






13 Birds

Species diversity and change

The total species checklist for Great Barrier Island birds stands at 111 species (Table 13.1 and Appendix 2). This total includes some species no longer found here, and some marine species occurring on land only as ‘beach wrecks’. Eighty-two of these are regularly present, or are visitors to the Island. This is about a quarter of the 328 species known from the whole of the New Zealand region since 1995.

Table 13.1 Number of bird species recorded on Great Barrier Island since 1868¹ by habitat.

Main Habitat	No. of species	Extinct ⁽¹⁾	Introduced ⁽²⁾	Example: species characteristic of habitat
Marine	27	2	0	 <p>Photo⁽³⁾ :New storm petrel – First sighted off Whitianga in Jan 2003 found Great Barrier Island late 2003 – previously thought extinct.</p>
Coastal	22	1	1	 <p>Photo⁽⁴⁾ : Variable Oystercatcher.</p>
Fresh water wetland	16	0	5	 <p>Photo⁽⁵⁾ : Spotless crane. Recently confirmed at Kaitoke Swamp.</p>

Forest and scrub	24	8	2	 <p>Photo⁽⁶⁾ : Kaka feeding on figs.</p>
Open and general	22	1	17 (73%)	 <p>Picture⁽⁷⁾ : Introduced goldfinches. Female left, male centre and right.</p>
Totals	111	12	25	

Notes: (1) Extinct from Great Barrier Island since Hutton's 1868 list. (2) Includes naturally introduced species, spreading from the mainland. (3) Brent Stephenson. (4) Don Armitage. (5) Department of Conservation website (6) S. Phillips (7) Painting by Derek Onley, from Heather & Robertson, with permission.

Of the difference between the 111 which have been recorded, and the 82 'now present', 12 are known to have gone extinct on the Island since 1868, when Hutton visited and made a list. The remaining 17 are very rare visitors or of uncertain status.ⁱⁱ

The birds lost since 1868 are predominantly from forest habitats, such as stitchbird, saddleback and kokakoⁱⁱⁱ. Over the same time period the Island has gained 25 introduced species. These are predominantly generalist European birds, such as sparrows, finches and starlings, associated with people and inhabiting open areas. Clearly the shift in the landscape, from the forest of Hutton's day, to the more open farmed landscape this century, has resulted in massive changes in bird populations. In percentage terms the Island has lost 33% of forest bird species. Many of those remaining, such as pigeon and kakariki, are in much smaller numbers than formerly. Meanwhile the Island has gained 73% of farmland birds, flooding into the new man-made habitats.

In contrast, marine and coastal environments appear to have suffered little change. This however may not be quite as it seems, because there are almost no data on some species. Mostly they're only identified for sure when they're washed up dead on a beach. We have lost only one coastal bird – the shore plover – but other species (New Zealand dotterel, banded dotterel, wrybill, Caspian tern, reef heron, red-billed gull, black shag, little black shag, variable oystercatcher and even little blue penguin) are to varying degrees at risk (Table 13.2).

Great Barrier Island has one large wetland – Kaitoke Swamp – but unfortunately it is inhabited by rats, cats and pigs. Despite that, it is the key site for fern-birds in the Auckland region, and still has banded rails, spotless crane and occasional bitterns^{iv}. Most other wetlands, such as those formerly behind the dunes at Awana, Claris and Medlands, have been drained and their native birds have been replaced by the introduced generalists. Brown teal are hanging on due to intensive management by the Department of Conservation at Okiwi,

but pure strains of grey duck have been almost totally eliminated by interbreeding with mallard (Fig 13.1).



Fig 13.1 Mallard and domestic goose occupying former grey duck and brown teal habitat at Kaitoke Bridge. May 2009.

Photo: John Ogden

Notes on Great Barrier Island extinctions since 1868

The endemic New Zealand quail (*Coturnix novaezelandiae*) recorded on Great Barrier Island by Hutton in 1868 must have been some of the last of the species, which became extinct (worldwide) about 1875.

The most recent birds to be lost from Great Barrier Island are the kokako, whitehead and probably rifleman. Kokako survived in the northern block, Te Paparahi, until 1996, when the last pair were caught by staff of the Department of Conservation and taken to Little Barrier Island (Hauturu) to add to the stable breeding population there. Whiteheads persisted on Rakitu (Arid Island) after disappearing from Great Barrier Island, until at least 1957^v. Despite intensive searching, none could be found in 1981^{vi}. The tiny rifleman, New Zealand's smallest bird, was reported (but not seen by) Reed in 1972^{vii}, and there have been occasional claims since then, including 2008. However, the bird can be confused with the equally tiny grey warbler, or even the similarly coloured silver-eye. As no experienced observer appears to have recorded it since 1868, it must be presumed extinct on the Island. Hutton's record of the yellow crowned parakeet (*Cyanoramphus auriceps*) has been questioned by later writers.

New Zealand bush falcon may still be an occasional visitor from Coromandel. It is recorded as present in the 1999-2004 period covered by the Atlas of Bird Distribution in New Zealand^{viii}. However it is not now a permanent resident.

Great Barrier Island birds currently nationally endangered or vulnerable

This section discusses the birds of Great Barrier Island in the context of recent classifications of the degree of risk of the species in New Zealand as a whole (Table 13.2)^{ix}

Table13.2 Great Barrier Island birds lost or currently endangered. Excluding sea-birds known only in off-shore waters or as beach wrecks, but including those nesting on Great Barrier Island or on close-by Islands. Species 'Extinct GBI' were recorded by Hutton in 1868. Classification follows Hitchmough et al. 2007⁸, as follows: **NE** = Nationally endangered; **NV** = Nationally vulnerable; **GD** = Gradual decline; **S** = Sparse and **RR** = Range restricted. MisKelly et al. (2008)^{xi} categories are defined in the far right column. Colours follow terminology in MisKelly et al. (2008)^{xii}: **Yellow** = globally extinct; **Gold** = Threatened; **Magenta** = Data deficient; **Green** = At Risk. Species for which Great Barrier Island is a significant stronghold are indicated in **bold** text. Species in *italics* are extinct on Great Barrier Island.

Species	Extinct GBI	Hitchmough et al. (2007) Categories	Miskelly et al. (2008) Categories	Status description from MisKelly et al. (2008).
<i>New Zealand quail</i>	x	Extinct	A	Extinct (since AD 1800)
<i>Shore plover</i>	x	NE	B1	Nationally Critical
Grey duck		NE	B1	Nationally Critical
<i>Stitchbird</i>	x	NE	B2	Nationally Endangered
Bittern		NE	B2	Nationally Endangered
<i>Kokako</i>	x	NE	B3	Nationally Vulnerable
<i>Falcon^l</i>	x	NV	B3	Nationally Vulnerable
NZ dotterel N. I.		NV	B3	Nationally Vulnerable
Wrybill		NV	B3	Nationally Vulnerable
Reef heron		NV	B3	Nationally Vulnerable
Caspian tern		NV	B3	Nationally Vulnerable
Kaka		NE	B3	Nationally Vulnerable
Weka North Island		NE	B3	Nationally Vulnerable
Red billed gull		GD	B3	Nationally Vulnerable
banded dotterel		GD	B3	Nationally Vulnerable
Black petrel		RR	B3	Nationally Vulnerable
Pied shag			B3	Nationally Vulnerable
NZ Storm petrel		DD	C	Data Deficient
<i>Rifleman</i>	x	GD	D1	Declining
White fronted tern		GD	D1	Declining
Northern blue penguin		GD	D1	Declining
Fernbird N. I		S	D1	Declining
New Zealand pipit			D1	Declining
Pied stilt			D1	Declining
NZ Pied Oystercatcher			D1	Declining
<i>Saddleback</i>	x	RR	D2	Recovering
Brown teal/pateke		NE	D2	Recovering
Variable oystercatcher			D2	Recovering
Cooks petrel		GD	D3	Relict
Spotless crake		S	D3	Relict
Fairy prion			D3	Relict
Diving petrel northern			D3	Relict
Fluttering shearwater			D3	Relict
Red-crowned parakeet			D3	Relict
Long tailed cuckoo		GD	D4	Naturally Uncommon
Banded rail		S	D4	Naturally Uncommon
Black shag		S	D4	Naturally Uncommon
Little black shag		RR	D4	Naturally Uncommon

Little shag			D4	Naturally Uncommon
Bullers shearwater		RR	D4	Naturally Uncommon
<i>Brown creeper</i>	x		E	Not threatened
<i>Yellow crowned parakeet</i>	x	GD	E	Not threatened
<i>Black bellied storm petrel</i>	x	7	E	Not threatened
<i>White headed petrel</i>	x	7	E	Not threatened
<i>Whitehead</i>	x		E	Not threatened
North Island robin		2	E	Not threatened
NZ pigeon/kereru		5	E	Not threatened
Bellbird		7	E	Not threatened

Sixteen Great Barrier Island bird species are placed in the nationally ‘Threatened’ category, of which four are already extinct on the Island. The remaining twelve species comprise 16% of the New Zealand total in this category. There are twenty extant birds in the ‘At Risk’ category, comprising about 21% of the New Zealand total. These 32 threatened or at risk species comprise about 30% of the total species ever recorded on Great Barrier Island, and nearly 40% of those usually present on the Island. Because some of these are relatively common birds on the Island their national vulnerability is sometimes not realised by local inhabitants (eg. kaka). Some of these species are discussed in more detail below.

- **Grey duck** (*Anas superciliosa*)

Grey ducks also occur in Australia, where they are called black duck. They are closely related to mallard, with which they interbreed. This is why they are considered endangered. Very little can be done to preserve the grey duck genetic stock, where, as in all of New Zealand, these two species occur together.

Grey duck were recorded by Hutton in 1868^{xiii}, when mallard were absent. Between 1957 and 1960 Bell & Braithwaite (1964) recorded a flock of 23 at Awana and at least 40 in the Sugarloaf area. They estimated the total population at c. 100 birds. In contrast only one mallard (at Sugarloaf creek) was seen by them during their two visits. Now, definite ‘greys’ are rare: many female ‘mallard’ on Great Barrier Island have the strongly striped facial characteristics of grey duck, but have a blue, rather than green, speculum (wing flash). This suggests that considerable hybridisation has occurred. In March 2008 a clear grey duck, with a definite green speculum, was seen on the Oruawharo stream. However, as mallard seem to be increasing, it is likely that ‘pure strain grey duck’ will soon be absent from Great Barrier Island. There may be some influx of mallard from the mainland during the shooting season – 30 arrived on Kaitoke creek in early May 2009. There are probably at least 100 mallard on the Island as a whole, so the transition from grey ducks to mallard has taken about 50 years

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- **Brown teal** (*Anas aucklandica chlorotis*)

The genus *Anas* is a large worldwide genus, and there are several related teal species in the Australian region. However brown teal occur only in New Zealand, where they were very common when Europeans arrived. They were shot for food and sport in large numbers and almost exterminated. Although now considered to be recovering as a result of conservation efforts, they are still placed within the ‘At Risk’ category, and their largest remaining population is on Great Barrier Island.

Brown teal are subject to research and protection by the Department of Conservation in the Okiwi basin. The number of birds at known flock sites is counted every year, and these annual monitoring reports are available from the Department of Conservation. The count provides an index of change, and presumably underestimates the total population by an unknown amount. The long-term trend is negative (Fig 13.3), but there is a clear indication of improvement since 2000. If this trend continues for another three years it will become statistically significant ($P > .05$). Independently assessed trends at Awana closely mirror the overall trends, but the improvement since 2000 is much less evident.

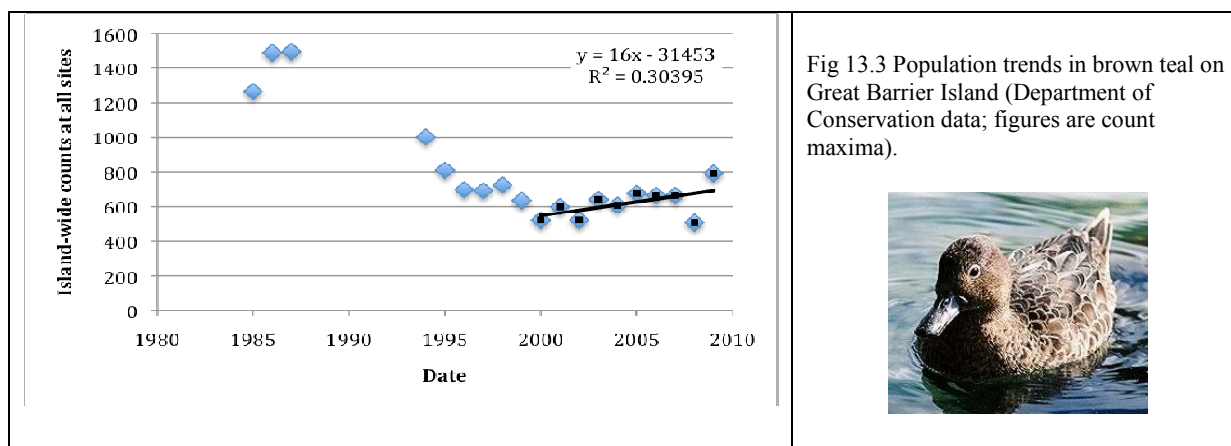


Photo: Rod Dickson.

- **Bittern** (*Botaurus poiciloptilus*)

This species is native, but occurs also in Australia. It has suffered a marked decline during the last century probably due to habitat loss consequent on wetland drainage.

Bitterns were found at five locations on Great Barrier Island by Colin Ogle in 1980^{xv}, but he suggested that their numbers were declining. They were present at Awana before the wetlands were drained (M. Curren, personal communication), and probably still breeding in the Kaitoke area in 2004, when a juvenile was found dead on the road.

There have been over 20 recorded sightings since 2004, from a wide range of locations, but mostly centred on the eastern end of the Kaitoke swamp, Kaitoke creek, the Golf Course and “Police Station Swamp” areas^{xvi} or on DOC land at Okiwi. A bird or possibly a pair was present at Okiwi Station between May and September 2008, and records there have continued (June 09). Reliable records have also come from Kaiaraara on the eastern side of Great Barrier Island. Spring (Sept – December) and late summer (Feb – March) are the most likely times to see or hear bittern. All five records of ‘booming’ since 2004 relate to the Sept – December period. they suggest that one or two pairs might be present throughout the year, possibly breeding (or attempting to) in the Kaitoke/Golf Course/Police Station Swamp area or at Okiwi.

- **North Island New Zealand dotterel** (*Charadrius obscurus aquilonius*).

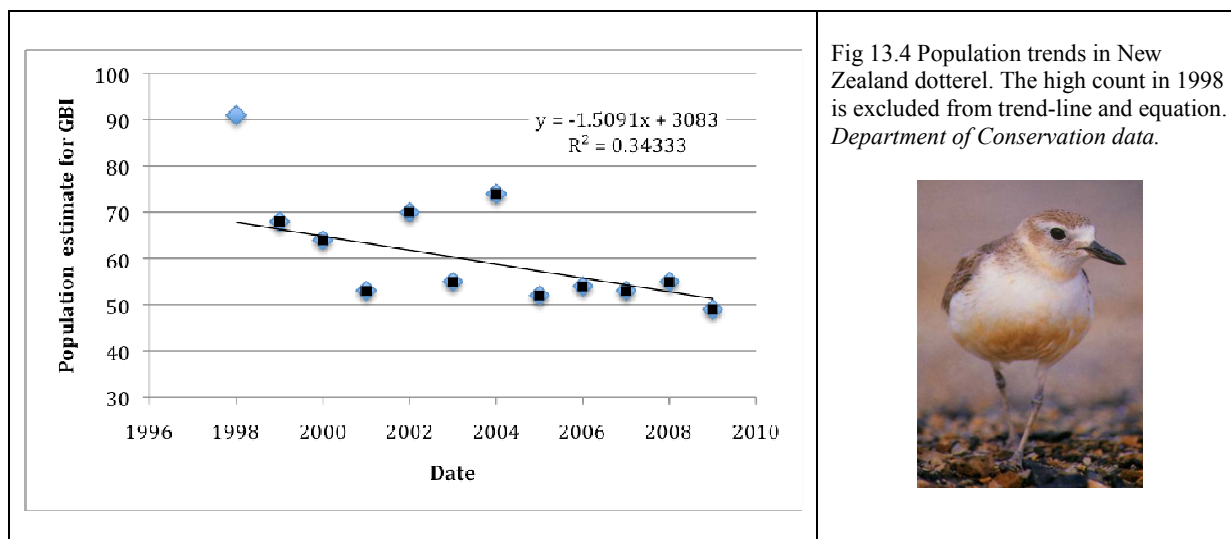
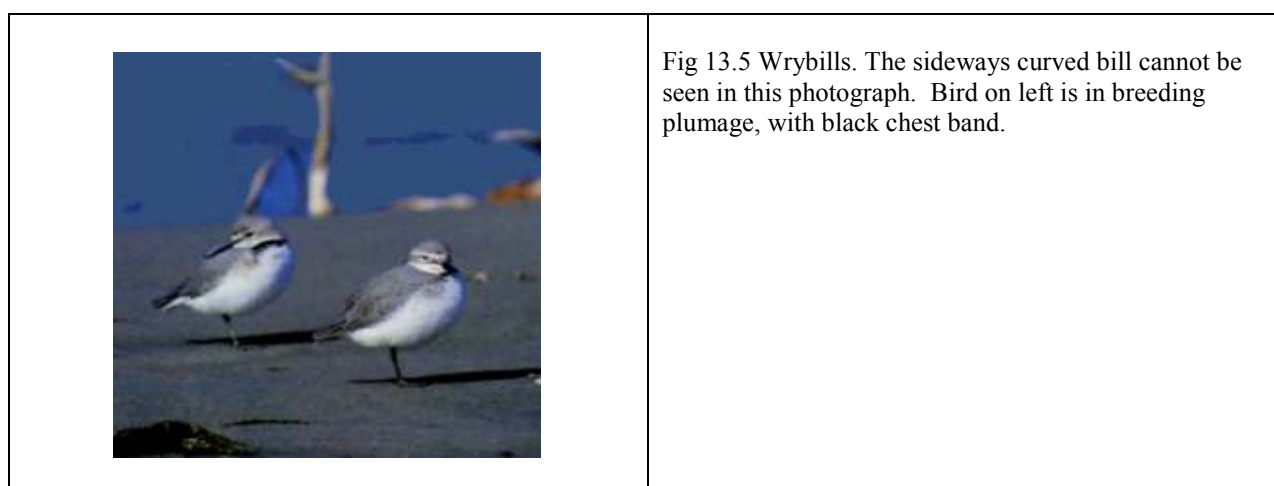


Photo: Halema Jamieson, Department of Conservation

A paper on the status of this species on Great Barrier Island is in preparation (Ogden, J. & Dowding, J.). The general population trends have been negative since counts began in 1998 (Fig 13.4). Even excluding the high count in 1998, the current downward trend will likely be significant ($P > .05$) if it continues for another season.

The species now nests only on the larger sandy beaches on the east coast, and even here it is rarely successful. Disturbance by people and dogs results in failure of many nests, especially those attempting to breed on Medlands beach. Disturbance results in eggs being ‘fried’ in the hot sun, or subject to predation by black-backed gulls or other species which would not find them if the adult bird was sitting. Second nesting attempts are often on the beach, rather than in the dunes, and consequently even more vulnerable to disturbance and exceptional high tides. Pre-fledged young are similarly susceptible, and it is rare for more than one, from the three eggs usually laid, to reach adulthood.

- **Wrybill** (*Anarhynchus frontalis*).



This tiny endemic wader (Fig 13.5) is one of New Zealand’s ornithological curiosities, having a sideways bent bill, unique among birds. It nests on the braided river flats of inland Otago

and Canterbury, but up to c. 10 visit Whangapoua estuary, Okiwi spit and Kaitoke beach each year between March and July. This is probably a declining number: Ogle recorded 15 at Whangapoua in 1980^{xvii}.

- **Reef Heron** (*Egretta sacra*)

Reef herons are found in coastal areas from eastern Asia, Australia and the tropical Pacific. There are two colour forms, one white, the other, dark grey. Only the grey form occurs in New Zealand (see photo Ch 1.6).

Single individuals have been seen at Awana in 1999, 2000 and 2002 and at Okupu, Shoal Bay and Okiwi between 2007 and 2009. All records have been between September and April. Reef heron was reported from two locations near Port Fitzroy by Ogle in March/April 1980, and by Hutton in 1868: as these records were made on short visits they suggest it may have been commoner then.

- **Caspian tern** (*Sterna caspia*).

These large red-billed terns are worldwide in distribution, but are currently in decline in New Zealand as their usual nesting sites, on bare sand-spits, are disturbed by people, dogs and off-road vehicles.

Judging from the occasional presence of fledged juveniles on Kaitoke beach a few nest somewhere on the Island – formerly possibly on Okiwi spit^{xviii}. The largest number recorded at once was 12 on Kaitoke beach in 2006.

- **North Island Kaka** (*Nestor meridionalis septentrionalis*)

The kaka (is a 'Nationally Endangered' endemic parrot, related to the kea of the South Island mountains. When Europeans first came to New Zealand kaka were very abundant, but by 1900 they had declined to localised flocks mostly in remote forested areas and on the larger off-shore islands. Numbers have continued to decline since then and the remaining populations have become more isolated^{xix}. The decline is largely due to predation by stoats and rats. Great Barrier Island is one of the few places where one of their main predators is absent. Kaka are noisily conspicuous, and strong fliers, so it is easy to get the impression that there are more about than there really are^{xx}.

'Island-wide' kaka counts were made on 26/12/07 (summer) and 07/09/08 (winter). The second count was synchronised with counts on the mainland organised by Suzi Philips. The Great Barrier Island results are summarised in Table 13.4.

Table 13.4 Community Kaka counts on Great Barrier Island. For details see Great Barrier Island Environmental News (2008). 13: 7-8; 16: 5-6.

Date	Number of different observers	Maximum number counted ⁽¹⁾	Minimum number based on locations ⁽²⁾	Maximum flock count number ⁽³⁾
Totals 26/12/07	45	222	141	221
Totals 07/09/08	40	136	61	117
Difference	-5	-86	-80	-104
% difference		-39%	-57%	-47%

(1) Assumes all counts by different observers, both morning and evening, were different birds.

(2) Assumes that all birds in any one location were all the same birds, so the maximum actual count by any one observer is taken as the minimum for the location.

(3) Uses the maximum flock count over the last few weeks reported for the location.

The winter counts show a dramatic reduction on those obtained in summer. The decline averages 48% over all three methods of ‘estimating numbers’. This change implies either that kaka numbers have declined dramatically since the summer, or else that kaka are less conspicuous at this time of year. This could arise because they are ‘in the bush’, or because they are quieter or less active. It is more likely that a proportion of the kaka population is “off island” during the winter and return in spring (September): Suzi Philips reports that numbers on the mainland build up after May and decline after September. Birds have been reported flying between Great Barrier Island and Little Barrier Island (Hauturu), and between Great Barrier Island and Coromandel, so a winter exodus, when food is scarce, is quite possible. It is interesting to note that the Great Barrier Island winter count gave a range of from 61 to 136 birds present, while counts on the same day (over a much larger area) on the mainland returned only 77 observations (145 over the previous weeks). This emphasises the regional (and national) importance of the Great Barrier Island population. Movement between the breeding population on Great Barrier Island and the winter population on the Auckland Isthmus is clearly an important topic for future research and cooperation between mainland and Great Barrier Island -based bird counters^{xxi}.

- **North Island Weka** (*Gallirallus australis greyi*)

Evidence from middens shows that eight endemic species of rail, including a very large weka, have become extinct in New Zealand between the arrival of Maori and European settlement. The surviving weka comprises four subspecies, all of them now at risk.

Thirteen North Island weka were released on Rakitu Island in 1951. Numbers reported since then vary from 20 – 40 in 1957 to c. 100 by 1960 (Bell & Braithwaite 1964). Bellingham et al. (1982)^{xxii} estimated sixty calling birds. Department of Conservation staff (Halema Jamieson) report that they are still present on Rakitu (Arid Island) and they are also recorded as present in the Atlas of New Zealand Birds (1999 – 2004).

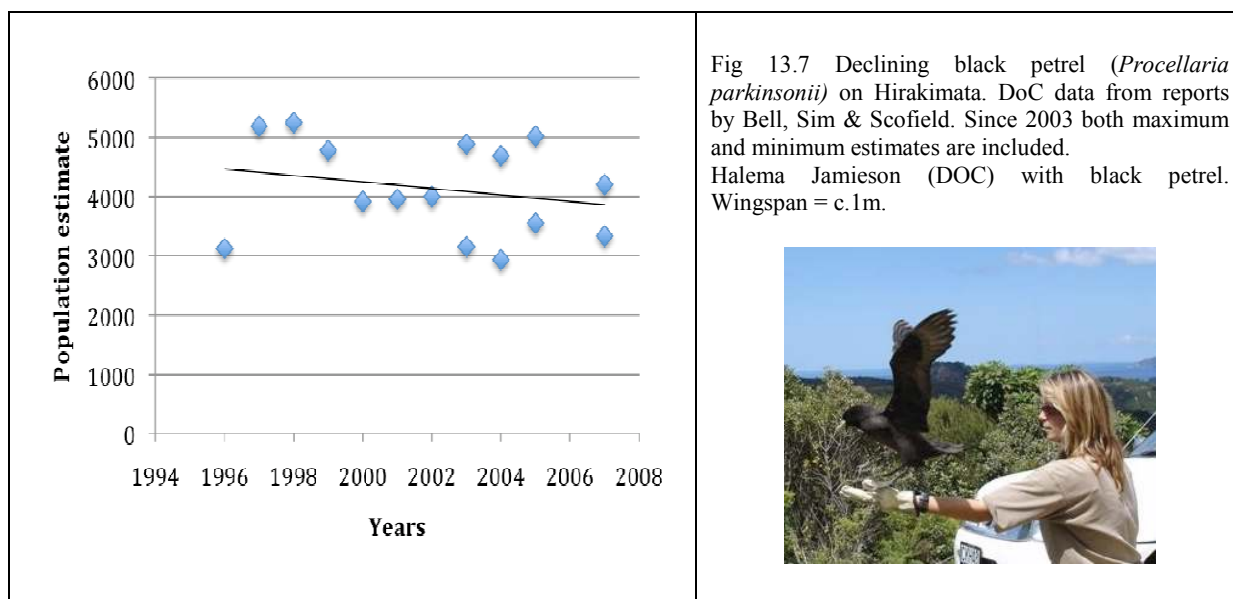


Fig 13.6 Weka (*Gallirallus australis greyi*) with young.

- **Black petrel** (*Procellaria parkinsoni*)

At least three species of petrel: black, grey faced, and Cook’s , occur on Great Barrier Island. Black petrels breed in deep burrows on the summit of Hirakimata and elsewhere on Great Barrier Island. Their numbers have been estimated by the Department of Conservation most

years since 1996. The results, summarised from the annual reports in Fig 13.7, are a cause for some concern; numbers are stable or declining.



The low slope of the decline in Fig 13.7 is strongly influenced by the 1996 data point, which is acknowledged to be unreliable. If that point is disregarded and the slope recalculated, it gets steeper, implying a more significant decline, with an average loss of 122 birds per year. ($y = -122x + 248858$; $R^2 = .248858$; $n = 14$; $p .10 > .05$.)

- **Cook's petrel** (*Pterodroma cookii*)

A few Cook's petrels nest on Great Barrier Island, although the number is not known. Bartle recorded "up to fifty at one time" circling the summit of Hirakimata at night in 1967, but numbers probably declined after that. Adults succumb to cats while on the ground, while chicks and eggs are eaten by rats. The main (world) nesting location for Cook's petrels is Hauturu. Elimination of rats from that island in 2004 appears to have greatly increased breeding success by this species, and they have been recorded significantly more frequently as beach-wrecks and cat-kills on Great Barrier Island since then^{xxiii} There may be scattered nesting pairs at mid to low altitudes throughout the Island.

- **North Island Robin** (*Petroica australis longipes*)

This is one of three subspecies found in New Zealand. It is related to the New Zealand tomtit and to other robins in Australasia. It is one of a 'guild'^{xxiv} of endemic species feeding on invertebrates in the forest litter, most of which are now extinct (the New Zealand wrens).

The North Island robin is regarded as 'not threatened' nationally^{xxv}, but it became extinct on Great Barrier Island between Hutton's visit (1868) and the reintroduction at Windy Hill in 2004. The Island populations, at Windy Hill, Glenfern Sanctuary (Fig 13.8) and possibly (a pair) on Hirakimata are all at serious risk from predation by rats.



Fig 13.8 North Island robin feeding chicks in hollow tree. Glenfern Sanctuary 2007.

Photo: Glenfern Sanctuary

Table 13.3 shows the breeding data for robins at Windy Hill. Twenty-four birds were translocated to the rat-controlled area at Windy Hill from Tiritiri Matangi in 2004 and a booster population of 25 birds from Mokoia Island were added in March 2009. These latter have still to ‘make their mark’ on the breeding success, which dropped in 2008-09, probably due to exceptionally bad weather prior to the nesting period.

Table 13.3 Breeding Success Of Robins At Windy Hill 2005 – 2009^{xvii}

Year	08-09	07-08	06-07	05-06	04-05
Pairs⁽¹⁾	2 + 2 F	2+3F	4	5	5
Nest attempts	6	14	16	20	9
Eggs	16	36	41	44	25
Hatched eggs	13	17	23	21	19
Fledged chicks	9	15	23	16	13
Banded fledglings	5	12	23	18 (2 drowned)	12

Notes: ⁽¹⁾ Minimum breeding pairs, plus ‘spare’ females.

Juvenile recruitment is not recorded in Table 13.3; seven juveniles have stayed in the area to breed since 2004 and at least three birds, 2 with bands from Windy Hill, are sighted regularly on Mt Hirakimata. At least 70 birds have been successfully fledged at Windy Hill since 2005. Twenty three fledged in the 1009-2010 season.

The statistics of robin survivorship from Glenfern Sanctuary are not so encouraging. The 27 birds released in 2005 were reduced to 5 breeding pairs by the 2005/06 breeding season. All five nest sites were located in the rat controlled area in Kotuku Scenic Reserve and on the Orama side of the peninsula. Fledging success was high the first breeding season with 22 juveniles successfully fledged. The following season 11 successfully fledged. A severe storm in July 2007 was disastrous for the six pairs of birds. The breeding season started with only 4 pairs. Of these 3 females were lost, 2 to rats and one to an unknown cause. Chicks died from rat predation and exposure, and the last two were taken by a morepork. The surviving 4

males and one female were boosted by a new release of 25 birds from Mokoia Island in March 2009. Hopefully some of these will nest within the area now enclosed by a predator proof fence.

Other significant or uncommon Great Barrier birds

Other Great Barrier Island species warrant comment because they are at risk to some extent on the island (if not nationally) or because they shed light on the changing environment.

Grey faced petrels (Fig 13.9) were formerly very abundant on Rakitu Island (Arid Island), headlands and off-shore islands around Great Barrier Island. Their chicks were an important food for Maori. However, Hutton reported local Maori said that they had “become scarce, having been killed off by rats” prior to his visit in 1868. Bellingham et al. (1982) found recently occupied burrows on Rakitu in 1981, and is likely that a small colony survives there. A few small colonies remain on the mainland (at Awana and Mohunga) and probably on Pitokuku, Islands off Palmer’s point, islands north of Waikaro point, and Saddle Island^{xxvii} Halema Jamieson (DOC) recorded grey faced petrels breeding on Nelson Island in 2008



Fig 13.9 Grey faced petrel chick, Mohunga peninsula.

Below, maximum number of possibly active grey-faced petrel burrows at Awana 1998 – 2006.

Data: J. Ogden.

Sep-98	24
Sep-05	37
Sep-06	47

Photo by Joanne O'Reilly.

Storm and diving petrels nest in the vicinity of Great Barrier Island, probably in the broken Islands and elsewhere. Diving petrels (*Pelicanoides urinatrix*) were recorded nesting on ‘Close Island’ – a stack off Rakitu (Arid Island) – in 1981^{xxviii}. The common diving petrel is one of the most frequently beach-wrecked sea-birds. At least three species of storm petrel (white faced, grey backed and New Zealand) have been recorded close to Great Barrier Island. The New Zealand storm petrel (generally referred to *Oceanites maorianus*) was presumed extinct until photographed off Whitianga in 2003 and captured by Department of Conservation staff between Hauturu, Great Barrier Island and the Hen & Chicken Islands in 2007. Halema Jamieson at Department of Conservation, Port FitzRoy is involved in publishing what little is known about this bird – even the correct Latin name is disputed!

Little blue penguins are in decline nationally, but still abundant around Great Barrier Island. They are by far the most frequently found dead bird on beaches, with dramatic ‘wrecks’ in some years (eg. 114 dead penguins recorded on eastern beaches in 2008). Whether this peak is the beginning of a trend, or simply part of the natural variability of the population, only time, and monitoring, will tell.

New Zealand is a centre of diversity for shags, with twelve different species. Five have been recorded on Great Barrier Island, three of which (black, little black, and little shag) have restricted national distributions (Fig 13.10). Shags mostly nest colonially in coastal trees (pohutukawa), so that nests are easily located and counted. However, no comprehensive numerical data is available for the Island. The pied shag (*Phalacrocorax varius*) is considered 'Nationally Vulnerable'. There are several small nesting colonies around the Coast of Great Barrier Island.

Variable oystercatchers (*Haematopus unicolor*) are present on all Great Barrier Island beaches and are sometimes seen on rocky shores and paddocks. They can be totally black, or have variable white bellies. Great Barrier Island is a national stronghold for the species. Although numbers seem to be stable, breeding success is generally low, and the



Fig 13.10 Great Barrier Island shags.

Top left to right. Little shag (*Phalacrocorax melanoleucos*), little black shag (*P. sulcirostris*) and (big) black shag (*P. carbo*). On rock in Kaitoke creek (June 2009).

Photo: John Ogden

long-term future for this predominantly beach-nesting bird is open to doubt. Many of the pairs on the eastern beaches apparently go to Whangapoua for the autumn/winter, where there are generally 60 – 80 birds in March/April. Taking into account numbers elsewhere – eg c. 30 in the Kaitoke area - it seems likely that the total island population is c. 200 birds, but a proper census is required. One or two genuine pied oystercatchers (*H. finschi*) join the flocks each winter. This species is regarded 'Declining' by Miskelly et al. (2008)^{xxix}.

As noted earlier, at least eight New Zealand endemic forest birds have become extinct on Great Barrier Island since Hutton's visit in 1886. Of those remaining, many are in much reduced numbers and some are on the brink of extinction. The tom tit (*Petroica macrocephala toitoi*) is related to the North Island robin (*P. longipes*) and the famous Chatham Island black robin (*P. traversi*). Although not threatened nationally, the status of this bird on Great Barrier Island is precarious. It was recorded by Hutton 1868 and Bull et al. in 1978^{xxx}, but only a few pairs now remain in the Hirakimata and Kaiaraara area. It has gone from Rakitu (Arid Island) since 1868. The same can be said for the red crowned parakeet (*Cyanoramphus novaezelandiae*), with a sparse population of maybe 10 pairs in the Hirakimata – Te Paparahi area. Recent breeding, though only partially successful, occurred in an area where rat control has been taking place.

Bellbirds (*Anthornis melanura*) were recorded by Hutton in 1868 and on Rakitu (Arid Island) by Bell & Braithwaite in 1964. Since then, apart from a few stragglers from Tiritiri Matangi

or Little Barrier Island (Hauturu) most years, they have become extinct on the Island. Following rat eradication on Hauturu 2004, there was major influx with records from Port FitzRoy, Whangaparapara, Okiwi, Awana, Harataonga, Tryphena, Windy Hill and other places, in March and April 2005. Some survived into the 2005 – 06 summer at Awana and in the Okiwi area. In September 2005 a pair were observed feeding young on Cooper's Castle. This is the only recorded occurrence of nesting on Great Barrier Island. There have been a few records each year since then, but there is no established breeding population.

The larger forest birds, except kokako, have fared slightly better in the face of competition from rats. Tuis are abundant, and kaka are present in fair numbers (see earlier). Kereru are probably less numerous than kaka, < 200 birds for the whole Island possibly. Kereru are closely tied to native forest remnants containing puriri, kohekohe, and other native fruiting trees, although they also visit gardens for guavas, loquats etc. Where suitable trees are present a pair or two of kereru are usually to be found. A flock of 12 was seen at Medlands in 2009 (J.Ogden. personal observation). This species must have declined dramatically as a result of the loss of lowland and mid-altitude forest throughout the Island. As with kaka, movement between island and mainland populations may occur.

The North Island fernbird (*Bowdleria punctata*) has a sparse and declining national distribution. Although very secretive it is commonly heard on Kaitoke swamp (Anderson & Ogden, 2003), in the Whangapoua basin, and occasionally elsewhere on the Island. Spotless crakes (*Porzana tabuensis*) also occur at Kaitoke, Awana and probably Whangapoua swamps. Marsh crake (*Porzana pusilla*) has not (yet!) been recorded on Great Barrier Island.

Common birds on Great Barrier Island

The bird species, which are now most frequent on the Island, are presumably those for which the current environment is most suitable, and/or those species able to withstand the high levels of predation. Some assessment of the relative abundances of different species in different habitat types can be obtained from "5-minute bird count" data collected by the Great Barrier Island Trust from 2006 – 2008 (continuing), at Windy Hill by the Windy Hill Rosalie Bay Trust from 2000 to 2008 (continuing) and at Glenfern Sanctuary from 2002 to 2006. These unpublished data sources are listed (Table 13.4)^{xxx1}.

Table 13.4 Bird count data sources – Great Barrier Island. **Yellow:** Little Windy Hill. **Green:** Glenfern Sanctuary; **Uncoloured:** Island-wide (GBICT).

Date	Author(s)	Title	Report to
2000	Smit, A M. & Ferreira, S M.	Little Windy Hill Monitoring Programme: Bird communities – September 2000.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-01.
2000	Smit, A M. & Ferreira, S M.	Little Windy Hill Monitoring Programme: Bird communities – December 2000	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-02.
2001	Smit, A M. & Ferreira, S M.	Little Windy Hill Monitoring Program: Pest management; Bird communities; Sealing composition.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-03.
2001	Smit, A M. & Ferreira, S M.	Little Windy Hill Monitoring Program: Annual Report 2000/2001..	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-04.
2001	Smit, A M. & Ferreira, S M.	Little Windy Hill Monitoring Program: Bird Communities – December 2001.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-05.
2002	Smit, A M. & Ferreira, S M.	Special Report: Review of Rodent Control – April 2001.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-06.
2002	Smit, A M. & Ferreira, S M.	Little Windy Hill Monitoring Program: Bird Communities – June 2002.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-07.
2002	Smit, A M. & Ferreira, S M.	Cat control at Little Windy Hill.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-08.
2003	Smit, A M. & Ferreira, S M.	Little Windy Hill Monitoring Program: Bird Communities – Dec 2002.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-10.
2003	Smit, A M. & Ferreira, S M.	A Review of the consequences of three years of integrated pest management for forest bird communities at Windy Hill.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-11.
2004	Smit, A M. & Ferreira, S M.	Little Windy Hill Monitoring Programme. Bird Counts December 2003.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-13.
2004	Smit, A M. & Ferreira, S M.	Benthorn farm Monitoring Program: Bird counts – July 2004..	Report to Benthorn Farm, Rolaie Bay Rd., Report ECO006-12.
2004	Smit, A M. & Ferreira, S M.	Windy Hill Rosalie Bay Catchment. Bird counts December 2004.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-12 – 1. .
2005	Smit, A M. & Ferreira, S M.	Little Windy Hill Monitoring Program: Bird counts – June 2005.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-12-2..
2006	Smit, A M. & Ferreira, S M.	Windy Hill Rosalie Bay Catchment. Bird counts December 2005.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-12 – 3 .
2006	Ogden, J.	Biodiversity Advice Fund Report 1.	Report to Department of Conservation. Grant reference ADV207.
2006	Ogden, J.	Biodiversity Advice Fund Report 2.	Report to Department of Conservation. Grant reference ADV207.
2007	Ferreira, S M.	Windy Hill Rosalie Bay Catchment. Bird counts December 2006.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-12 – 5 .
2007	Ferreira, S M.	Windy Hill Rosalie Bay Catchment. Bird counts June 2007.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-12 – 6 .
2007	Ogden, J.	Biodiversity Advice Fund Report 3.	Report to Department of Conservation. Grant reference ADV207.
2007	Ogden, J.	Biodiversity Advice Fund Report 4.	Report to Department of Conservation. Grant reference ADV207.
2008	Ferreira, S M.	Windy Hill Rosalie Bay Catchment. Bird counts June 2008.	Report to Little Windy Hill Co. Ltd. EcoRAP Report ECO006-12 – 8 .
2008	Ogden, J.	Final Report on Birds of Great Barrier Island 2006- 2008.	Biodiversity Advice Fund Report. DoC. Grant Reference: ADV207
2008	Ogden, J.	Bird Counts December 2008	Windy Hill Rosalie Bay Catchment Trust. Judy Gilbert.
2008	Ogden, J.	Analysis of 5-minute bird counts from Glenfern Sanctuary, Great Barrier Island: 2002 – 2006 (Pre-fence)	Glenfern Sanctuary. Tony Bouzaid.

Although the majority of reports are based on data from Windy Hill, because these relate only to a restricted range of vegetation types, and because they were designed primarily to assess the effects of the rat control program, they do not necessarily give a good indication of the overall Great Barrier Island pattern. This is better described by the counts made on four occasions between 2006 and 2008 by the Great Barrier Island Charitable Trust (GBICT; Biodiversity Advice Fund; ADV 207). However, counts made at Windy Hill and Glenfern and earlier observations (e.g. Bellingham et al. 1982 on Rakitu (Arid Island)^{xxxii} provide useful additional data and comparisons. The total data available should be collated and analysed.

The Windy Hill data, and some work by Deline Samaka^{xxxiii} at Windy Hill and Glenfern Sanctuary, provide the only direct Great Barrier Island evidence for the effects of rats and feral cats on the birds, lizards, invertebrates and vegetation. There is however clear evidence from other places.^{xxxiv}

Great Barrier Island Charitable Trust (GBICT) Surveys

These surveys employed “5-minute bird counts”, carried out at sets of 5 points in different ‘vegetation types’ by different groups of observers. (Appendix 3) The methodology presents some problems in interpretation, as it is strongly influenced by the ‘conspicuousness’ of different species. Although the results cannot be easily compared between species, they can be used to provide an indication of species composition, and, with care, comparisons between different times. The results indicate that the bird communities can be considered under three groupings (Table 13.5).

Table 13.5 Number Of Bird Species Recorded In Four Sets Of 5-Minute Bird Counts, 2006 – 2008, In Different Vegetation Types^{xxxv}.

Group	‘Vegetation’ type	Total species recorded (richness)	Introduced species recorded	Percentage introduced species
1	Montane bush	12	3	25
	Manuka/Kanuka	19	6	32
2	Lowland bush	31	13	42
	Coastal/urban	42	13	31
3	Coastal paddocks	44	15	34

Group 1 - montane bush and areas of manuka and kanuka, are generally very sparsely populated, especially in winter. The commonest native species are the insectivorous grey warbler, silvereye and fantail. On this basis these communities can be called ‘The small bird bush’. The larger tui and kaka also occur in spring and summer, but these birds are highly mobile, coming and going seasonally and even daily. Introduced birds are chaffinch, greenfinch and blackbird, with dunnock recorded occasionally at lower altitudes. (The other species recorded in these areas were mainly just flying over, or heard at a distance).

Group 2 - sites include some lowland bush remnants at Okiwi and Tryphena, and ‘urban’ coastal sites from Schooner Bay to Shoal Bay, Tryphena. The total bird diversity is greater here, with more than twice as many introduced species. However, in these lowland sites the predominant species are kingfisher, tui and kaka, especially in the warmer months. This lowland bush can thus be called “The big bird bush”. The small insectivores also occur here, probably in similar abundance to elsewhere, but they are not so prominent. Introduced birds also include larger species in the prominent category: myna and magpie. The smaller introduced species include the insectivorous welcome swallow. Finches, sparrows, blackbirds and song-thrushes also occur, especially in winter and spring.

Group 3 - counts were made along the roads traversing the open coastal paddocks (Medlands, Kaitoke, Awana and Okiwi/Mabey Rd.). These paddocks may be flooded in winter, when coastal and wetland birds, gulls, waders, ducks, herons etc., are frequently present. The overall species richness is greatest here, though this may be partly due to the large field of vision possible. The most conspicuous birds are pukeko, spur-winged plover and kingfisher, though the latter is sparse in the winter. The most frequent introduced birds are also those of open land; swallow, skylark and magpie. Paradise shell duck and harrier are evident, especially in spring.

The three Groups form a sequence of increasing species richness, from low diversity montane bush and kanuka stands (richness 10 – 20), through higher diversity lowland bush (richness 30 – 40), to maximum diversity in the coastal paddocks (> 40 species). The species characterising these communities also shift, with small insectivores such as grey warbler characterising the kanuka, to the larger tui and kingfisher in the lowland forest remnants and urban areas. The paddocks are characterised by big ground-nesting birds such as pukeko, rather than forest species. Kaka and kingfisher, being big noisy and mobile, were heard or seen in all locations in summer, so they, and other mobile birds, tend to ‘link’ these otherwise fairly distinct assemblages.

Table 13.6 lists the ten most conspicuous bird species (over the year) in three different communities, drawing attention to prevalence of endemic species in the bush, and non-endemic native and introduced species in the cleared areas.

TABLE 13.6 Ten Most Conspicuous Birds In Three Vegetation Types. The species are ranked from that most commonly recorded, at top, downwards. Unshaded cells are introduced birds, yellow are native (i.e. also occurring outside New Zealand), green are endemic (i.e. only in New Zealand). Montane bush includes stands of manuka and kanuka at mid-altitudes.

Coastal paddocks	Lowland bush	Montane bush
pukeko	tui	grey warbler
SW plover	kingfisher	kaka
kingfisher	kaka	tui
swallow	grey warbler	silvereye
skylark	fantail	fantail
magpie	silvereye	kingfisher
P shellduck	myna	kereru
harrier	magpie	chaffinch
house sparrow	kereru	harrier
tui	banded rail	blackbird

The characteristic species of different vegetation types reflect food availability. Grey warblers and silvereyes tend to glean small insects and spiders from leaves and twigs (silvereyes also eat small fruit) . Fantails catch insects in the air. In winter these three species seem to work together in small flocks. They can all occur wherever there are trees or shrubs, but are

probably the only species able to make a permanent living in the low diversity kanuka dominated forests, which cover 54% of the Island.

At the other forest extreme, in high diversity lowland forests dominated by puriri, kohekohe, tawa, and nikau palms, a much greater suite of bird species can be supported. The characteristic species of these forests are large fruit, nectar and leaf eaters, such as kaka, tui and kereru. Kingfisher, predating lizards and large insects, are also prominent. However, it appears that insufficient habitat of this type remains to support high bird populations right through the year; kaka predate orchards in autumn and many move off-shore in winter; tui seek exotic nectar in urban gardens; kingfisher move to the coast or off the island; kereru hang on only in small numbers.

The species characterising the eastern paddocks are field birds, which have colonised Great Barrier since forest clearance and swamp drainage, taking advantage of the new habitat. Pukeko, spur-winged plover and magpie are omnivorous, but tend to seek their food in the soil surface layers.

Counts at Glenfern Sanctuary

Between 2002 and 2006, five-minute bird counts were made repeated each morning for a week, at ten sites in the Glenfern Sanctuary (Unpublished reports by Phil Thomson^{xxxvi}). The list below ranks the top most conspicuous species over all counts in decreasing order:

kaka
kingfisher
grey warbler
tui
silvereye
chaffinch
fantail
blackbird
myna
yellowhammer

All of these species, except yellowhammer, were also ranked in the top ten in lowland and/or montane bush counts made by the Great Barrier Island Charitable Trust (Table 13.6). Over the five years at Glenfern there appeared to be increases in grey warblers, tui and silvereyes, and a decrease in yellowhammers.

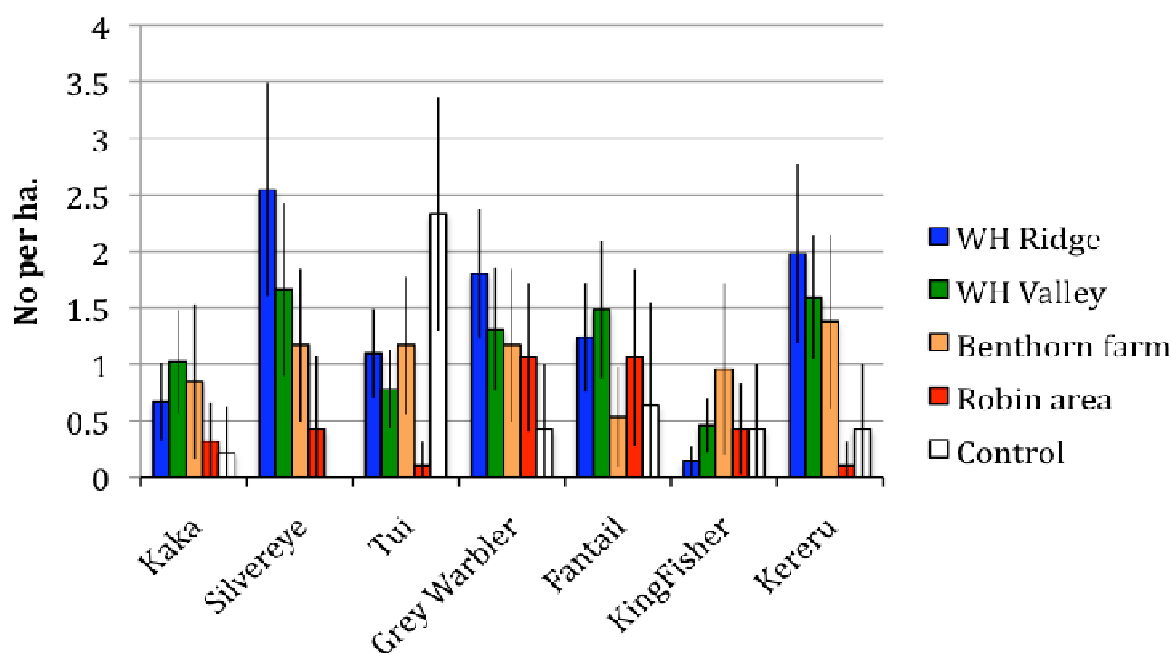
The Glenfern data also demonstrate the relatively low bird species richness in the native forest compared to more varied areas of paddocks and the coastal strip: over five years a total of 17 species were recorded in the bush, compared to 29 in nearby pastures. Kereru was the only species with its highest frequency in bush, although it was not so frequent there as the leading five species in the list above. Chaffinches and blackbirds seem to have penetrated the native forest vegetation more than other introduced birds.

Counts at Windy Hill.

Comprehensive reports on counts at Windy Hill are available (13.4). The method of counting is similar to that employed by the GBICT, and the counts are also influenced by species conspicuousness. Since 2000, seasonal counts have been made on replicated transect lines on ridges and in gullies at Windy Hill, on Benthorn Farm, and in the area where the translocated robins nested (kanuka forest). All these areas have had quite intensive rodent control. Since

2005 a 'control' area, without rodent control, has also been monitored. Because bird-point distances were estimated, it is possible to estimate density per hectare, although some influence of 'conspicuousness' remains (Fig13.11).

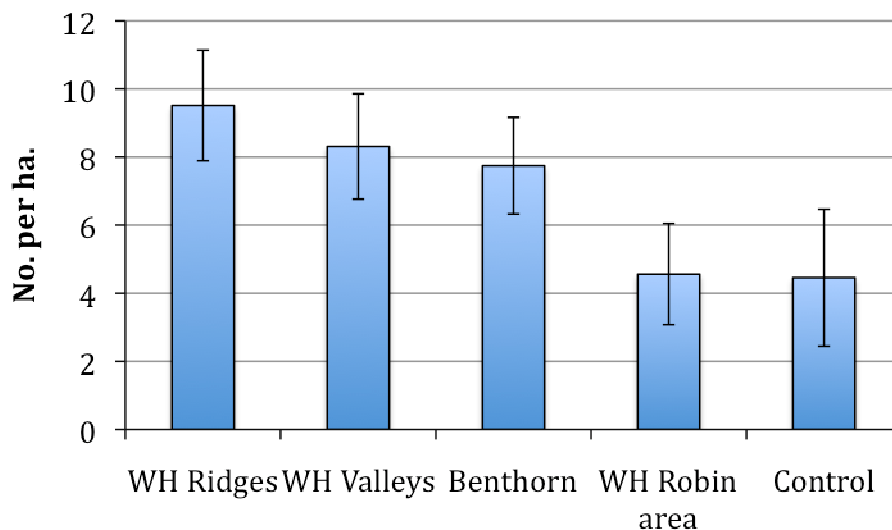
Fig. 13.11 Estimated density (with 95% confidence limits shown as a line) in 5 sample areas at Windy Hill. Data from December 2008 only.



The seven species in Fig13.11 were almost the only bird species seen in 2008, indicating again the relatively low species diversity in heavily bushed areas. Shining cuckoos in summer, moreporks at night, robins in the nesting territories, and the occasional blackbird are almost the only other birds in evidence. The absence of introduced passerines, which have declined since 2000 as manuka and kanuka have reclaimed open areas and the bush cover has thickened, is notable. The relative abundance of kereru here, where there is more cover of native fruit bearing trees and nikau palms than at Glenfern, is particularly significant. The high density of tui in the control area probably relates to a high incidence of flowering puriri in the area at the time the counts were made (December).

The Windy Hill results also allow comparisons between vegetation types, in more detail than previously (Fig13.12). While the ridges, valleys and Benthorn Farm may not differ statistically, the manuka/kanuka stand in the robin area, and the rat and feral cat infested control stand (mostly on a ridge), are significantly less diverse than the Windy Hill transects. .

Fig 13.12 Total bird species numbers per hectare in different vegetation types at Windy Hill, December 2008. Vertical lines are 95% confidence limits.



Coastal birds

Coastal species were included in some of the Great Barrier Island Charitable Trust five-minute bird counts. Some of the more important resident species (New Zealand dotterel, variable oystercatcher, reef heron, caspian tern, penguins, shags and petrels) have already been discussed. Other than these, gatherings of white fronted terns, red-billed gulls and gannets are frequent, either fishing off-shore or roosting on coastal stacks. Exact numbers are not known but flocks of over 200 white fronted terns can sometimes be seen, and there are smaller flocks of red-billed gulls. The gannet colony at Mahuki peninsula may have 2500 pairs (Fig 13). There is probably another colony on Rakitu (Arid Island). Nesting colonies of coastal shags have never been surveyed, and the locations of nesting sites around Great Barrier Island for various shearwaters and petrels are also poorly documented. Migratory shore birds are discussed below.

Key bird locations on Great Barrier Island

Whangapoua estuary and Okiwi spit must be ranked the most significant bird location overall. Whangapoua contains the largest surviving population of brown teal, banded rail and (possibly) a pair of bitterns. Spotless crane are probably still present, and fernbirds definitely. The spit is an important nesting site for New Zealand dotterel and variable Oystercatcher, which also gather here in late summer through to midwinter. Autumn pre-migration gatherings of bar-tailed godwits (< 80) and Pacific golden plover (< 20) also occur. South-north New Zealand migrants include a few wrybills (< 10) and banded dotterels (< 80). Occasional knots, turnstones, sharp-tailed sandpiper, whimbrel and sand dotterel have also been recorded. The environment of the estuary, in particular the extent of various swamp vegetation types and mangroves, has changed considerably since European arrival on Great Barrier Island^{xxxvii}, and there is some indication that this is associated with a decline in waders^{xxxviii}.

Fig 13.13. Gannet colony at Mahuki, south of Fitzroy Harbour on Great Barrier Island. Hauturu in distance.



Photo: Halema Jamieson.

Kaitoke wetland, the estuary of the Kaitoke creek, and the long Kaitoke beach are also important bird locations. Kaitoke swamp has a relatively large population of fern birds^{xxxix} (Anderson & Ogden 1999) and a few spotless crakes. Until very recently the lower swamp had nesting bitterns. The creek estuary is a significant brown teal flock site, and one of the easiest places to see all four species of shag. Kaitoke beach is the second most important nesting location for New Zealand dotterels and variable oystercatchers, and also usually has a nesting pair of banded dotterels. Gatherings of gulls and terns also occur here, occasionally attracting the attention of migratory arctic skuas.

Both Whangapoua estuary and Kaitoke wetland are classified as “Acutely Threatened” vegetation types (Landcare Research Classification) because less than 10% of these types of vegetation remain nationally.

The central forested area of Hirakimata, from Okiwi to the Kaiaraara valley, is the prime location for forest birds, and the main nesting colony of black petrels and probably a few Cook’s petrels. Probably the last nesting pairs of tom tits and parakeets (kakariki) are in this area. It is also the area where a few robins have been recorded, and where bell-birds recently nested. The small reserve of lowland hardwood forest species at Okiwi often has kakariki, kaka and kereru.

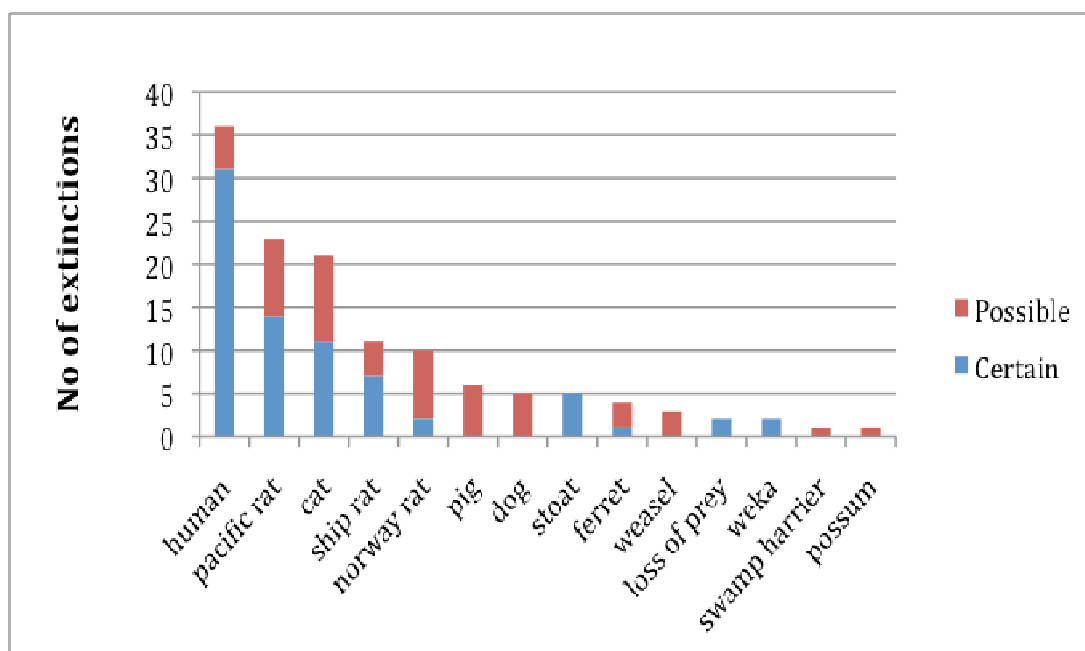
Insufficient recent data are available to assess the Te Paparahi area, but as the last kokako occurred in this area it seems likely to be significant. However, the vegetation has been severely impacted by goats in the past, and still carries wild cattle and a high population of pigs. Feral cattle are the subject of a current Department of Conservation eradication in the

area with eighteen animals culled between 2008 and 2009. It is estimated that only a small number remains.

Causes of the loss of forest birds on Great Barrier Island

Surveys of the most likely causes for the extinction of land birds, and ground nesting sea birds, in New Zealand have invariably recognised predation by exotic mammals as a primary cause (Fig 13.14). Maori hunting of the larger ground birds, eleven species of moa in particular, but also giant weka, geese, swans and adze-bills, probably accounted for 35 species. Three species of rats probably accounted for a further 44, and cats for about 20. There is no evidence for extinction by direct hunting on Great Barrier Island, although the presence of moa bones (at Awana) and gizzard stones on the eastern dunes, suggests their former presence.

Fig 13.14. Primary causes for the extinctions of New Zealand birds (redrawn from Tennyson & Martinson, 2006, Fig. 3)^{xl}. 'Possible' implies a possible cause of extinction, 'certain' indicates a certain contribution to extinction.



However, the key feature of Fig 14 is that the top four causes of extinction are all currently present on Great Barrier Island, rats and feral cats in abundance. Kiore (Pacific rat – *Rattus exulans*) have probably been present for 700 years, while ship rats arrived here soon after Europeans reached New Zealand. Hutton's (1868) report indicates they were present on Rakitu in the 1860's.

Fortunately mustelids (stoats, weasels and ferrets) have not established on Great Barrier Island. Possums too are absent.

Overall, the five minute bird count data from various locations indicates a relatively low bird species abundance and diversity in native forest at present, especially so in the dense stands of manuka and kanuka which cover 54% of the Island. Fecund native insectivores with short life cycles, such as grey warblers, fantails and silvereyes are able to survive by utilising the kanuka. The larger, longer lived, native forest frugivores – kaka, tui and kereru, are able to move across the landscape in search of new resources, and have survived the combined effects of habitat loss and nest predation by rats. 'Intermediate' native forest birds with lower fecundity or mobility (whitehead and brown creeper, stitchbird, saddleback and kokako)

probably had their populations decimated by habitat loss during the kauri logging era, but finally succumbed to rats and/or cats.

The role of the newly arrived introduced birds in the loss or reduction of native species deserves more study. In general, introduced birds predominate in the new man-made habitats, and seem not to compete much with native forest species. However, blackbirds, song-thrushes, and dunnocks all penetrate into native scrub and forest, and may reduce food resources for species such as robins. Chaffinches, yellowhammers, greenfinches seem to have little niche overlap with endemic birds. A few interactions, such as that between mallard and grey duck, are obvious.

Summary - Birds

One hundred and eleven bird species have been recorded on Great Barrier. Island, of which 82 are regularly present. This is c. a quarter of the total bird species in New Zealand.

Losses and declines

- Twelve bird species have been lost from the Island since Hutton's visit in 1868.
- The losses have been predominantly in endemic forest birds (eg. saddleback, stitchbird, whitehead and kokako). Most surviving species in this category have suffered numerical decline (eg kereru) and several are critically at risk on the Island (e.g. Tomtit, kakariki).
- Only one shore bird (shore plover) has gone extinct on GBI since 1868, but several seabirds and coastal species appear to be declining (eg. New Zealand dotterel, black petrels) while others have small populations (Caspian tern, reef heron).
- Wetland species, such as bittern, spotless crane and fern bird are also represented by critically small populations, or are highly vulnerable to predation and habitat change through drainage or the spread of exotic weeds in wetlands.
- Ten species are listed in the New Zealand Threat Category (Hitchmough 2007) as category 2 – 4 (Nationally endangered – serious decline). Information on the status of each of these species on Great Barrier. Island is presented.
- A further 14 species, classified as rare or of restricted distribution nationally, are briefly discussed. Some of these species have strong-holds on Great Barrier Island.
- The populations of brown teal, New Zealand dotterel and black petrel all have negative trend lines since counts were started. There is an indication of stabilisation in brown teal, but not in dotterel or black petrels. The population of the latter on Hirakimata appears to be declining by c. 122 birds/year at present.

Gains

- Twenty five species of introduced birds occur on Great Barrier. Some of these are quite recent arrivals and are probably still expanding their populations. They are predominantly (17/25) species of open paddocks or habitations, and with a few exceptions, they appear to have little interaction with native and endemic (forest) species.
- Mallard appear to have almost eliminated grey duck on Great Barrier by interbreeding since the 1950s. They may also compete with brown teal, but niche overlap between these two species is probably small.
- The North Island robin was re-introduced to Great Barrier at Windy Hill and Glenfern Sanctuary in 2004. The history of these two populations is described. A booster population of robins from Mokoia Island was added in March 2009.

Common birds

- Common birds have been assessed using replicated 3- or 5-minute bird counts in different vegetation types. This work has been reported in > 20 unpublished reports by the Great Barrier Island Charitable Trust (2006 – 2008), Windy Hill Rosalie Bay Trust (2000-2008) and the Glenfern Sanctuary (2002 – 2006).
- The Great Barrier Island Charitable Trust study recognised three bird communities in intergrading habitats: (1) montane forest and kanuka scrub; (2) lowland forest and coastal urban areas with trees; (3) coastal paddocks.
- Montane forest and kanuka scrub are characterised by small insectivorous or frugivorous species such as grey warbler, silvereve and fantail.
- Lowland forest and garden areas around Tryphena are characterised by larger birds such as tui, kingfisher and kaka.
- Paddocks are characterised by larger ground nesting species such as pukeko and spur-winged plover, and contain the greatest proportion of introduced birds.
- Species diversity is lowest in the native forest, especially in kanuka and montane forest, and greatest in the paddocks.
- Bird counts from Windy Hill and Glenfern extend the Great Barrier Island Charitable Trust study temporally and spatially, but confirm the general pattern of low species diversity (of predominantly native species) in forest, and higher diversity (of predominantly introduced species) in open vegetation.
- Data from the control area (where rats are not trapped or poisoned) at Windy Hill supports the contention that rats are a key factor in low bird densities in Great Barrier Island forest.

Key areas

- Three key bird localities are recognised: Whangapoua harbour/Okiwi spit, Kaitoke swamp, estuary and beach, and the central forested area of Hirakimata from Okiwi to Kaiaarara. Te Paparahi appears less significant due to severe impact from ungulates.

Causes of losses and declines

- Three interacting factors appear responsible for species losses and declines on Great Barrier Island – habitat loss, predation by introduced mammalian predators, and competition with introduced birds.
- Except in a few cases (mallard/grey duck/brown teal) competition between endemic and introduced species is unlikely to be a factor, because they rarely occur in the same habitats.
- For the extinct species, habitat (forest) loss may have been the primary cause of decline, followed by high levels of nest predation by rats,
- Larger, longer-lived endemic and native species, such as kereru and kaka, were able to withstand habitat loss by mobility, and have persisted, albeit with reduced populations. Direct predation and competition with rats for forest food (nikau, puriri etc) is probably a factor in their failure to recover.
- Some of the smaller endemics, such as grey warbler, with a fairly generalised insectivorous diet, were able to utilise manuka and kanuka arising following fire and pasture abandonment, and are able to withstand rat predation by high fecundity. These species have also persisted.

- Thus small insectivorous endemics tend to predominate in vegetation types representing the beginning (manuka/kanuka) of the forest succession, while large frugivorous species characterise the end (broadleaf forest) of the sequence.

The primary mammalian predators causing bird extinctions in New Zealand have been kiore, feral cats and ship rats. These three primary predators are currently present on Great Barrier Island in abundance.

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- i Hutton, F. W. 1868. Notes on the birds of Great Barrier Island. *Transactions and Proceedings of the New Zealand Institute* 1: 104-106.
- ii Some of these figures have been corrected using additional data from those originally published in *GBI Environmental News* No.6 2006
- iii The last pair of kokako was taken from Great Barrier to Little Barrier by DOC in 1964.
- iv Anderson, S. H. & Ogden, J. 2003. The bird community of Kaitoke wetland, Great Barrier Island. *Notornis* 50: 201-209.
- v Bell, D. B. & Braithwaite, D. H. 1964. The birds of Great Barrier and Arid Islands. *Notornis* 10 (8): 363-383.
- vi Bellingham, P. J., Hay, J. R., Hitchmough, R. A. & McCallum, J. 1982. *Birds of Rakitu (Arid) Island*. *Tane* 28: 141-147.
- vii Reed, S. M. 1972. Report on Great Barrier Island, January 1972. *Notornis* 19: 274-276.
- viii Robertson, C. J. R., Hyvonen, P., Fraser, M. J. & Pickard, C. R. 2007. *Atlas of bird distribution in New Zealand 1999-2004*. Ornithological Society of New Zealand Inc. Pp. 533.
- ix Hitchmough, R. Bull, L. & Cromarty, P. (Compilers). 2007. *New Zealand threat classification system species lists 2005*. Science & Technical Publishing, Department of Conservation, Wellington, NZ. (ISBN 0-478-14128-9). /Miskelly, C. M., Dowding, J., Elliott, G. P., Hitchmough, R. A., Powlesland, R. G., Robertson, H. A., Sagar, P. M., Scofield, P. R. & Taylor, G. A. 2008. Conservation status of New Zealand Birds, 2008. *Notornis* 55: 117-135.
- x Ibid
- xi Ibid
- xii Ibid
- xiii see endnote 1.
- xiv Ogle, C. C. 1981. Great Barrier Island wildlife survey. *Tane* 27: 177-200. Also: Ogle, C. C. 1980. Wildlife and wildlife habitats of Great Barrier Island, June 1980. *Fauna Survey Unit Report No 24*. New Zealand Wildlife Service, Dept. of Internal Affairs. Wellington. Pp. 53.
- xv Ibid
- xvi see endnote 14
- xvii Ibid
- xviii See endnote 5
- xix See endnote 8
- xx Final GBICT Report to Dept. of Conservation Biodiversity Advice Fund ADV207, March 2009. Also *GBI Environmental News*, Issues 8 (2006), 13, 16 (2007) and 17 (2009).
- xxi See www.kakawatchnz.org. Email sightings to: kakawatchnz@gmail.com giving location, time of day, number of birds etc and information on tree species where they are perched or feeding if possible.
- xxii see endnotes 5 and 6
- xxiii Ogden, J. 2009. *GBICT Final Report to Department of Conservation Biodiversity Advice Fund ADV207*.
- xxiv A guild refers to a group of species with similarities in feeding ecology, jointly exploiting an ecological niche, such as the forest floor, or forest canopy.
- xxv Miskelly, C. M., Dowding, J., Elliott, G. P., Hitchmough, R. A., Powlesland, R. G., Robertson, H. A., Sagar, P. M., Scofield, P. R. & Taylor, G. A. 2008. Conservation status of New Zealand Birds, 2008. *Notornis* 55: 117-135.
- xxvi Data from Judy Gilbert.
- xxvii See endnotes 5 and 6
- xxviii See endnote 6
- xxix See endnote 25
- xxx Bull, P. C., Gaze, P. D. & Robertson, C. J. R. 1978. *Bird distribution in New Zealand. A Provisional Atlas 1969-1976*. Ornithological Society of New Zealand, Wellington. Pp.253.
- xxxi In addition to the listed reports the Department of Conservation (Port Fitzroy office) holds 5-minute bird count data from Rakitu (Arid Island) (T. Beauchamp, 1994) and Mohunga (P. Thompson, 2006; J. O'Reilly and H. Jamieson, 2008).
- xxxii See endnote 6.
- xxxiii Samaka, D. M. 2004. The benefits and costs of community-based conservation: a case study on Great Barrier Island, New Zealand. Unpublished MSc thesis. University of Auckland.
- xxxiv Best, L. W. 1969. Food of the roof rat (*Rattus rattus* L.) in two forest areas in New Zealand. *New Zealand Journal of Science* 12: 258-267. /Atkinson, I.A.E., 1985. The spread of commensal species of *Rattus* to oceanic islands and their effects on island avifaunas. In: Moors, P.J.(Ed.), *Conservation of Island Birds (International Council for Bird Preservation Technical Publication 3)*. pp. 35-81. /Towns, D.R., Daugherty, C.H., Cree, A., 2001. Raising the prospects for a forgotten fauna: a review of ten years of conservation effort for New Zealand reptiles. *Biological Conservation* 99, 3-16./Campbell, D. J. & Atkinson I. A. E. 2002. Depression of tree recruitment by the Pacific rat (*Rattus exulans* Peale) on New Zealand's northern off-shore islands. *Biological Conservation* 107: 19-35.
- xxxv Ogden, J. 2009. GBICT Final Report to Department of Conservation Biodiversity Advice Fund ADV207. (Fig 9.8).
- xxxvi Data analysed in: Ogden, J. 2008. Analysis of 5-minute bird counts from Glenfern Sanctuary, Great Barrier Island: 2002-2006 (Pre-fence). Unpublished report.
- xxxvii Ogden, J., Deng, Y., Horrocks, M., Nichol, S. & Anderson, S. 2006. Sequential impacts of Polynesian and European settlement on vegetation and environmental processes recorded in sediments at Whangapoua Estuary, Great Barrier Island, New Zealand. *Regional Environmental Change* 6: 25-40.
- xxxviii Comparing recent counts with numbers given by Bell & Braithwaite in 1964 – see endnote 5.
- xxxix See endnote 4
- xl Tennyson, A. & Martinson, P. 2006. *Extinct Birds of New Zealand*. Te Papa Press. Pp. 180.