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Pa and People in New Zealand: An Archaeological Estimate of Population

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ABSTRACT

The ethnographic evidence for the small size of Maori nuclear families in the late eighteenth and early nineteenth centuries is examined and compared with the results of recent anatomical research. Archaeological evidence indicates that, on average, one household utilising two storage pits was located on a terrace within a pa. The figure of six adults and two pits is applied to terraced pa in the Auckland region; it demonstrates that the population was much less than previously believed.

Keywords: PA, POPULATION, STORAGE PITS, TERRACES.

INTRODUCTION

The problem of estimating the population of Maori settlements in the prehistoric era is an old one, which has usually been linked with estimates of the population of New Zealand as a whole. The starting point was Cook's remark to George Forster that he thought there were 100,000 inhabitants in both islands in 1770 (Pool 1977:49). This guess, based on Cook's limited landings and his view of the coasts, was repeated with minor variations by several early nineteenth century writers anxious to make a case for European settlement in an allegedly under-populated land (Pool 1977:234-5, citing Nicholas, Yate, Polack and Hamlin). A contrary view was prevalent in the mid-twentieth century when the geographers Cumberland (1949:417) and Lewthwaite (1950:36, 48) visualised a densely settled eighteenth century landscape with about 250,000 inhabitants concentrated in the numerous pa and open settlements.

This article is not primarily concerned with the total prehistoric population, though the conclusions obviously will affect it. It is an attempt to answer the question: how many people lived in any one pa at the time of its maximum extent? The calculations are based partly on ethnographic accounts but mainly on archaeological evidence derived from excavation and field survey. A basic assumption is that pa were built for people to live in, using "pa" as a generic term for sites defended by earthworks or by terracing. The idea promoted by Groube (1965:45-52) that pa were refuges occupied in times of crisis and at other times deserted is now surely as outmoded as the fallacy that storage pits were house sites, though Groube's remarks were meant to be applied to the Contact period of the late eighteenth and early nineteenth century. Excavation and radiocarbon dating have shown that most pa have a history of an occupation covering several hundred years, which included successive alteration of the defences and that they contain substantial houses. Seasonal absence of many of the inhabitants and short breaks in an occupation can be postulated, although these are not easy to detect archaeologically.

THE ETHNOGRAPHIC ACCOUNTS

The attempts by early travellers and explorers to estimate numbers from first-hand contacts are of prime importance, because they serve as a yardstick with which to measure the credibility of conclusions based on archaeological evidence. It becomes

obvious from the sources that only some were interested in making a count. Concern with the ship's security led Cook and Banks to count or assess the numbers of men in the canoes that approached the "Endeavour"; for example, Banks' "150 men in 10 or 12 Canoes all armed with pikes lances and stones" in the Bay of Plenty (Beaglehole 1962 (I):426), or Cook's "five Canoes . . . two large and three small ones" in Mercury Bay, with 47 people in one, but fewer in the others (Beaglehole 1955:195). On their subsequent visit to Wharetaewa pa near Whitianga, Banks recorded that they were greeted by the inhabitants "men women and children about 100 in number" (Beaglehole 1962 (I):432). The most populous region appeared to have been the Bay of Islands where Banks said "Every where round us we could see large Indian towns [i.e. pa], houses and cultivations" and where 37 canoes crowded upon them and people appeared from the hill tops and coves, about 200 in all (Beaglehole 1962 (I):440-2). He dismissed the estimate of 500-600 by other gentlemen aboard as excessive.

During their stay at Queen Charlotte Sound in January 1770, Banks visited two island pa, the first Hippa Island off Motuara defended by a palisade and a fighting stage, and the second Hippa Rocks where he estimated there were 80 to 100 houses (Beaglehole 1962 (I):458 and 460). A recent archaeological survey has shown that this is exaggerated, and there are only 26 terraces with room for no more than 40 small houses or other structures on the rocky islet (Brailsford 1981:25). On the second voyage when the "Resolution" was again in the Sound in 1773, Cook revisited Motuara pa and found a new group living there; "The chief and the whole tribe which consisted of between 90 and 100 people" (Beaglehole 1961:171). On his final visit in 1777, Cook recorded a visit by "a tribe or family I had never seen before, consisting of about 30 persons" and also from chief Kahura with a "family" of twenty or more (Beaglehole 1967:65, 68). At the same time, Wm. Anderson, the ship's surgeon, estimated there might be "about 200 [Maoris] in the Bay at this time" (Beaglehole 1967:798). It appears that nowhere in the North Island did Cook and Banks encounter more than 200 people in any one place, whilst in the South Island, the population was fluctuating, mobile, and sparse. It must be remembered that their observations were limited to the coasts and nearby islands and did not include the Auckland isthmus.

Samuel Marsden of the Church Missionary Society and his travelling companion J. L. Nicholas had better opportunities in 1814-15 for longer contacts with the Maori people in the Bay of Islands and when travelling inland. Marsden was apparently not interested in their numbers, but Nicholas, a keen observer, consistently made estimates of how many "natives" he saw at each place. At "Kedah's" pa near Matauri Bay he noted 150 inhabitants and 50 huts (Nicholas 1817 (I):141); at "Wiveeah's" pa of "Wycaddee" (Waikare) on the southeast part of the Bay, "150 souls" (Nicholas 1817 (I):253); at Okuratope, Hongi's brother's pa near Waimate North, 200 or 300, although the greater part of the inhabitants were away fishing at the coast (Nicholas 1817 (I):338). At "Duaterra's" (Ruatarara's) pa, Rangihoua, where the first mission station was founded, Nicholas estimated there were "150 or 200 souls" and 100 huts and sheds (Nicholas 1817 (I):177); these had grown to 300 by the time he came to give a general account of New Zealand (Nicholas 1817 (II):297-8). He then concluded that other settlements in the Bay "contained but from fifty to one hundred inhabitants, and the greater part of them had only from twenty to thirty."

These round figures may not be reliable. It is always difficult to count accurately when large numbers are involved, as anyone who has taken part in a bird census knows. Like the birds, a human populace is unlikely to stand still, especially the

children. However, Nicholas' opinion of 150 to 200 persons in a pa is worth remembering and may be compared with the 100 recorded by Banks and Cook. In both cases there is the possibility that some of the inhabitants were away at the time of the count.

Accuracy is more likely to have been achieved when small numbers were concerned. There are several accounts of family groups that were related to houses and offer a chance of correlation with the archaeological record. William Monkhouse, Cook's surgeon on the "Endeavour", went ashore in Anaura Bay in 1769 and described "a single house pleasantly situated" on the hills on the south side of the Bay. "Here was a man, his wife, two Sons, an old Woman and a younger who acted as servants" (Beaglehole 1955:584): in short a household of six. On the same occasion Banks observed that "each family or the inhabitants of 2 or 3 houses which generally stood together were collected in a body, 15 or 20 men women and children" (Beaglehole 1962 (I):415). There will then have been five to seven people in a house if there were three, up to ten if only two. There is also the better-known family Cook encountered in Dusky Sound in 1773, consisting of "a man, two wives, a young woman (his daughter), a boy of about 14 years old and three small children" (Beaglehole 1961:117), living in two wretched huts, again a household of five excluding the small children. Similarly Nicholas encountered in 1814 "a family living entirely by themselves, remote from any village, and in a perfect state of seclusion. It consisted of a man with his head wife, two subordinate ones, and three or four very fine children", a household of seven or eight, four if the children be excluded (Nicholas 1817 (I):258).

These accounts indicate that Maori nuclear families were relatively small, at least by Victorian standards when English families of eight or ten were not uncommon. The proposition finds unexpected support from recent anatomical work on prehistoric Maori skeletons at Otago University Medical School. Examination by M. A. L. Phillipps of the pelvic bones of 59 females has shown that the maximum number of births was only five, and most were three or four (Phillipps 1980:155). Abortion and infanticide are attested Maori practices which also will have limited families (Polack 1838 (I):380-83). Houghton's work at Otago has demonstrated that the people were short-lived; nearly all died before they were 50 and most in their late twenties or thirties (Houghton 1980:96 and Fig. 6. 12). This in turn both limited the numbers and altered the character of the population, with a whole generation of elders missing.

There is a picture by Webber that is vital to this inquiry, entitled "The inside of a hippah in New Zealand", which he painted in 1777 in Queen Charlotte Sound, probably at Motuara (Fox 1976:fig. 11). It shows in the foreground a group of four adults, including a chief, in front of a substantial house and two others squatting at the edge of the terrace. The thatched roofs of other structures below and behind the figures show that the summit platform of a terraced pa is depicted; it was occupied by six adults.

THE ARCHAEOLOGICAL EVIDENCE

An acceptable equation has thus been established from literary and pictorial sources; a terrace = one household = six persons, excluding small children. This will now be used, with caution, to estimate the population of a terraced pa. There is some evidence from recent archaeological excavations to support this proposition, although there are very few terraces that have been totally stripped in pa or in open settlements. At Maioro, South Auckland (N51/15) Roger Green's excavation of a palisaded hilltop settlement showed there was a rectangular house on the summit

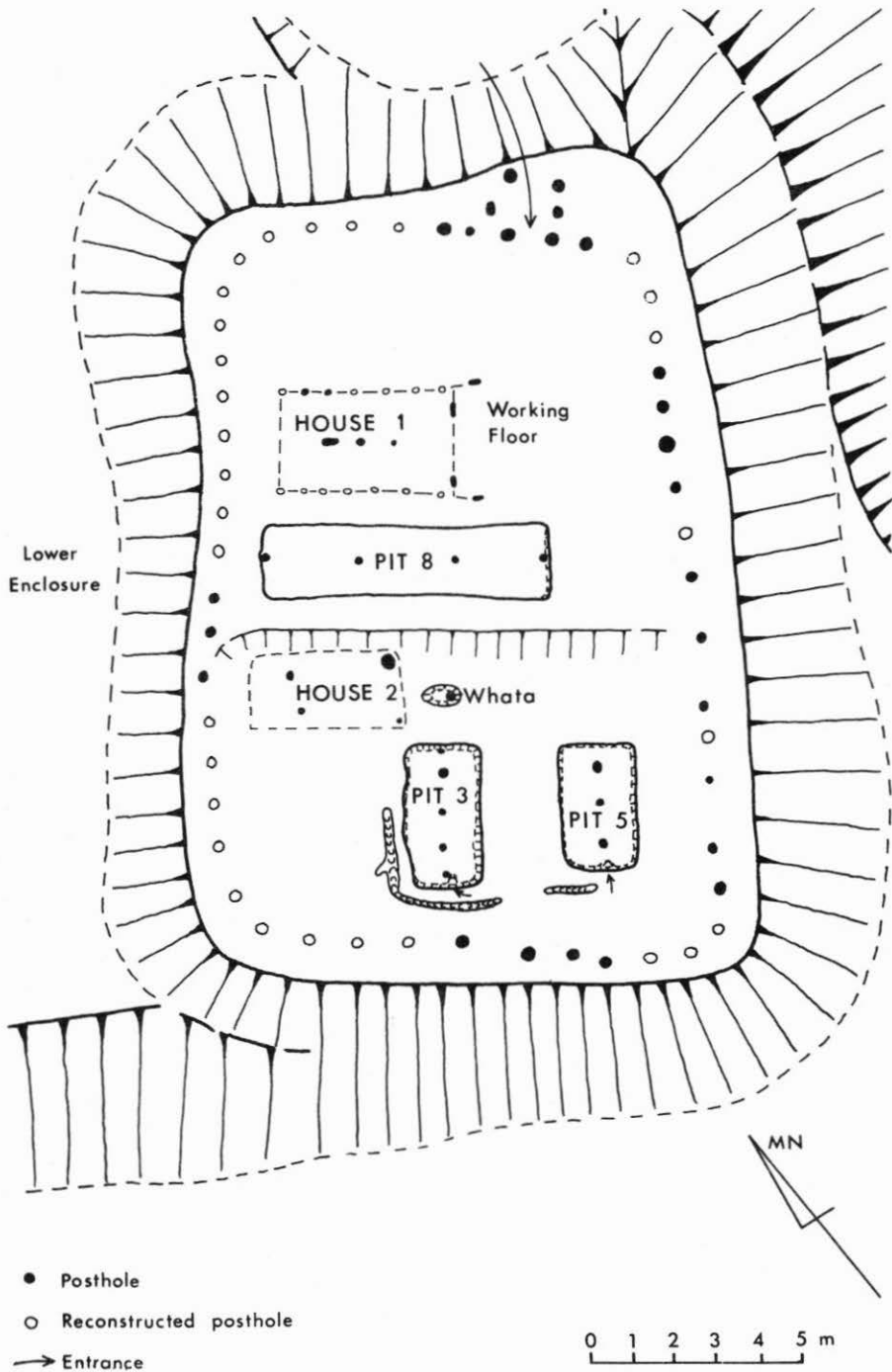


Figure 1: Reconstructed plan of the summit platform at Maioro (N51/15), South Auckland. Fox and Green 1982: Fig. 11, reproduced by permission of Auckland Institute and Museum.

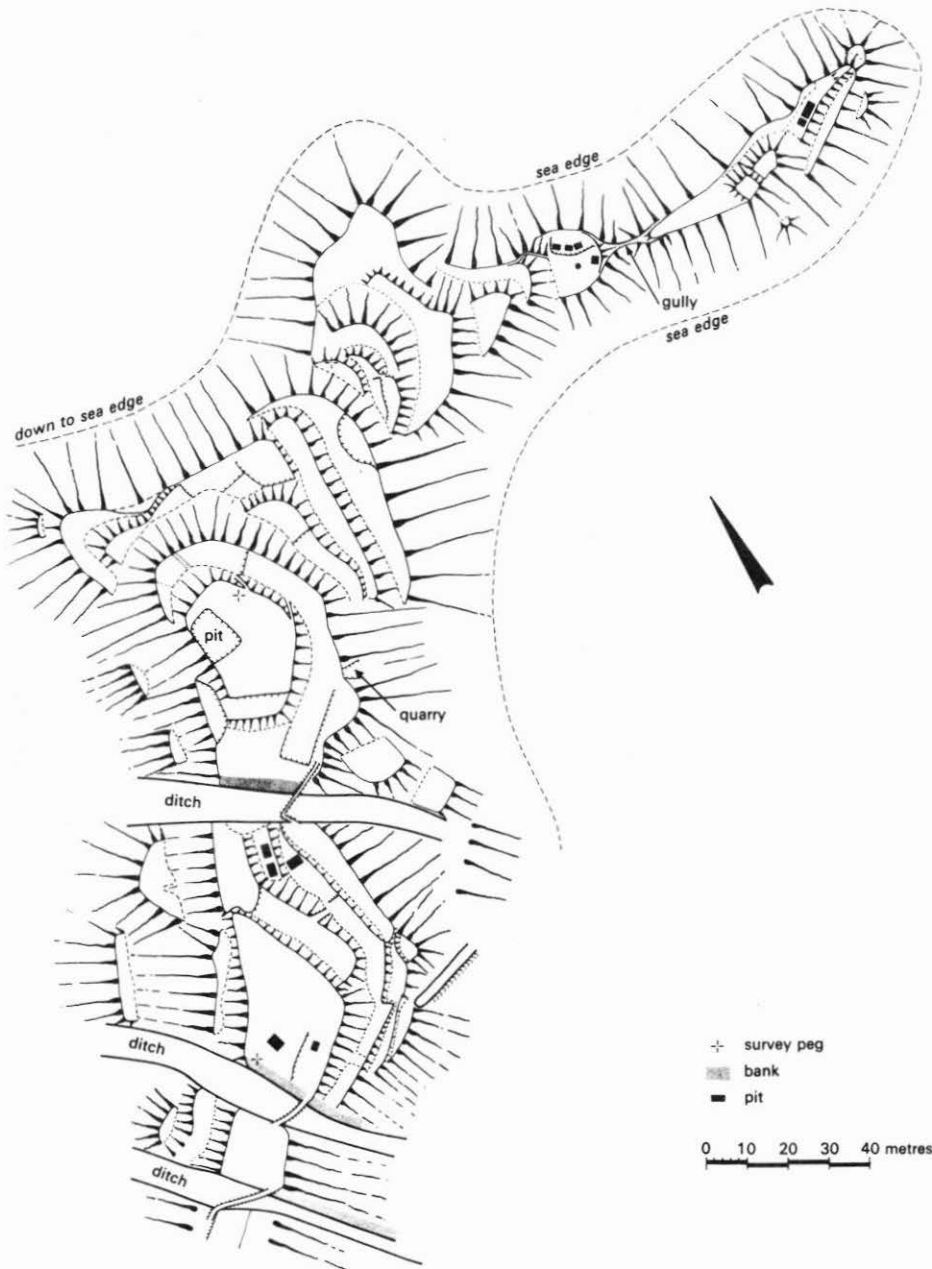


Figure 2: Plan of the pa at Pawhetau Point (N43/59), Clevedon, South Auckland. Fox 1974: Fig. 1, reproduced by permission of Auckland Institute and Museum.

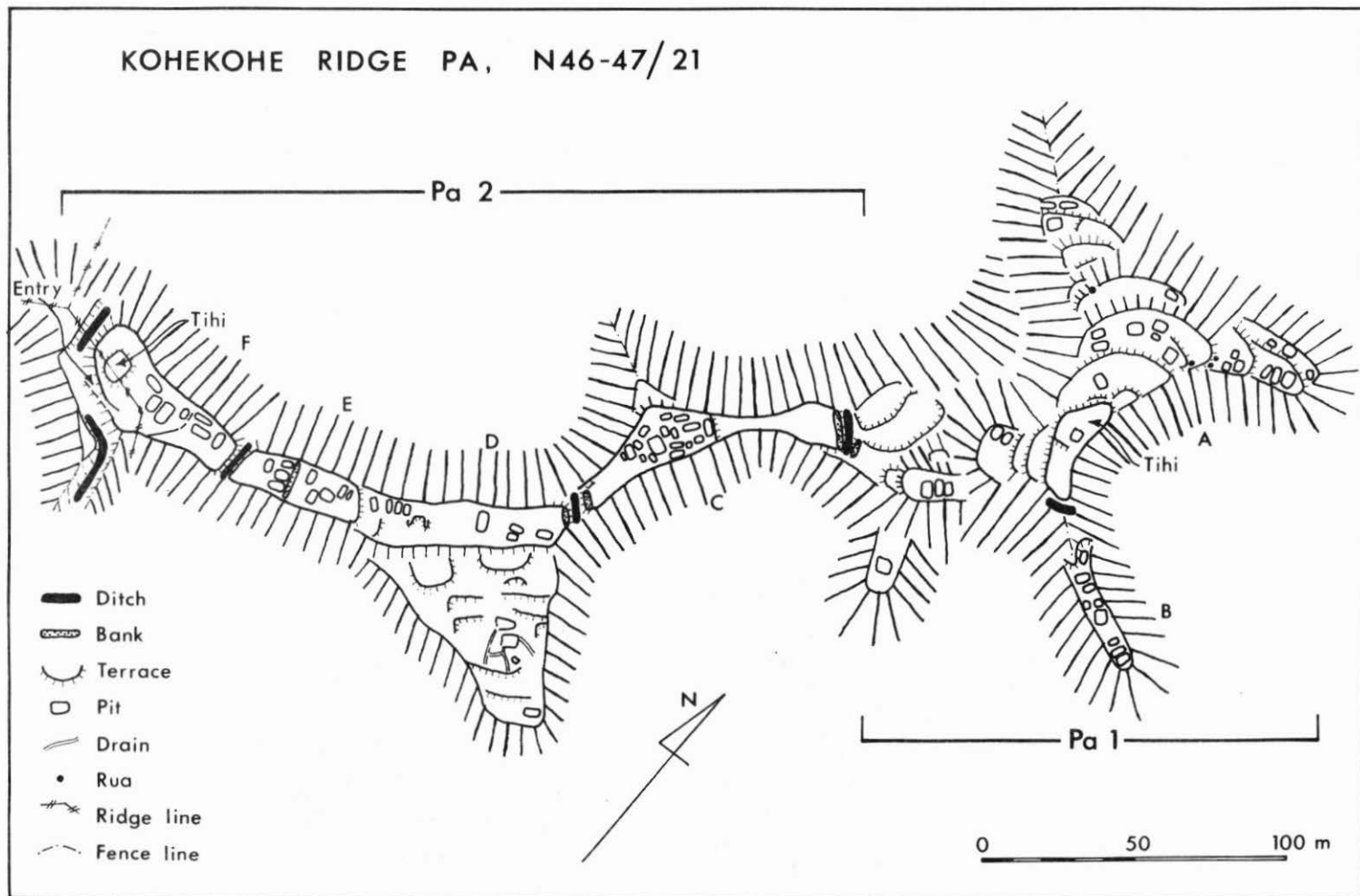


Figure 3: Plan of the pa on Kohekohe ridge (N46-7/21), Awhitu peninsula. After Law 1969.

platform as well as a secondary structure, probably a lean-to cookhouse, at a slightly lower level (Fox and Green 1982 and Fig. 1). At Tiromoana pa, Te Awanga, Hawkes Bay, a lateral terrace was investigated (Fox 1978: Site V. 21) and was found to contain a single building 5-6 m long by 2.5 m wide with a drainage gutter at the foot of the scarp; it was probably a shed of lean-to construction. On another terrace outside the pa (Site X. 27) there was a small sleeping house, 5 × 3.25 m, with a similar gutter at the rear. At Aotea, a small settlement (N64/25) on the west coast of the Waikato, one terrace in the group excavated by Cassels in 1972 had a small sleeping house and another had only a cookhouse erected on it (R. J. S. Cassels, pers. comm.). Anne Leahy's pioneer excavations of a terrace at Station Bay on Motutapu Island (N38/30) uncovered a small house with an adjoining courtyard (1970:62; 1972:24). These examples suggest that one building per terrace was customary, though it was not invariably for domestic use. Many more excavations are required to establish a satisfactory basis for generalisation. The figure of six persons per terrace is only an average figure, balancing the larger households against the uninhabited.

With these limitations in mind, the pa on Pawhetau Point (N43/59), Kawakawa Bay near Clevedon (Fox 1974b) will be examined. This is a large headland pa defended by transverse ditches probably of two periods and with extensive terraced slopes to the sea (Fig. 2). There are very few pits, which suggests a predominantly fishing economy. It is essential for a terrace count that an accurate plan is available and there are obvious problems. Should the level space between the two outer ditches be counted, since it is unlikely that a dwelling would have been permitted within missile range and blocking the view of the defenders? The five small detached terraces on the western slopes have been omitted since they are suitable only for look-outs or as a position for defence. In all 38 terraces have been included, with the summit platform (*tihī*) with its large pit being estimated to house a chiefly family of ten. It is hoped that the errors will cancel each other out. Allowing six persons per terrace, there could have been at most 238 adult people living on Pawhetau Point; this assumes that all of the terraces were occupied at any one time, so the answer may well be less and is unlikely to be more.

The next example is the Kohekohe ridge pa (N46-7/21) (Fig. 3) on the Awhitu peninsula, mapped by the Auckland University Archaeological Society in 1968 and studied by R. G. Law (Law 1969). This is almost certainly two terraced pa occupying adjacent sites on the 600 foot (180 m) ridge. Pa 1, on the eastern summit and two adjoining spurs, is defended by terraced scarps and by one short length of ditch below the *tihī* (Law, Units A & B), whilst Pa 2, on the western summit, was strongly fortified by three separate lines of transverse ditches and banks facing east and by a massive deep ditch facing west beyond the *tihī*, where an entrance is situated (Law, Units C, D, E, F.). The two pa are presumably successive fortifications, the more elaborate western example being the later. Law recognised there were two centres of occupation on the ridge but judged them to constitute a single site. According to the present calculations, Pa 1 has 21 terraces, Pa 2 has 17, in addition to the *tihī*, and so should have held 136 and 112 adults respectively, or 248 in all, if both were occupied contemporaneously by related groups.

Law also made an estimate of the population basing his calculations on the storage capacity of the numerous pits, 36 in the eastern pa and 41 in the western. As the plan (Fig. 3) shows, these are arranged both in groups on the spurs and ridge top, indicative of communal storage, and in twos and threes on a terrace suggesting a family store. Law assumed that the stacked kumara took up half the volume of the pit, and he then equated a cubic metre of tubers with a weight of 757 kg (Law 1970).

He suggested that 75 percent of the crop would be consumed during the seven months of storage through the winter and early spring, and, of the remaining tubers, 20 percent would be needed for propagation and 5 percent would go to waste. With a subsistence level of 2400 calories per day, an intake of 2 kg of kumara per person would suffice, though this would need to be supplemented by other items such as fish, birds, eels, and shellfish to provide more protein. By this means, Law reckoned there was sufficient kumara stored in the pits on the two pa sites to feed between 270 and 625 people, with the probability of 450 as a mean. This is greatly in excess of the present calculations of 248 inhabitants. A probable error is the assumption that kumara were stacked as a solid mass in the pit. Excavation has now demonstrated that the pits were constructed as cellars, with a roof supported by one, two, or more rows of timber uprights bedded in the pit floor and entered by a low door at one end (Fox 1974a:141). Space would be necessary to enable people entering to get at the crops and to check the tubers for contagious moulds. Probably no more than 30 percent of the pit's volume was filled with kumara.

It is clear that there is a relation between the total of storage pits, whether grouped or scattered, and the number of inhabitants in a settlement. The ratio is best ascertained from the identification of a single family unit in rural surroundings, uncomplicated by the problem of defence. For example, on Motutapu Island (Leahy 1972:24-6), the inhabitants of a small house on a single terrace had two roofed storage pits, with a third (Pit 5) added later. Similarly the Maioro excavations (Fig. 1) showed that the rectangular house on the palisaded summit platform was associated with a long narrow pit of exceptional capacity (7 × 1.7 m, 1.5 m deep), whilst there were two pits of average size (3 × 1.75, 1 m deep) beside the lean-to cook-house structure on the lower level. This pair of pits were the last in a succession of three phases of construction. It has been conjectured that the terraced summit platform was the living quarters of a chiefly family of six to ten persons (Fox and Green 1982:78). Surface observations reinforce the idea that two, or sometimes three, pits per household was a common requirement. More than one pit would be needed to safeguard the kumara from an outbreak of mould, or perhaps two were needed as separate stores for different crops. Recent fieldwork has shown, for example, in the central Bay of Islands that in the string of small settlements at the north end of Lake Ohwareiti recorded by Cassels (Phillips 1980:151), five out of seven consisted of a levelled house site with a stone-edged fireplace and two pits (N15/254-258). In Hawke's Bay, in the Waitio and Valley Road areas southwest of Napier, two or three pits are the numbers most frequently found with well-defined single house sites with associated field systems (N134/91, 132, 138, 142; Fox and Jeal 1979:2 and 8). Excavation, however, is likely to reveal underlying complexities with previous replacement of pits as at Maioro.

The formula of two pits per household can now be applied to the Kohekohe ridge pa, retaining the average number of persons in a household as six. The results (Table 1) compare very closely with the total of 248 persons as calculated from the terraces.

Pa 1, 36 pits = 18 households = 108 people.

Pa 2, 41 pits = 20-21 households = 120-126 people.

Total, 228-234 persons in both.

Taniwha pa near Te Kauwhata, Waikato, is another well recorded pa in which the relationship of terraces to pits can be defined. There are 44 exceptionally well-preserved pits arranged in rows on the higher part of the site and 25 terraces in the lower area behind the defences, one with a fireplace (Law and Green 1972:257, Fig. 2). Excavation revealed such slight signs of occupation that it was concluded that the



Figure 4: Aerial view of terraces on Maungakiekie, One Tree Hill, Auckland. Photo Whites Aviation.

pa had functioned as a fortified food store. It was probably built in an emergency and only occupied intermittently in the late eighteenth or early nineteenth century. Though obviously a special case, it falls into line with other examples; the 25 terraces imply a population of 150, whilst the 44 pits would be sufficient for 132 people (Table 1). Law's calculations suggested that the pits could hold kumara for 100-350 people, with 225 as the probable mean.

Encouraged by these results, it is proposed to examine four of the large terraced pa on the Auckland cones, Mount Eden, One Tree Hill, Mount St John and Mount Wellington for which there are detailed plans. These are based on surveys by students of the Anthropology Department under the supervision of Roger Green and revised by myself (Fox 1977) and by Susan Bulmer (1980, 1982). The extensive damage to Mount Hobson, Remuera, and to Taylor's Hill, Glendowie, excluded these pa from consideration, although detailed plans have been made of what remains. The four pa are built on the rim and external slopes of one or more craters formed by volcanic eruptions and were surrounded by a zone of Maori cultivations, of which little has survived. Each of the pa has suffered some damage from quarrying and the building of reservoirs and roads, and allowance must be made for these in any calculations. There are four or five tiers of terraces around the external slopes but as many as six to eight below the summit of One Tree Hill (Fig. 4). These are not continuous but are broken up by unquarried strips of hillside into separate units. It is difficult to say without excavation whether these were used by different households, but they have been counted separately as such. Looking up at the slopes, it must have been like a set of tenements, one hut above another on the terraces, little paths between, and midden everywhere. Nor is it certain that all terraces were residential: a two-metre-wide section cut in 1980 for a pipe line down the slopes of One Tree Hill above Olive Grove Road revealed no signs of occupation on the lowest terrace (Bulmer 1980).

The numbers occupying the various "strong points" have been counted separately. There are natural volcanic extrusions on the crater rim which have been made defensible by scarping and by small-scale transverse ditches or by low banks as foundation for a palisade (Fox 1977:5, 16). They are larger than most terraces and have been counted as 10; like the *tahi*, they are likely to have been occupied by people of importance. The plans show that the distribution of pits on the cones is not uniform: some terraces have groups of 10 to 12 pits, others only one or two, others none at all. There are also big groups on the crater rims and on the "strong points", probably for communal use or as stores for an emergency. It is hoped that all these differences will average out. The principal concern is the assumption that all the terraces and pits were in use at any one time; if this is incorrect, the figures will be excessive.

The results are surprising but consistent: it is clear from these calculations that the population was numbered in hundreds, not the thousands of popular belief, even if an allowance of 100-200 extra people is made on account of recent damage. One Tree Hill was the most densely settled as befits the largest and traditionally the most important settlement of the Waiohau people. The figure of 1074 can be compared with the 1400 inhabitants of the similar sized Pouerua pa in the Bay of Islands, recorded by Williams in the 1830s. Mount Eden, although extensive, was abandoned in the early eighteenth century according to tradition, which may account for the lower numbers. It is noticeable that the numbers based on the pit count are invariably less than those from the terraces, but the graph (Fig. 5) prepared by Law shows that the relationship is constant.

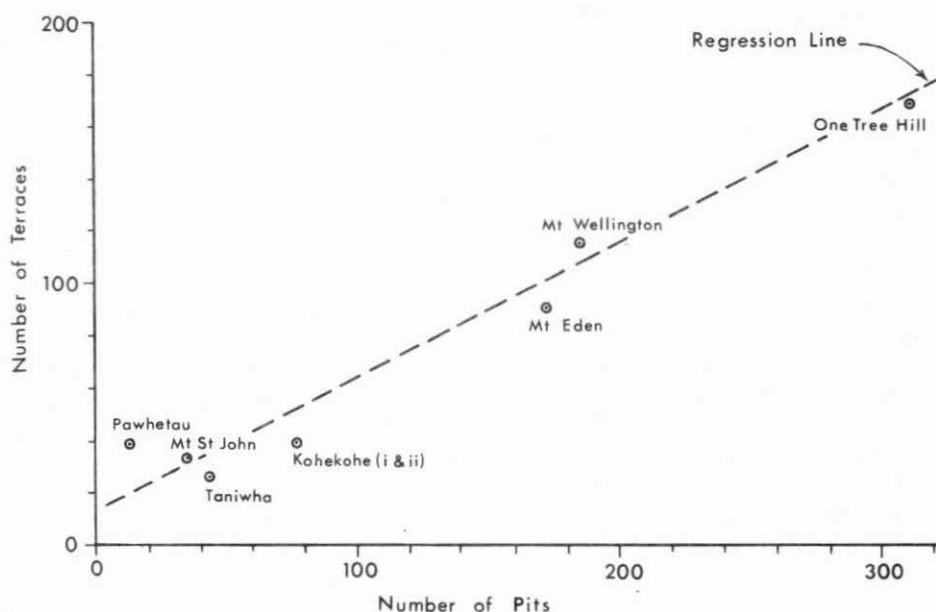


Figure 5: Graph, showing the relationship between terraces and pits on the pa sites on Table 1.

TABLE 1
ESTIMATES OF PA POPULATION

	Terraces*	Strong-points**	People	Pits*	Households	People
Mount Eden	90	3	570 +	171	85	510 +
One Tree Hill	169	6	1074 +	310	155	930 +
Mount Wellington	115	2	710 +	185	93	558 +
Mount St John	33	—	198	35	17	102
Pawhetau Point, Clevedon	38	1	238	12	—	—
Kohekohe, Pa 1	21	1	136	36	18	108
Awhitu Pa 2	17	1	112	41	20	120
Taniwha, Waikato	25	—	150	44	22	132
* Households of six **Ten + Add 100-200 for recent damage				* 2 pits per household of six.		

DISCUSSION

This reassessment of the Maori population obliges us "to think small", particularly remembering that the figures put forward are the maximum and relate to the final occupation of a site. The concept of a smaller population implies a reduction in the amount of land cleared and cultivated at any one time, with space available for rotating the gardens to restore fertility. It follows that a greater number of settlements could be accommodated in a district; sons could be given land to clear and cultivate and to found a pa within the territory of a *hapu*. This may explain the duplication of pa as on the Kohekohe ridge. In Auckland the three pa on the Three Kings traditionally belonged to three brothers. The lower numbers also affect

concepts of the scale of Maori warfare in the pre-musket era. It is well known that the fighting force "was organised on the basis of kinship and locality", the *hapu*, under the leadership of a chief (Vayda 1970:19-24). On the assumption that on average one warrior would be available from each household, the figures would indicate that Pawhetau Point and Kohekohe ridge pa might each raise 40 to 50 fighting men, a war canoe load. Mount Eden and Mount Wellington could produce 100-120 and One Tree Hill, 180-200 warriors. The small numbers may explain the frequent use of short lengths of transverse ditch in the defence of a pa, why pa were so infrequently besieged and why single combat, stratagems, and surprise were the key factors in an attack (Vayda 1970:42, 75).

In conclusion, it must be emphasised that the figures put forward in this article are tentative and that the numbers may well prove to be wide of the mark; they can easily be increased or decreased by a slight alteration in the accepted number of an average Maori household. Nevertheless, the writer believes that the basis of the calculations is sound, and it will prove its worth in so far as it stimulates others to try to translate archaeological findings into human terms. The study underlines the pressing need for more excavation directed to solving social problems. It is a grave lack that there have been so few investigations of the successive layouts of a terraced pa, either of individual terraces or of the summit platform and that so little is known from scientific excavation of any pa on the Auckland isthmus.

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