

## Conservation translocations of New Zealand birds, 1863-2012

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**Abstract** Translocations (deliberate movement and release of wildlife) have been of crucial importance in the management of New Zealand threatened birds, and as part of site restoration projects. We review attempts to translocate New Zealand birds for conservation reasons since 1863. Following an early pulse from 1895-1908, there was concerted and increasing effort (both in the number of translocations and the number of taxa translocated) and success since the early 1960s. Sixty-eight taxa (55 species) of New Zealand birds have been translocated in over 1100 separate releases, with new populations of 50 taxa (41 species) successfully established. Translocations of 9 further taxa (7 further species) are in progress. Overall, 61% of New Zealand's extant endemic waterfowl, shorebird and landbird taxa have been translocated (51% of the total successfully, with an additional 4% in progress). Five taxa exist solely as translocated populations (little spotted kiwi *Apteryx owenii*, buff weka *Gallirallus australis hectori*, kakapo *Strigops habroptilus*, South Island saddleback *Philesturnus carunculatus* and black robin *Petroica traversi*), and 10 further taxa would be confined to single wild populations but for successful translocations. Most translocations were undertaken within historical ranges, however, 6 taxa have been established beyond their historical ranges, with attempts for 2 further taxa in progress.

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### INTRODUCTION

Translocations are one of the success stories of New Zealand conservation. Recognition of the devastating impacts of introduced rats (*Rattus* spp.), mustelids (*Mustela* spp) and feral cats (*Felis catus*) on the birds of the 2 main islands led to early calls to translocate vulnerable bird species from the mainland to island sanctuaries (Potts 1872; Reischek 1886). Concerted efforts began in 1895-1907 during Richard Henry's employment as caretaker of Resolution I, Fiordland, with hundreds of kakapo<sup>1</sup>, little spotted kiwi and South Island brown kiwi translocated to islands in Dusky and Breaksea Sounds (Hill & Hill 1987).

Although invasion of many Fiordland islands by stoats (*Mustela erminea*) from 1900 on meant that most of Henry's efforts were ultimately futile, his pioneering efforts inspired later generations of New Zealand conservation managers (Ballance 2010; Jones & Merton 2012).

Few translocations were attempted for the next 56 years, but from 1964, the number of translocations increased dramatically, with many spectacular successes (Saunders 1994; Miskelly 2009a; Jones & Merton 2012). The increases in effort and success were due to improved techniques, especially use of newly-developed mist nets, and developments

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<sup>1</sup>Scientific names of birds are given in the appendices, except for those taxa mentioned only in the text.

in island pest eradications, with effort co-ordinated by increasingly effective conservation agencies (Lovegrove & Veitch 1994; Saunders 1994; Clout & Russell 2006; Jones & Merton 2012). Translocation effort has grown ever since, and for the last 2 decades community groups, trusts and private landowners have increasingly taken the lead in planning, funding and undertaking bird translocations in New Zealand (Parker 2008). A major development since 1999 has been the use of predator-resistant fencing to allow reintroduction of the most vulnerable bird species back to the mainland (Burns *et al.* 2012; Empson 2013; Smuts-Kennedy & Parker 2013).

We here summarise a comprehensive dataset of New Zealand bird translocations, and report on translocation effort and success over time, as well as taxa and restoration sites that have been the focus of the most effort, and taxa that have been saved from extinction or had their survival prospects greatly improved through translocations. We also summarise taxa that have proved difficult to translocate, describe the few translocations made beyond historical ranges, and identify endemic birds of New Zealand that have yet to be translocated.

## METHODS

We collated a dataset of 495 translocations of New Zealand birds undertaken between 1863 and 2012 (Appendix 1). Data were gleaned from a multitude of sources, including published partial summaries (Atkinson 1990; McHalick 1998; Miskelly 2004; Gaze & Cash 2008; Miskelly *et al.* 2009), 2 websites (Reintroduction Specialist Group <http://rsg-oceania.squarespace.com/nz-birds/>; Avian Reintroduction & Translocation website <http://www.lpzoosites.org/artd/index.php>, both viewed early Feb 2012), restoration site websites and newsletters linked from the Sanctuaries of New Zealand website (<http://www.sanctuariesnz.org/>), the Department of Conservation's translocation database, and our own recollections and information gathered during a combined 49 years working for the NZ Wildlife Service (RGP), Department of Conservation (CMM & RGP) and Museum of New Zealand Te Papa Tongarewa (CMM). The data were verified by 56 species or site experts (listed in the Acknowledgements) who were sent subsets of the dataset to check and expand.

We limited the review to translocations intended to establish new wild populations of native New Zealand birds. This specifically excluded both translocations to captivity, and reinforcement translocations (*sensu* Seddon *et al.* 2012), including releases of black stilts in the McKenzie basin (Maloney & Murray 2000; van Heezik *et al.* 2009), Operation Nest Egg kiwi recovery programmes (Colbourne *et al.* 2005) and similar blue duck, takahe

and kakapo releases (Eason & Willans 2001; Eason & Moorhouse 2006; Young 2006), and supplementary translocations of black petrel to Little Barrier I (Imber *et al.* 2003), New Zealand falcons to Marlborough vineyards (Fox & Wynn 2010), North Island kokako to the Hunua Ranges, and yellowhead to South Hurunui and Eglinton Valley. We also excluded translocations where there was no intention to establish a self-sustaining wild population, including single-sex 'banishments' of male kakapo to Pearl, Nukuwaiata and Maud Is (Ballance 2010) and North Island kokako to Mokoia I.

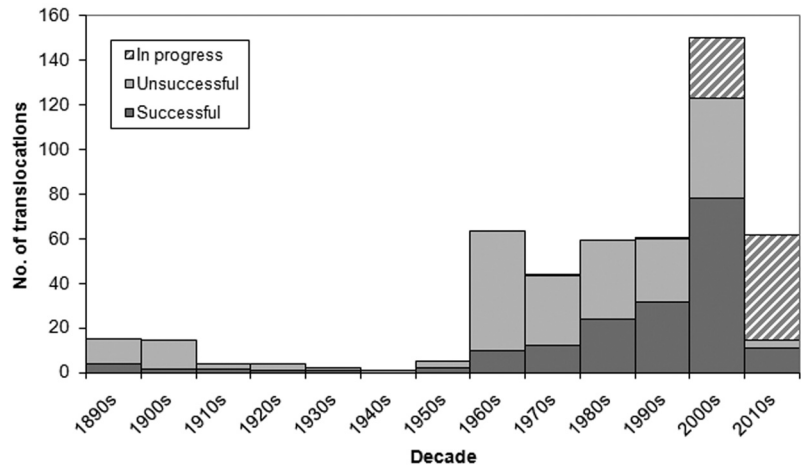
Translocations undertaken for reasons other than conservation were also excluded, including multiple poorly documented releases of weka to islands around Stewart I, Solander I, Open Bay Is and Macquarie I undertaken before 1910 (Brothers & Skira 1984; Marchant & Higgins 1993). The 1905 translocation of buff weka to Chatham I (and thence to Pitt I in the 1960s) is included as this, perhaps inadvertently, prevented extinction of buff weka (Aikman & Miskelly 2004). We similarly include translocations of black swan to New Zealand and thence to Chatham I, as these contributed to the restoration of a species otherwise extinct in New Zealand (Thomson 1922; Worthy 1998; Aikman & Miskelly 2004).

The review focuses on 5 parameters only for each translocation: taxon (bird species or subspecies name), whether the birds were captive-bred vs wild, release location, calendar year(s) of release(s), and translocation outcome. This overlooks other important translocation parameters including source populations, number, ages and sexes of birds translocated, release methodology, and post-release management, as well as post-release monitoring, and population modelling. It would be a large, and perhaps impossible, task to locate these data for all the translocations listed, and this is best tackled within taxon-focussed reviews. We applaud authors who have compiled and published species-, genus- or family-level summaries of translocation information (*e.g.*, Merton 1973; Nillson [sic] 1978; Butler & Merton 1992; Lloyd & Powlesland 1994; Lovegrove 1996; Boyd & Castro 2000; Colbourne & Robertson 2000; Dumbell 2000; Jamieson *et al.* 2000; Hooson & Jamieson 2003; Colbourne 2005; Dowding *et al.* 2005, Miskelly *et al.* 2009; Dowding & O'Connor 2013; Innes *et al.* 2013), and also site- or region-focussed reviews (*e.g.*, Brown 2004; Rimmer 2004; Gaze & Cash 2008; Smuts-Kennedy & Parker 2013).

## Translocation outcome definitions

Each translocation has been categorised as 'Successful' (population established and expected to persist for at least 50 years under the current site management regime), 'Few present' (birds still present, but fewer

**Fig. 1.** New Zealand bird translocation effort per decade, 1890 to 2012. Multiple releases of the same taxon at the same site within a 5-year period were scored as a single translocation, with effort and success split pro-rata between decades if the translocation bridged 2 or more decades. 'Unsuccessful' includes 'Failed', 'Few present', 'Hybrid population', and 'Unknown' (see Translocation outcome definitions).



than 6 pairs known), 'Hybrid population' (population known or believed to be descended from 2 or more congeneric taxa), 'Failed' (birds no longer present, or population functionally extinct) or 'In progress' if it is too soon to assess the outcome of the translocation. One translocation outcome is listed as 'Unknown': 11 banded rails released at Cape Sanctuary, Hawke's Bay, in Nov 2009 have not been seen since, but they may be present and breeding (Tamsin Ward-Smith, *pers. comm.*). We accept that the outcome categories may not be mutually exclusive or fully complementary, and note that not all species experts agreed on whether some recent translocations were 'Successful', 'Few present' or 'In progress'. These few borderline translocation outcomes are best discussed in case-by-case detail in species- or genus-level reviews.

Our definitions for translocation outcomes are focussed at population establishment, and may contradict perceptions or claims about whether translocations met their objectives. For example, the first translocation of yellowheads (6 birds released on Centre I, Lake Te Anau, in Oct 1992; Dilks *et al.* 1994) aimed to develop techniques later applied to 8 successful yellowhead translocations 1993-2010, and resulted in a small population persisting on Centre I for several years. However, the population has since died out (Dave Crouchley *pers. comm.* 7 Feb 2012), and so the translocation is here listed as 'Failed', even though its objectives were met. In a few cases translocations failed because managers decided to catch and remove all birds from a site (*e.g.*, kakapo from Little Barrier, Maud and Chalky Is, little spotted kiwi from Maud I, and little spotted kiwi x rowi hybrid from Mana I), or populations have failed to grow because young are harvested for translocation elsewhere (some North Island brown kiwi and takahe populations).

Abbreviations used for taxon names in text and tables are: CI = Chatham Island (except where

there is risk of confusion with Campbell Island), NI = North Island, NZ = New Zealand, SI = South Island.

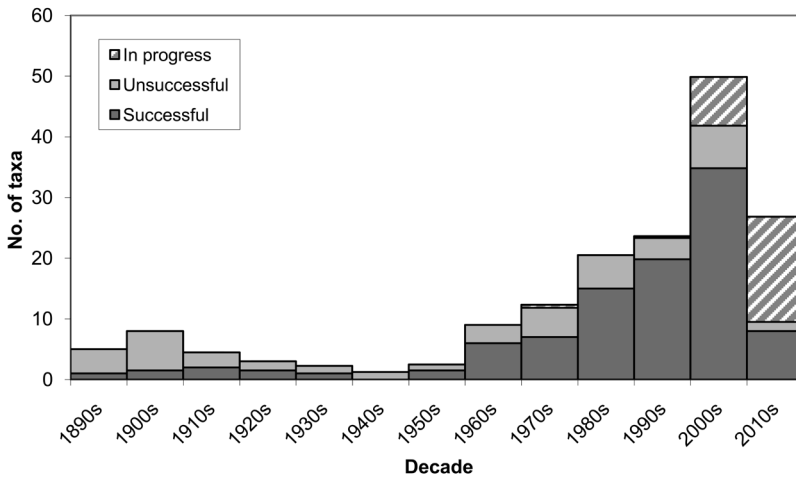
## ANALYSIS AND DISCUSSION

### Translocation effort and success over time

The earliest translocations in the dataset were the 1863-64 release of buff weka and NI brown kiwi on Kawau I (Oliver 1930; Colbourne 2005). Sir George Grey owned Kawau I from 1862-88 and attempted to turn it into an "earthly paradise" (Collier 1909), introducing (among other species) zebras, antelopes, gnu, deer, emus, monkeys, kangaroos and several species of wallabies (Thomson 1922; Bohan 1998; King 2005). We do not know Grey's motivation for introducing kiwi and weka to Kawau I, but contend that it was different from the translocations that are the focus of this review.

Starting in or slightly before 1864, several acclimatisation societies introduced black swans from Australia to multiple sites in both the South and North Is (Thomson 1922). Swans were not recognised as being part of the prehistoric New Zealand avifauna until 1890 (Forbes 1890), and the New Zealand birds were not synonymised with the Australian form until 1998 (Worthy 1998). It is therefore unlikely that any of the introductions to New Zealand (including the Chatham Is) were undertaken to achieve species conservation or restoration objectives. However, as they contributed to re-establishment of a species otherwise extinct in New Zealand, they are included here [see Kirk (1896) and Williams (1981) for discussion of the relative roles of deliberate introductions of black swans versus presumed natural dispersal across the Tasman Sea and to the Chatham Is].

The first known New Zealand bird translocations that were unequivocally undertaken for conservation reasons were Richard Henry's efforts in and around



**Fig. 2.** The number of New Zealand bird taxa translocated per decade, 1890-2012. Each taxon was scored once only per decade, with 'Successful' having priority over 'In progress', and both having priority over 'Unsuccessful'. 'Unsuccessful' includes 'Failed', 'Few present', 'Hybrid population', and 'Unknown' (see Translocation outcome definitions).

Dusky Sound, during his employment as caretaker of Resolution I, Fiordland (Hill & Hill 1987). Henry translocated at least 474 kakapo, little spotted kiwi and SI brown kiwi to 11 islands in Dusky and Breaksea Sounds during 1895-1907 (Hill & Hill 1987; Ballance 2010; Appendix 1). Invasion of the islands by stoats from 1900 on ultimately led to the failure of the kakapo and little spotted kiwi translocations, but SI brown kiwi populations on Indian, Long and Parrot Is in Dusky Sound (Appendix 1) are likely to be descended from birds that Henry translocated.

Few translocations were attempted in the 55 years after Henry left Fiordland (Figs. 1 & 2), with most effort between 1900 and 1960 expended on largely unsuccessful translocations to Little Barrier and Kapiti Is (Appendix 1). The high proportion of failed translocations were due to the small numbers of birds in each translocation, and little effort invested in controlling or eradicating introduced predators at the release sites (Wilkinson & Wilkinson 1952; Turbott 1961; Miskelly 2004). Notable successes among the few other translocations attempted during this era included paradise shelducks to the central North I (1915-21; Williams 1971), and NI weka to Arid I (Rakitu) (1951) and Mokoia I (1952, 1956, 1958).

Translocation effort surged in the 1960s (Fig. 1), dominated by 48 failed translocations of NI weka from the Gisborne area to various mainland sites. Although masked by the scale of the failed weka translocations, 1964 was a watershed year for conservation translocations of New Zealand birds (Merton 1975; Jones & Merton 2012). In Jan 1964, New Zealand Wildlife Service personnel developed methods for catching and moving saddlebacks during the first successful translocation of NI saddlebacks (to Whatupuke I; Merton 1965). Within 7 months the same techniques were urgently required for a rescue translocation of SI saddlebacks, following the invasion of Big South Cape (Taukihepa), Solomon (Rerewhakaupoko)

and Pukeweka Is by ship rats (*Rattus rattus*) (see Bell 1978). By the end of the decade, both saddleback species had been successfully translocated to 3 islands each, averting the extinction of the SI saddleback, and proving the feasibility of translocating forest passerines (Lovegrove & Veitch 1994; Jones & Merton 2012).

Effort in the 1970s was again dominated by 21 failed translocations of NI weka to mainland sites, with the sole NI weka success being to the only island release site (Kawau I). The greatest number of successful translocations was for SI saddleback, to 4 further islands around Stewart I (Nillson [sic] 1978). However, the most famous translocation of the decade was the 1976-77 translocation of the entire world population of black robins (7 birds) from Little Mangere I (Tapuaenuku) to Mangere I (Butler & Merton 1992).

Translocation effort and the diversity of species moved continued to increase each decade through to the 2000s (Figs. 1 & 2). The success rate of translocations (excluding those still in progress) also increased during this period, at an average rate of 12.8% per decade (Table 1).

The 1980s were dominated numerically by 10 failed translocations of brown teal on the mainland (Dumbell 2000). The majority of successful translocations across taxa during the decade (63%) were made to islands where rats (*Rattus exulans* or *R. norvegicus*) were present, although rats have since been eradicated from 13 of these 14 islands (Clout & Russell 2006; CMM, *unpubl. data*). Four species had 3 successful translocations each during the 1980s: NI brown kiwi, little spotted kiwi, NI saddleback and SI saddleback, with two of the SI saddleback translocations being to rodent-free islands.

Brown teal translocations (largely unsuccessful) continued to dominate into the 1990s (10 translocations, 2 successful), with this effort followed by that for NI robin (9 translocations, 5 successful).

**Table 1.** Translocation success rates from the 1970s to the 2000s, excluding the 18% of 2000s translocations still in progress. Translocations that spanned 2 or more decades were assigned a pro-rata score for both effort and success in relation to the number of decades they spanned.

| Decade | No. translocations | No. taxa | Success rate (%) |
|--------|--------------------|----------|------------------|
| 1960s  | 64                 | 9        | 15.3             |
| 1970s  | 48                 | 13       | 26.0             |
| 1980s  | 58                 | 22       | 41.3             |
| 1990s  | 61                 | 24       | 53.2             |
| 2000s  | 148                | 50       | 66.6             |

Other species that were successfully translocated during the 1990s included SI saddleback, with 3 successful translocations. Many translocations were made to islands where rodents had been recently eradicated, including to Tiritiri Matangi I (7 translocations), and Moturoa I, Bay of Islands and Mana I (5 translocations each). The 1990s also included initial translocations of taxa vulnerable to introduced predators to unfenced mainland sites under intensive predator control (including 'Mainland Islands' *sensu* Saunders 2000), with translocations (mainly of NI robins and NI kokako) to Trounson Kauri Park, Boundary Stream Mainland Island, Egmont National Park, Paengaroa Mainland Island, Pikiariki Ecological Area, and Wenderholm Regional Park. Translocations of burrow-nesting petrels began in the 1990s, although the long life-cycles of petrels meant that outcomes took several years to determine (Miskelly & Taylor 2004; Bell *et al.* 2005; Miskelly *et al.* 2009).

The 2000s saw a dramatic increase in effort, taxonomic diversity and success rates of translocations (Figs. 1 & 2, Table 1), due largely to the development of predator-resistant fencing (allowing the most vulnerable taxa to be returned to the mainland), and a rapid burgeoning of community-based site restoration groups. Among 175 translocations (some shared across adjacent decades), NI robin was translocated most often (16), followed by brown teal (11), NI brown kiwi (10) and NI kokako, SI saddleback and SI robin (9 each). Stoat eradication from many Fiordland islands, with efforts to keep them stoat-free by trapping on the adjacent mainland, allowed many translocations there, particularly of SI robin (7 translocations), SI saddleback (5) and yellowhead (4). Effective predator control at mainland release sites led to a turnaround in brown teal translocation success, with 8 successful translocations in the 2000s (4 on the mainland). This was followed by SI saddleback, yellowhead and NI robin (6 successful translocations each), and NI brown kiwi (5), NI weka, NI kokako and whitehead (4 each). Fenced mainland sanctuaries

received the most translocations during the 2000s: Karori Sanctuary (11), Cape Sanctuary, Hawke's Bay (8), Maungatautari (6) and Tawharanui (5). These efforts were followed numerically by translocations to islands cleared of all introduced predators: Tiritiri Matangi (6 translocations), Anchor I (5), Chalky I (5), Mana I (5), Secretary I (5; note that red deer *Cervus elephus* and stoats may still be present in low densities) and Ulva I (5; though Norway rats *Rattus norvegicus* periodically re-invade). Among the many taxa translocated for the first time during the 2000s were 6 species of burrow-nesting petrels (Miskelly *et al.* 2009), 2 kiwi species, the 2 rifleman subspecies, the 2 tui subspecies, orange-fronted parakeet, and rock wren.

The first 3 years of the current decade show that the momentum to undertake many translocations of diverse taxa has not diminished (Figs. 1 & 2).

The overall success rate for all 495 translocations was 44% (excluding the 77 translocations listed as 'In progress'). This is identical to the success rate reported for 80 threatened bird and mammal translocations from 5 nations including New Zealand during 1973-86 (Griffith *et al.* 1989).

Far higher success rates were achieved for translocations to islands (58% of 221 completed island translocations) and fenced mainland sites (73% of 37) than for translocations to mainland sites (16% of 160). Note that the fenced sanctuary success rate is inflated as most translocations have been in the last 5 years, and translocations for many taxa that did not immediately establish are continuing ('In progress'), and so were not included in analyses of success rates.

### Translocation effort and success within and between New Zealand bird taxa

#### *Number of bird taxa translocated within and from New Zealand*

A total of 70 New Zealand bird taxa of 57 species from 21 families have been translocated to the wild, although 2 species (black stilt, *Recurvirostridae*, and black petrel, *Procellariidae*) have been translocated solely as reinforcement translocations (Maloney & Murray 2000; Imber *et al.* 2003; van Heezik *et al.* 2009). The remaining 68 taxa have been translocated at least 495 times to at least 256 sites (Table 2, Appendix 1). Rails (6 taxa, 113 translocations) have been translocated more than any other family, with this figure dominated by 79 translocations of NI weka. Other families that have received much translocation effort are the wattlebirds (*Callaeidae*; 3 taxa, 68 translocations), robins & tomtits (7 taxa, 64 translocations), kiwi (7 taxa, 62 translocations) and ducks & swan (7 taxa, 51 translocations).

Among families with 10 or more completed translocations (*i.e.*, not 'In progress'; Table 2), *Pachycephalidae* (yellowhead, whitehead & brown

**Table 2.** Summary of conservation translocations of New Zealand birds undertaken between 1863 and 2012, grouped by families. Reinforcement translocations are not included, with the exception of white-flipped penguin, where the successful release site was embedded within a scattered breeding population. Note that kiwi and rail rows do not add up exactly as hybrid populations were formed by translocations of 2 and 3 taxa, respectively.

| Family          | Common name         | No. of taxa translocated | No. of translocations | Translocation outcome |                |                   |        |             |
|-----------------|---------------------|--------------------------|-----------------------|-----------------------|----------------|-------------------|--------|-------------|
|                 |                     |                          |                       | Successful            | Few present    | Hybrid population | Failed | In progress |
| Apterygidae     | Kiwi                | 8 <sup>1</sup>           | 62                    | 25                    | 4              | 1                 | 18     | 14          |
| Anatidae        | Ducks & swan        | 7                        | 51                    | 20                    | 1              | -                 | 26     | 4           |
| Spheniscidae    | Penguins            | 1                        | 2                     | 1                     | -              | -                 | 1      | -           |
| Procellariidae  | Petrels             | 8 <sup>2</sup>           | 13                    | 3                     | 2              | -                 | -      | 8           |
| Pelecanoididae  | Diving petrels      | 1                        | 3                     | 1                     | 1              | -                 | -      | 1           |
| Falconidae      | NZ falcon           | 1                        | 1                     | 1                     | -              | -                 | -      | -           |
| Rallidae        | Rails               | 7 <sup>1</sup>           | 113                   | 21                    | 4 <sup>3</sup> | 1                 | 81     | 4           |
| Scolopacidae    | Snipe               | 2                        | 4                     | 2                     | -              | -                 | 1      | 1           |
| Charadriidae    | Shore plover        | 1                        | 7                     | 2                     | -              | -                 | 3      | 2           |
| Columbidae      | Pigeons             | 2                        | 2                     | 0                     | -              | -                 | 2      | -           |
| Strigopidae     | Kakapo, kaka        | 3                        | 21                    | 5                     | -              | -                 | 14     | 2           |
| Psittacidae     | Parakeets           | 4                        | 24                    | 9                     | 2              | -                 | 7      | 6           |
| Strigidae       | Morepork            | 1                        | 1                     | 1 <sup>4</sup>        | -              | 1 <sup>4</sup>    | -      | -           |
| Acanthisittidae | Bush wren, rifleman | 4                        | 7                     | 4                     | 1              | -                 | 2      | -           |
| Callaeidae      | Kokako, saddlebacks | 3                        | 68                    | 37                    | 1              | -                 | 17     | 13          |
| Notiomystidae   | Stitchbird          | 1                        | 8                     | 4                     | -              | -                 | 4      | -           |
| Meliphagidae    | Bellbird, tui       | 3                        | 11                    | 1                     | 1              | -                 | 4      | 5           |
| Pachycephalidae | Yellowhead & allies | 3                        | 26                    | 15                    | 1              | -                 | 2      | 8           |
| Petroicidae     | NZ robins & tomtits | 7                        | 64                    | 28                    | 8              | -                 | 17     | 11          |
| Megaluridae     | Fernbirds           | 3                        | 7                     | 3                     | -              | -                 | 4      | -           |
| Total           |                     | 68                       | 495                   | 183                   | 26             | 3                 | 203    | 79          |

<sup>1</sup>Includes one translocation of a hybrid taxon.

<sup>2</sup>Does not include the 1986-90 black petrel (*Procellaria parkinsoni*) translocation to Little Barrier I, as this was a reinforcement translocation (Imber *et al.* 2003).

<sup>3</sup>Includes 1 'Unknown' outcome (banded rail at Cape Sanctuary)

<sup>4</sup>The single morepork translocation to Norfolk I is listed as both 'Successful' and 'Hybrid population', as this was the intended outcome (Olsen 1996).

creeper) had the highest translocation success rate (83%), followed by wattlebirds (67%), parakeets, and robins & tomtits (53%), kiwi (52%), and ducks & swan (43%). Rails had the lowest success rate (19%, dominated by 79 failed weka translocations), followed by large parrots (26%, dominated by 14 failed kakapo translocations).

The 68 taxa translocated included 65 endemic taxa. New Zealand had 147 extant endemic taxa in the 1960s, and so 44% of New Zealand's endemic

taxa have been translocated, 36% successfully (Table 3A). Many endemic taxa are confined to relatively unmodified outlying island groups, where they have little or no need for direct conservation management. In contrast, taxa formerly or still present on the main islands of New Zealand have been exposed to the full suite of introduced predators, and it is here that translocation effort has been greatest (Table 3B). Seventy-three percent of the extant or recently extinct endemic land birds,

**Table 3.** Translocations of extant New Zealand endemic bird taxa (plus the extinct Stead's bush wren) summarised by ecological groupings. Land birds include kiwi, falcon, rails, pigeons, parrots, cuckoo, owl, kingfisher and songbirds; Waterfowl include ducks and grebes; Shorebirds include snipe, oystercatchers, stilt and plovers; Seabirds include penguins, albatrosses, petrels, shags, gulls and terns. A = entire New Zealand geopolitical region, including outlying island groups; B = only those taxa currently or formerly present on 1 or more of the 3 main islands, excluding seabirds. The numbers in the table are number of taxa, with each taxon (apart from morepork, see footnote) counted once only; Successful translocations were given priority, followed by In progress, Few present, Hybrid, then Failed. Translocations of known or assumed hybrid populations excluded. SI kokako is included in the 'Taxa not translocated' total, as they were considered to be extant in 1964, when Stead's bush wrens were translocated.

| Bird group   | Translocation outcome |                   |        |             | Taxa not translocated | Total |
|--------------|-----------------------|-------------------|--------|-------------|-----------------------|-------|
|              | Successful            | Hybrid population | Failed | In progress |                       |       |
| A. Full list |                       |                   |        |             |                       |       |
| Land birds   | 41                    | 1 <sup>1</sup>    | 5      | 4           | 24                    | 74    |
| Waterfowl    | 5                     | -                 | 1      | -           | 1                     | 7     |
| Shorebirds   | 3                     | -                 | -      | -           | 12                    | 15    |
| Seabirds     | 5                     | -                 | -      | 5           | 42                    | 52    |
| Total        | 54                    | 1 <sup>1</sup>    | 6      | 9           | 79                    | 148   |
| B. Mainland  |                       |                   |        |             |                       |       |
| Land birds   | 34                    | 1 <sup>1</sup>    | 4      | 4           | 9                     | 51    |
| Waterfowl    | 4                     | -                 | -      | -           | 1                     | 5     |
| Shorebirds   | 1                     | -                 | -      | -           | 7                     | 8     |
| Total        | 39                    | 1 <sup>1</sup>    | 4      | 4           | 17                    | 64    |

<sup>1</sup>Morepork *Ninox novaeseelandiae novaeseelandiae* x Norfolk Island boobook *N. novaeseelandiae undulata* on Norfolk I also counted as 'Successful' (Olsen 1996).

waterfowl and shorebirds of the 3 main islands have been translocated, 61% successfully, with a further 6% in progress.

*New Zealand bird taxa that have received most translocation effort*

The most translocated bird in New Zealand conservation history has been the NI weka (79 translocations, 8 successful; Table 4). Six of the successful NI weka translocations were to islands, contrasting with 1 only of the 70 failed translocations being to an island (the remainder being to multiple sites on the North I mainland). Other taxa to receive much translocation effort include brown teal (34 translocations), NI robin (30), SI saddleback (29), NI brown kiwi (27), NI saddleback (24) and SI robin (20).

The most successful taxon in terms of the number of successful translocations is the SI saddleback (Fig. 3), with 18 successful translocations (75%) and 5 more in progress. These statistics are even more remarkable given that the SI saddleback would be extinct were it not rescued by translocation in 1964 (Merton 1973, 1975). In 2011-12, SI saddlebacks were reintroduced to 2 of the 3 islands from which they were extirpated by rats in the 1960s. This

followed the successful eradication of ship rats from Taukihepa, Rerewhakaupoko and Pukeweka Is in 2006 (McClelland *et al.* 2011).

Among taxa that have been translocated 8 or more times, the highest success rate has been for whitehead (86%; Table 4), followed by yellowhead (80%), SI saddleback (75%), takahe (71%), red-crowned parakeet (67%), NI saddleback (62%), NI kokako (60%), NI brown kiwi and SI robin (59%), little spotted kiwi and NI robin (55%), and buff weka and stitchbird (50%). The lowest success rates have been for bellbird (0%), kakapo (7%), NI weka (10%), SI brown kiwi (27%) and brown teal (29%).

*Taxa that were translocated without populations becoming established*

Efforts to establish populations of Auckland Island teal, New Zealand pigeon, CI pigeon (parea), Antipodes Island parakeet, Stead's bush wren, bellbird and SI tomtit by translocations were unsuccessful, although recent translocations of bellbird to Karori Sanctuary, Mana I, Motuihe I, Waiheke I and Hamilton may yet prove successful. Based on the level of investment made for minimal conservation gain, kakapo, bellbird and tomtits (3 subspecies) are the most difficult New Zealand

**Table 4.** Translocation outcomes for the 21 New Zealand bird taxa that have been translocated more than 5 times, ranked in descending order of the number of translocation attempts. Scientific names given in Appendix 1.

| Taxon                   | No. of translocations | Translocation outcome |             |                   |        |             |
|-------------------------|-----------------------|-----------------------|-------------|-------------------|--------|-------------|
|                         |                       | Successful            | Few present | Hybrid population | Failed | In progress |
| NI weka                 | 79                    | 8                     | -           | 1                 | 70     | -           |
| Brown teal              | 34                    | 9                     | 1           | -                 | 21     | 3           |
| NI robin                | 30                    | 12                    | 6           | -                 | 4      | 8           |
| SI saddleback           | 29                    | 18                    | -           | -                 | 6      | 5           |
| NI brown kiwi           | 27                    | 13                    | 2           | 1                 | 6      | 5           |
| NI saddleback           | 24                    | 13                    | -           | -                 | 8      | 3           |
| SI robin                | 20                    | 10                    | 2           | -                 | 5      | 3           |
| Kakapo                  | 17                    | 1                     | -           | -                 | 14     | 2           |
| NI kokako               | 15                    | 6                     | 1           | -                 | 3      | 5           |
| Whitehead               | 13                    | 6                     | -           | -                 | 1      | 6           |
| Little spotted kiwi     | 13                    | 6                     | -           | -                 | 5      | 2           |
| Yellowhead              | 12                    | 8                     | 1           | -                 | 1      | 2           |
| Red-crowned parakeet    | 11                    | 6                     | -           | -                 | 3      | 2           |
| Buff weka               | 11                    | 5                     | 1           | -                 | 4      | 1           |
| SI brown kiwi           | 11                    | 3                     | 1           | 1                 | 6      | -           |
| Takahe                  | 10                    | 5                     | 1           | -                 | 1      | 3           |
| Bellbird                | 9                     | 0                     | 1           | -                 | 4      | 4           |
| Stitchbird              | 8                     | 4                     | -           | -                 | 4      | 0           |
| Yellow-crowned parakeet | 7                     | 3                     | -           | -                 | 2      | 2           |
| Shore plover            | 7                     | 2                     | -           | -                 | 3      | 2           |
| NZ scaup                | 6                     | 3                     | -           | -                 | 3      | -           |

birds to translocate of the 68 taxa attempted to date, plus stitchbirds are dependent on intensive management at all release sites (Armstrong *et al.* 2007). These species are among the most sexually dimorphic New Zealand birds in plumage markings, a character strongly correlated with low translocation success for bird species introduced to New Zealand (Sorci *et al.* 1998).

The failure of the rescue translocation of 6 Stead's bush wrens to Kaimohu I in 1964 following the irruption of ship rats (*Rattus rattus*) on Big South Cape (Taukihepa) resulted in the extinction of the last population of bush wren (*Xenicus longipes*; see Bell 1978; Ballance 2007). An attempted rescue of SI snipe (*Coenocorypha iredalei*) at the same time also failed when the two birds caught (which were both male) died before translocation (Miskelly 2012).

CI pigeon (perea) and Antipodes Island parakeet remain confined to single wild populations following failed translocations to Rangatira (South East) I and Stephens I (Takapourewa), respectively.

Recent first translocations of a further 8 taxa remain of unproven success: Okarito brown kiwi (rowi), Haast tokoeka, grey-faced petrel, CI taiko, Cook's petrel, fairy prion, Hutton's shearwater, and tui (mainland subspecies).

#### *Success rates of translocations of captive-bred birds*

At least 79 translocations (15 taxa) comprised 50% or more captive-bred or captive-reared individuals (Table 5). This has been the sole method used in translocations of Haast tokoeka, brown teal, NZ scaup, NZ falcon, SI kaka and orange-fronted parakeet, and the main method in translocations of blue duck (Young 2006), Campbell I teal, banded rail, shore plover (Dowding & O'Connor 2013) and NI kaka. The overall success rate of completed translocations of captive-bred birds was 43%, which was identical to that for wild-sourced birds (43%,  $n = 330$ ).

In addition to the translocations summarised in Table 5, captive-rearing of wild-sourced eggs and





**Fig. 3.** Juvenile South Island saddleback, Anchor Island, Mar 2011. The South Island saddleback has been successfully translocated to more sites than any other New Zealand bird taxon (18 sites, with 5 more in progress), and would be extinct had it not been rescued by translocation in 1964. Photo: Colin Miskelly.

young to reinforce wild populations is extensively used in conservation programmes for 4 kiwi taxa, blue duck, takahe and black stilt (Maloney & Murray 2000; Eason & Willans 2001; Colbourne *et al.* 2005; Young 2006; van Heezik *et al.* 2009).

*Endemic waterfowl, shorebirds and land birds never translocated, and opportunities for future translocations* Thirty-seven endemic New Zealand waterfowl, shorebird and land bird taxa of 23 species have never been translocated and released to the wild with the intention of establishing or re-establishing new populations (Appendix 2). At least 5 of these taxa have been the focus of conservation management not involving translocations to new sites: Chatham Island oystercatcher, black stilt, northern NZ dotterel, southern NZ dotterel and Forbes' parakeet. Reasons that these 37 taxa have not been translocated include that they occupy or are capable of recolonising all their historical range, or that there is no habitat currently suitable for their reintroduction. Among these taxa, the 7 species or subspecies that we consider the most promising candidates for translocation are NZ dabchick to the South I, Auckland Island rail to Port Ross islands or main Auckland I, black stilt, Forbes' parakeet to Chatham I (see Aikman *et al.* 2001), Reischek's parakeet to replace extinct *Cyanoramphus* parakeet populations on Campbell or Macquarie Is (Miskelly 1999, and see below), SI fernbird to Canterbury

wetlands, and Snares Island fernbird to replace the extinct Chatham Island fernbird (*Bowdleria rufescens*) (see Aikman & Miskelly 2004).

### Restoration sites that have received the most translocations of New Zealand birds

Kapiti I is the site that has received the most New Zealand bird taxa via translocations, with 16 taxa (Table 6). Kapiti I was managed as a museum of New Zealand's national fauna and flora from just before the island's reservation in 1897 through to the 1930s, providing a rationale for introductions of a range of taxa including Auckland Island teal, Antipodes Island parakeet, 2 species of brown kiwi and 3 subspecies of weka (Miskelly 2004). This inflated the number of taxa released there compared to more conservative recent restoration projects. The 4 other sites to receive 10 or more taxa via translocations are 2 island restoration sites: Mana I with 13 species, and Tiritiri Matangi I with 12 species (Rimmer 2004); and 2 predator-fenced mainland restoration sites: Karori Sanctuary (Zealandia) with 12 species, and Cape Sanctuary, Hawke's Bay with 11 species.

Tiritiri Matangi I has had the largest number of successful translocations to date (11, 92% of completed translocations), followed by Karori Sanctuary (9, 82%), Kapiti I (7, 44%) and Mana I (6, 67%).

### Conservation outcomes of New Zealand bird translocations

Six New Zealand bird taxa would be extinct but for successful translocations: little spotted kiwi, buff weka, black stilt, kakapo, SI saddleback and black robin (note that black stilt has been the focus of reinforcement translocations only).

The poorly documented translocations of buff weka to Chatham I (1905) and of little spotted kiwi to Kapiti I (believed to be in 1912 and/or 1923; Colbourne & Robertson 1997, 2000; Colbourne 2005) were fortuitous, occurring during an era when there was little co-ordination and fewer resources available to guide translocations. Capt Walter Hood translocated 12 buff weka to Chatham I about 12 years before they suddenly declined within their natural range (Oliver 1955; Aikman & Miskelly 2004). Hood's motives for translocating the birds were not recorded, but he also introduced black swans, starlings (*Sturnus vulgaris*) and skylarks (*Alauda arvensis*) to the island during the 1890s (Aikman & Miskelly 2004).

Kakapo, SI saddleback and black robin are acclaimed worldwide as examples of critically endangered birds being rescued at the last minute through translocations. Their early translocations and subsequent recovery have been well documented (*e.g.*, Merton 1973, 1975; Butler & Merton 1992; Williams 2006; Ballance 2010).

**Table 5.** Outcomes of translocations of 15 New Zealand bird taxa that were based solely or predominantly on captive-bred individuals. Scientific names given in Appendix 1.

| Taxon                     | No. of translocations | Translocation outcome |             |         |        |             |
|---------------------------|-----------------------|-----------------------|-------------|---------|--------|-------------|
|                           |                       | Successful            | Few present | Unknown | Failed | In progress |
| Brown teal                | 34                    | 9                     | 1           | -       | 21     | 3           |
| NZ scaup                  | 6                     | 3                     | -           | -       | 3      | -           |
| NI weka                   | 6                     | 3                     | -           | -       | 3      | -           |
| Red-crowned parakeet      | 6                     | 3                     | -           | -       | 3      | -           |
| Shore plover              | 5                     | 1                     | -           | -       | 2      | 2           |
| Orange-fronted parakeet   | 4                     | -                     | 2           | -       | -      | 2           |
| NI kaka                   | 3                     | 3                     | -           | -       | -      | -           |
| Blue duck                 | 3                     | 1                     | -           | -       | 1      | 1           |
| Banded rail               | 3                     | 1                     | -           | 1       | 1      | -           |
| NI brown kiwi             | 2                     | 2                     | -           | -       | -      | -           |
| Campbell Island teal      | 2                     | 2                     | -           | -       | -      | -           |
| Yellow-crowned parakeet   | 2                     | -                     | -           | -       | 1      | 1           |
| NZ falcon                 | 1                     | 1                     | -           | -       | -      | -           |
| SI kaka                   | 1                     | 1                     | -           | -       | -      | -           |
| Antipodes Island parakeet | 1                     | -                     | -           | -       | 1      | -           |
| Total                     | 79                    | 30                    | 3           | 1       | 36     | 9           |

Ten further New Zealand bird taxa that were reduced or naturally confined to single populations have been successfully translocated to one or more additional sites: Campbell Island teal, Chatham petrel, NI weka, takahe, Chatham Island snipe, Snares Island snipe, shore plover, NI saddleback, stitchbird and Codfish Island fernbird. In addition, 2 kiwi taxa (Okarito brown kiwi = rowi, and Haast tokoeka) are currently confined to single wild populations pending the outcomes of recent translocations. Sixteen further bird taxa (including 8 seabirds) are identified as single-island endemics in the New Zealand threat classification system (Miskelly *et al.* 2008).

It is self-evident that every successfully established additional population will reduce a taxon's extinction risk. However, for a taxon to achieve a healthier conservation status, the total population must cross one or more thresholds in relation to population size or rate of population change (Townsend *et al.* 2008). The thresholds used in the New Zealand threat classification system include the number of mature individuals (250, 1000, 5000, 20,000, 100,000) and population trends per decade (or 3 generations, whichever is longer) of >10% increase, or >10%, >30%, >50% or >70% decline (Townsend *et al.* 2008). A taxon may achieve greater security without necessarily crossing one of these thresholds.

To assess whether any taxa had achieved or maintained a healthier conservation status as a result of translocation, we considered the likely fate (in the absence of translocations) of all the taxa listed in Appendix 1. Our predicted population size and trend for each taxon were assessed against the criteria of Townsend *et al.* (2008) to identify 14 taxa that we believe have achieved or maintained a better conservation status than they would have if they had never been successfully translocated (Table 7). Note that 7 successfully translocated taxa still have the highest threat ranking of Nationally Critical (Miskelly *et al.* 2008), and so these were included in Table 7 only if we believed that they would be extinct or functionally extinct were it not for translocations; this explains the absence of Campbell Island teal, takahe, shore plover and orange-fronted parakeet from Table 7, and the inclusion of black stilt, kakapo and black robin.

We note that 4 taxa in Table 7 are ranked as 'Recovering' (little spotted kiwi, brown teal, NI saddleback and SI saddleback), a category currently assigned to 10 endemic New Zealand bird taxa (Miskelly *et al.* 2008). All 4 of these species have achieved this status almost entirely as a result of translocations, plus intensive predator control at several mainland brown teal release sites.

**Table 6.** Translocation outcomes for the 19 restoration sites that have received translocations of 5 or more New Zealand bird taxa, ranked in descending order of the number of taxa for which there have been translocation attempts.

| Restoration site           | No. of taxa | Translocation outcome |                |                   |        |             |
|----------------------------|-------------|-----------------------|----------------|-------------------|--------|-------------|
|                            |             | Successful            | Few present    | Hybrid population | Failed | In progress |
| Kapiti I                   | 16          | 7                     | -              | 2 <sup>1</sup>    | 4      | -           |
| Mana I                     | 13          | 6                     | 1              | -                 | 2      | 4           |
| Tiritiri Matangi I         | 12          | 11                    | -              | -                 | 1      | -           |
| Karori Sanctuary           | 12          | 9                     | -              | -                 | 2      | 1           |
| Cape Sanctuary             | 11          | 3                     | 2 <sup>2</sup> | -                 | -      | 6           |
| Moturoa I, Bay of Islands  | 8           | 2                     | -              | -                 | 5      | 1           |
| Maud I                     | 8           | 2                     | 1              | -                 | 5      | -           |
| Waitakere Ranges           | 8           | 0                     | -              | -                 | 5      | 3           |
| Maungatautari              | 7           | 4                     | 1              | -                 | -      | 2           |
| Anchor I                   | 7           | 3                     | -              | -                 | 3      | 1           |
| Ulva I                     | 6           | 5                     | -              | -                 | 1      | -           |
| Tawharanui                 | 6           | 4                     | -              | -                 | -      | 2           |
| Chalky I                   | 6           | 3                     | 1              | -                 | 1      | 1           |
| Little Barrier I (Hauturu) | 6           | 3                     | -              | -                 | 2      | 1           |
| Mokoia I                   | 5           | 3                     | -              | -                 | 1      | 1           |
| Mt Bruce (Pukaha)          | 5           | 3                     | -              | -                 | 2      | -           |
| Motuihe I                  | 5           | 2                     | -              | -                 | -      | 3           |
| Secretary I                | 5           | 2                     | -              | -                 | -      | 3           |
| Motutapu I                 | 5           | -                     | -              | -                 | -      | 5           |

<sup>1</sup>Hybrid brown kiwi and weka populations derived from 2 and 3 taxa, respectively

<sup>2</sup>Includes banded rail (translocation outcome unknown)

### Taxa translocated to sites beyond their historical range

Defining historical ranges is difficult in the absence of historical, archaeological or paleontological records. For the purposes of this review, we consider islands that would have been connected to the mainland during the last glacial maxima as being within the historical range of those taxa known or likely to have occurred on the adjacent mainland, unless there is good evidence that another ecologically equivalent taxon occurred in the vicinity (*i.e.*, 2 fernbird taxa recognised on islands off Stewart I). Using this definition, 6 New Zealand bird taxa have been successfully translocated to sites beyond their historical ranges: Campbell Island teal to Codfish I (Whenua Hou), buff weka to Chatham & Pitt Is, SI takahe to Mana I, Snares Island snipe to Putauhinu I, Codfish Island fernbird to Putauhinu I, and morepork to Norfolk I. 'Out-of-range' translocations for 2 further taxa are in progress: Haast tokoeka to Rarotoka (Centre) I and Orokonui Sanctuary, and NI kokako to Secretary I.

The reasons for these out-of-range introductions were varied. Buff weka were probably (Chatham I, 1905) or certainly (Pitt I, 1960s) translocated as a hunting and food resource (Ken Lanauze, *pers. comm.* to CMM Dec 1983). Two male moreporks were translocated in 1987 in the (successful) hope that one would breed with the last remaining female Norfolk Island boobook (*Ninox novaeseelandiae undulata*; see Olsen 1996). SI takahe (1988-2011) and Haast tokoeka (2008-11) were translocated as part of national recovery programmes when there were few options for releases within historical ranges (Jamieson & Ryan 2001; Hugh Robertson, *pers. comm.*). Codfish Island fernbird were translocated in 1997-98 to create an insurance population before the single natural population was exposed to brodifacoum toxin during the Codfish I (Whenua Hou) rat eradication programme (McClelland 2002). Captive Campbell Island teal were translocated to Codfish I in 1999-2000 to create a population of wild individuals for eventual translocation back to Campbell I, which was not declared rat-free until 2003 (Gummer & Berry 2007).

**Table 7.** New Zealand bird taxa assessed as having a better conservation status *cf.* the predicted outcome if they had not been translocated. The list includes several taxa that have received reinforcement translocations, with black stilt exclusively so. Little spotted kiwi, buff weka, black stilt, kakapo, SI saddleback and black robin would probably all be extinct if they had not been translocated. Conservation status and qualifiers from Miskelly *et al.* (2008); see Appendix 1 for qualifier abbreviations. Scientific names given in Appendix 1.

| Taxon                | Conservation status           | Qualifiers  |
|----------------------|-------------------------------|-------------|
| NI brown kiwi        | Nationally Vulnerable D (1/1) | CD PD RF    |
| Little spotted kiwi  | Recovering A                  | CD Inc RR   |
| Brown teal           | Recovering A                  | CD RR       |
| NI weka              | Nationally Vulnerable B (1/1) | CD EF RR Sp |
| Buff weka            | Relict A                      |             |
| Chatham Island snipe | Nationally Vulnerable B (1/1) | IE RR St    |
| Black stilt          | Nationally Critical A         | CD RR       |
| Kakapo               | Nationally Critical A         | CD Inc RR   |
| NI kokako            | Nationally Vulnerable B (1/1) | CD Inc Sp   |
| NI saddleback        | Recovering B                  | Inc RR      |
| SI saddleback        | Recovering A                  | Inc RR      |
| Stitchbird           | Nationally Endangered C       | CD De RR    |
| Yellowhead           | Nationally Vulnerable C (1/1) | CD          |
| Black robin          | Nationally Critical A         | IE RR       |

The 2 remaining taxa were translocated specifically to replace extinct relatives: Snares Island snipe (2005) to replace South Island snipe (Miskelly 2012; Miskelly *et al.* 2012), and NI kokako (2009-10) to replace SI kokako (*Callaeas cinerea*) (Seddon *et al.* 2012). Other candidate taxa for translocations to replace extinct relatives include paradise shelduck to replace the Chatham Island shelduck (*Tadorna* undescribed sp.) (see Aikman & Miskelly 2004), Campbell Island teal to replace the Macquarie Island teal (*Anas* undescribed sp.), Chatham Island snipe to replace NI snipe (*Coenocorypha barrierensis*) (see Roberts & Miskelly 2003), Antipodes Island parakeet (with or without Reischek's parakeet) to replace the extinct parakeet populations on Campbell and Macquarie Is, and bellbird to replace CI bellbird (*Anthornis melanopephala*; see Atkinson 1988; Aikman & Miskelly 2004).

## CONCLUDING COMMENTS

This compilation and analysis of New Zealand bird translocation data is unlikely to be complete. The widely dispersed accounts, and poor documentation of failed translocation attempts undertaken before 1990 is a challenge to anyone attempting to undertake a review of all New Zealand bird translocations. We welcome information on errors, omissions and updates, but have no intention of developing a further web-based database of New Zealand translocations when 2 exist already

(Reintroduction Specialist Group <http://rsg-oceania.squarespace.com/nz-birds/>; Avian Reintroduction & Translocation website <http://www.lpzoosites.org/artd/index.php>). We hope that either or both of these sites will capture the data presented here in order to expand their existing datasets, and use these minimal data as a framework to seek out more comprehensive details for translocations where they exist.

The analyses presented here are necessarily superficial due to the breadth of data covered. Many topics await more thorough analyses, particularly where more complete translocation data are available, beyond the 5 parameters reported here. Topics worthy of further investigation include quantification of the main source populations used for New Zealand bird translocations, investigating the relationship between sexual dimorphism and translocation success (Sorci *et al.* 1998), relative success rates of releases of captive-bred birds versus wild birds within the same species, and further consideration of the risks, costs and benefits of taxon replacement introductions (Atkinson 1988; Miskelly *et al.* 2012; Seddon *et al.* 2012).

The main findings of this review are drawn from the quantification of the extraordinary breadth and scale of conservation translocations in New Zealand. We are unaware of any previous review that has allowed comparison of translocation effort and success within and between New Zealand bird families and species. Awareness of the relative ease or difficulty

with which different bird species can be translocated should be taken into account during preparation and assessment of translocation proposals. In particular, we note that 2 widespread and reasonably common species – bellbird and tomtit – are among the most difficult species to translocate successfully. Further, the high success rates of translocations into fenced sanctuaries compared to unfenced sites is of relevance to the assessment of potential release sites, as well as contributing data to the debate over the costs and benefits of predator-resistant fencing (Scofield *et al.* 2011; Burns *et al.* 2012).

Translocations have been a crucially important part of bird conservation management in New Zealand for well over a century. The data we present show that both the number of translocations being attempted, and the range of species being moved, are continuing to grow apace. This activity is regulated by the Department of Conservation (Cromarty & Alderson 2013), with little external scrutiny beyond input from relevant species recovery groups. We suggest that it would be wise for an advisory panel to be established to make recommendations on any species translocations beyond their historical ranges. This would provide greater scrutiny and transparency of Department of Conservation decisions, such as the controversial release of North Island kokako into Fiordland National Park (Seddon *et al.* 2012).

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## Appendix 1

Translocations of native New Zealand birds undertaken between 1863 and 2012. This summary does not include translocations to captivity, and releases never intended to establish permanent populations (including Operation Nest Egg kiwi crèche sites). A few reinforcement translocations are included to clarify why they were excluded from analyses (e.g., brown teal, black petrel, black stilt, North Island kokako, yellowhead).

'Successful' in this context refers to whether a population was established and persists at the release site, and is expected to persist for at least 50 years under the current management regime. Some translocations may have achieved shorter-term or ongoing translocation objectives, but if they did not result in a thriving population, they are listed under either 'Few present' (<6 pairs), or 'Failed'.

Taxonomy and nomenclature follow Gill *et al.* (2010), with regularly-used alternative names given in parentheses. Conservation classifications follow Miskelly *et al.* (2008). Qualifiers: CD = conservation dependent, De = designated, DP = data poor, EF = extreme fluctuations, IE = island endemic, Inc = increasing, OL = one location, PD = partial decline, RF = recruitment failure, RR = range restricted, SO = secure overseas, Sp = sparse, St = stable.

### APTERYGIDAE

**North Island brown kiwi *Apteryx mantelli*** Nationally Vulnerable D (1/1), CD PD RF

Successful: Kawau I (1863-64); Little Barrier I (Hauturu) (1900-02; 1919); Ponui I (1963-64); Moturoa I, Bay of Islands (1982, 1984-85); Moturua I, Bay of Islands (1984); Motuarohia (Robertson) I, Bay of Islands (mid 1980s); Motukawanui I, Cavalli Is (1995, 1997); Motuora I (1999); Mount Bruce Scenic Reserve (Pukaha) (2003-2010), Maungatautari (2005-07, 2012); Rimutaka Forest Park (2006, 2008); Tawharanui (2006-08).

In progress: Mokoia I (1970, 2004, 2007); Whale I (Moutohora) (2001, 2003, 2005-07); Mayor I (Tuhua) (2006, 2008, 2011); Cape Sanctuary, Hawke's Bay (2008-10); Lake Rotokare (2010-11), Motutapu I (2012).

Few present: Boundary Stream Mainland Island (2000-07); Limestone I (Matakohe) (2001).

Hybrid population (with SI brown kiwi): Kapiti I (1915, 1923, 1931, 1935, 1940).

Failed: Rangitoto Range (c.1973-77); Motutapu I (c.1978-79); Waitakere Ranges (1979-85); Gwavas forest, Hawke's Bay (1980-81); Tapora (1982-84, 1986); Logue's bush, Wellsford (1987-88).

References: Oliver (1922); MacMillan (1990); McLennan & Potter (1992); Colbourne & Robertson (2000); Colbourne (2005); Burns *et al.* (2012); Smuts-Kennedy & Parker (2013).

**Okarito brown kiwi (*rowi*) *A. rowi*** Nationally Critical A, CD Inc OL

In progress: Blumine I (2010); Mana I (2012).

**South Island brown kiwi (*tokoeka*) *A. australis australis*** Nationally Vulnerable D (1/1), CD RF

Successful: Indian I (1895-96); Long I, Dusky Sound (1896); Parrot I (1896-97).

Few present: Doubtful I, Lake Te Anau (2002).

Hybrid population (with NI brown kiwi): Kapiti I (1908, 1912).

Failed: Harbour I, Dusky Sound (1897); Anchor I (1897-98); Breaksea I (1900); Maori I (1900); Prove I (1900); Little Barrier I (Hauturu) (1903).

References: Oliver (1922); Atkinson (1990); Colbourne & Robertson (2000); Colbourne (2005).

**Stewart Island brown kiwi *A. australis lawryi*** Nationally Vulnerable D (1/1), RF

Successful: Ulva I (1980s).

References: Colbourne & Robertson (2000); Colbourne (2005)

**Haast tokoeka *A. australis indet.*** Nationally Critical A, De RF

In progress: Rarotoka I (Centre I) (2008); Coal I (2009-11); Pomona I (2011); Orokonui Sanctuary (2010-11).

**Little spotted kiwi *A. owenii*** Recovering A, CD Inc RR

Successful: Kapiti I (1912, 1923); Long I, Queen Charlotte Sound (1982, 1987, 1989); Red Mercury I (1983); Hen I (Taranga) (1988-89); Tiritiri Matangi I (1993, 1995); Karori Sanctuary (2000-01).

In progress: Chalky I (2008-09); Motuihe I (2009-10).

Failed: Long I, Dusky Sound (1896); Resolution I (1896-98); Anchor I (1898); Maud I (1980); Mana I (1994).

References: Atkinson (1990); Colbourne & Robertson (1997, 2000); Colbourne (2005); Miskelly *et al.* (2005); Burns *et al.* (2012).

**Little spotted kiwi *A. owenii* / *rowi* *A. rowi* hybrid** Not ranked

Few present: Allports I (2006).

**Great spotted kiwi *A. haastii*** Nationally Vulnerable D, De OL RF

Successful: Rotoiti Mainland Island (2004, 2006).

In progress: Flora Saddle, Mt Arthur (2010); Nina Valley, Lewis Pass (reinforcement translocation 2011-12).

Failed: Little Barrier I (Hauturu) (1915).

Reference: Colbourne (2005); Gasson (2005).

### ANATIDAE

**Black swan *Cygnus atratus*** Not Threatened

Successful: Nelson, Canterbury, Otago, Auckland & Southland (1864-70); Chatham Island (1890).

References: Thomson (1922); Aikman & Miskelly (2004).

**Paradise shelduck *Tadorna variegata*** Not Threatened

Successful: Central North Island (1915, 1917, 1920-21); Kapiti I (1931); Northland (1959-69).

References: Wilkinson & Wilkinson (1952); Williams (1971).

**Blue duck *Hymenolaimus malacorhynchos*** Nationally Vulnerable C (1/1), CD Sp

Successful: Flora Stream (2004-08).

In progress: Egmont National Park (1999-2010).

Failed: Egmont National Park (1987, 1989, 1991)

References: Hutchinson (1998); Holmes & Caskey (2001); Young 2006; Glaser *et al.* (2010).

**Brown teal *Anas chlorotis*** Recovering A, CD RR

Successful: Kapiti I (1968, 2000-01); Mimiwhangata (reinforcement translocations: 1984, 1986-88, 1991); Tiritiri Matangi I (1987, 1990, 2002); Russell (1990s); Mana I (2000-01); Karori Sanctuary (2000-01); Port Charles (2003-07); Mayor I (Tuhua) (2006, 2008); Tawharanui (2008-10); Cape Sanctuary (2008-10).

In progress: Tutukaka (2007, 2011-12); Arthur Valley, Fiordland (2009-12); Purerua Peninsula (2011-12).

Few present: Urupukapuka I (1988, 1990, 1992, 1994).

Failed: North Auckland (2 sites, c.1968); Lake Omanuka, Manawatu (1969-75); Pukepuke Lagoon (1973, 1977-83); Lake Koputara, Foxton (1974-82); Kaihoka Lakes, Nelson (1978); Matakana I (1981-82); Sinclair wetland, Otago (1982); Lake Kaikokopu, Manawatu (1983); Nga Manu Sanctuary, Waikanae (1983-85); Matapouri Estuary (1984-85); Takau Bay (1985); Moturoa I, Bay of Islands (1985-86, 1994); Kaeo River (1986); Purerua Peninsula (1989-92); Hokianga Harbour (1993-94); Waikino Inlet (1994); Trounson Kauri Park (1996-97); Waihoanga Stream (1996-97); Parorerahi Bay (1997-98); Travis Wetland (2007).

References: Williams (1969); Reid & Roderick (1973); Hayes & Williams (1982); Hayes & Dumbell (1989); Dumbell (2000); Gillies *et al.* (2003); Roxburgh *et al.* (2005); Burns *et al.* (2012).

**Auckland Island teal** *A. aucklandica* Nationally Vulnerable B (1/1), IE RR St

Failed: Kapiti I (1906).

Reference: Miskelly (2004).

**Campbell Island teal** *A. nesiotis* Nationally Critical A, IE Inc OL

Successful: Codfish I (Whenua Hou) (1999-2000); Campbell I (2004-06)

References: McClelland (2000); Gummer & Berry (2007).

**New Zealand scaup** *Aythya novaeseelandiae* Not Threatened

Successful: Lake Mangamahoe, Taranaki (between 1966 & 1969); Henley Lake, Masterton (1989); Karori Sanctuary (2001-03).

Failed: Pukekura Lagoon, New Plymouth (c.1970); Lake Ponui, Wairarapa (1975); Lake Papaitonga (1982 - dispersed to nearby wetlands, where they persist).

Reference: Reid & Roderick (1973); Burns *et al.* (2012).

## SPHENISCIDAE

**Little (white-flipped) penguin** *Eudyptula minor* Nationally Vulnerable, De RR

Successful: Harris Bay, Godley Head, Christchurch (1984-2005).

Failed: Lyttelton Harbour (2003-04).

## PROCELLARIIDAE

**Grey-faced petrel** *Pterodroma macroptera gouldi* Not Threatened, De Inc RR

In progress: Cape Sanctuary, Hawke's Bay (2008-12); Longbush Reserve, Gisborne (2011-12).

Few present: Limestone I (Matakohe) (2004-08).

References: Miskelly *et al.* (2009); Burns *et al.* (2012).

**Chatham Island taiko** *P. magentae* Nationally Critical A, CD IE Inc OL

In progress: Sweetwater Conservation Covenant, Chatham I (2006-11).

Reference: Miskelly *et al.* (2009); Burns *et al.* (2012).

**Chatham petrel** *P. axillaris* Nationally Vulnerable A (1/1), CD IE Inc OL

Successful: Ellen Elizabeth Preece Conservation Covenant, Pitt I (2002-05).

In progress: Sweetwater Conservation Covenant, Chatham I (2008-11).

Reference: Miskelly *et al.* (2009); Burns *et al.* (2012).

**Cook's petrel** *P. cookii* Relict B, Inc RR

In progress: Cape Sanctuary, Hawke's Bay (2010-12).

**Pycroft's petrel** *P. pycrofti* Recovering B, Inc RR

Successful: Cuvier I (2001-03).

Reference: Miskelly *et al.* (2009).

**Fairy prion** *Pachyptila turtur* Relict B, RR SO

Few present: Mana I (2002-04).

References: Miskelly *et al.* (2009); Miskelly & Gummer (2013).

**Black petrel** *Procellaria parkinsoni* Nationally Vulnerable B (1/1)

Reinforcement translocation only, Little Barrier I (Hauturu) (1986-90).

Reference: Imber *et al.* (2003).

**Fluttering shearwater** #, ±, ¶<sup>a</sup>↖↗ Relict B, RR

Successful: Maud I (1991-96).

In progress: Mana I (2006-08); Matiu/Somes I (2012).

References: Bell *et al.* (2005); Miskelly *et al.* (2009).

**Hutton's shearwater** # «, <sup>2</sup>±↖↗ Declining C (1/1), OL

In progress: Kaikoura Peninsula (2005-08, 2012).

Reference: Miskelly *et al.* (2009).

## PELECANOIDIDAE

**Common diving petrel** *Pelecanoides urinatrix urinatrix* Relict B, Inc RR SO

Successful: Mana I (1997-99).

In progress: Cape Sanctuary, Hawke's Bay (2011).

Few present: Motuora I (2007-09).

References: Miskelly & Taylor (2004); Miskelly *et al.* (2009).

## FALCONIDAE

**New Zealand falcon** *Falco novaeseelandiae* Nationally Vulnerable B (1/1), DP St

Successful: Kakepuku Mountain, Waikato (2005-11).

Reference: For reinforcement translocation, see Fox & Wynn (2010), Kross *et al.* (2012).

## RALLIDAE

**Banded rail** *Gallirallus philippensis assimilis* Naturally Uncommon, DP

Successful: Moturoa I, Bay of Islands (1996); Kundy I (1999).

Unknown outcome: Cape Sanctuary, Hawke's Bay (2009).

Failed: Whangamarino wetland (2007).

**North Island weka** *G. australis greyi* Nationally Vulnerable B (1/1), CD EF RR Sp

Successful: Arid I (Rakitu) (1951); Mokoia I (1952, 1956, 1958); Kawanui I (1976); Pakatoa I (1996); Whanganui I (1997-2001); Russell Peninsula (2002-03); Kawakawa Bay (2003); Rotorua I (2004).

Hybrid population with western weka and Stewart Island weka: Kapiti I (c.1896).

Failed: Kings College, Auckland (1957); Aorangi Forest Park (1958, 1960, 1968-70); Orongorongo (1958, 1960, 1966, 1968-70); Bethells Beach (1960); Pakihi River, Opotiki (1960); Tirau (1960); Rotorua (1960, 1971, 1976); Bayview,

Napier (1960-61); Maxwell (1960); Little Bush Wildlife Refuge, Puketitiri (1960); Te Moana, Waikanae (1960); Waiorongomai, Featherston (1960-61); Masterton (1960, 1964, 1971); Wharerata (1961); Tangarakau gorge (1961); Tutira (1961); Wharerangi, Taradale (1961); Puketapu, Napier (1961); Warkworth (1962); Hartree Reserve, Patoka (1962, 1968); Woodville (1962, 1966); Cape Palliser (1962, 1966, 1968-70); Wellington (1962); Urupukapuka I, Bay of Islands (1963); Tairua (1963, 1965); Ngaruawahia (1963); Ngatapa (1963-64); Makikiriri Reserve, Dannevirke (1963, 1965-66); Mt Bruce Scenic Reserve (1963, 1965-66, 1970); Longbush, Masterton (1963); Hinekura, Martinborough (1963, 1966); Kamo (1964); Tuai (1964, 1966); Bushy Park (1964, 1976); Waimana gorge, Taneatua (1965); Ngapaeruru Reserve, Mangatoro (1965); Maraetotara (1965, 1967); Waitotara Valley (1965); Tinui (1965); Te Arai Pt, Wellsford (1966); Port Charles (1966); Whatarangi, Palliser Bay (1966, 1968); Rawhiti (1966-72, 1976-81); Kennedy Bay (1967); Turangi (1967); Takapau (1967-70); Russell State Forest (1968); South Head, Kaipara (1968-69); Mt Holdsworth (1968, 1980); Pirinoa (1968); Te Uku, Raglan (1969); Aniwanuiwa (1969-70); Motu (1970); Egmont National Park (1971, 1976); Middlemore golf course, Auckland (1971); Waikawau Bay, Coromandel (1971); Makihi (1971); Tikokino (1971); Massey, Auckland (1973); Morere Reserve (1973); Okato, New Plymouth (1973); Huinga, Stratford (1975); Eketahuna (1975); Manukau Harbour (1976); Tokoroa (1976); Huia Bay, Waitakere (1976-77, 1980-82); Opua (1978); Karangahake Gorge (1992-96); Karori Sanctuary (2000); Whirinaki (2005-06).  
References: Bell & Braithwaite (1964); Pracy (1969); Robertson (1976); MacMillan (1990); Beauchamp *et al.* (1998; 2000, 2009); Bramley & Veltman (1998); Miskelly *et al.* (2005); Burns *et al.* (2012).

**Western weka** *G. australis australis* Declining A (1/1), DP EF  
Successful: Totaranui (2006).

Hybrid population (with NI weka and Stewart Island weka): Kapiti I (c.1904).

Failed: Chetwode Is (1928; this population thrived until eradicated in 1993); The Glen, Nelson (1993).

References: Brown (1996); Preece & Shaw (1998); Miskelly (2004); Gaze & Cash (2008).

**Buff weka** *G. australis hectori* Relict A

Successful: Chatham I (1905); Pitt I (1960s); Harwich I (Mou Waho), Lake Wanaka (2005); Pigeon I (Wawahia-Waka), Lake Wakatipu (2005-06, 2008); Pig I (Matau) Lake Wakatipu (2006-08).

In progress: Motutapu Station, Lake Wanaka (2011-12).

Few present: Stevensons I (Te Peka Karara), Lake Wanaka (2002-03, 2008).

Failed: Kawaii I (1863); Banks Peninsula (1949); Arthur's Pass (1962); Stevensons Peninsula, Lake Wanaka (2009).

References: Oliver (1930); Aikman & Miskelly (2004); Cagney (2007).

**Stewart Island weka** / *G. australis hectori* Nationally Vulnerable B (1/1), DP

Few present: Halfmoon Bay, Ackers Point, Iona I (2005).

Hybrid population (with NI weka and western weka): Kapiti I (c.1896).

Failed: Halfmoon Bay (1979); north-west Stewart I (1980-81, 1983).

**Weka (hybrid population)** *G. australis* indet.

Failed: Tauherenikau Valley, Tararua Forest Park (1996).

Reference: Baldwin (1997).

**South Island takahe** #2 *Porphyrio mantelli* Nationally Critical A, CD RR

Successful: Maud I (1984-85); Mana I (1988-91); Rarotoka I (Centre I) (2001-03, 2006, 2011).

In progress: Secretary I (2009-11); Motutapu I (2011-12); Cape Sanctuary, Hawke's Bay (2012).

Few present: Kapiti I (1989-91); Tiritiri Matangi I (1991-92, 1994-95, 1997); Maungatautari (2006, 2009).

Failed: Stuart Mountains (1987-92).

References: Jamieson *et al.* (2000); Jamieson & Ryan (2001); Jamieson (2011); Burns *et al.* (2012); Smuts-Kennedy & Parker (2013).

## SCOLOPACIDAE

**Chatham Island snipe** *Coenocorypha pusilla* Nationally Vulnerable B (1/1), IE RR St

Successful: Mangere I (1970).

Failed: Ellen Elizabeth Preece Conservation Covenant, Pitt I (2008).

References: Bell (1974); Miskelly (2009b); Burns *et al.* (2012).

**Snares Island snipe** *C. huegeli* Naturally Uncommon, IE RR St

Successful: Putauhinu I (2005).

In progress: Codfish I (Whenua Hou) (2012).

Reference: Miskelly *et al.* (2012).

## RECURVIROSTRIDAE

**Black stilt** *Himantopus novaezelandiae* Nationally Critical A, CD RR

Reinforcement translocations only, McKenzie basin.

References: Maloney & Murray (2000); van Heezik *et al.* (2009).

## CHARADRIIDAE

**Shore plover** *Thinornis novaeseelandiae* Nationally Critical A, CD Inc RR Sp

Successful: Portland I (1998-2006); Mangere I (2001-03).

In progress: Mana I (2007-11), Motutapu I (2012).

Failed: Mangere I (1970, 1972-73); Motuora I (1994-99); Rarotoka I (Centre I) (2006).

References: Aikman (1999); O'Connor (2000); Dowding *et al.* (2005); Dowding & O'Connor (2013).

## COLUMBIDAE

**New Zealand pigeon (kereru, kukupa)** *Hemiphaga novaeseelandiae* Not Threatened, CD Inc

Failed: Great King I (2000).

Karori Sanctuary (2006-10) excluded as this was a supplementary translocation.

References: Miskelly *et al.* (2005); Burns *et al.* (2012).

**Chatham Island pigeon (parea)** *H. chathamensis* Nationally Critical A, CD IE OL

Failed: Rangatira (South East) I (1984-85).

## STRIGOPIDAE

**Kakapo** *Strigops habroptilus* Nationally Critical A, CD Inc RR

Successful: Codfish I (Whenua Hou) (1987-92, 1997).

In progress: Anchor I (2005-10); Little Barrier I (Hauturu) (2012).

Failed: Indian I (1895); Long I, Dusky Sound (1895-97); Resolution I (1895-98, 1905, 1907); Anchor I (1897-98); Cooper I (1898); Parrot I (1900); Entry I, Dusky Sound (1900); Little Barrier I (Hauturu) (1903, 1915, 1982); Kapiti I (1912); Maud. I (1974-99); Mana I (1992); Chalky I (2002, 2005).

References: Powlesland (1989); Atkinson (1990); Lloyd & Powlesland (1994).

**North Island kaka** *Nestor meridionalis septentrionalis* Nationally Vulnerable C (1/1), CD PD RF

Successful: Mount Bruce Scenic Reserve (Pukaha) (1996-2000); Karori Sanctuary (2002-07); Maungatautari (2007-09).

References: Berry (1998); Miskelly *et al.* (2005); Burns *et al.* (2012); Smuts-Kennedy & Parker (2013).

**South Island kaka** *N. meridionalis meridionalis* Nationally Endangered C (1/1), CD PD RF

Successful: Orokonui Sanctuary (2008).

Reference: Burns *et al.* (2012).

## PSITTACIDAE

**Red-crowned parakeet** *Cyanoramphus novaezelandiae novaezelandiae* Relict B

Successful: Tiritiri Matangi I (1974-76); Cuvier I (1974); Whale I (Moutohora) (1986); Matiu/Somes I (2003-04); Motuihe I (2008-09); Karori Sanctuary (2010-11).

In progress: Tawharanui (2009-10); Cape Sanctuary, Hawke's Bay (2012).

Failed: Mt Bruce Scenic Reserve (1968); Waitakere Ranges (1977-85); Moturoa I, Bay of Islands (1988-90).

References: MacMillan (1990); Miskelly *et al.* (2005); Ortiz-Catedral & Brunton (2008, 2010); Ortiz-Catedral (2010); Burns *et al.* (2012).

**Yellow-crowned parakeet** *C. auriceps* Not Threatened, EF

Successful: Long I, Queen Charlotte Sound (2001); Mana I (2004); Motuara I (2007).

In progress: Maungatautari (2009-10); Boundary Stream Mainland Island (2012).

Failed: Kapiti I (1906); Stephens I (Takapourewa) (1970).

References: Brown [2001: 215]; Miskelly (2004); Gaze & Cash (2008); Burns *et al.* (2012); Smuts-Kennedy & Parker (2013).

**Orange-fronted parakeet** *C. malherbi* Nationally Critical A, CD EF Inc RR

In progress: Mayor I (2009-11); Blumine I (2011-12).

Few present: Chalky I (2005-07); Maud I (2007-08).

Reference: Ortiz-Catedral (2009).

**Antipodes Island parakeet** *C. unicolor* Naturally Uncommon, IE RR St

Failed: Kapiti I (1907); Stephens I (Takapourewa) (1986).

References: Brown [2001: 215-216]; Miskelly (2004); Gaze & Cash (2008).

## STRIGIDAE

**Morepork** *Ninox novaeseelandiae novaeseelandiae* Not Threatened

Hybrid population (with Norfolk Island boobook *N. novaeseelandiae undulata*): Norfolk I (1987).

Reference: Olsen (1996).

## ACANTHISITTIDAE

**North Island rifleman** *A. chloris chloris* Declining B (1/1)

Successful: Tiritiri Matangi I (2009-11).

Few present: Cape Sanctuary, Hawke's Bay (2008-10).

References: Withers (2009); Burns *et al.* (2012).

**South Island rifleman** *A. chloris chloris* Declining C (1/1)

Successful: Ulva I (2003); Dancing Star Preserve, Stewart I (2008-09).

Reference: Leech *et al.* (2007); Burns *et al.* (2012).

**Stead's bush wren** *Xenicus longipes variabilis* Extinct

Failed: Kaimohu I (1964).

Reference: Ballance & Merton (2007).

**Rock wren** *X. gilviventris* Nationally Vulnerable C (1/1), DP

Successful: Secretary I (2008-10).

Failed: Anchor I (2005).

Reference: Willans & Weston (2005).

## CALLAEIDAE

**North Island kokako** *Callaeas wilsoni* Nationally Vulnerable B (1/1), CD Inc Sp

Successful: Little Barrier I (Hauturu) (1981-83, 1986, 1988, 1994); Kapiti I (1991, 1993-97); Tiritiri Matangi I (1997-98, 2007-08, 2010); Mount Bruce Scenic Reserve (2003-04, 2006-07, 2010); Boundary Stream Mainland Island (2004, 2007); Ngapukeariki (2005).

In progress: Secretary I (2008-09); Whirinaki (2009); Waitakere Ranges (2009-10); Otago Mainland Conservation Area (2010-11); Puketi Forest (2012).

Few present: Lady Alice I (Mauimua) (2004-06).

Failed: Trounson Kauri Park (1995-96, 1998); Pikiariki Ecological Area (1997); Puketi Forest (2000, 2007-08).

Hunua Range (1998, 2006-08, 2010) excluded as these were reinforcement translocations. Mokoia I (2006) excluded as this was a male-only translocation.

References: Innes & Flux (1999); Gillies *et al.* (2003); Brown *et al.* (2004); Rowe & Bell (2007); Molles *et al.* (2008); Seddon *et al.* (2012); Innes *et al.* (2013).

**North Island saddleback** *Philesturnus rufusater* Recovering B, Inc RR

Successful: Whatupuke I (1964); Red Mercury I (1966); Cuvier I (1968); Lady Alice I (Mauimua) (1971); Stanley I (1977); Kapiti I (1981-83, 1987-89); Little Barrier I (Hauturu) (1984, 1986-88); Tiritiri Matangi I (1984); Mokoia I (1992); Whale I (Moutohora) (1999); Karori Sanctuary (2002-03); Motuihe I (2005); Bushy Park (2006).

In progress: Motutapu I (2011-12); Rangitoto I (2011-12); Tawharanui (2012).

Failed: Little Barrier I (1925); Kapiti I (1925); Lady Alice I (Mauimua) (1950); Fanal I, Mokohinau Is (1968, 1985); Motukawanui I, Cavalli Is (1983-84); Moturoa I, Bay of Islands (1997); Boundary Stream Mainland Island (2004).

References: Merton (1965a & b, 1973, 1975); Lovegrove (1989, 1996); Armstrong & Craig (1995); Armstrong *et al.* (1995); Owen & Blick (2000); Hooson & Jamieson (2003a); Armstrong *et al.* (2002, 2005); Lambert *et al.* (2005); Miskelly *et al.* (2005); Taylor *et al.* (2005); Sullivan (2006); Parker & Laurence (2008); Jamieson *et al.* (2009); Adams *et al.* (2010); Parker *et al.* (2010); Burns *et al.* (2012).

**South Island saddleback *P. carunculatus*** Recovering A, Inc RR

Successful: Big I (1964); Kaimohu I (1964); Betsy I (1969); Womens I (1972); North I, Stewart I (1972); Putauhinu I (1974, 1976, 1984); Kundy I (1978); Edwards I (Motunui) (1981); Jacky Lee I (1986); Breaksea I (1992); Motuara I (1994); Pohowaitai I (1999); Ulva I (2000); South Passage I (2001); Anchor I (2002, 2004); Long I, Queen Charlotte Sound (2005); Chalky I (2008); Blumine I (2009-10).

In progress: Orokonui Sanctuary (2009); Big South Cape I (Taukihepa) (2011-12); Big Moggy I (Mokinui) (2011); Little Moggy I (Mokiiti) (2012); Solomon I (Rerewhakaupoko) (2012).

Failed: Nukuwaiata (Inner Chetwode I) (1965, 1970); Maud I (1980, 1982); Allports I (1999); Bauza I (2003, 2010); Erin I, Lake Te Anau (2003-04).

References: Merton (1973, 1975); Nillson [sic] (1978); Rasch & McClelland (1993); Lovegrove (1996); Pierre (1999, 2000, 2001); Cash & Gaze (2000); Hooson & Jamieson (2003a, 2003b); Jamieson *et al.* (2005); Ludwig & Jamieson (2007); Taylor & Jamieson (2007, 2008); Taylor *et al.* (2007); Gaze & Cash (2008); Michel *et al.* (2008, 2010); Taylor *et al.* (2008); Jamieson (2011); Burns *et al.* (2012).

## NOTIOMYSTIDAE

**Stitchbird *Notiomystis cincta*** Nationally Endangered C, CD De RR

Successful: Kapiti I (1983-84, 1990-92, 2002); Tiritiri Matangi I (1995-96, 2001, 2010); Karori Sanctuary (2005-06, 2008, 2010); Maungatautari (2009-11).

Failed: Hen I (Taranga) (1980-81); Cuvier I (1982, 1985); Mokoia I (1994); Waitakere Ranges (2007-08).

References: Angher (1984); Castro *et al.* (1994); Rasch *et al.* (1996); Armstrong *et al.* (1999, 2002, 2007); Armstrong & Perrott (2000); Boyd & Castro (2000); Perrott & Armstrong (2000); Armstrong & Ewen (2001a); Castro *et al.* (2004); Ewen *et al.* (2004, 2006, 2011a & b, 2012); Taylor *et al.* (2005); Ewen & Armstrong (2007); Brekke *et al.* (2010, 2011); Richardson *et al.* (2010); Burns *et al.* (2012); Chauvenet *et al.* (2012); Thorogood *et al.* (2012); Smuts-Kennedy & Parker (2013).

## MELIPHAGIDAE

**Bellbird *Anthornis melanura melanura*** Not Threatened

In progress: Karori Sanctuary (2001-03, 2007-11); Mana I (2010, 2012); Waiheke I (2010); Motuihe I (2010).

Few present: Hamilton (2010).

Failed: Waitakere Ranges (1931); Moturoa I, Bay of Islands (1983); Whangaparaoa (1983-84); Waiheke I (1988-91).

References: Lee (2005); Miskelly *et al.* (2005); Burns *et al.* (2012).

**Tui *Prothemadera novaeseelandiae novaeseelandiae*** Not Threatened, St

In progress: Banks Peninsula (2009-10).

**Chatham Island tui *P. novaeseelandiae chathamensis*** Nationally Endangered B (1/1), IE RR St

Successful: Awatotara Conservation Covenant, Chatham I (2009-10).

Reference: Bell *et al.* (2013).

## PACHYCEPHALIDAE

**Whitehead *Mohoua albicilla*** Not Threatened

Successful: Tiritiri Matangi I (1989-90); Karori Sanctuary (2001-02); Tawharanui (2007); Motuora I (2008); Maungatautari (2009); Mana I (2010).

In progress: Waitakere Ranges (2004, 2008, 2011-12); Cape Sanctuary, Hawke's Bay (2007-08); Moturoa I, Bay of Islands (2011); Motuihe I (2012); Motutapu I (2012); Rangitoto (2012).

Failed: Hunua Ranges (2003).

References: Allen (1990); Armstrong *et al.* (1995); Miskelly *et al.* (2005); Leuschner *et al.* (2007); Burns *et al.* (2012); Smuts-Kennedy & Parker (2013).

**Yellowhead (mohua) *M. ochrocephala*** Nationally Vulnerable C (1/1), CD

Successful: Pigeon I (Wawahi-Waka), Lake Wakatipu (1993); Breaksea I (1995); Ulva I (2001); Chalky I (2002); Anchor I (2002); Codfish I (2003); Pigeon I, Dusky Sound (2007); Secretary I (2008). South Hurunui (2008-09) and Eglington Valley (2010) were excluded as these were reinforcement translocations.

In progress: Pomona I (2011); Resolution I (2011).

Few present: Nukuwaiata (Inner Chetwode I) (1999, 2001).

Failed: Centre I, Lake Te Anau (1992).

References: Dilks *et al.* (1994); King (2004); Opper & Beaven (2004a & b); Tracy *et al.* (2011).

**Brown creeper *M. novaeseelandiae*** Not Threatened

Successful: Dancing Star Preserve, Stewart I (2008-09).

Reference: Burns *et al.* (2012).

## PETROICIDAE

**North Island tomtit *Petroica macrocephala toitoi*** Not Threatened

Successful: Cape Sanctuary, Hawke's Bay (2007-08).

Failed: Karori Sanctuary (2001-04); Tiritiri Matangi I (2004).

References: Parker *et al.* (2004); Hughes & Parker (2005); Miskelly *et al.* (2005); Burns *et al.* (2012); Empson (2013).

**South Island tomtit *P. macrocephala macrocephala*** Not Threatened

Failed: Maud I (2004).

Reference: Gaze & Cash (2008).

**Chatham Island tomtit *P. macrocephala chathamensis*** Nationally Endangered B (1/1), IE RR St

Successful: Mangere I (1987-89).

Failed: Tuku Valley, Chatham I (1998); Awatotara Conservation Covenant, Chatham I (2011).

Reference: Powlesland *et al.* (2013).

**North Island robin *P. longipes*** Not Threatened, St

Successful: Moturoa I, Bay of Islands (1986); Mokoia I (1991); Tiritiri Matangi I (1992-93); Mana I (1995-96); Boundary Stream Mainland Island (1998); Moturoa I, Bay of Islands (1999); Karori Sanctuary (2001-02); Bushy Park (2001, 2004); Mayor I (Tuhua) (2003); Tawharanui (2007); Cape Sanctuary, Hawke's Bay (2007-08); Puketū Forest (2009-10).

In progress: Windy Hill – Rosalie Bay, Great Barrier I (2004, 2009, 2012); Glenfern Sanctuary, Great Barrier I (2005, 2009, 2012); Waitakere Ranges (2005, 2009); East Harbour Regional Park, Wellington (2008, 2010, 2012); Moehau (2009, 2011); Longbush Reserve, Gisborne (2010, 2012); Maungatautari (2011-12); Wainuiomata water catchment (2012).



**Few present:** Kakepuku Mountain (1999); Wenderholm Regional Park (1999); Paengaroa Mainland Island (1999); Mangaokewa Reserve (2001); Benneydale forest fragments (2005-07); Matiu/Somes I (2006-07).

**Failed:** Moturoa I, Bay of Islands (1984); Trounson Kauri Park (1997); Barnett Reserve, Waotu Lands bush and Stephenson Covenant, Waotu (2001); Hunua Ranges (2001).

**References:** Armstrong (1995, 2000); Armstrong *et al.* (1995); Field (1999); van Houte (1999); Armstrong *et al.* (2000, 2002, 2006a & b); Owen & Asquith (2000); Armstrong & Ewen (2001b, 2002); Lovegrove *et al.* (2002); Gillies *et al.* (2003); Miskelly *et al.* (2005); Taylor *et al.* (2005); Armstrong & Davidson (2006); Dimond & Armstrong (2007); Ewen & Armstrong (2007); Jamieson *et al.* (2007, 2009); Taylor *et al.* 2007; Morgan *et al.* (2008); Lewis *et al.* (2009); McGavin (2009); Jamieson (2011); Burns *et al.* (2012); Parlato & Armstrong (2012); Empson (2013); Smuts-Kennedy & Parker (2013).

**South Island robin *P. australis australis*** Not Threatened  
**Successful:** Allports I (1973); Motuara I (1973); Hawea I (1987); Anchor I (2002, 2004); Pigeon I, Dusky Sound (2007); West Matukituki Valley (2008); Adele I (2009); Pomona I (2009); Chalky I (2010); Orokonui Sanctuary (2010-11).

**In progress:** Secretary I (2008); Rona I (2009); Cleddau delta (2011).

**Few present:** Doubtful I, Lake Te Anau (2002); Erin I, Lake Te Anau (2003).

**Failed:** Conway River area (1972); Maud I (1972, 1983); Entry I, Dusky Sound (1989); Hinewai Reserve (1993-94).

**References:** Flack (1974); Ardern & Lambert (1997); Miller & Lambert (2004); Taylor *et al.* (2008).

**Stewart Island robin *P. australis rakiura*** Nationally Vulnerable B (1/1), IE RR

**Successful:** Putauhinu I (1999); Ulva I (2000-01).

**Failed:** Iona I (2005); Ackers Point, Stewart I (2005).

**References:** Oppel & Beaven (2002); Taylor *et al.* (2008); Laws *et al.* (2010); Michel *et al.* (2010); Jamieson (2011); Laws & Jamieson (2011).

**Black robin *P. traversi*** Nationally Critical A, IE RR

**Successful:** Mangere I (1976-77); Rangatira I (1983-88).

**Failed:** Ellen Elizabeth Preece Conservation Covenant, Pitt I (2001-05).

**References:** Flack (1978); Merton (1990); Butler & Merton (1992); Ardern & Lambert (1997); Miller & Lambert (2004); Burns *et al.* (2012).

## MEGALURIDAE

**North Island fernbird *Bowdleria punctata vealeae***

Declining B (1/1), RR St

**Successful:** Tiritiri Matangi I (2001-02).

**Failed:** Tahuna Torea reserve, Auckland (1975-76, 1979); Pauatahanui Inlet (1985).

**Reference:** Parker (2002).

**Stewart Island fernbird *B. punctata stewartiana***

Nationally Vulnerable B (1/1), DP RR

**Successful:** Kundy I (1995).

**Failed:** Ulva I (2004).

**Codfish Island fernbird *B. punctata wilsoni*** Naturally

Uncommon, IE RR

**Successful:** Putauhinu I (1997-98).

**Failed:** Kaimohu I (1997).

**Reference:** McClelland (2002).

**Appendix 2**

Extant endemic New Zealand waterfowl, shorebird and landbird taxa that have never been translocated (other than multiple releases of black stilts to bolster wild populations in the McKenzie basin). All subspecies listed apart from marsh crake and New Zealand kingfisher are endemic at the species level, although red-crowned parakeet and fantail formerly had extra-limital subspecies on Lord Howe I.

Taxonomy and nomenclature follow Gill *et al.* (2010). Conservation classifications follow Miskelly *et al.* (2008). Qualifiers: CD = conservation dependent, DP = data poor, EF = extreme fluctuations, IE = island endemic, Inc = increasing, OL = one location, RR = range restricted, St = stable.

- New Zealand dabchick** *Poliiocephalus rufopectus* Nationally Vulnerable B (1/1)
- Auckland Island rail** *Lewinia muelleri* Naturally Uncommon, IE RR St
- Marsh crake** *Acridia terminalis* Relict A, DP
- Auckland Island snipe** *Coenocorypha aucklandica aucklandica* Naturally Uncommon, IE RR St
- Antipodes Island snipe** *Coenocorypha aucklandica antipodensis* Naturally Uncommon, IE RR St
- Campbell Island snipe** *C. aucklandica perseverancei* Nationally Critical A, IE Inc OL
- Variable oystercatcher** *Haematopus unicolor* Recovering A
- South Island pied oystercatcher** *H. chathamensis* Declining B (1/1)
- Chatham Island oystercatcher** *H. chathamensis* Nationally Critical A, CD IE RR St
- Black stilt** *Himantopus novaezelandiae* Nationally Critical A, CD RR
- Northern New Zealand dotterel** *Charadrius obscurus aquilonius* Nationally Vulnerable B (1/1), CD
- Southern New Zealand dotterel** *C. obscurus obscurus* Nationally Critical A, CD OL St
- Banded dotterel** *C. bicinctus bicinctus* Nationally Vulnerable D (1/1), RR
- Auckland Island banded dotterel** *C. bicinctus exilis* Naturally Uncommon, DP IE RR
- Wrybill** *Anarhynchus frontalis* Nationally Vulnerable C (1/1), RR

- Kea** *Nestor notabilis* Naturally Uncommon
- Kermadec parakeet** *Cyanoramphus novaezelandiae cyanurus* Recovering A, EF IE Inc RR
- Chatham Island red-crowned parakeet** *C. novaezelandiae chathamensis* Naturally Uncommon, IE RR St
- Forbes' parakeet** *C. forbesi* Nationally Endangered B (1/1), IE OL
- Reischek's parakeet** *C. forbesi reischekii* Naturally Uncommon, IE RR St
- Long-tailed cuckoo** *Eudynamys taitensis* Naturally Uncommon, DP
- New Zealand kingfisher** *Todiramphus sanctus vagans* Not Threatened
- Grey warbler** *Gerygone igata* Not Threatened
- Chatham Island warbler** *G. albofrontata* Nationally Vulnerable B (1/1), IE RR St
- Three Kings bellbird** *Anthornis melanura obscura* Naturally Uncommon, IE OL St
- Poor Knights bellbird** *A. melanura oneho* Naturally Uncommon, IE OL St
- North Island fantail** *Rhipidura fuliginosa placabilis* Not Threatened
- South Island fantail** *R. fuliginosa fuliginosa* Not Threatened
- Chatham Island fantail** *R. fuliginosa penita* Naturally Uncommon, EF IE RR
- Snares Island tomtit** *Petroica macrocephala dannefaerdi* Naturally Uncommon, IE OL St
- Auckland Island tomtit** *P. macrocephala marrineri* Naturally Uncommon, IE RR
- South Island fernbird** *Bowdleria punctata punctata* Declining B (1/1)
- Snares Island fernbird** *B. punctata caudata* Naturally Uncommon, IE OL St
- New Zealand pipit** *Anthus novaeseelandiae novaeseelandiae* Declining C (1/1)
- Chatham Island pipit** *A. novaeseelandiae chathamensis* Naturally Uncommon, IE RR St
- Auckland Island pipit** *A. novaeseelandiae aucklandicus* Recovering B, Inc RR
- Antipodes Island pipit** *A. novaeseelandiae steindachneri* Naturally Uncommon, IE RR St