caught, sampled and released, and two were retained as specimens (Table 11, Fig. 20).

Distribution and abundance. On Phillip Island, skinks were found during diurnal surveys under building materials in the area around the Parks Hut. During the nocturnal surveys, one member of the team focused on the Parks Hut area while the other two members headed down to Long Valley. Seven individuals were captured in a 45 min (20:30–21:15) period actively foraging in Long Valley.

Reproduction. Five of the adult females (83%) were gravid with clutch sizes between 2–6 eggs. Data on reproduction in this species on Phillip Island is limited to the surveys in 2022 and 1978, due to the timing of reproduction. In 1978, two gravid females were brought back to the AMS, laying clutches of eggs in December (Cogger *et al.*, 1979). Hatchlings were captured and measured in the 2005 survey conducted in March (Cogger *et al.*, 2006). Data on clutch size is limited but does suggest a positive relationship between SVL and clutch size, with larger females producing more eggs. This relationship is seen in many skink species (Shine & Greer, 1991).

Size distribution within the population. Analysis of adult snout-vent length data across the three surveys (1978, 2005 and 2022) shows an ongoing increase in maximum SVL and average SVL over time (1978, max SVL = 74 mm, mean SVL = 63.64 mm; 2005, max SVL = 78 mm, mean SVL = 66.38 mm; 2022, max SVL = 82 mm, mean SVL = 72 mm). The variation in minimum SVL may be due to the timing, length or methods of the surveys; for instance, the 2005 survey was undertaken in March when hatchlings are present in the population. Moreover, both the 1978 and 2005 surveys included pitfall trapping, whilst the 2022 survey was restricted to hand capture.

Analysis of skink SVL highlighted a difference in size distribution across survey years (Fig. 19). Due to the timing of this survey, no hatchlings or juveniles were present in the population; thus, the lower density peak is not observed. Despite the small number of individuals captured during each survey, the increase in both maximum SVL and mean SVL suggests an overall increase in SVL in the population and increased longevity. In addition, the more elongated shape of the density plot in 2022, in comparison to 1978 and 2005, suggests a more even distribution of SVL in adults, rather than only a few individuals reaching larger sizes as seen in previous surveys. These factors suggest greater survivorship, which may in turn lead to increased reproductive output (due to the link between SVL and number of eggs per clutch in this species). Taken together, the results are a positive indication of the ongoing recovery of this species.

Ancillary data. All captured individuals were in good body condition. Two individuals had foot injuries; one missing a single digit and a second missing one digit and an entire foot. Only one individual captured had an intact tail. Dorsal colouration varied from mottled lichen green/brown to dark brown with banding (Fig. 20). Cream, yellow and orange ventral colouration was observed varying by individual (Fig. 20). Yellow and orange colouration was observed in both males and females while cream colouration was only seen in females (noting that sample size is small). No other difference in colouration frequency between males and females was observed. Data from the 2005 survey is incomplete as SVL data were only supplied for 15 of 31 individuals in the report.

Status of native lizards. Although only a single day and night survey could be carried out on Phillip Island, the observation of geckos in high abundance and the capture of 16 skinks by hand during this time suggests populations of both species are stable or likely to have continued to increase since the 1978 and 2005 surveys. For comparison, 24 individual *O. lichenigerum* were captured across 12 nights in 1978 and 31 individuals in four nights in 2005 (Cogger *et al.*, 1979, 2006) with larger survey teams.

Recommendations

1. Further reptile surveys to be conducted on the offshore islets (e.g., Moo'oo Stone, Red Rock (Bird Rock), Cathedral Rock, Nepean Island, Green Pool Stone and small vegetated stacks) that were not visited during this Expedition. With a reported sighting of *O. lichenigerum* on Moo'oo Stone in the 1980s we recommend overnight surveys are conducted on Moo'oo Stone and other northern islets to investigate the ongoing status of *C. guentheri* and whether *O. lichenigerum* is present.
2. Cogger *et al.* (2006) suggested that African Olive, *Olea europaea cuspidata* may not provide suitable habitat for native reptiles. Surveys of this habitat on Phillip Island are required to understand



Figure 20. Variation in colouration of endemic *Oligosoma lichenigerum* on Phillip Island; Norfolk Island Group; a) patterned (AMS R.189041), b) striped (AMS R.189042). (Photography: Dane Trembath, AMRI).

whether there is a negative impact of this plant species on the native reptiles.

3. Surveys across Phillip Island to understand the full distribution and density of the native skink.
4. Continued investment in biosecurity programs for offshore islets, in particular Phillip Island (see biosecurity recommendations below for details).
5. Investigation of reintroduction of *C. guentheri* to Norfolk Island (see Cogger *et al.*, 2006).

Marine turtles

The mtDNA D-loop sequence recovered from ‘Doris’ was identified as haplotype CmP47.1. This haplotype is common in Green Turtles nesting in the southern Great Barrier Reef and Coral Sea. However, it has also been found in low frequency in nesting populations in New Caledonia and in very low frequency in nesting populations in the northern Great Barrier Reef, American Samoa and Vanuatu (Dutton *et al.*, 2014; Read *et al.*, 2015).

Introduced reptiles and amphibians

Although 10 species of non-native reptiles and amphibians have now been reported from NI (Table 12), only the Asian House Gecko, *H. frenatus* appears to have established a population.

Genetic analysis of the single Green Tree Frog specimen collected on NI revealed that it shared an identical mtDNA (ND4) haplotype with a specimen from Mt Nebo, near Brisbane, Queensland (Qld) (Fig. 21). Many other related

haplotypes were present throughout Australia and Papua New Guinea, with little evidence of strong geographic structure (Oliver *et al.*, 2020).

The introduced Asian House Gecko was encountered in Burnt Pine, NI. Three specimens were collected (AMS R.189038, R.189044, R.189045) (Fig. 22). Genetic analysis of two NI specimens revealed that they shared an identical mtDNA (12S) haplotype which was also found in two specimens from Cape York, Qld and has also been reported from south and southeast Asia (Fig. 23). Analysis of other Australian specimens revealed two additional 12S haplotypes (Fig. 23). The most common and widespread haplotype in Australia was found in specimens from Northern Territory (NT), north Qld, eastern NSW and Lord Howe Island, and has previously been reported from across the Pacific (Papua New Guinea (PNG), Hawaii, French Polynesia, Galapagos), as well as in south Asia and South America (Fig. 23). The other Australian haplotype found in a single individual from northeast NSW, has also been reported from French Polynesia (Fig. 23). The presence of three divergent 12S haplotypes within *H. frenatus* in Australia, suggests multiple introductions of this highly invasive species.

A single specimen of an introduced *Lepidodactylus* gecko, collected in Burnt Pine, NI, was donated to us by Mark Scott during the Expedition (Fig. 24). It was initially identified as a Mourning Gecko, *L. lugubris* which is an invasive parthenogenetic species now present in northern and northeastern Australia, and also widespread in the Indo-Pacific (Cogger, 2014; Karin *et al.*, 2021). However, the results of our genetic analysis (Fig. 25) revealed that this

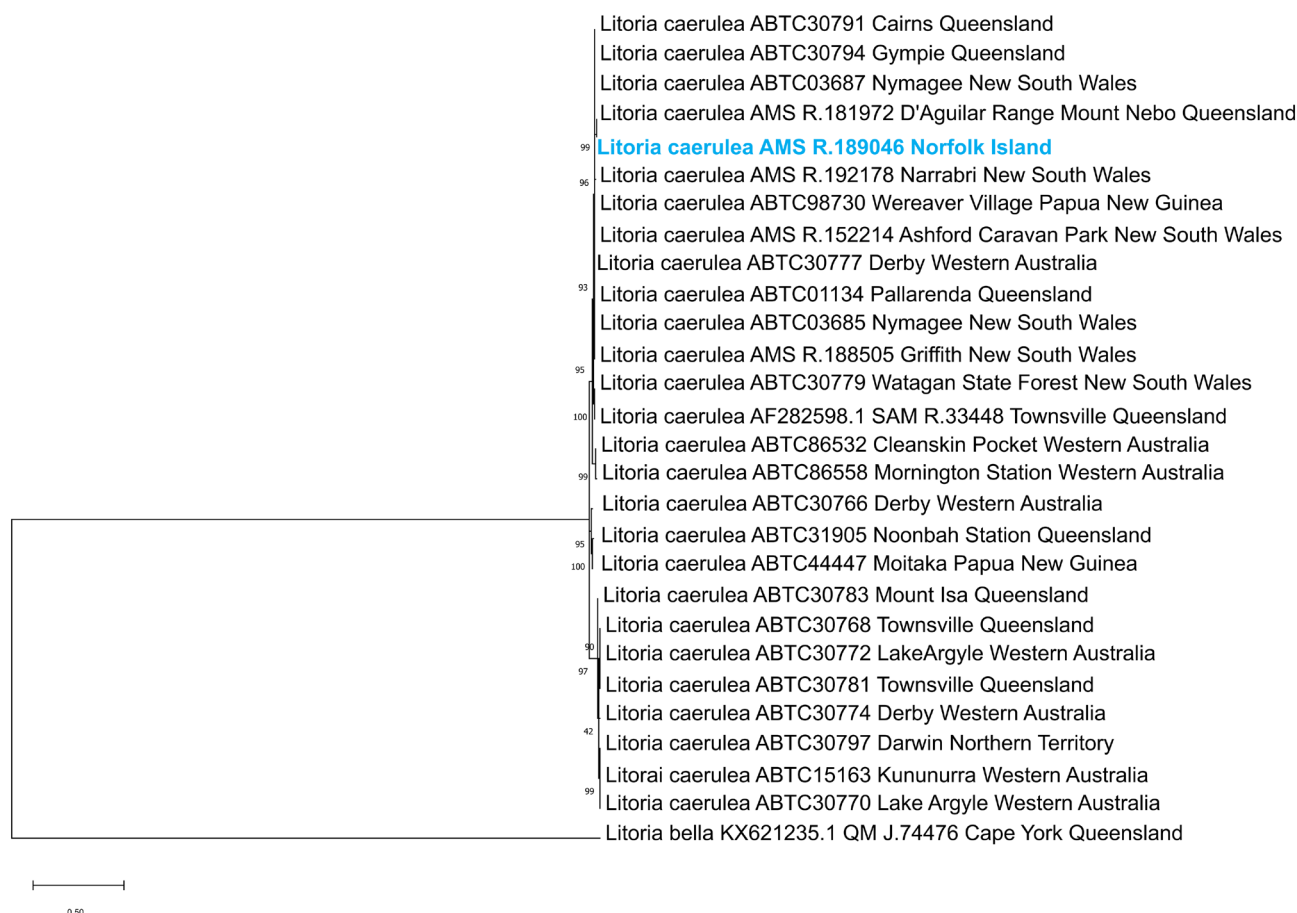


Figure 21. Phylogenetic tree (Maximum Likelihood) showing relationships of ND4 (mtDNA) haplotypes from a Green Tree Frog, *Litoria caerulea* from Norfolk Island (AMS R.189046) compared to samples from throughout Australia and Papua New Guinea. The tree is drawn to scale, with branch lengths corresponding to the number of nucleotide substitutions per site. There were a total of 644 positions in the final aligned dataset.

specimen was not *L. lugubris*, but a morphologically similar species, the Beach Scaley-toed Gecko, *Lepidodactylus pantai* which was recently described from the Kai Islands, Maluku, Indonesia (Stubbs *et al.*, 2017), but also occurs more widely on islands in the Pacific including Palau, Palmyra, French Polynesia and several small islands near PNG (Karin *et al.*, 2021). The presence of *L. pantai* on NI is significant as it represents a new species record for Australia and its external territories. Whether this species has become established on NI is yet to be determined, as is its potential impact on the NI ecosystem. Additional surveys and research are required.

No other introduced reptile or amphibian species were encountered during our surveys on NI or Phillip Island. Incursions by non-native species are now regularly reported (Table 12) and the establishment of additional invasive species is a significant concern. Additional species with a high potential to be introduced and become established in the NI Group include the Brown Tree Snake, *Boiga irregularis* and the Cane Toad, *Rhinella marina*, which would likely have major detrimental impacts on biodiversity. Both of these species are highly invasive and known to have detrimental effects on native vertebrates (Rodda *et al.*, 1999; Lever, 2001; Shine, 2018).

Recommendations

1. NI has a strong biosecurity program, ongoing support and strengthening of biosecurity control particularly in high-risk areas (airport and places that receive large amounts of freight e.g. Postal Office, building material suppliers, supermarkets

etc) is essential, as well as continued community engagement and participation. Invasive reptile and amphibian species are typically highly mobile and are adept at hitchhiking with luggage, freight and cargo. It is apparent that exotic species are continuing to reach NI, with some species making multiple incursions (e.g. Green Tree Frog, Table 12). Early detection is an advantage for removal and preventing establishment.

2. Additional surveys to determine if the Beach Scaley-toed Gecko, *Lepidodactylus pantai* has established on NI.
3. Community education in FrogID app as an additional tool to aid in incursion detection and identification through frog call recordings.
4. Provide Biosecurity and National Parks staff with training in tissue sampling and specimen preparation, to aid invasive species identification.
5. Ongoing investment in the prevention of introduced and pest species reaching Phillip Island, Nepean Island and northern islets and monitoring for incursions.

Mammals

Samples and/or specimens were collected from a total of 17 individuals of five species of mammals, including one cetacean and representatives of four introduced species (Appendix 4).

Table 12. Introduced Reptiles and Amphibians recorded from Norfolk Island Group.

Species	Year	Circumstances	Source
?Frogs	1830	From Allan Cunningham – likely in error	Mills, 2012
?Leaf-tailed Gecko, <i>Phyllurus</i> sp.	1830	From Allan Cunningham	Mills, 2012
?Pacific Boa, <i>Candoia</i> sp.	1830	From Allan Cunningham	Mills, 2012
Land Tortoise, Testudinidae	1986/7	Found at airport. Likely pet tortoise off yacht that wrecked at Head Stone. Yacht was sailing from the US to NZ.	Neil “Snowy” Tavener, pers. comm. 2022
Green Tree Frog <i>Litoria caerulea</i>	1998, 1999, March 2022, August 2025	2 individuals in 1998, Burnt Pine and in air freight; 1999 individual at airport; 2022 individual detected at airport, euthanized and subsequently donated to the Australian Museum; 2025 individual found on Hibiscus Drive and photos forwarded to the Australian Museum.	Covacevich <i>et al.</i> , 2001; Caroline McAllen, pers. comm. 2022; Nash Magri, email to Dane Trembath August 2025.
Graceful Tree Frog <i>Litoria gracilentia</i>	December 2022	Individual heard calling on Norfolk Island. Calls were forwarded to the Australian Museum and confirmed by Jodi Rowley and Dane Trembath.	Caroline McAllen, email to Dane Trembath December 2022.
Cane Toad <i>Rhinella marina</i>	1999	Single individual, Burnt Pine.	Covacevich <i>et al.</i> , 2001
Asian House Gecko, <i>Hemidactylus frenatus</i>	2000, 2005, 2006, 2008, 2022	2 individuals in freight in 2000. Multiple individuals detected 2005-2008. Now established population at Burnt Pine.	Covacevich <i>et al.</i> , 2001; Cogger <i>et al.</i> , 2006; Whitaker & Whitaker, 2007, 2008; current study.
Garden Skink <i>Lampropholis delicata</i>	November 2005	Single individual, Burnt Pine.	Whitaker & Whitaker, 2007
Eastern Water Dragon, <i>Intellagama lesueurii</i>	2011/12	Found in roll of imported carpet. Specimen now in the collection of Biosecurity Office, NI.	Neil “Snowy” Tavener, pers. comm. 2022.
Beach Scaly-toed Gecko, <i>Lepidodactylus pantai</i>	June 2022	Found in hardware store, euthanized and subsequently donated to the Australian Museum.	Mark Scott, pers. comm. 2022.

Table 12. Continued...

Table 12. Continued.

Species	Year	Circumstances	Source
Unidentified Elapid Snake	March 2024	Supermarket staff member bitten while unpacking eggs at Foodland Supermarket. Snake was captured and at first thought to “may be a yellow headed whipped snake and also first thought to have been a marsh or swamp snake”. Based on the photographs within the online article we believe it is likely a Marsh Snake, <i>Hemiaspis signata</i> .	Matthews, 2024b

Microbats

Microbat call detection

Of the total of 90,808 sound files examined from 36 sites (Table 9), none contained bat call sequences or fragments of call sequences. The great majority of sound files were generated by prevailing wind, with insect noise, including crickets, present in a minority of sound files.

Community survey of bat sightings

Residents and a visiting researcher reported either seeing, or in one case hearing, bats from several areas of NI in the last 20 years. Several earlier sightings of microbats and a flying fox were also recorded (Table 13). Although sightings of microbats have continued during the past 30 years (Hoye, 2011; Table 13), none have been corroborated with specimens, photographs or sound recordings. Our surveys have not been able to substantiate the continued existence of microbats on Norfolk or Phillip Islands. Thus, there is currently no evidence of the continued existence of a population of any species of bat on Norfolk or Phillip Islands, nor have three targeted bat surveys over the past 40 years found firm evidence of their presence (Gordon, 1983; Hoye, 2011; this study). This adds to the likelihood that bats are extinct in the NI Group. To our knowledge, the last confirmed record of *Chalinolobus* cf. *gouldii* from NI are specimens obtained in the mid-1940s (see Table 6).

If microbats were present, it is very likely they would have been found in the extensive call detection survey at 30 sites in 2003 (Hoye, 2011) or at 36 sites during this survey. Detector sites sampled all night and covered most areas of the Island, with much of the Island being within about a kilometre of a detector site (Fig. 26), i.e. well within commuting distance of this fast-flying species. The continued sightings of microbats in last 30 years, if valid, may be vagrant individuals of a variety of species, although no recordings, photos or specimens are available to allow confirmation of identifications. A wide variety of vagrant birds are regularly reported from NI (Christian 2005, 2025) and vagrant bats might also be expected though far less frequently, but their small size and nocturnal habits would make them harder to detect and identify. In addition, Welcome Swallows can be often confused with microbats, even by experienced observers, and this NI resident species could have generated some of the alleged microbat sightings. Welcome Swallows have narrow wings and rapid flight reminiscent of bats and the species can also be active at dusk.

Rodents

Three *R. exulans* specimens (AMS M.53923, M.53925, M.53929) were collected by AMRI staff and an additional two (AMS M.53916 and M.53922) were donated by Island residents. These samples provide additional material for future studies of the origin and timing of the introduction of *R. exulans* to NI which is linked to the arrival of Polynesians on Norfolk (Anderson & White, 2001). Two *R. rattus* (AMS M.53926–53927) were trapped by AMRI staff and one was donated by a member of the public (AMS M.53917). Only one *M. musculus* was trapped and they appear to be at low density on NI.

Genetic analysis of two of the *R. rattus* (M.53926–53927) trapped on NI, using 307 bp of the CytB gene (mtDNA), revealed a single shared haplotype that is identical to a haplotype widespread in *R. rattus* from eastern New South Wales, New Zealand, Papua New Guinea and the south-west



Figure 22. Invasive Asian House Gecko, *Hemidactylus frenatus* from Norfolk Island (AMS R.189038). (Photography: Dane Trembath, AMRI).

Pacific Islands (Fig. 27), but has also been found globally e.g., Asia, Africa, North America (Aplin *et al.*, 2011; Conroy *et al.*, 2013; Ramatla *et al.*, 2019; Frankham *et al.*, 2026). Interestingly, the haplotype from NI *R. rattus* was different from the haplotype found in samples from Lord Howe Island (Fig. 27) (Frankham *et al.*, 2026).

The rodent specimens and genetic samples collected during this study will provide a scientifically valuable, time anchored record of the genetic and morphological characteristics of the introduced populations on NI should rodent eradication be considered in future. In addition, introduced rodent populations are of ongoing scientific and historic interest. These species have been widely introduced around the world, at varying time scales, including to many islands, with serious impacts on biodiversity, agriculture and human health (Howald *et al.*, 2007; Varnham, 2010; Aplin *et al.*, 2011). Also, introduced rodent populations often have complex histories, diverse genetic/geographic origins and are the subject of ongoing research (Matisoo-Smith *et al.*, 2001; Searle *et al.*, 2009; Aplin *et al.*, 2011; Bonhomme *et al.*, 2011; Amos *et al.*, 2016).

Feral cats

Seven feral cat specimens were obtained during this survey (AMS M.53913–53915, M.53918–53921). Six were trapped during pest control operations by National Park staff or Island residents. An additional specimen was found mummified under a house on private property by Island residents. Four were tabby, one was white and tabby and the coat colour of the remaining cat was unknown due to it being desiccated. The stomach contents of five were examined, and four contained bird and/or rodent remains.

These specimens and genetic samples represent the first permanent museum record of the NI feral cat population and will provide reference material for the morphological and genetic characteristics of the population. These will prove useful for any future eradication plans and for ongoing research into the historical spread and establishment of feral cats around the globe (e.g. Spencer *et al.*, 2016).

The beaked whale (AMS M.53928) that stranded on NI in April 2016 was identified morphologically as a female Dense Beaked Whale, *M. densirostris* based on its size and the shape of the lower jaw (Bachara & Matthews, 2016). Both the morphological species identification and sex have now been confirmed by genetic analysis (Figs 28 and 29). The sex determination PCR revealed the presence of a single band in both samples from the whale (M.53928), indicating that it is a female (Fig. 28). For the species identification, 357 bp of the mtDNA CytB gene was obtained and compared with published sequences from other *Mesoplodon* species. The DNA sequence data from M.53928 was most similar to and clustered within sequences from specimens of *M. densirostris* (Fig. 29).

Sightings of beaked whales are uncommon in the vicinity of NI with *M. densirostris* having been reported on a limited number of previous occasions (Bachara & Matthews, 2016). The species has previously been reported to be more common around oceanic islands (MacLeod, 2014). Local fishermen have regularly sighted small pods (up to 4 individuals) of this species in the waters around Lord Howe Island (Eldridge *et al.*, 2017). The Australian Museum currently holds five specimens of *M. densirostris* from Lord Howe Island, twelve from locations along the New South Wales (NSW) coast and one from the Solomon Islands. There are also tissue

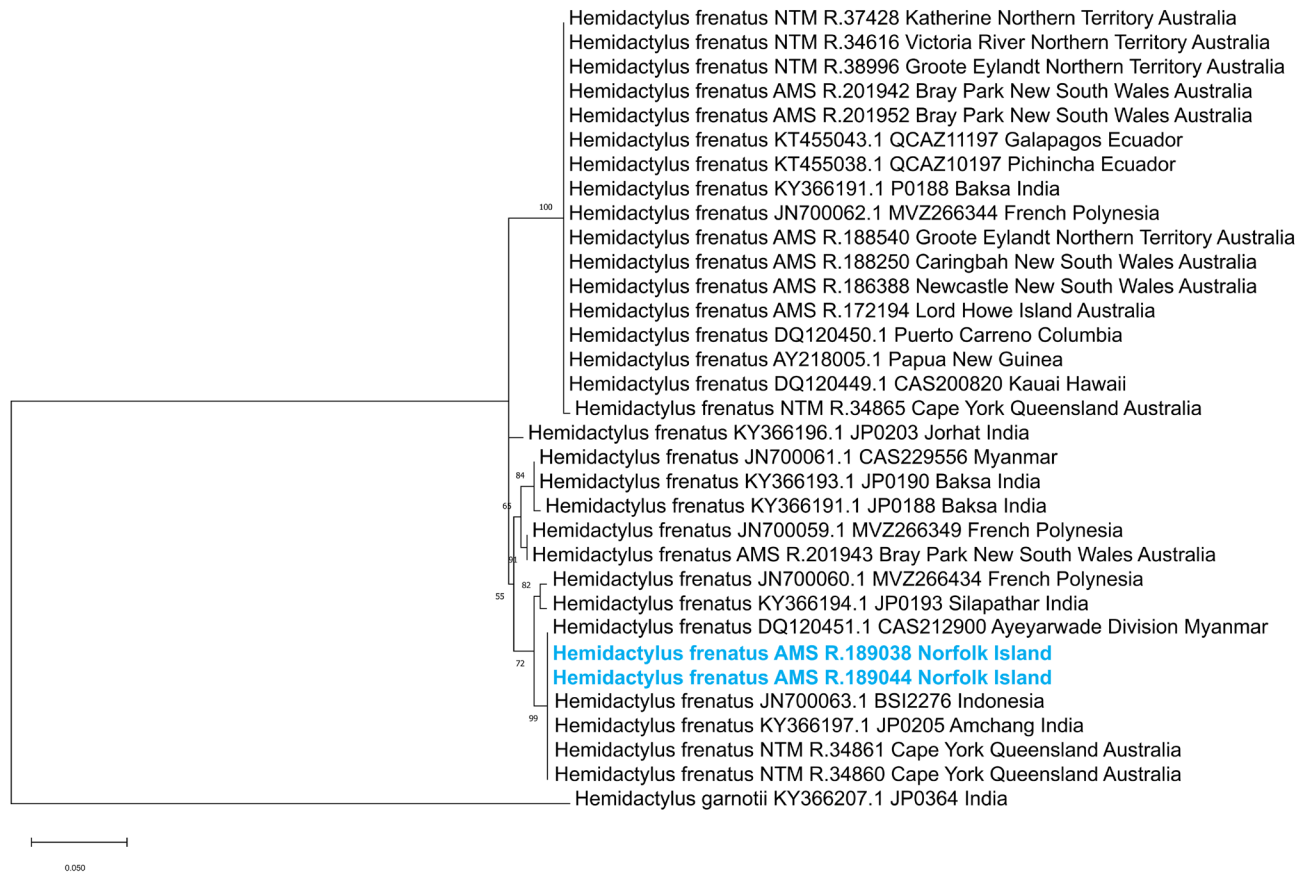


Figure 23. Phylogenetic tree (Maximum Likelihood) showing relationships of 12S (mtDNA) haplotypes from samples of the Asian House Gecko, *Hemidactylus frenatus* from Norfolk Island (AMS R.189038, 189044) compared to samples from eastern and northern Australia, south-west Pacific Islands and globally. The tree is drawn to scale, with branch lengths corresponding to the number of nucleotide substitutions per site. There were a total of 313 positions in the final aligned dataset.



Figure 24. Specimen of Beach Scaly-toed Gecko, *Lepidodactylus pantai* from Norfolk Island (AMS R.189043). (Photography: Dane Trembath, AMRI).

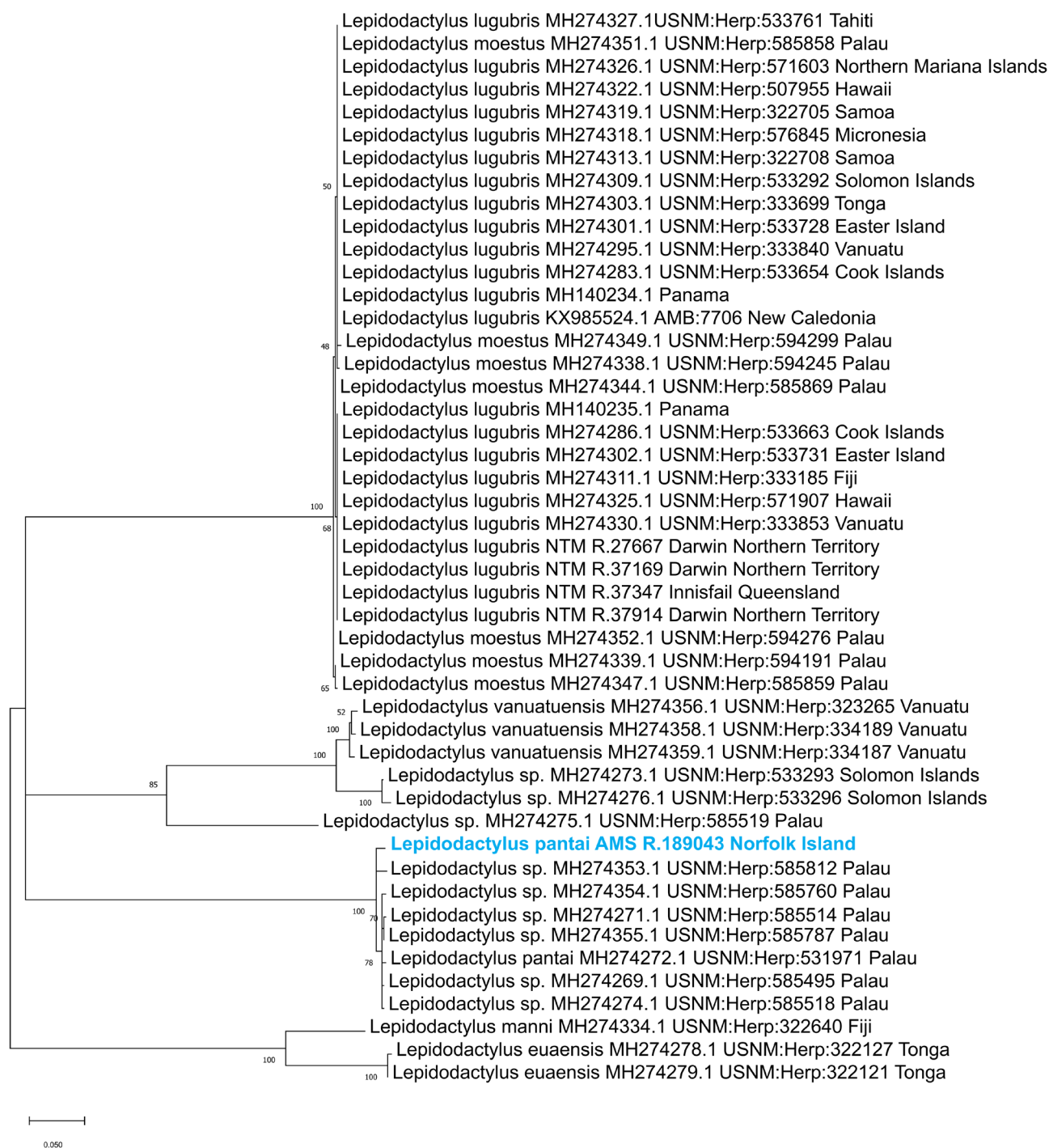


Figure 25. Phylogenetic tree (Maximum Likelihood) showing relationships of CO1 (mtDNA) haplotypes from a sample of a *Lepidodactylus* from Norfolk Island (AMS R.189043) compared to samples from the invasive Mourning Gecko, *Lepidodactylus lugubris* from northern Australia and globally, as well as related species. The sample from Norfolk Island is most similar to and clusters with samples from known Beach Scaly-toed Gecko, *Lepidodactylus pantai* specimens. The tree is drawn to scale, with branch lengths corresponding to the number of nucleotide substitutions per site. There were a total of 556 positions in the final aligned dataset.

samples from 14 individuals - three from Lord Howe Island, one from NI and the remainder from the NSW coast. The 2016 stranded individual is the first specimen record of a beaked whale from NI. Three *M. densirostris* skeletons were successfully exhumed from Lord Howe Island in March 2017 by AMRI staff and registered in the AM collection after being buried for more than five years (Eldridge *et al.*, 2017).

Recommendations

1. Acoustic surveys of bats from walking transects using hand-held bat detectors should be undertaken throughout the island that sample from early

dusk for at least an hour. Although several comprehensive acoustic surveys for microbats on NI over the last ~20 years have failed to detect any microbats, there remains a slim possibility that a very low-density population persists. Rather than deploying fixed detectors, we would suggest trying to detect bats by simultaneous observation and acoustic detection, focusing on dusk when bats could be observed even if their calls are out of range of call detection. Transects should be at least 1 km long and traverse more than one habitat.

2. The introduction of mainland Gould's Wattled Bat to NI

Table 13. Community reports of bats from the Norfolk Island Group.

Name	Location	Date	Comments
Luis Ortiz-Catedral	Burnt Pine	Second week of June, 2015	Luis Ortiz-Catedral was researching Norfolk Parrakeets on NI. He reported the sighting to both Margaret and Joel Christian at the time. In an email from December 2022, he wrote “ <i>saw a bat at dusk near the roundabout of Burnt Pine on Taylor’s Road. Only saw the silhouette for a few seconds near a lamp post. It flew in the direction of New Cascade Rd and then lost sight of it. I was in a moving vehicle. My companion and I stopped the car and tried to spot it again, but failed.</i> ”
Ron Ward & Glynn Maynard	Bumbora Reserve	~2017	At a property adjacent to Bumbora Reserve, Ron Ward and Glynn Maynard “ <i>heard a microbat chirping during the night over several nights, it was a fullish moon, calm and warm. We noted it as it was a different noise to the Orthoptera songs (my partner is an entomologist). At this time the property next door had a very old large hollow Norfolk Island pine which reputedly was a microbat roost.</i> ” The pine was reported removed a few years after this sighting.
Researcher reported to Margaret Christian	Verandah of tourist	pre 2010	The researcher was unpacking luggage on the veranda of their accommodation and saw several bats catching insects around the street lights. Reported it to Margaret Christian at the time.
Margaret Christian & Arthur Evans	“Simons Water” a property on Stockyard Road.	Around 2006-2008	Reported several bats seen flying around at dusk at Simons Water. Also commented that bats roosted in the walls of a work depot building at Kingston near the tent embassy and were seen by Mervin Buffet. The tent embassy was established in 2016.
Damien Snell	NI Airport	1980s	Reported that a “fruit bat” was sighted over several days in a Banyan tree at the airport but that it was shot. Also commented that Owen Evans had last seen bats around 20–30 years ago on the north side of Mount Bates.

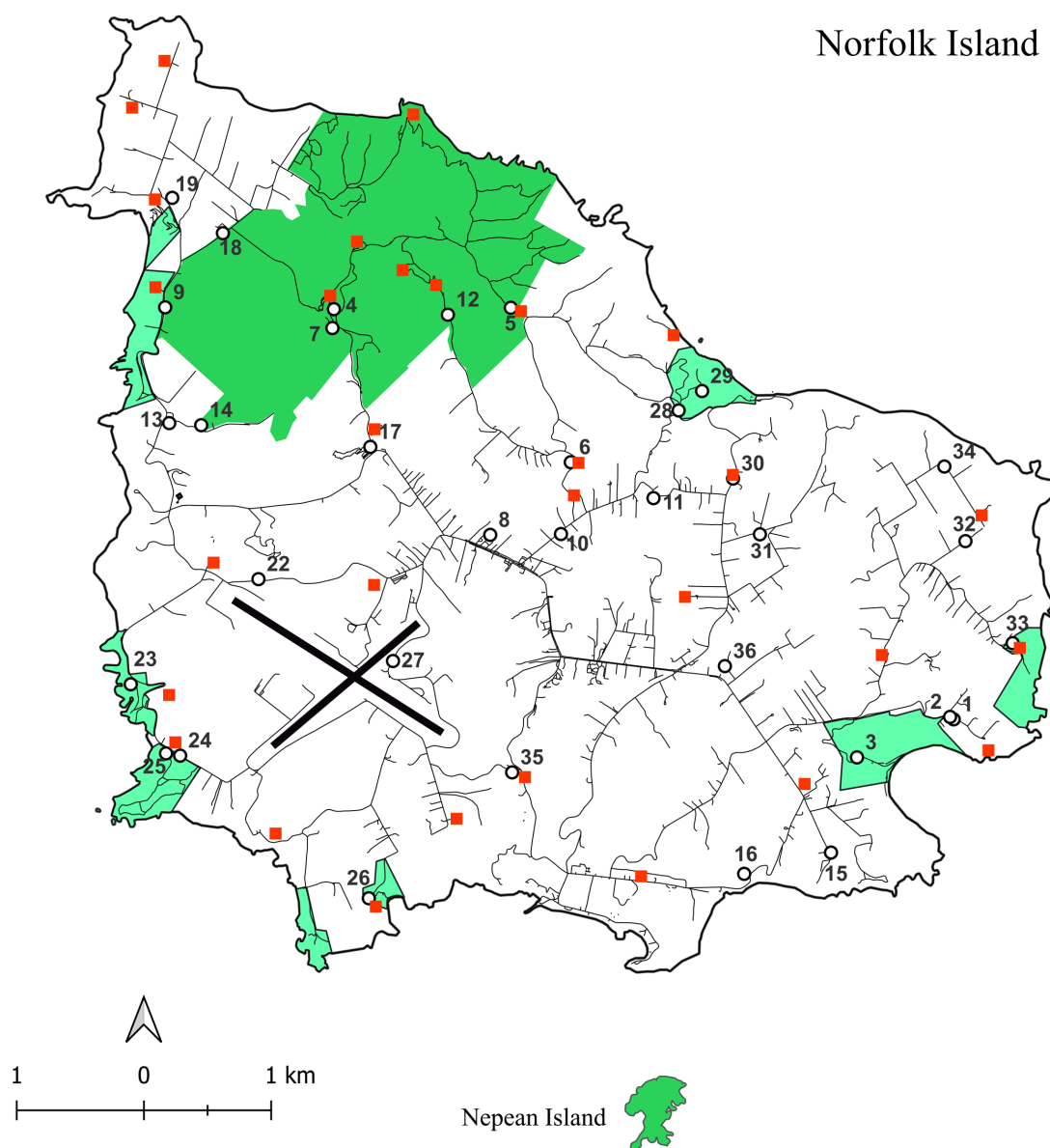


Figure 26. Location of the 30 bat detector sites sampled in 2003 (red rectangles) by Hoyer (2011) in relation to the 36 detector sites of this survey (numbered circles). Note that Hoyer (2011) was unable to sample Phillip Island.

should not be considered until the taxonomic status of NI *Chalinolobus* has been definitively resolved and a better understanding of the causes of decline established.

3. Further comprehensive population sampling ($n = 20-30$) and archiving of genetic samples from all four introduced mammal species should be prioritised. Although the current Expedition has increased the genetic sampling of the introduced rodent and cat populations, additional samples would be very useful for ongoing research into the evolutionary history and genetic characteristics of these populations. This would also allow the establishment of baseline genetic data to aid ongoing monitoring and management and would inform any future plans should island-wide eradication become feasible (Harper *et al.*, 2020; Frankham *et al.*, 2026).

Conclusion

Thanks to the support and collaboration of the Norfolk Island authorities and community, the Australian Museum's 2022 Expedition to the NI Group has been a great success. Novel data has been obtained and new bird, reptile, amphibian and mammal specimens and tissue samples collected. These will not only significantly enhance the Australian Museum's collection, but provide valuable documentation of the contemporary bird, reptile and mammal fauna of the NI Group, as well as supporting current and future research projects and conservation efforts. The Expedition also stimulated significant historical research on NI terrestrial vertebrates and the Australian Museum's existing NI Group vertebrate collections. This uncovered important additional information and data which has added considerable context and value to the natural history of the NI Group.

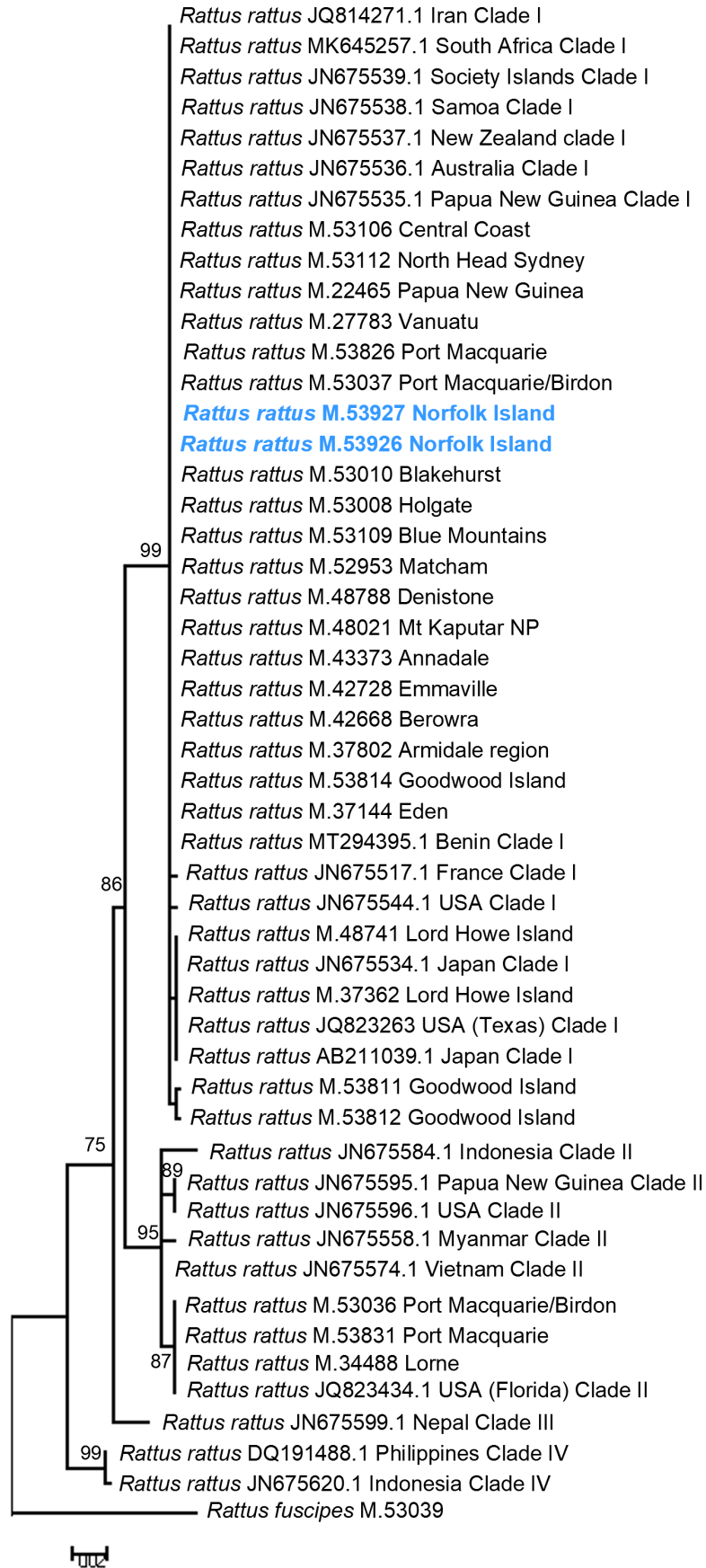


Figure 27. Phylogenetic tree (ML) showing relationships of CytB (mtDNA) haplotypes from samples of Black Rat, *Rattus rattus* from Norfolk Island (AMS M.53926-27) compared to samples from eastern NSW, Papua New Guinea, the south-west Pacific Islands and globally.



Figure 28. Visualization, under UV light, of sex-test PCR products confirming that the sampled Dense-beaked Whale, *Mesoplodon densirostris* specimen (AMS M.53928) was female.

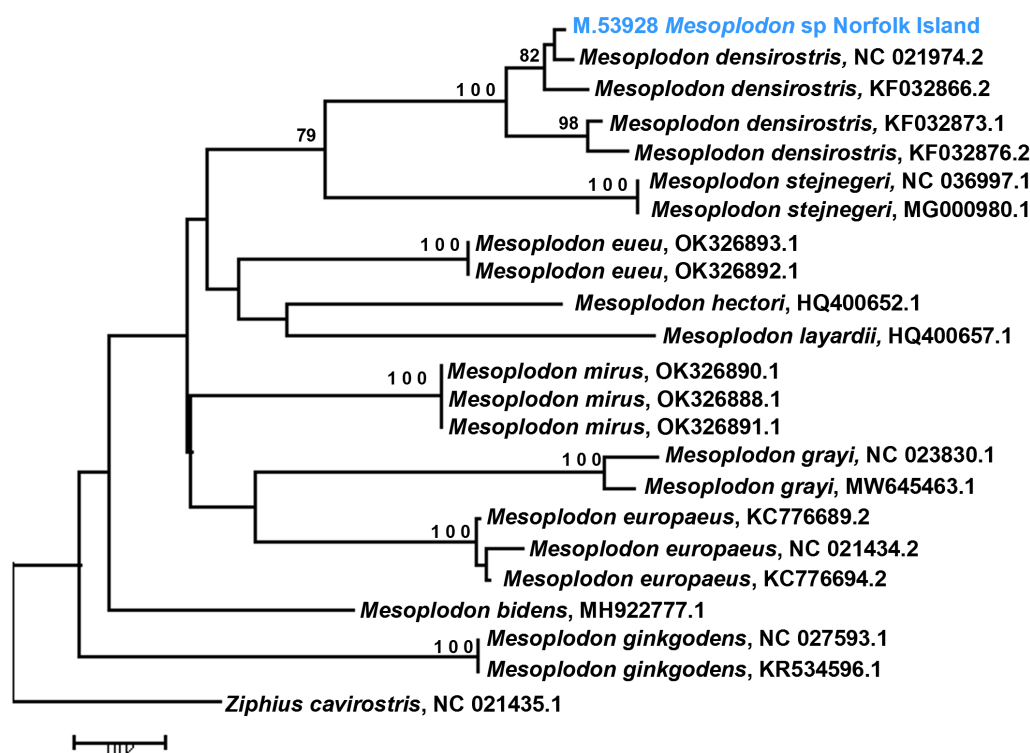


Figure 29. Phylogenetic tree (ML) showing relationships of CytB (mtDNA) haplotypes from samples of 10 *Mesoplodon* species. The sample from Norfolk Island (AMS M.53928) is most similar to, and clusters with, samples from known Dense-beaked Whale, *M. densirostris* specimens.

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<https://doi.org/10.1073/pnas.1417301112>

Appendix 1. Museum specimens used in genetic analyses in this study and their GenBank accession numbers.

Registration Number	Institution	Species	Locality	Reference or GenBank Accession Number
Amphibians				
ABTC01134	SAM	<i>Litoria caerulea</i>	Pallarenda, Queensland, Australia	Oliver <i>et al.</i> , 2020
ABTC03685	SAM	<i>Litoria caerulea</i>	Nymagee, New South Wales, Australia	Oliver <i>et al.</i> , 2020
ABTC03687	SAM	<i>Litoria caerulea</i>	Nymagee, New South Wales, Australia	Oliver <i>et al.</i> , 2020
ABTC15163	SAM	<i>Litoria caerulea</i>	Kununurra, Western Australia, Australia	Oliver <i>et al.</i> , 2020
ABTC30766	SAM	<i>Litoria caerulea</i>	Derby, Western Australia, Australia	Oliver <i>et al.</i> , 2020
ABTC30768	SAM	<i>Litoria caerulea</i>	Townsville, Queensland, Australia	Oliver <i>et al.</i> , 2020
ABTC30770	SAM	<i>Litoria caerulea</i>	Lake Argyle, Western Australia, Australia	Oliver <i>et al.</i> , 2020
ABTC30772	SAM	<i>Litoria caerulea</i>	Lake Argyle, Western Australia, Australia	Oliver <i>et al.</i> , 2020
ABTC30774	SAM	<i>Litoria caerulea</i>	Derby, Western Australia, Australia	Oliver <i>et al.</i> , 2020
ABTC30777	SAM	<i>Litoria caerulea</i>	Derby, Western Australia, Australia	Oliver <i>et al.</i> , 2020
ABTC30779	SAM	<i>Litoria caerulea</i>	Watagan SF, New South Wales, Australia	Oliver <i>et al.</i> , 2020
ABTC30781	SAM	<i>Litoria caerulea</i>	Townsville, Queensland, Australia	Oliver <i>et al.</i> , 2020
ABTC30783	SAM	<i>Litoria caerulea</i>	Mount Isa, Queensland, Australia	Oliver <i>et al.</i> , 2020
ABTC30791	SAM	<i>Litoria caerulea</i>	Cairns, Queensland, Australia	Oliver <i>et al.</i> , 2020
ABTC30794	SAM	<i>Litoria caerulea</i>	Gympie, Queensland, Australia	Oliver <i>et al.</i> , 2020
ABTC30797	SAM	<i>Litoria caerulea</i>	Darwin, Northern Territory, Australia	Oliver <i>et al.</i> , 2020
ABTC31905	SAM	<i>Litoria caerulea</i>	Noonbah Station, Queensland, Australia	Oliver <i>et al.</i> , 2020
ABTC44447	SAM	<i>Litoria caerulea</i>	Moitaka, NDC, Papua New Guinea	Oliver <i>et al.</i> , 2020
ABTC86532	SAM	<i>Litoria caerulea</i>	Cleanskin Pocket, Western Australia, Australia	Oliver <i>et al.</i> , 2020
ABTC86558	SAM	<i>Litoria caerulea</i>	‘Mornington’, Western Australia, Australia	Oliver <i>et al.</i> , 2020
ABTC98730	SAM	<i>Litoria caerulea</i>	Wereaver, Western Province, Papua New Guinea	Oliver <i>et al.</i> , 2020
R.33448	SAM	<i>Litoria caerulea</i>	Townsville, Queensland, Australia	Oliver <i>et al.</i> , 2020
R.152214	AMS	<i>Litoria caerulea</i>	Ashford, New South Wales, Australia	PV656454
R.181972	AMS	<i>Litoria caerulea</i>	Mount Nebo, Queensland, Australia	PV656455
R.188505	AMS	<i>Litoria caerulea</i>	Griffith, New South Wales, Australia	PV656456
R.189046	AMS	<i>Litoria caerulea</i>	Norfolk Island	PV656457
R.192178	AMS	<i>Litoria caerulea</i>	Narrabri, New South Wales, Australia	PV656458
Reptiles				
R.34616	NTM	<i>Hemidactylus frenatus</i>	Victoria River, Northern Territory, Australia	PV661942
R.34860	NTM	<i>Hemidactylus frenatus</i>	Cape York, Queensland, Australia	PV661943
R.34861	NTM	<i>Hemidactylus frenatus</i>	Cape York, Queensland, Australia	PV661944
R.34865	NTM	<i>Hemidactylus frenatus</i>	Cape York, Queensland, Australia	PV661945
R.37428	NTM	<i>Hemidactylus frenatus</i>	Katherine, Northern Territory, Australia	PV661946
R.38996	NTM	<i>Hemidactylus frenatus</i>	Groote Eylandt, Northern Territory, Australia	PV661947
R.172194	AMS	<i>Hemidactylus frenatus</i>	Lord Howe Island, New South Wales, Australia	PV661933
R.188250	AMS	<i>Hemidactylus frenatus</i>	Caringbah, New South Wales, Australia	PV661935
R.188540	AMS	<i>Hemidactylus frenatus</i>	Groote Eylandt, Northern Territory, Australia	PV661936
R.186388	AMS	<i>Hemidactylus frenatus</i>	Newcastle, New South Wales, Australia	PV661934
R.201942	AMS	<i>Hemidactylus frenatus</i>	Bray Park, New South Wales, Australia	PV661939
R.201943	AMS	<i>Hemidactylus frenatus</i>	Bray Park, New South Wales, Australia	PV661940
R.201952	AMS	<i>Hemidactylus frenatus</i>	Bray Park, New South Wales, Australia	PV661941
R.189038	AMS	<i>Hemidactylus frenatus</i>	Norfolk Island	PV661937
R.189044	AMS	<i>Hemidactylus frenatus</i>	Norfolk Island	PV661938
R.27667	NTM	<i>Lepidodactylus lugubris</i>	Darwin, Northern Territory, Australia	PV650634
R.37169	NTM	<i>Lepidodactylus lugubris</i>	Darwin, Northern Territory, Australia	PV650635
R.37347	NTM	<i>Lepidodactylus lugubris</i>	Innisfail, Queensland, Australia	PV650636
R.37914	NTM	<i>Lepidodactylus lugubris</i>	Darwin, Northern Territory, Australia	PV650637
R.189043	AMS	<i>Lepidodactylus pantai</i>	Norfolk Island	PV650633
R.192842	AMS	<i>Chelonia mydas</i>	Norfolk Island	PV646263

Appendix 1. Continued...

Appendix 1. Continued.

Registration Number	Institution	Species	Locality	Reference or GenBank Accession Number
Mammals				
M.53928	AMS	<i>Mesoplodon densirostris</i>	Norfolk Island	PV646264
M.22465	AMS	<i>Rattus rattus</i>	Sideia, Milne Bay, Papua New Guinea	PV646411
M.27783	AMS	<i>Rattus rattus</i>	Saori, West Santo, Vanuatu	PV646410
M.34488	AMS	<i>Rattus rattus</i>	Lorne, NSW, Australia	PV646419
M.37144	AMS	<i>Rattus rattus</i>	Eden, NSW, Australia	PV646308
M.37362	AMS	<i>Rattus rattus</i>	Lord Howe Island, NSW, Australia	PV646301
M.37802	AMS	<i>Rattus rattus</i>	Armidale, NSW, Australia	PV646380
M.42668	AMS	<i>Rattus rattus</i>	Berowra, NSW, Australia	PV646381
M.42728	AMS	<i>Rattus rattus</i>	Emmaville, NSW, Australia	PV646382
M.43373	AMS	<i>Rattus rattus</i>	Annandale, NSW, Australia	PV646383
M.48021	AMS	<i>Rattus rattus</i>	Mt Kaputar NP, NSW, Australia	PV646384
M.48741	AMS	<i>Rattus rattus</i>	Lord Howe Island, NSW, Australia	PV646367
M.48788	AMS	<i>Rattus rattus</i>	Denistone, NSW, Australia	PV646388
M.52953	AMS	<i>Rattus rattus</i>	Matcham, NSW, Australia	PV646391
M.53008	AMS	<i>Rattus rattus</i>	Holgate, NSW, Australia	PV646398
M.53010	AMS	<i>Rattus rattus</i>	Blakehurst, NSW, Australia	PV646399
M.53036	AMS	<i>Rattus rattus</i>	Birdon, NSW, Australia	PV646400
M.53037	AMS	<i>Rattus rattus</i>	Birdon, NSW, Australia	PV646359
M.53039	AMS	<i>Rattus fuscipes</i>	Birdon, NSW, Australia	PV646420
M.53106	AMS	<i>Rattus rattus</i>	Central Coast, NSW, Australia	PV646418
M.53109	AMS	<i>Rattus rattus</i>	Blue Mountains, NSW, Australia	PV646397
M.53112	AMS	<i>Rattus rattus</i>	North Head, Sydney, NSW, Australia	PV646415
M.53811	AMS	<i>Rattus rattus</i>	Goodwood Island, NSW, Australia	PV646356
M.53812	AMS	<i>Rattus rattus</i>	Goodwood Island, NSW, Australia	PV646344
M.53814	AMS	<i>Rattus rattus</i>	Goodwood Island, NSW, Australia	PV646355
M.53826	AMS	<i>Rattus rattus</i>	Port Macquarie, NSW, Australia	PV646405
M.53831	AMS	<i>Rattus rattus</i>	Port Macquarie, NSW, Australia	PV646392
M.53926	AMS	<i>Rattus rattus</i>	Norfolk Island	PV646403
M.53927	AMS	<i>Rattus rattus</i>	Norfolk Island	PV646404

AMS, Australian Museum; NTM, Northern Territory Museum; SAM, South Australian Museum.

Appendix 2. Australian Museum (AMS) registration numbers for bird specimens and samples obtained during October 2022, Norfolk Island Group.

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84501	NI22-BIRD-01	Skin	<i>Turdus merula</i>	—	Hollow Pine, Mt Pitt Rd	25/10/2022
O.84501.001		Frozen blood		119551		
O.84501.002		Frozen feathers		119639		
O.84501.003		Wet specimen		—		
O.84501.004		Frozen muscle		101510		
O.84502.001	NI22-BIRD-02	Frozen blood	<i>Zosterops tenuirostris</i>	119552	Hollow Pine, Mt Pitt Rd	25/10/2022
O.84502.002		Frozen feathers		119648		
O.84503	NI22-BIRD-03	Skeleton	<i>Sturnus vulgaris</i>	—	Prince Phillip Dr, Cascade Bay	25/10/2022
O.84504 ^a	NI22-BIRD-04	Skin	<i>Platyercus elegans</i>	—	Nursery, Bishop Patterson Rd	27/6/2022
O.84504.001		Skeleton		—		
O.84504.002		Frozen muscle		101156		
O.84504.003		Frozen muscle		101157		
O.84504.004		Frozen liver		101158		
O.84504.005		Frozen liver		101159		
O.84505 ^a	NI22-BIRD-05	Skin	<i>Platyercus elegans</i>	—	Nursery, Bishop Patterson Rd	27/6/2022
O.84505.001		Wet specimen		—		
O.84505.002		Frozen muscle		101511		
O.84506	NI22-BIRD-06	Skeleton	<i>Carduelis carduelis</i>	—	Douglas Dr	25/10/2022
O.84506.001		Frozen muscle		77889		
O.84506.002		Frozen liver		77890		
O.84507 ^a	NI22-BIRD-07	Skeleton	<i>Callipepla californica</i>	—	Nursery, Bishop Patterson Rd	4/7/2022
O.84507.001		Wet specimen		—		
O.84507.002		Frozen muscle		101512		
O.84508 ^a	NI22-BIRD-08	Skin	<i>Callipepla californica</i>	—	Nursery, Bishop Patterson Rd	4/7/2022
O.84508.001		Skeleton		—		
O.84508.002		Frozen muscle		101160		
O.84508.003		Frozen muscle		101161		
O.84508.004		Frozen liver		101162		
O.84508.005		Frozen liver		101163		

Appendix 2. Continued...

Appendix 2. Continued.

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84509 ^a	NI22-BIRD-09	Skeleton	<i>Platyercus elegans</i>	—	Nursery, Bishop Patterson Rd	25/10/2022
O.84509.001		Wing		—		
O.84509.002		Frozen muscle		101115		
O.84509.003		Frozen muscle		101116		
O.84509.004	NI22-BIRD-10	Frozen liver	<i>Platyercus elegans</i>	101117	Hundred Acres Reserve	2/8/2022
O.84510 ^a		Skeleton		—		
O.84510.001		Frozen muscle		101145		
O.84510.002		Frozen muscle		101146		
O.84510.003	NI22-BIRD-11	Frozen liver	<i>Platyercus elegans</i>	101147	Norfolk Island	<2022
O.84510.004		Frozen liver		101148		
O.84511 ^a	NI22-BIRD-12	Skeleton	<i>Platyercus elegans</i>	—	New Cascade Rd	31/7/2022
O.84511.001		Wing		—		
O.84511.002		Wet specimen		—		
O.84511.003		Frozen muscle		101513		
O.84512 ^a	NI22-BIRD-13	Skin	<i>Platyercus elegans</i>	—	New Cascade Rd	26/7/2022
O.84512.001		Skeleton		—		
O.84512.002		Frozen muscle		101109		
O.84512.003		Frozen muscle		101110		
O.84512.004	NI22-BIRD-14	Frozen liver	<i>Falco cenchroides</i>	101111	Norfolk Island	<2022
O.84513 ^a		Skin		—		
O.84513.001		Skeleton		—		
O.84513.002		Frozen muscle		101106		
O.84513.003	NI22-BIRD-14	Frozen muscle	<i>Falco cenchroides</i>	101107	Norfolk Island	<2022
O.84513.004		Frozen liver		101108		
O.84514 ^a	NI22-BIRD-14	Skeleton	<i>Falco cenchroides</i>	—	Norfolk Island	<2022
O.84514.001		Wing		—		
O.84514.002		Frozen muscle		101121		
O.84514.003		Frozen muscle		101122		
O.84514.004	NI22-BIRD-14	Frozen liver	<i>Falco cenchroides</i>	101123	Norfolk Island	<2022
O.84514.005		Frozen liver		101124		

Appendix 2. Continued...

Appendix 2. *Continued.*

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84515 ^a	NI22-BIRD-15	Skin	<i>Callipepla californica</i>	—	New Cascade Rd	5/8/2022
O.84515.001		Skeleton		—		
O.84515.002		Frozen muscle		101142		
O.84515.003		Frozen muscle		101143		
O.84515.004	NI22-BIRD-16	Frozen liver	<i>Callipepla californica</i>	101144	New Cascade Rd	5/8/2022
O.84516 ^a		Skin		—		
O.84516.001		Skeleton		—		
O.84516.002		Frozen muscle		101139		
O.84516.003	NI22-BIRD-17	Frozen muscle	<i>Zosterops tenuirostris</i>	101140	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84516.004		Frozen liver		101141		
O.84517.001	NI22-BIRD-18	Frozen blood	<i>Zosterops tenuirostris</i>	119553	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84517.002		Frozen feathers		119640		
O.84518.001	NI22-BIRD-19	Frozen blood	<i>Zosterops tenuirostris</i>	119554	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84518.002		Frozen feathers		119657		
O.84519.001	NI22-BIRD-20	Frozen blood	<i>Zosterops tenuirostris</i>	119555	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84519.002		Frozen feathers		119651		
O.84520.001	NI22-BIRD-21	Frozen blood	<i>Gerygone modesta</i>	119556	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84520.002		Frozen feathers		119668		
O.84521.001	NI22-BIRD-22	Frozen blood	<i>Gerygone modesta</i>	119557	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84521.002		Frozen feathers		119645		
O.84522.001	NI22-BIRD-23	Frozen blood	<i>Gerygone modesta</i>	119558	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84522.002		Frozen feathers		119643		
O.84523.001	NI22-BIRD-24	Frozen blood	<i>Zosterops tenuirostris</i>	119559	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84523.002		Frozen feathers		119655		
O.84524.001	NI22-BIRD-25	Frozen blood	<i>Zosterops lateralis</i>	119560	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84524.002		Frozen feathers		119642		
O.84525.001	NI22-BIRD-26	Frozen blood	<i>Rhipidura albiscapa pelzelni</i>	119561	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84525.002		Frozen feathers		119641		
O.84526.001	NI22-BIRD-26	Frozen blood	<i>Rhipidura albiscapa pelzelni</i>	119562	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84526.002		Frozen feathers		119638		

Appendix 2. *Continued...*

Appendix 2. Continued.

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84527.001 O.84527.002	NI22-BIRD-27	Frozen blood Frozen feathers	<i>Zosterops tenuirostris</i>	119563 119650	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84528.001 O.84528.002	NI22-BIRD-28	Frozen blood Frozen feathers	<i>Gerygone modesta</i>	119564 119636	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84529.001 O.84529.002	NI22-BIRD-29	Frozen blood Frozen feathers	<i>Zosterops tenuirostris</i>	119565 119649	McLachlans Ln, Norfolk Island NP	26/10/2022
O.84530 ^a O.84530.001 O.84530.002 O.84530.003 O.84530.004 O.84530.005	NI22-BIRD-30	Skin Skeleton Frozen muscle Frozen liver Frozen liver	<i>Pluvialis fulva</i>	— — 101172 101173 101174 101175	Norfolk Island Airport	August 2022
O.84531 ^a O.84531.001 O.84531.002 O.84531.003 O.84531.004 O.84531.005	NI22-BIRD-31	Skin Skeleton Frozen muscle Frozen liver Frozen liver	<i>Pluvialis fulva</i>	— — 101164 101165 101166 101167	Norfolk Island Airport	August 2022
O.84532 ^a O.84532.001 O.84532.002 O.84532.003 O.84532.004 O.84532.005	NI22-BIRD-32	Skin Skeleton Frozen muscle Frozen liver Frozen liver	<i>Pluvialis fulva</i>	— — 101168 101169 101170 101171	Norfolk Island Airport	August 2022
O.84533 ^a O.84533.001 O.84533.002	NI22-BIRD-33	Skeleton Wet specimen Frozen muscle	<i>Sturnus vulgaris</i>	— — 101508	New Cascade Rd	1/8/2022
O.84534 ^a O.84534.001 O.84534.002	NI22-BIRD-34	Skeleton Wet specimen Frozen muscle	<i>Sturnus vulgaris</i>	— — 101502	New Cascade Rd	1/8/2022
O.84535 ^a O.84535.001 O.84535.002	NI22-BIRD-35	Skeleton Wet specimen Frozen muscle	<i>Sturnus vulgaris</i>	— — 101504	New Cascade Rd	1/8/2022

Appendix 2. Continued...

Appendix 2. *Continued.*

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84536 ^a	NI22-BIRD-36	Skeleton	<i>Turdus merula</i>	—	Norfolk Island	7/8/2021
O.84536.001		Wet specimen		—		
O.84536.002		Frozen muscle		101506		
O.84537 ^a	NI22-BIRD-37	Skeleton	<i>Turdus merula</i>	—	Norfolk Island	7/8/2021
O.84537.001		Wet specimen		—		
O.84537.002		Frozen muscle		101503		
O.84538 ^a	NI22-BIRD-38	Skin	<i>Passer domesticus</i>	—	New Cascade Rd	1/8/2022
O.84538.001		Skeleton		—		
O.84538.002		Frozen muscle		101176		
O.84538.003		Frozen muscle		101177		
O.84538.004		Frozen liver		101178		
O.84539 ^a	NI22-BIRD-39	Skin	<i>Zosterops lateralis</i>	—	Norfolk Island	5/8/2021
O.84539.001		Skeleton		—		
O.84539.002		Frozen muscle		101185		
O.84539.003		Frozen muscle		101186		
O.84539.004		Frozen liver		101187		
O.84540 ^a	NI22-BIRD-40	Skeleton	<i>Carduelis chloris</i>	—	Norfolk Island Airport	28/7/2022
O.84540.001		Wing		—		
O.84540.002		Wet specimen		—		
O.84540.003		Frozen muscle		101505		
O.84541 ^a	NI22-BIRD-41	Skin	<i>Zosterops lateralis</i>	—	New Cascade Rd	7/8/2021
O.84541.001		Skeleton		—		
O.84541.002		Frozen muscle		101179		
O.84541.003		Frozen muscle		101180		
O.84541.004		Frozen liver		101181		
O.84542 ^a	NI22-BIRD-42	Skin	<i>Carduelis chloris</i>	—	New Cascade Rd	1/8/2022
O.84542.001		Skeleton		—		
O.84542.002		Frozen muscle		101188		
O.84542.003		Frozen muscle		101189		
O.84542.004		Frozen liver		101190		

Appendix 2. *Continued...*

Appendix 2. Continued.

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84543 ^a	NI22-BIRD-43	Skeleton	<i>Carduelis chloris</i>	—	New Cascade Rd	1/8/2022
O.84544	NI22-BIRD-44	Skin	<i>Hirundo neoxena</i>	—	Norfolk Island	1/8/2022
O.84544.001		Skeleton		—		
O.84544.002		Frozen muscle		101188		
O.84544.003		Frozen liver		101189		
O.84545	NI22-BIRD-45	Skin	<i>Hirundo neoxena</i>	—	Norfolk Island	≤2022
O.84545.001		Skeleton		—		
O.84545.002		Frozen muscle		101191		
O.84545.003		Frozen muscle		101192		
O.84545.004		Frozen liver		101193		
O.84546	NI22-BIRD-46	Skin	<i>Hirundo neoxena</i>	—	Norfolk Island	≤2022
O.84546.001		Skeleton		—		
O.84546.002		Frozen muscle		101194		
O.84546.003		Frozen muscle		101195		
O.84546.004		Frozen liver		101196		
O.84547 ^a	NI22-BIRD-47	Skeleton	<i>Carduelis chloris</i>	—	Norfolk Island	19/8/2022
O.84547.001		Frozen muscle		77887		
O.84547.002		Frozen liver		77888		
O.84548 ^a	NI22-BIRD-48	Skin	<i>Zosterops lateralis</i>	—	Norfolk Island	19/8/2022
O.84548.001		Skeleton		—		
O.84548.002		Frozen muscle		101182		
O.84548.003		Frozen muscle		101183		
O.84548.004		Frozen liver		101184		
O.84549 ^a	NI22-BIRD-49	Skin	<i>Zosterops lateralis</i>	—	Norfolk Island	19/8/2022
O.84549.001		Skeleton		—		
O.84549.002		Frozen muscle		101137		
O.84549.003		Frozen liver		101138		
O.84550	NI22-BIRD-50	Skin	<i>Artamus personatus</i>	—	Norfolk Island	≤2022
O.84550.001		Skeleton		—		
O.84550.002		Frozen muscle		101131		
O.84550.003		Frozen muscle		101132		
O.84550.004		Frozen liver		101133		

Appendix 2. Continued...

Appendix 2. Continued.

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84551	NI22-BIRD-51	Skin	<i>Artamus personatus</i>	—	Norfolk Island	≤2022
O.84551.001		Skeleton		—		
O.84551.002		Frozen muscle		101128		
O.84551.003		Frozen muscle		101129		
O.84551.004		Frozen liver		101130		
O.84552	NI22-BIRD-52	Skeleton	<i>Artamus personatus</i>	—	Norfolk Island	≤2022
O.84552.001		Frozen muscle		77773		
O.84553 ^a	NI22-BIRD-53	Skeleton	<i>Turdus philomelos</i>	—	Hundred Acres Reserve	25/10/2022
O.84554 ^a	NI22-BIRD-54	Skeleton	<i>Turdus philomelos</i>	—	Hundred Acres Reserve	25/10/2022
O.84554.001		Frozen muscle		77774		
O.84555 ^a	NI22-BIRD-55	Skeleton	<i>Turdus philomelos</i>	—	Norfolk Island	<2022
O.84555.001		Wet specimen		—		
O.84555.002		Frozen muscle		101500		
O.84556 ^a	NI22-BIRD-56	Skeleton	<i>Sturnus vulgaris</i>	—	Norfolk Island	<2022
O.84556.001		Wet specimen		—		
O.84556.002		Frozen muscle		101501		
O.84557	NI22-BIRD-57	Skin	<i>Todiramphus sanctus norfolkensis</i>	—	Norfolk Island	4/8/2022
O.84557.001		Skeleton		—		
O.84557.002		Frozen muscle		101134		
O.84557.003		Frozen muscle		101135		
O.84557.004		Frozen liver		101136		
O.84558	NI22-BIRD-58	Skeleton	<i>Columbia livia</i>	—	Norfolk Island	25/10/2022
O.84558.001		Wet specimen		—		
O.84558.002		Frozen muscle		101509		
O.84559	NI22-BIRD-59	Skin	<i>Columbia livia</i>	—	Norfolk Island	25/10/2022
O.84559.001		Skeleton		—		
O.84559.002		Frozen muscle		101149		
O.84559.003		Frozen muscle		101150		
O.84559.004		Frozen liver		101151		
O.84559.005		Frozen liver		101152		

Appendix 2. Continued...

Appendix 2. Continued.

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84560	NI22-BIRD-60	Skeleton	<i>Passer domesticus</i>	—	Norfolk Island	25/10/2022
O.84560.001		Frozen muscle		101118		
O.84560.002		Frozen muscle		101119		
O.84560.003		Frozen liver		101120		
O.84561	NI22-BIRD-61	Skin	<i>Passer domesticus</i>	—	Norfolk Island	25/10/2022
O.84561.001		Skeleton		—		
O.84561.002		Frozen muscle		101125		
O.84561.003		Frozen muscle		101126		
O.84561.004		Frozen liver		101127		
O.84562	NI22-BIRD-62	Skeleton	<i>Passer domesticus</i>	—	Norfolk Island	25/10/2022
O.84562.001		Frozen muscle		77891		
O.84562.002		Frozen liver		77892		
O.84563	NI22-BIRD-63	Skeleton	<i>Passer domesticus</i>	—	Norfolk Island	25/10/2022
O.84563.001		Frozen muscle		77775		
O.84564 ^a	NI22-BIRD-64	Skeleton	<i>Anas platyrhynchos</i> (hybrid)	—	Norfolk Island	2022
O.84564.001		Frozen muscle		119566		
O.84564.002		Frozen liver		119567		
O.84565.001	NI22-BIRD-65	Frozen blood	<i>Chalcophaps longirostris</i>	119568	Mt Pitt South, Norfolk Island NP	27/10/2022
O.84565.002		Frozen feathers		119662		
O.84566	NI22-BIRD-66	Skeleton	<i>Turdus merula</i>	—	Mt Pitt South, Norfolk Island NP	27/10/2022
O.84566.001		Frozen blood		119569		
O.84566.002		Frozen muscle		77776		
O.84567	NI22-BIRD-67	Skin	<i>Turdus merula</i>	—	Mt Pitt South, Norfolk Island NP	27/10/2022
O.84567.001		Frozen blood		119570		
O.84567.002		Frozen muscle		101153		
O.84567.003		Frozen muscle		101154		
O.84567.004		Frozen liver		101155		
O.84567.005		Skeleton		—		
O.84568.001	NI22-BIRD-68	Frozen blood	<i>Pachycephala pectoralis xanthoprocta</i>	119571	Mt Pitt South, Norfolk Island NP	27/10/2022
O.84568.002		Frozen feathers		119660		

Appendix 2. Continued...

Appendix 2. *Continued.*

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84569.001	NI22-BIRD-69	Frozen blood	<i>Petroica multicolor</i>	119572	Mt Pitt South, Norfolk Island NP	27/10/2022
O.84569.002		Frozen feathers		119644		
O.84570.001	NI22-BIRD-70	Frozen blood	<i>Gerygone modesta</i>	119573	Mt Pitt South, Norfolk Island NP	27/10/2022
O.84570.002		Frozen feathers		119661		
O.84571.001	NI22-BIRD-71	Frozen feathers	<i>Cyanoramphus cookii</i>	119664	Mt Pitt South, Norfolk Island NP	27/10/2022
O.84572	NI22-BIRD-72	Skeleton	<i>Turdus merula</i>	—	Mt Pitt South, Norfolk Island NP	27/10/2022
O.84572.001		Frozen blood		119574		
O.84572.002		Wet specimen		—		
O.84572.003		Frozen muscle		101507		
O.84573	NI22-BIRD-73	Skeleton	<i>Turdus philomelos</i>	—	Mt Pitt South, Norfolk Island NP	27/10/2022
O.84573.001		Frozen blood		119575		
O.84573.002		Frozen muscle		101112		
O.84573.003		Frozen muscle		101113		
O.84573.004		Frozen liver		101114		
O.84574.001	NI22-BIRD-74	Frozen feathers	<i>Zosterops lateralis</i>	119658	Mt Pitt South, Norfolk Island NP	27/10/2022
O.84575 ^b	NI22-BIRD-75	Wet specimen	<i>Cyanoramphus cookii</i>	—	Norfolk Island	<2022
O.84575.001		Frozen muscle		119584		
O.84575.002		Frozen muscle		119585		
O.84575.003		Frozen muscle		119629		
O.84576	NI22-BIRD-76	Skeleton	<i>Porphyrio melanotus</i>	—	Norfolk Island	≤2022
O.84576.001		Frozen muscle		119576		
O.84576.002		Frozen muscle		119577		
O.84576.003		Frozen liver		119578		
O.84576.004		Frozen liver		119579		
O.84577 ^a	NI22-BIRD-77	Skeleton	<i>Gallus gallus</i>	—	Norfolk Island NP	27/10/2022
O.84577.001		Frozen muscle		119580		
O.84577.002		Frozen muscle		119581		
O.84577.003		Frozen liver		119582		
O.84577.004		Frozen liver		119583		

Appendix 2. *Continued...*

Appendix 2. Continued.

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84578 ^a	NI22-BIRD-78	Skeleton	<i>Gallus gallus</i>	—	Norfolk Island NP	27/10/2022
O.84578.001		Frozen muscle		119586		
O.84578.002		Frozen muscle		119587		
O.84578.003		Frozen liver		119588		
O.84578.004		Frozen liver		119589		
O.84579 ^a	NI22-BIRD-79	Skin	<i>Gallus gallus</i>	—	Norfolk Island NP	27/10/2022
O.84579.001		Frozen muscle		119590		
O.84579.002		Frozen muscle		119591		
O.84579.003		Frozen liver		119592		
O.84579.004		Frozen liver		119593		
O.84579.005		Skeleton		—		
O.84580	NI22-BIRD-80	Skeleton	<i>Egretta novaehollandiae</i>	—	Norfolk Island	≤2022
O.84580.001		Frozen muscle		119594		
O.84580.002		Frozen muscle		119595		
O.84580.003		Frozen liver		119596		
O.84580.004		Frozen liver		119597		
O.84581 ^a	NI22-BIRD-81	Skeleton	<i>Porphyrio melanotus</i>	—	Phillip Island	7/7/2022
O.84581.001		Frozen muscle		119598		
O.84581.002		Frozen muscle		119599		
O.84581.003		Frozen liver		119600		
O.84581.004		Frozen liver		119601		
O.84582 ^a	NI22-BIRD-82	Skeleton	<i>Porphyrio melanotus</i>	—	Phillip Island	<2022
O.84582.001		Frozen muscle		119602		
O.84582.002		Frozen muscle		119603		
O.84582.003		Frozen liver		119604		
O.84582.004		Frozen liver		119605		
O.84583 ^a	NI22-BIRD-83	Head in alcohol	<i>Porphyrio melanotus</i>	—	Phillip Island	<2022
O.84583.001		Frozen muscle		119606		
O.84583.002		Frozen muscle		119607		
O.84583.003		Frozen liver		119608		
O.84583.004		Frozen liver		119609		

Appendix 2. Continued...

Appendix 2. Continued.

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84584 ^a	NI22-BIRD-84	Skeleton	<i>Porphyrio melanotus</i>	—	Phillip Island	<2022
O.84584.001		Frozen muscle		119610		
O.84584.002		Frozen muscle		119611		
O.84584.003		Frozen liver		119612		
O.84584.004		Frozen liver		119613		
O.84585 ^a	NI22-BIRD-85	Head in alcohol	<i>Porphyrio melanotus</i>	—	Phillip Island	<2022
O.84585.001		Frozen muscle		119614		
O.84585.002		Frozen muscle		119615		
O.84585.003		Frozen liver		119616		
O.84585.004		Frozen liver		119617		
O.84586.001	NI22-BIRD-86	Frozen blood	<i>Pachycephala pectoralis</i>	119618	Bridle Track, Norfolk Island NP	28/10/2022
O.84586.002		Frozen feathers		119665		
O.84587.001	NI22-BIRD-87	Frozen blood	<i>Pachycephala pectoralis</i>	119619	Bridle Track, Norfolk Island NP	28/10/2022
O.84587.002		Frozen feathers		119652		
O.84588.001	NI22-BIRD-88	Frozen blood	<i>Pachycephala pectoralis</i>	119620	Bridle Track, Norfolk Island NP	28/10/2022
O.84588.002		Frozen feathers		119653		
O.84589.001	NI22-BIRD-89	Frozen feathers	<i>Pachycephala pectoralis</i> <i>xanthoprocta</i>	119637	Bridle Track, Norfolk Island NP	28/10/2022
O.84590.001	NI22-BIRD-90	Frozen blood	<i>Petroica multicolor</i>	119622	Bridle Track, Norfolk Island NP	28/10/2022
O.84590.002		Frozen feathers		119647		
O.84591.001	NI22-BIRD-91	Frozen blood	<i>Gerygone modesta</i>	119623	Bridle Track, Norfolk Island NP	28/10/2022
O.84591.002		Frozen feathers		119663		
O.84592.001	NI22-BIRD-92	Frozen blood	<i>Zosterops tenuirostris</i>	119624	Bridle Track, Norfolk Island NP	28/10/2022
O.84592.001		Frozen feathers		119666		
O.84593.001	NI22-BIRD-93	Frozen blood	<i>Zosterops tenuirostris</i>	119625	Bridle Track, Norfolk Island NP	28/10/2022
O.84593.002		Frozen feathers		119659		
O.84594.001	NI22-BIRD-94	Frozen blood	<i>Zosterops tenuirostris</i>	119626	Bridle Track, Norfolk Island NP	28/10/2022
O.84594.002		Frozen feathers		119646		

Appendix 2. Continued...

Appendix 2. Continued.

Registration Number	Field Number	Sample Type	Taxon	Frozen Tissue EBU Number	Location*	Date
O.84595.001	NI22-BIRD-95	Frozen blood Frozen feathers	<i>Gerygone modesta</i>	119627	Bridle Track, Norfolk Island NP	28/10/2022
O.84595.002				119667		
O.84596.001	NI22-BIRD-96	Frozen blood Frozen feathers	<i>Gerygone modesta</i>	119628	Bridle Track, Norfolk Island NP	28/10/2022
O.84596.002				119654		
O.84597.001	NI22-BIRD-97	Frozen feathers	<i>Gerygone modesta</i>	119656	Bridle Track, Norfolk Island NP	28/10/2022

*All locations are from the main Norfolk Island, unless indicated. Wet specimen = specimen preserved in ethanol.

^a donated by Mark Scott; ^b donated by Nigel Greenup, Park Manager, Norfolk Island National Park.

Appendix 3. Australian Museum (AMS) registration numbers for reptile and amphibian specimens and samples obtained during October 2022, Norfolk Island Group.

Reg No.	Sample type	Family	Taxon	Location	Latitude S	Longitude E
R.189038	Wet specimen	Gekkonidae	<i>Hemidactylus frenatus</i>	Burnt Pine, Rawson Hall	29° 01' 54"	167° 57' 00"
R.189038.001	Frozen tissue		—	—	—	—
R.189039	Wet specimen	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.189039.001	Frozen tissue		—	—	—	—
R.189040	Wet specimen	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.189040.001	Frozen tissue		—	—	—	—
R.189041	Wet specimen	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Long Valley	29° 07' 05"	167° 57' 13
R.189041.001	Frozen tissue		—	—	—	—
R.189042	Wet specimen	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island	29° 07' 08	167° 56' 57"
R.189042.001	Frozen tissue		—	—	—	—
R.189043 ^a	Wet specimen	Gekkonidae	<i>Lepidodactylus pantai</i>	Burnt Pine, Norfolk Island Building Supplies	29° 01' 58"	167° 57' 12"
R.189403.001	Frozen tissue		—	—	—	—
R.189044 ^b	Wet specimen	Gekkonidae	<i>Hemidactylus frenatus</i>	Burnt Pine, Australia Post Office Depot	29° 01' 58"	167° 57' 02"
R.189044.001	Frozen tissue		—	—	—	—
R.189045 ^c	Wet specimen	Gekkonidae	<i>Hemidactylus frenatus</i>	Burnt Pine, South Pacific Hotel	29° 02' 16"	167° 57' 15"
R.189045.001	Frozen tissue		—	—	—	—
R.189046 ^d	Wet specimen	Hylidae	<i>Litoria caerulea</i>	Norfolk Island Airport	29° 02' 05"	167° 56' 36"
R.189046.001	Frozen tissue		—	—	—	—
R.192813.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Evans Camp	29° 07' 25"	167° 57' 01"
R.192814.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Evans Camp	29° 07' 25"	167° 57' 01"
R.192815.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Evans Camp	29° 07' 25"	167° 57' 01"
R.192816.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Evans Camp	29° 07' 25"	167° 57' 01"
R.192817.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Evans Camp	29° 07' 25"	167° 57' 01"
R.192818.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192819.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192820.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192821.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192822.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192823.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Rangers Hut Aviary	29° 07' 08"	167° 57' 00"
R.192824.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Long Valley	29° 07' 06"	167° 57' 12"
R.192825.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Long Valley	29° 07' 06"	167° 57' 12"
R.192826.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Long Valley	29° 07' 06"	167° 57' 12"
R.192827.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Long Valley	29° 07' 06"	167° 57' 12"
R.192828.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Long Valley	29° 07' 06"	167° 57' 12"
R.192829.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Long Valley	29° 07' 06"	167° 57' 12"
R.192830.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"

Appendix 3. Continued...

Appendix 3. *Continued.*

Reg No.	Sample type	Family	Taxon	Location	Latitude S	Longitude E
R.192831.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Long Valley	29° 07' 06"	167° 57' 12"
R.192832.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Long Valley	29° 07' 06"	167° 57' 12"
R.192833.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Long Valley	29° 07' 06"	167° 57' 12"
R.192834.001	Frozen tissue	Scincidae	<i>Oligosoma lichenigerum</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192835.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192836.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192837.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192838.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192839.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192840.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192841.001	Frozen tissue	Gekkonidae	<i>Christinus guentheri</i>	Phillip Island, Rangers Hut	29° 07' 08"	167° 56' 59"
R.192842.001 – 2 ^e	Frozen tissues	Chelonidae	<i>Chelonia mydas</i>	Kingston, Emily Bay	29° 03' 37"	167° 57' 42"

Wet specimen = specimen preserved in alcohol.

^a donated by Mark Scott; ^b donated by Shyanne Evans; ^c donated by Margaret Christian; ^d donated by Caroline McAllen, Department of Agriculture, Fisheries and Forestry – Biosecurity;

^e donated by Hannah Taylor, Department of Environment – Marine and Island Parks Branch.

Appendix 4. Australian Museum (AMS) registration numbers for mammal specimens and samples obtained during October 2022, Norfolk Island Group.

Registration Number	Sample type	Species	Location	Latitude S	Longitude E
M.53913 ^a	Skin, skull	<i>Felis catus</i>	Norfolk Island	29° 02' 27"	167° 57' 17"
M.53913.001–3	Frozen tissues	—	—	—	—
M.53914 ^a	Frozen tissues	<i>Felis catus</i>	Middlegate	29° 02' 32"	167° 58' 02"
M.53914.001–3	Skeleton	—	—	—	—
M.53915 ^b	Skeleton	<i>Felis catus</i>	Cascade Rd	29° 01' 53"	167° 58' 07"
M.53916 ^b	Skeleton	<i>Rattus exulans</i>	Cascade Rd	29° 01' 53"	167° 58' 07"
M.53917 ^b	Skull	<i>Rattus rattus</i>	Cascade Rd	29° 01' 53"	167° 58' 07"
M.53918 ^c	Skull	<i>Felis catus</i>	Selwyn Road	29° 01' 16"	167° 56' 56"
M.53918.001–3	Frozen tissues	—	—	—	—
M.53919 ^a	Wet specimen	<i>Felis catus</i>	Norfolk Island	29° 01' 32"	167° 56' 29"
M.53919.001–3	Frozen tissues	—	—	—	—
M.53920 ^a	Wet specimen	<i>Felis catus</i>	Norfolk Island	29° 1' 32"	167° 56' 29"
M.53920.001–3	Frozen tissues	—	—	—	—
M.53921 ^a	Wet specimen	<i>Felis catus</i>	Burnt Pine	29° 01' 56"	167° 56' 53"
M.53921.001–3	Frozen tissues	—	—	—	—
M.53922 ^d	Wet specimen	<i>Rattus exulans</i>	New Cascade Road	29° 01' 54"	167° 57' 21"
M.53922.001–2	Frozen tissues	—	—	—	—
M.53923	Wet specimen	<i>Rattus exulans</i>	Taylor's Road, Burnt Pine	29° 02' 00"	167° 57' 09"
M.53923.001–2	Frozen tissues	—	—	—	—
M.53924	Wet specimen	<i>Mus musculus</i>	paddock near SDA Church, New Cascade Rd, Burnt Pine	29° 01' 55"	167° 57' 22"
M.53924.001–3	Frozen tissues	—	—	—	—
M.53925	Wet specimen	<i>Rattus exulans</i>	Marsh's Road, Ball Bay Reserve	29° 02' 52"	167° 58' 43"
M.53925.001–3	Frozen tissues	—	—	—	—
M.53926	Wet specimen	<i>Rattus rattus</i>	Mount Pitt Road, Norfolk Island NP	29° 00' 57"	167° 56' 18"
M.53926.001–3	Frozen tissues	—	—	—	—
M.53927	Wet specimen	<i>Rattus rattus</i>	Garden behind shed, Mill Rd	29° 01' 50"	167° 58' 28"
M.53927.001–3	Frozen tissues	—	—	—	—
M.53928.001–6 ^e	Frozen tissues	<i>Mesoplodon densirostris</i>	Slaughter Bay, Kingston	29° 03' 37"	167° 57' 36"
M.53929	Wet specimen	<i>Rattus exulans</i>	Martins Road, Ball Bay Reserve	29° 02' 40"	167° 59' 15"
M.53929.001–3	Frozen tissues	—	—	—	—

Wet specimen = specimen preserved in ethanol.

^a donated by Norfolk Island National Park; ^b donated by Heather Bruce; ^c donated by Geoff Edwards; ^d donated by Mark Scott; ^e donated by Margaret Christian.

