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Archaeological avifauna of Harataonga, Great Barrier Island, New Zealand: implications for avian palaeontology, Maori prehistory, and archaeofaunal recovery techniques

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A recent analysis of archaeological bird remains from Harataonga Bay, Great Barrier Island is reported and compared with a prior study conducted in the 1960s. The assemblages come from two Maori occupations, one dating to ca. fourteenth century AD and the other to late prehistory. The new study identifies several previously unreported species for Harataonga, and the first record of prehistoric Maori use of Black Petrel or Taiko (*Procellaria parkinsoni*), and possibly Pycroft's Petrel (*Pterodroma pycrofti*). The assemblages are dominated by seabirds, a common pattern for the South Island but unusual for more northern areas, where forest birds are typically better represented. The limited forest birds are concentrated in the early occupation. Combining the two studies broadens our understanding of past species distributions on Great Barrier Island, and Maori use of these resources over time. Analytically, comparison of the two studies, one conducted some time ago, demonstrates the impact of fine-mesh sieves and in-lab processing on the observed assemblage size, composition, and diversity.

Keywords: avifauna; screen size; Procellariidae; Great Barrier Island; Maori prehistory; archaeology; palaeontology; sampling strategies

Introduction

Harataonga Bay is one of the earliest known areas of Maori occupation on Great Barrier Island, and indeed in the Coromandel region as a whole. The bay's long and rich human history offers the opportunity to gain insights into not only aspects of Maori occupation, but also the island's indigenous avifauna. Under the jurisdiction of the Department of Conservation, Harataonga has been the site of two archaeological studies, the first in 1962 under the direction of Roger Green and Wynne Spring-Rice (Spring-Rice 1963), with detailed analyses subsequently reported by Law (1972). The second, carried out in 1999–2000 (hereafter 2000) under the direction of Douglas Sutton (Jones MD, Sutton DG eds. n.d. The archaeology of Harataonga Beach, Great Barrier Island; unpublished manuscript), also had a significant palaeoecological component which has provided important new information on the area's environmental history over the last 600 years (Horrocks et al. 2002a, 2002b; Nichol et al. 2007). Here we report on avifaunal remains recovered from the more recent study and compare them with findings from the earlier study. The combined results aid establishment of the pre-contact distributions of several Great Barrier bird species, add to understanding of early Maori subsistence patterns on the North Island (where moa was less abundant), and allow comparison of zooarchaeological data produced under two different analytical approaches.

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Throughout prehistory, birds were important to Maori communities as sources of food and feathers, and as a raw material for tools. The species used and the relative importance of birds have, however, varied considerably over time (Anderson 1983; Nagaoka 2002; Smith 2004). During the early occupation period (ca. AD 1200–1400), avifauna (especially moa) dominated South Island subsistence economies, while in the north fowling played a more modest role, with sealing, fishing, and use of the domestic dog also being important (Davidson 1979; Anderson 1983; Allen & Nagaoka 2004). Also contrasting with South Island patterns was the typically generalized nature of North Island fowling, wherein a range of species from a variety of habitats were hunted (e.g., Davidson 1979; Foley 1980; Worthy 1999; McGovern-Wilson 2002). Although often represented in small numbers, birds in early North Island archaeological sites typically derive from coastal habitats, inland forests, and wetland areas.

Problematically, however, few early North Island sites have been investigated in the recent past and earlier excavators often did not use fine-mesh sieves, which are critical for recovery of small forest birds. The two studies reported here offer an opportunity to evaluate the impact of this and other methodological approaches on faunal recovery and species representation. The results also potentially assist in evaluating the impact of varied collection strategies elsewhere.

The study area

Great Barrier or Aotea Island, located 80 km from the Coromandel Peninsula, is the largest island off the North Island coast (Armitage 2001). Harataonga Bay (36°10′S, 175°30′E) lies on the more exposed northeastern coast (Fig. 1), somewhat protected by Rakitu Island and several other smaller offshore islets. The roughly 500 m long shoreline is a stationary backbarrier system, bounded at each end by rocky headlands (Nichol et al. 2007). The barrier takes the form of a dune ca. 100 m wide and up to 15 m high that extends almost the length of the beach (Fig. 2). It is this barrier dune which was the focus of human settlement. At the western end of the beach, the dune is breached by Harataonga Stream, which drains a backbarrier wetland system; the latter is ca. 2 km long and extends inland for ca. 1 km (Horrocks et al. 2002b). Nichol et al. (2007) suggest the barrier and wetland were in place by ca. 3500 BP, that is, well before Maori settlement.

At the time of first human occupation, the area around Harataonga Bay provided several habitats for native birds. The dune system could have been suitable habitat for burrowing petrels and shearwaters, although few burrow in dune systems today, even in the absence of mammalian predators. The nearby wetland could have supported ducks, rails, crakes, and other waterbirds. While the near coastal area now supports bracken and scrub forest, palynological study indicates that native forest once extended almost to the coast (Horrocks et al. 2002a, 2002b), potentially another important habitat for birds. With human settlement, however, low-lying areas were brought into cultivation and the native forest was replaced by gardens of kumara (*Ipomoea batatas*), gourd (*Lagenaria siceraria*) and possibly other cultivated species (Horrocks et al. 2002b).

Both the 1962 and 2000 excavations focused on two areas along Harataonga Beach. In each case, testing was carried out at both the western end of the beach, near the outflow of Harataonga Stream, where an early Maori occupation had been identified, Site T08/5 (modern metric site number; former imperial site number Site N30/5), and also at the eastern end of the beach where a buried cultural deposit (formerly Site N30/4, now T08/4) and a fortified hill or *pa* (formerly N30/3, now T08/3) are found. The 2000 study involved extensive coring of the dune system, followed by excavation of a limited number of test units where three-dimensional control was tightly maintained (Jones MD, Sutton DG eds. n.d. The archaeology of Harataonga Beach, Great Barrier Island; unpublished manuscript). At the western end of the beach, two (TP1 and U1) out of four units opened in 2000 provided faunal materials. Most of those materials derived from TP1, a 2×2 m unit. The excavators identified at least three dune-building episodes in this unit, one

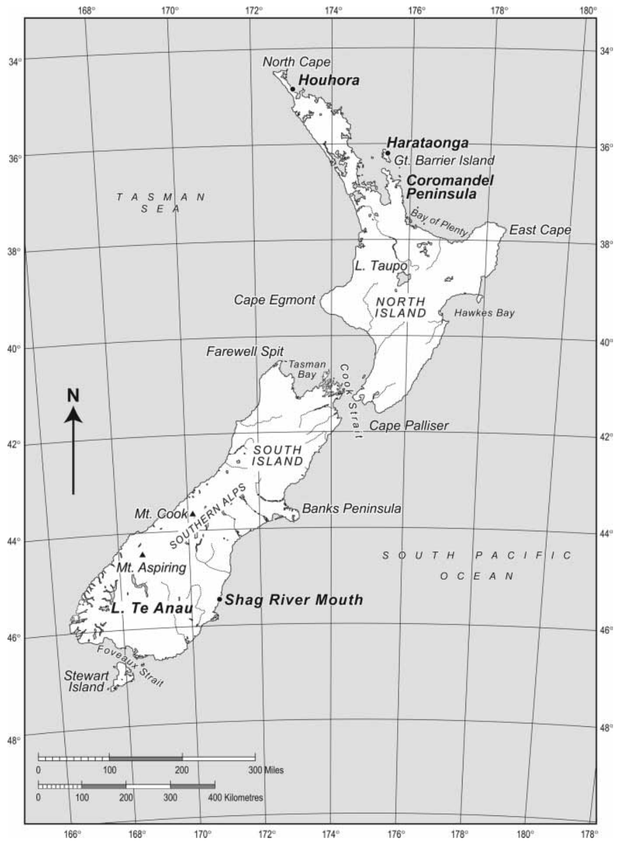

Fig. 1 Location of Harataonga Beach on Great Barrier Island and other localities mentioned in the text.

containing a small amount of cultural materials; all three overlay a well-defined cultural layer (identified here as Layer 3) with fire features, artefacts, and faunal remains (Jones, personal communication, 2003). The excavated sediments were bulk collected for lab processing. The main cultural layer was radiocarbon dated to about the fourteenth century AD (Law 1972, 1975; Jones 2002; see also Horrocks et al. 2009). More specifically, after Bayesian analysis of 17 newly acquired wood charcoal ($n = 6$) and shell ($n = 11$) radiocarbon determinations, Jones (The chronology of Harataonga Bay; unpublished manuscript) placed the most likely date of the early Harataonga occupation between AD 1280 and 1410.

At the eastern end of the beach, three out of seven units opened in 2000 exposed a single cultural deposit (Layer 2): TP4, TP6, and TP11. TP4 measured 1×60 cm and was bulk sampled in total, with the sediments subsequently processed in the lab. TP6 was a 1×2 m controlled excavation that exposed a series of intercutting fire features (ovens and hearths). Materials from this unit were processed in the field with 5.7 mm mesh, and the residue bulk sampled for further processing in the lab. TP11 measured 1×2 m and the excavated cultural sediments were bulk sampled, as with TP4. The excavators thought it likely that all three of these test units sampled the same cultural deposit that was identified and sampled in 1962, specifically Site T08/04 (formerly N30/4). Based on Bayesian analysis of 23 newly acquired radiocarbon determinations, 10 on wood charcoal and 13 on shell, Jones (The chronology of Harataonga Bay; unpublished manuscript) placed the occupation layer exposed in TP4, TP6, and TP 11 in the period

Fig. 2 Harataonga Beach; view to west towards early Site T08/5.

AD 1650 to 1800, while the artefactual and faunal contents suggest a pre-European age.

Methods

Samples obtained in 2000 were processed to separate the vertebrate remains from the sedimentary matrix using sieves of three mesh sizes: 6.7 or 5.7 mm, 3.2 mm, and 2 mm. TP6 was screened with 5.7 mm mesh sieves in the field. All other test units and bulk samples processed in the lab by MSA were screened with 6.7 mm mesh sieves, selected because it is roughly comparable to ¼ inch mesh screen which is commonly used in the central Pacific and has an associated methodological literature. Although other vertebrate remains from TP6 were re-screened in the lab with 6.7 mm sieves to provide a consistent set of results across all of the excavation units, this was considered unnecessary for, and potentially damaging to, the small bird bone assemblage reported here. The bird remains in particular were separated from the other vertebrate material by MSA, which resulted in an assemblage of 211 avian specimens. These were subsequently identified by RNH using comparative material from the Canterbury Museum, Christchurch.

The specimens were quantified using both 'Number of Identified Specimens' (NISP), a simple count, and 'Minimum Number of Individuals' (MNI), whereby the most abundant side of the most abundant element was used to determine the number of individuals. Specimen age and size were not taken into account when determining MNI, mainly because this kind of variation was not apparent. Notably, both measures can be problematic, with NISP potentially inflated by fragmentation, and MNI potentially affected by the way an assemblage is aggregated (Grayson 1984). Presentation of both measures allows for assessment of these biases, but, most importantly in the present context, derivation of MNI values allows for comparisons with the 1962 findings.

Results

Of the 211 bird bones recovered in 2000, RNH identified 62 specimens to family or below in addition to a single moa bone, roughly 30% of the recovered material. Overall 12 taxa were identified (Table 1). Most of the avian bones (72%) and all of the forest birds derive from the early occupation at the western end of the beach (Table 2). Only three of the eastern units produced avifaunal remains: TP6, TP11, and TP4. Thirty-four bones were recovered from TP6, 16 came from TP4, and seven (all unidentified) from TP11 (Table 3).

Numerically, seabirds dominate the assemblage overall (85%), in terms of NISP and MNI. Most of these individuals were probably obtained from locally breeding populations. They include several petrels/shearwaters (Procellariidae) and blue penguins (*Eudyptula minor*). A single large albatross (*Diomedea* sp.) bone was also recovered. The finds of Black Petrel or

Table 1 Taxonomic list of avifauna recovered in the 2000 and 1962 excavations

Order/family name	Latin name	Common name	Maori name	2000[a]	1962[b]
Oceanic and waterbirds					
Diomedeidae	*Diomedea/Thalassarche* sp.	albatross/mollymawk		X	X
	Thalassarche (?) *cauta*	mollymawk	*Toroa*		X
Procellariidae	*Pachyptila* (?) *turtur*	prion (small), (?) Fairy	*Titi Wainui*		X
	Pterodroma cf. *macroptera*	Grey-faced Petrel	*Oi*	X	X
	Pterodroma cf. *pycrofti*	Pycroft's Petrel		X	
	Pterodroma sp.	petrel		X	
	Procellaria parkinsoni	Black Petrel	*Taiko*	X	
	Puffinus gavia gavia	Fluttering Shearwater	*Pakaha*		X
	Pelecanoides urinatrix	Common Diving Petrel	*Kuaka*		X
Spheniscidae	*Eudyptula minor*	Blue Penguin	*Korora*	X	X
Phalacrocoracidae	*Phalacrocorax carbo novaehollandiae*	Black Shag	*Kawau*		X
	P. (?) *melanoleucos brevirostris*	shag, (?) White-throated	*Kawaupaka*		X
	Phalocrocorax (?) (Stictocarbo punctatus punctatus)	Shag, (?) Spotted	*Parekareka*		X
Anatidae	*Anas superciliosa*	Grey Duck	*Parera*	X	
	Anas (?) *castanea chlorotis*	Teal, (?) Brown			X
Laridae	*Larus* sp.	gull			X
Forest birds					
Dinornithiformes	unidentified moa	moa	moa	X	X
Columbidae	*Hemiphaga novaeseelandiae*	New Zealand Pigeon	*Kereru*	X	X
Psittacidae	*Cyanoramphus* sp.	native parakeet	*Kakariki*	X	
	Nestor meridionalis	*Kaka*	*Kaka*	X	X
Callaeatidae	cf. *Callaeas wilsoni*	?North Island *Kokako*	*Kokako*	X	
	Philesturnus rufusater	North Island Saddleback	*Tieke*	X	
Meliphagidae	*Prosthemadera novaeseelandiae*	*Tui*	*Tui*		X

[a]Identified by Richard Holdaway.
[b]Identified by Ron Scarlett; nomenclature as in Law (1972) except where also identified in 2000 materials.

Table 2 Avifauna recovered from Harataonga in 2000, Site T08/5 (N30/5), TP1

	Layer 2		Layer 3		U1
	NISP	MNI	NISP	MNI	NISP
Oceanic birds					
Diomedeidae					
Diomedea sp.	–	–	1	1	
Procellariidae	1		13		
Pterodroma cf. *macroptera*	–	–	4	1	
Pterodroma cf. *pycrofti*			1	1	
Pterodroma sp.	–	–	4	1	
Procellaria parkinsoni	–	–	1	1	
Spheniscidae					
Eudyptula minor	2	1	8	2	
Subtotal oceanic birds	3		32		
Forest birds					
Dinornithiformes					
unid moa	–	–	1	1	
Columbidae					
Hemiphaga novaeseelandiae	–	–	1	1	
Psittacidae					
Cyanoramphus sp.	–	–	1	1	
Nestor meridionalis	–	–	2	1	
Callaeatidae					
cf. *Callaeas wilsoni*					1
Philesturnus rufusater	2	1	1	1	
Subtotal forest birds	2		6		1
Unidentified bird	6	–	102	–	2
Total bird	11		140		3

Taiko (*Procellaria parkinsoni*) and possible Pycroft's Petrel (*Pterodroma* cf. *pycrofti*) are new archaeological records for Harataonga, neither having been recorded from the 1962 excavations. Further, neither was listed in the 177 North and South Island archaeological sites reviewed by Worthy (1999). There is still a small population (ca. 800 pairs) of Black Petrels on Great Barrier (Turbott 1990), one of two places where they breed today (Lovegrove 2001:151–152). Summer breeders, they return to the colony in October and fledglings depart between April and July. The Grey-faced Petrel (*Pterodroma macroptera*) is also probably represented among the 2000 materials and possibly a Buller's Shearwater (*Puffinus bulleri*). The Grey-faced Petrel (Fig. 3) is thought to be the most widespread petrel breeding on Great Barrier today (Lovegrove 2001:153). It is a winter breeder, present at its colonies from March onwards. The young were traditionally harvested by Maori in November. The 2000 remains appear to be largely from adults but two immature Procellariidae bones were recovered from TP6 and one immature Fluttering Shearwater (*Puffinus gavia*) was identified from the late occupation at Site N30/4 (T08/4) in the 1962 analysis (Law 1972:108). Fluttering Shearwaters are summer breeders. The large albatross could either have been obtained as a beach stranding or caught live from a fishing canoe at any season.

Table 3 Avifauna recovered from Harataonga in 2000, east end of beach, TP4, TP6, and TP11, Site T08/4

	TP4 Layer 2		TP6 Layer 1		TP6 Layer 2		TP11 Layer 2	
	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
Oceanic birds								
Procellariidae					10			
Pterodroma cf. *macroptera*	–	–	1	1	1	1	–	–
Pterodroma cf. *pycrofti*	–	–	–	–	1	1	–	–
Pterodroma sp.	1	1	–	–	2	1	–	–
Spheniscidae								
Eudyptula minor	–	–	–	–	1	1	–	–
Waterbirds								
Anatidae								
Anas superciliosa	–	–	–	–	1	1	–	–
Unidentified bird	15	–	–	–	17	–	7	–
Total bird	16		1		33		7	–

Given the times when these petrels would have been available ashore, and the few immature bones identified, it is not possible to assign a season of occupation for these occupation layers based on the bird remains alone. More importantly, the small sample sizes make any seasonal interpretations highly speculative (see also Law 1972:102 and Grayson 1984 for a general discussion of seasonality reconstructions).

Although seabirds dominate the assemblages, several forest species are represented. A single long bone fragment from an undetermined species of moa (Dinornithiformes) was recovered. As suggested for a similar find in 1962 (identified as ?*Euryapteryx geranoides*, now ?*Euryapteryx curtus*), this bone may represent an industrial import rather than evidence of a local population. All but one of the 13 finished fishhook fragments found in 1962 were probably made from moa bone (Law 1972:85–86). Other forest birds recovered in 2000 include North Island Saddleback or *Tieke* (*Philesturnus rufusater*), New Zealand Pigeon or *Kereru* (*Hemiphaga novaeseelandiae*), parakeet or *Kakariki* (*Cyanoramphus* sp.), *Kaka* (*Nestor meridionalis*) and possibly *Kokako* (*Callaeas wilsoni*). The saddleback, *Kakariki*, and *Kokako* are new archaeological records for Harataonga. Grey duck or *Parera* (*Anas superciliosa*) was also present. All of these species survived on Great Barrier into the nineteenth century, and all but the saddleback into the twentieth century. At Harataonga the remains of these forest birds were largely restricted to the early occupation at the western end of the beach.

Fig. 3 Grey-faced Petrel (*Pterodroma macroptera*) (photo courtesy of Alan J. D. Tennyson).

Three modified bird bones give insights into the industrial importance of non-moa species. Two worked fragments were part of a single juvenile albatross (*Diomedea* sp.) or mollymawk (*Thalassarche* sp.) humerus (Fig. 4), both recovered from the surface of Layer 3 of TP1. The humerus had been sawn midway along the shaft. The larger of the two fragments included a small portion of the

Fig. 4 Worked juvenile albatross (*Diomedea* sp.) humerus.

proximal end of the bone, and the other came from the mid-shaft. In 1962, albatross bone was recovered from all three of the investigated sites and a worked specimen from the Pa site (T08/3 or N30/3) (Law 1972:113). Albatrosses or *Toroa* were highly prized by Maori for their white feathers, which were used for adornment by persons of rank and to decorate elaborated war canoes (Orbell 2003). Based on evidence from elsewhere, the larger long bones were used to make neck and ear pendants, and to produce flutes, while smaller pieces became fishhook barbs. The Harataonga finds also point to the importance of large bird bones for tools, although no specific implements are indicated. Lastly, a fine bone needle (Fig. 5) was recovered from Layer 3 of TP1. The bone morphology and surface features are consistent with *Diomedea* or *Thalassarche* albatrosses but it also could have been fashioned from bone of another taxon.

Discussion

Comparison with the 1962 findings

The taxa recovered from the 1962 excavations are provided in Table 4 (based on Law 1972). In contrast to the 12 taxa recovered in 2000, Ron Scarlett identified 15 taxa from the earlier excavations, although as the material and identifications from the earlier collections have not been checked, that list must be considered provisional. In particular, the record of Chestnut Teal (*Anas castanea*) is considered extremely unlikely because it is a very rare vagrant; the material probably represents a Brown Teal (*Anas chlorotis*), still resident on Great Barrier Island, or another small duck. The greater number of taxa recovered by this early effort is not surprising given the larger area that was opened in 1962. At the early Site T08/5 (or N30/5), more than 7.5 m^2 was excavated, while at the later Site T08/4 (or N30/4) more than 12 m^2 was opened. The strong correlation between sample size and assemblage diversity is widely recognized (e.g., Grayson 1984).

The fossil avifaunas from the two projects are fairly similar in taxonomic composition. Seabirds dominate in both, with the Grey-faced Petrel (*Pterodroma macroptera*) being the most common species in the 1962 excavations at N30/5. Moa and albatross were represented in both, albeit only by a few pieces of bone. Forest birds were also better represented in the early occupation on both occasions.

Findings from the two projects differed in two respects. Several coastal birds, including a gull and several species of shag identified in the 1962 collections, were not represented in the 2000 collections. These species were difficult to identify with the methods of identification used at the time and the determinations reported in Law (1972) should be revisited. However, given the more extensive excavation area and larger bone assemblage, a greater number of taxa would not be unexpected.

A second contrast between the current analysis and the 1962 study is the comparatively poorer representation of forest species in the earlier study (e.g., fewer bones per metre square). This may reflect the use of coarser

Fig. 5 Bone needle from TP1, Site T08/5.

Table 4 Avifauna recovered from Harataonga in 1962 (data from Law 1972)

Taxon[a]	N30/5 (T08/5) MNI	N30/4 (T08/4) MNI	N30/3 (T08/3) Present
Oceanic and waterbirds			
Diomedeidae			
Diomedea sp.	1	1	X
Thalassarche (?) *cauta*	1		
Procellariidae			
Puffinus gavia	2	3	
Puffinus sp.		1	
Pelecanoides urinatrix		1	
(?) *Pachyptila turtur*	1		
Pterodroma macroptera	5	1	
Spheniscidae			
Eudyptula minor	4	1	
Phalacrocoracidae			
Phalacrocorax (?) melanoleucos	1		
Phalacrocorax carbo	1		
Phalacrocorax sp.	1		
Stictocarbo punctatus		1	
(?) *Stictocarbo punctatus*	2		
Anatidae			
Anas (?) castanea[b]	1		
Laridae			
Larus sp.	1		
Subtotal oceanic and waterbirds	21	9	
Forest birds			
Dinornithiformes			
(?) *Euryapterx geranoides*	1		
unid moa		1	
Columbidae			
Hemiphaga novaeseelandiae	1		
Psittacidae			
Nestor meridionalis	3	1	X
Meliphagidae			
Prosthemadera novaeseelandiae	1		
Subtotal forest birds	6	2	
Total bird	27	11	

[a]Identifications by Ron Scarlett. Nomenclature as in Law (1972); subspecies names not included.
[b]This was the name for Brown Teal at that time.

screens in 1962 in comparison to the 2 mm screens used in 2000. Law (1972) did not report the size of mesh used at T08/5 (or N30/5), but ¼ inch (6.3 mm) mesh screens were used at T08/4 (or N30/4) (Law 1972:106). Perusal of the fish remains from the 1962 excavation (MSA) held at the Museum of New Zealand Te Papa Tongarewa in Wellington suggests that if screens were used in field processing of sediments, they were probably of a fairly coarse mesh.

Evaluation of differing analytical strategies

The abundance and taxonomic composition of bird remains recovered during the two excavations were broadly comparable. The use of fine sieves on the 2000 bulk samples resulted, as expected (e.g., Worthy 1999:132), in greater recovery of bird bone and better representation of small forest birds. The 2000 collection contained 15 identifiable bones per m^2 from the early occupation, compared to the 3.3 bones per m^2 recovered from the same area in 1962. The 2000 excavation also produced two or three new forest bird species (including North Island Saddleback, *Kakariki*, and possibly *Kokako*). Additionally, a significant amount of unidentifiable bone was recovered from the 2000 excavation that, despite being unidentifiable on morphology, may be amenable to identification using ancient DNA, if appropriate to future research questions.

Although smaller screens assisted recovery of materials in 2000, the 1962 excavations opened a larger area at each locality. Our initial expectation was that these larger samples would be more representative, and potentially include a greater number of species. Our comparison indicates that the two main patterns identified in 1962, dominance by seabirds and concentration of forest birds in the early assemblage, held in the 2000 analysis despite the smaller excavation area. The larger 1962 sample did, however, result in a greater species diversity, with 15 taxa recorded in 1962 and only 12 in 2000; as noted before, however, the 1962 list is provisional and the material has not been re-examined.

Overall, results from the two studies are generally comparable. Differences can, for the most part, be attributed to the use of alternative field procedures (i.e., the extent of excavation), processing strategies (i.e., bone recovery techniques), and (for bird bone) different identification protocols. In this respect the two studies complement and extend one another in predictable and useful ways that are often suggested in the literature but more rarely demonstrated (but see Gordon 1993).

Implications for Maori prehistory

Many early Maori occupations evidence a diversity of species from varied habitats, findings which most likely reflect opportunistic hunting. Specialized fowling (apart from moa), however, also has been demonstrated, particularly on the South Island. For example at Lake Te Anau, *Kereru*, *Kaka*, and *Kakariki* were targeted (Anderson & McGovern-Wilson 1991). Similarly, at Shag River Mouth, despite more than 49 identified taxa, the initial focus was on blue penguins and shags, a pattern that gave way to an emphasis on New Zealand Quail in the later part of the sequence (McGovern-Wilson et al. 1996; Nagaoka 2002). Even systematic harvesting of seabirds such as *Puffinus griseus,* once thought to be of recent origin, is now known to have a considerable antiquity in the Foveaux Strait region (Anderson 1996, 2001). At Harataonga, the small number of specimens and diversity of taxa point to opportunistic hunting, while the species composition indicates both forest and coastal fowling. This pattern is consistent with the evidence from other early sites on the nearby Coromandel Peninsula, where ‘generalised hunting without marked concentration on particular species’ is evidenced (Davidson 1979:188). The recovery of a bone bird-spear fragment (Law 1972:88) provides further evidence of purposeful hunting.

The taxa represented at Harataonga and their relative abundances are also of interest vis-à-vis archipelago-wide patterns. Penguins and procellariids are common seabirds in Maori coastal sites, and *Kereru, Kaka, Kakariki,* and *Tui* (*Prosthemadera novaeseelandiae*) are the more typically encountered forest species (Worthy 1999). All of these taxa are represented at Harataonga. The preference for marine birds over those from other habitats seen at Harataonga has been demonstrated for several early South Islands sites (Anderson 1982). On the North Island, however, only two early sites besides Harataonga suggest such a focus: Houhora in Northland (McGovern-Wilson 2002) and Parker’s Midden (N40/2) on the Coromandel (Davidson 1979). Other Coromandel sites, in contrast, point to an emphasis on forest species, as for example Port Jackson and Hotwater Beach (Davidson 1979). Comparisons, however, are hampered by information on relative abundance being available for only a few North Island sites (Davidson 1979).

With respect to temporal patterns, avifaunal remains were concentrated in the early occupation in both the 1962 and 2000 Harataonga assemblages. Birds seem never to have been important in the local diet at Harataonga and over time became even less so, possibly because they became less readily available. Presumably the decline in forest species to some degree reflects the receding forest edge, concomitant with the expansion of horticultural activities, both which are trends indicated in the pollen and sediment evidence (Horrocks et al. 2002b; Nichol et al. 2007).

The low frequency of bird remains in general raises the question of whether the early occupation at Site N30/5 represents first use of this catchment. There is a notable lack of vulnerable species which elsewhere became extinct soon after Maori settlement. For example, among the species that appear in nearby Coromandel sites, and which might have found suitable habitat at Harataonga, are the extinct North Island Raven (*Corvus antipodum antipodum*), North Island Harrier (*Circus* sp.), New Zealand Coot (*Fulica prisca*), and Black Swan (*Cygnus atratus*) (Worthy and Holdaway 2002:227). Several ground-dwelling species are also absent at Harataonga, as for example North Island *Takahe* (*Porphyrio mantelli*), North Island Snipe (*Coenocorypha barrierensis*), rails, and North Island Brown Kiwi (*Apteryx mantelli*), all which were present on Great Barrier Island before Polynesian arrival (Holdaway et al. 2001; Lovegrove 2001:147). While note might be made of the fourteenth-century Kaharoa volcanic eruption, now identified at several Great Barrier localities (Horrocks et al. 2002b), it seems unlikely that this event would have had more than a minor and transitory impact on bird habitats and food supplies at Harataonga.

The few remains of moa from the Harataonga excavations are also notable. Although Lovegrove (2001:147) suggested that at least six moa species were once resident on Great Barrier Island, there is at present unequivocal evidence for only one, a population of small *Euryapteryx curtus* (Holdaway et al. 2001:125). An MNI of only two was reported from the 1962 excavations and only a single bone was recovered in 2000. If a moa population existed on the island there would have been few individuals, and confined mostly to the lower, gentler slopes and flat land, with individual home ranges of 10–15 km^2. Such a population would have been extirpated within a couple of years by even a very small human population.

The two studies considered here do not, unfortunately, extend our knowledge of the natural composition of Great Barrier Island's avifauna. Although some now-extinct taxa were identified, they are species which persisted into the European contact period. However, one and possibly two species have been added to the list of birds obtained by prehistoric Maori foragers, namely the Black Petrel or *Taiko* (*Procellaria parkinsoni*) and possibly Pycroft's Petrel (*Pterodroma* cf. *pycrofti*). Neither species was known previously from Harataonga or from the 177 North and South Island archaeological sites reviewed by Worthy (1999), although the Black Petrel bred widely throughout the North and South Islands into the early twentieth century. Finally, this more comprehensive list of Harataonga species adds texture to our understanding of the distribution of native birds on Great Barrier, and insights into the articulation between their decline and both habitat alteration and patterns of cultural exploitation.

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Appendix. Complete listing of 2000 Harataonga avifaunal remains.

Acc. No.	Test pit	Layer	Mesh (mm)	Taxa	Element	Symmetry	Portion	NSIP	Notes
F55.3	TP1	2	6.7	*Eudyptula minor*	coracoid	left	whole	1	nearly whole
F72.3	TP1	2	6.7	*Eudyptula minor*	humerus	left	whole	1	
F50.3	TP1	2	6.7	*Philesturnus rufusater*	tibiotarsus	right	proximal	1	
F64.5	TP1	2	6.7	*Philesturnus rufusater*	tarsometatarsus	left	whole	1	
F19	TP1	2	2.0	Procellariidae	quadrate	undetermined	fragment	1	petrel
F50.2	TP1	2	6.7	Unidentified	synsacrum	axial	fragment	1	
F64.1	TP1	2	6.7	Unidentified	undetermined	undetermined	fragment	3	
FS-50.4	TP1	2	6.7	Unidentified	sternal rib?	undetermined	whole	1	
FS-52.2	TP1	2	2.0	Unidentified	undetermined	undetermined	fragment	1	
92.7	TP1	3	2.0	*Cyanoramphus* sp.	coracoid	left	anterior	1	
82	TP1	3	6.7	*Diomedea* sp.	humerus	right	proximal shaft	1	top of Layer III, modified; juvenile
158.13	TP1	3	6.7	*Eudyptula minor*	radius	undetermined	distal	1	
158.14	TP1	3	6.7	*Eudyptula minor*	humerus	undetermined	distal	1	
158.15	TP1	3	6.7	*Eudyptula minor*	undetermined	undetermined	fragment	3	top of Layer 3, modified; juvenile
158.16	TP1	3	6.7	*Eudyptula minor*	tibiotarsus	right	distal	1	
159	TP1	3	6.7	*Eudyptula minor*	tibiotarsus	right	whole	1	top of Layer 3
F118.5	TP1	3	6.7	*Eudyptula minor*	femur	left	shaft	1	
158.17	TP1	3	6.7	*Hemiphaga novaeseelandiae*	humerus	left	fragment	1	
158.15	TP1	3	6.7	*Nestor meridionalis*	premaxilla	axial	distal	1	top of Layer 3
158.22	TP1	3	6.7	*Nestor meridionalis*	coracoid	left	proximal	1	
158.18	TP1	3	6.7	*Philesturnus rufusater*	humerus	left	fragment	1	
F200.1	TP1	3	2.0	*Procellaria parkinsoni*	sternum		anterior	1	
75	TP1	3	2.0	Procellariidae	pedal phalanx	undetermined	whole	1	petrel
83	TP1	3	2.0	Procellariidae	pedal phalanx	undetermined	distal	1	petrel
83	TP1	3	2.0	Procellariidae	pedal phalanx	undetermined	proximal	1	petrel
107	TP1	3	2.0	Procellariidae	pedal phalanx	undetermined	distal	1	petrel
124.16	TP1	3	2.0	Procellariidae	pedal phalanx	undetermined	distal	1	petrel
124.17	TP1	3	2.0	Procellariidae	tarsometatarsus, trochlea	undetermined	distal	1	petrel
138.11	TP1	3	2.0	Procellariidae	pedal phalanx	undetermined	distal	1	petrel
138.9	TP1	3	2.0	Procellariidae	tarsometatarsus, trochlea	undetermined	distal	2	petrel
161.22	TP1	3	2.0	Procellariidae	scapula	left	proximal	1	large petrel
161. 10	TP1	3	6.7	Procellariidae	humerus	undetermined	shaft	1	petrel; Top of Layer 3
F166	TP1	3	6.7	Procellariidae	humerus	undetermined	shaft	1	petrel?
no #	TP1	3	6.7	Procellariidae	humerus	undetermined	shaft	1	large petrel
95	TP1	3	6.7	*Pterodroma* cf. *macroptera*	tarsometatarsus	left	whole	1	
121.5	TP1	3	2.0	*Pterodroma* cf. *macroptera*	tarsometatarsus	left	distal	1	
136	TP1	3	6.7	*Pterodroma* cf. *macroptera*	femur	right	whole	1	

Appendix. (*Continued*)

Acc. No.	Test pit	Layer	Mesh (mm)	Taxa	Element	Symmetry	Portion	NSIP	Notes
120. 10	TP1	3	2.0	*Pterodroma* cf. *macroptera*	pedal phalanx	undetermined	proximal	1	
121.2	TP1	3	2.0	*Pterodroma* cf. *pycrofti*	humerus	left	fragment	1	
158.19	TP1	3	6.7	*Pterodroma* sp.	humerus	left	proximal	1	
158.2	TP1	3	6.7	*Pterodroma* sp.	humerus	right	distal	1	
161.21	TP1	3	2.0	*Pterodroma* sp.	tarsometatarsus	undetermined	distal	1	
158.21	TP1	3	6.7	*Pterodroma* sp.	ulna	left	distal	1	
no #	TP1	3	6.7	Small moa?	tibiotarsus	undetermined	shaft	1	oven surface
75	TP1	3	2.0	Unidentified	undetermined	undetermined	fragment	8	
76.5	TP1	3	2.0	Unidentified	undetermined	undetermined	fragment	2	
103.3	TP1	3	2.0	Unidentified	undetermined	undetermined	fragment	1	
109	TP1	3	6.7	Unidentified	undetermined	undetermined	fragment	1	
114	TP1	3	2.0	Unidentified	undetermined	undetermined	fragments	2	
119.1	TP1	3	6.7	Unidentified	quadrate	undetermined	fragment	1	
120.8	TP1	3	2.0	Unidentified	undetermined	undetermined	fragment	6	
121.3	TP1	3	2.0	Unidentified	undetermined	undetermined	fragments	9	
121.4	TP1	3	2.0	Unidentified	pedal phalanx	undetermined	distal	1	
123.2	TP1	3	6.7	Unidentified	cervical vertebra	axial	fragment	1	
124.15	TP1	3	2.0	Unidentified	undetermined	undetermined	fragment	11	
126	TP1	3	6.7	Unidentified	undetermined	undetermined	fragment	4	
138.8	TP1	3	2.0	Unidentified	undetermined	undetermined	fragments	7	
141.1	TP1	3	2.0	Unidentified	undetermined	undetermined	fragments	4	
141.11	TP1	3	2.0	Unidentified	pedal phalanx	undetermined	distal	1	
141.12	TP1	3	2.0	Unidentified	radius	undetermined	proximal	1	
141.13	TP1	3	2.0	Unidentified	vertebra	axial	centrum	1	
142	TP1	3	2.0	Unidentified	undetermined	undetermined	fragments	5	
158.12	TP1	3	6.7	Unidentified	vertebra	axial	whole	1	
158.5	TP1	3	6.7	Unidentified	undetermined	undetermined	shaft	7	top of Layer 3
161.2	TP1	3	2.0	Unidentified	vertebra	axial	whole	1	
161.8	TP1	3	2.0	Unidentified	undetermined	undetermined	fragment	15	
138. 10	TP1	3	2.0	Unidentified	metatarsal	undetermined	distal	1	
F119.3	TP1	3	6.7	Unidentified	undetermined	undetermined	shaft	1	
F124	TP1	3	2.0	Unidentified	undetermined	undetermined	fragment	1	
F176.12	TP1	3	2.0	Unidentified	pedal phalanx	undetermined	distal	2	
F176.13	TP1	3	2.0	Unidentified	undetermined	undetermined	fragment	2	
F176.2	TP1	3	2.0	Unidentified	radius	undetermined	proximal	1	
F122	TP1		6.7	Unidentified	undetermined	undetermined	fragment	1	
92.1	TP1	3	2.0	? Aves	undetermined	undetermined	fragment	1	
92.8	TP1	3	2.0	? Aves	undetermined	undetermined	fragment	1	
92.9	TP1	3	2.0	? Aves	undetermined	undetermined	fragment	1	
149	TP4	2	2.0	Unidentified	undetermined	undetermined	fragment	6	provenience note: Fb
149	TP4	2	2.0	*Pterodroma* sp.	femur	left	distal	1	provenience note: Fb

Appendix. (*Continued*)

Acc. No.	Test pit	Layer	Mesh (mm)	Taxa	Element	Symmetry	Portion	NSIP	Notes
149	TP4	2	2.0	Unidentified	caudal vertebra	axial	fragment	1	provenience note: Fb
149	TP4	2	2.0	Unidentified	undetermined	undetermined	fragment	8	provenience note: Fb
FS-35.4	TP6	1	5.7	*Pterodroma* cf. *macroptera*	femur	left	proximal	1	
FS-65.4	TP6	2	5.7	*Anas superciliosa?*	ulna	right	proximal	1	
FS-42.1	TP6	2	5.7	*Eudyptula minor*	humerus	right	whole	1	
FS-23.4	TP6	2	5.7	Procellariidae	scapula	right	proximal	1	petrel
FS-24.13	TP6	2	5.7	Procellariidae	tibiotarsus	right	proximal	1	large shearwater, immature
FS-34	TP6	2	5.7	Procellariidae	vertebra	undetermined	whole	2	petrel
FS-34	TP6	2	5.7	Procellariidae	scapula	right	proximal	1	
FS-34	TP6	2	5.7	Procellariidae	tarsometatarsus, trochlea?	undetermined	distal	1	
FS-69	TP6	2	3.2	Procellariidae	pedal phalanx	undetermined	whole	1	petrel
FS-70.5	TP6	2	5.7	Procellariidae	pedal phalanx	undetermined	whole	1	petrel
FS-90.10	TP6	2	5.7	Procellariidae	pedal phalanx	undetermined	distal	1	petrel
FS-80.2	TP6	2	5.7	Procellariidae?	tibiotarsus	undetermined	proximal	1	petrel?, immature
FS-72	TP6	2	5.7	*Pterodroma* cf. *macroptera*	tarsometatarsus	left	distal	1	
FS-79.4	TP6	2	5.7	*Pterodroma* cf. *pycrofti*	ulna	left	distal	1	
FS-37.13	TP6	2	5.7	*Pterodroma* sp.	scapula	right	proximal	1	
FS-37.8	TP6	2	5.7	*Pterodroma* sp.	premaxilla	axial	distal	1	
FS-14.5	TP6	2	5.7	unidentified	undetermined	undetermined	fragment	1	
FS-40.14	TP6	2	5.7	unidentified	vertebra	axial	fragment	1	
FS-64.12	TP6	2	3.2	unidentified	undetermined	undetermined	fragment	6	
FS-64.12	TP6	2	3.2	unidentified	pollex	undetermined	proximal	1	
FS-64.12	TP6	2	3.2	unidentified	radius	indeterminant	proximal	1	
FS-65.4	TP6	2	5.7	unidentified	undetermined	undetermined	shaft	3	
FS-68.5	TP6	2	5.7	unidentified	undetermined	undetermined	shaft	1	
FS-69.1	TP6	2	5.7	unidentified	undetermined	undetermined	shaft	1	
FS-79.4	TP6	2	5.7	unidentified	undetermined	undetermined	fragment	1	
FS-79.4	TP6	2	5.7	unidentified	vertebra	axial	whole	1	
FS-41.4	TP11	2.11	2.0	unidentified	tarsometatarsus, trochlea	undetermined	distal	1	
FS-41.5	TP11	2.11	6.7	unidentified	undetermined	undetermined	shaft	2	
FS-45.17	TP11	2.13	2.0	unidentified	undetermined	undetermined	fragment	1	
FS-45.2	TP11	2.13	6.7	unidentified	undetermined	undetermined	fragment	1	
FS-53.17	TP11	2.15	2.0	unidentified	pedal phalanges	undetermined	distal	2	
81	U1	no data	2.0	cf. *Callaeas wilsoni*	coracoid	undetermined	posterior	1	
81	U1	no data	2.0	Unidentified	undetermined	undetermined	fragment	2	