The Archaeology of Omaha Sandspit, Northland, New Zealand

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ABSTRACT

In the course of mitigation of earthworks associated with residential development at Omaha, 249 middens were recorded and investigated. Dates range from about AD 1400–1700, placing the occupation and use of Omaha firmly within the late phase of prehistory. The middens contained very little other than shell, and we interpret their use as a combination of industrial scale shellfish processing and formal gatherings. The economic analysis of Omaha is fairly straight forward, but we also offer a socially oriented explanation to account for aspects of the archaeology that clearly are not economic.

Keywords: OMAHA, NORTHLAND, SHELL MIDDEN, FISH, LANDSCAPE, SOCIETY.

INTRODUCTION

The Omaha Beach development is a residential subdivision on the southern half of Omaha (or Mangatawhiri) Sandspit, 12 km north east of Warkworth, about an hour's drive north of Auckland. The sandspit encloses the Whangateau Harbour, which is fed by the Omaha River and the Waikokopu Creek. The spit itself is composed of a series of old beach ridges and eroding dunes, and prior to residential development was largely in dairy pasture.

This paper summarises the archaeological investigation of middens recorded during earthworks mitigation in two main seasons of fieldwork between July 2000 and October 2002.

TRADITIONAL HISTORY AND LAND USE

The coast and islands of the outer Hauraki Gulf were valued for their rich marine life, particularly shark, which was preserved by drying, as well as other fish and shellfish. The large expanse of estuarine mud flats in the Whangateau Harbour would have been a particularly rich source of shellfish. A wide range of natural resources could be procured from the swamps and forests near Omaha, and Great Barrier Island provided a source of obsidian. Good quality agricultural soils were available locally, and cleared land would have provided a source of edible bracken fern.

The history of Omaha is closely related to that of the larger coastal area between Mahurangi and Te Arai Point, as well as the wider Northland/Auckland/Hauraki region. The

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Mahurangi area, including Omaha, was originally occupied by Ngai Tahuhu, who traced their decent from Tahuhunui, commander of the Moekakara or Te Whakatuwhenua canoe that landed near Goat Island (ARC 1992).

Around the 1620s a group of Ngati Awa migrated north from Kawhia, led by Maki and his brother Mataahu, who defeated Ngai Tahuhu at Pukenihinihi Pa to the southeast of Omaha. It was around this time that the descendants of Maki and Mataahu became known as Kawerau, and came to occupy the land from Takapuna to Te Arai and the Gulf Islands as far north as Hauturu (Little Barrier Island). The descendants of Maki's son Manuhiri became Ngati Manuhiri, and settled the area between Whangateau and Pakiri (ARC 1992).

In the 1820s Kawerau found themselves under threat from musket-armed Ngapuhi. Ngapuhi were defeated in battle at Mahurangi in 1820, where their leader Koriwhai was killed. Two years later they sought to avenge this death, attacking Kawerau at Te Kohuroa (Matheson's Bay). After the initial attack Ngapuhi retired to Omaha Sandspit where fires were lit. The next day there was another brief engagement, which Ngapuhi won (ARC 1992). In 1825 Kawerau aided Ngati Whatua in battle against Ngapuhi at Mangawhai, and then at Te Ika a Ranganui near Kaiwaka. Despite heavy losses Ngapuhi emerged victorious. Kawerau lost many warriors and, fearing further attack, left their homes. Ngati Manuhiri sought refuge north of Whangarei with their Ngati Wai relatives (Pritchard 1983).

In 1839 a 10,000 acre block, which included Omaha Sandspit, was sold to William Webster, an American trader, who purchased the land from Hauraki tribes rather than the traditional occupants. In 1844 Webster's claim was found to be excessive, though he was granted a smaller holding on the northern side of the Whangateau harbour. Meanwhile, the Crown purchased a large tract of land, known as the Mahurangi Purchase, stretching from Takapuna to Te Arai Point, from Ngati Paoa and Ngapuhi. Hearing of the land sales the Kawerau people began returning to their land unimpeded by the Crown. Chief Tawhiti lived on Omaha Sandspit prior to 1865, when he moved to the flats nearby. Land sales continued in the area and in the 1870s the Maori Land Court heard claims to the Mangatawhiri block. This particular block had many claimants and it was agreed that it should be divided into three. Mangatawhiri No 1, essentially Omaha Sandspit, was granted to Kawerau for sale. It was bought by John Atkinson of Dunedin, and subsequently passed through a number of hands. Its various owners exploited their holdings for timber and firewood, and by 1896 sufficient timber had been removed for a flock of 900 sheep to be grazing the block. In 1907 John Wilson of Wilson's Portland Cement Company purchased the property for its sand and shell resources. In 1928 Wilson granted the McCallum brothers a five-year licence to remove shell and sand from the property (ARC 1992).

This long recorded history of occupation and exploitation is reflected in the depositional history of the middens as well as the dynamics of the physical environment.

DEVELOPMENT AND GEOMORPHOLOGY OF THE DUNE SYSTEM

Because of the presence of the Barrier Islands the Outer Hauraki Gulf is sheltered from some wind and wave conditions, but the wave environment is still defined as open (Rodney District Council 2003). This is not generally a high-energy coast, but the deep re-entrant of Omaha Bay has provided suitable conditions for the development of the foredune barrier that forms Omaha Sandspit, which encloses the estuary of the Whangateau Harbour (Shepherd and Hesp 2003; Hume 2003; McClay 1976).

The spit is bounded by the beachfront of Little Omaha Bay to the north east, by moderately steep hills of eroded and weathered greywacke to the south east, including Te

Kie Point, and by the Waikokopu Creek draining these hills into the harbour to the south and west. The whole of the site is located within a valley or basin that opens into the harbour, and the spit has enclosed the harbour mouth with alluvial and estuarine sediments forming tidal mudflats to the west, and dune sands to the east (Tonkin & Taylor 2000). Basement rocks consist of indurated sandstones (greywacke) and mudstones of the Waipapa group (of Jurassic origin, 150–120 million years ago), and more recent sandstones of the Waitemata group (Miocene, 12–16 million years ago). The latter are soft and easily weather to form sands and clays (Harrison Grierson 1999: 1). The sandstones outcrop at Te Kie Point, while the greywacke to the south of the spit was quarried in historic times.

The dunes are of marine origin and have formed along with the spit within the last 4,000 years (Tonkin & Taylor 1998: 1). The colour of the sands varies from white to yellow according to the presence of organic and other material, such as clay and limonite (iron salts) (Harrison Grierson 1999). The spit is characterised as being in dynamic equilibrium (Tonkin & Taylor 1998: 2), with the net gain and loss of sediments both in the estuary and along the beach cancelling each other out. A tendency to accretion of the dune system, particularly at the southern end of the site, is balanced by major episodes of storm-induced erosion. Tidal currents and littoral drift move sand north and south along the beach, and the northern tip of the spit was stabilised using groynes in the 1970s (Rodney District Council 2003). The relative stability of the dune system cannot necessarily be projected back into prehistoric times, but it seems likely that the dunes have been fairly stable for some time. The stability of the overall system does not apply to individual dunes and their associated middens, which have been subjected to various agents of erosion, particularly wind deflation, which would have been exacerbated by vegetation clearance and running stock.

An 1874 survey plan shows a band of forest along the western side of the sandspit and a small area of forest to the northeast end. The remainder of the block at that time was covered in fern and manuka. A 1934 plan indicates that the forest had been cleared in the interim, and around half the sandspit was covered with light manuka bush and flanked by sandhills, which were not shown on the 1874 plan. This suggests at least two cycles of clearance, with the latter in particular exposing the dunes to significant erosion.

The dune system of the subdivision falls into three distinct areas (at the time of archaeological investigation; earthworks have since levelled the dunes entirely). In the northern half the dunes are generally older and more stable, corresponding by and large with the prehistoric dune formations. However, in some places new dunes are present and probably relate to dune formation after the late nineteenth or subsequent twentieth century land clearance, but before pasture formation. These dunes can be clearly seen in Figure 1 as ridges running along the sandspit. To the east the dunes are less stable and many are actively blowing out, deflating the middens located on them.

In the central part of the development area the dunes are less stable, and apparently younger. Very few middens were observed here. Either they have been removed by quarrying for sand and shell, as noted in the historic records, with subsequent build-up of the modern dunes; or this area may have been more like the flat area to the south of it, and dunes have since blown up across it, deeply burying any archaeological evidence. The recent wind-blown white sand was observed to be up to 2 m deep in places.

The southern part of the subdivision comprises a flat area of ground that rises gently by about 2 m from a natural drainage path running north–south behind the foredunes to a low ridge approximately 600 m long. This is low-lying swampy ground, with water dammed by the foredunes. It consists of alluvial sands that are reworked dune sands (Harrison Grierson 1999). Behind this low ridge the land drops away again by 2 m to kahikatea swamp forest (which has been placed in reserve) and the Waikokopu Creek. This flat area is generally damp, especially in winter, and especially close behind the foredunes, although the low ridge is drier.

HISTORY OF ARCHAEOLOGICAL INVESTIGATION

The middens at Omaha have been known to archaeologists for some time, although prior to development only six had been recorded in the development area. Shawcross (1967) examined shellfish densities in the Whangateau Harbour and concluded that the estuarine environment could, in theory at least, support a high human population. An initial survey and assessment associated with the residential development was carried out in 1997 (Clough 1998). Forty-four middens were located, only one of which was confidently identified as one of those previously recorded (R09/208). All were shell middens of varying size and condition, many typically deflated by wind erosion. Although middens are the only site type on the sandspit, the spit and harbour are surrounded by six headland pā and numerous other

Figure 1: Aerial view of the Omaha subdivision prior to earthworks, looking south. The unstable foredunes can be seen on the eastern, beach side, while to their west the lines of dunes running north–south are more stable. South of this are recently disturbed dunes, while south of this again is a low lying flat area. To the west lie the golf course and kahikatea forest. Season 2 was mainly located in the unstable foredunes to the north-east, season 1 in the rest of the subdivision. Photo courtesy of Omaha Beach Ltd.

settlement sites. The density of archaeological sites both on the spit and surrounding it clearly established the significance of the area. The recorded middens were set aside and protected from development, but because it was thought that further material would be uncovered during earthworks, a monitoring and research strategy was devised to record and analyse this. In time a further 249 middens, some very substantial, came to light.

THE ARCHAEOLOGY OF OMAHA

EARTHWORKING

Earthworks were substantial, and generally involved re-contouring the entire development area, levelling the dunes in the northern part and infilling the low-lying areas to the south, as well as minor landscaping of the golf course to the west, between the residential development and the kahikatea swamp. The northern half of the sandspit had already been developed, mainly in the 1970s, although without the requirement of archaeological investigation. Most earthworks were carried out by 15 cubic metre motor scrapers, with limited use of backhoes. Earthworks proceeded in two phases: July to December 2000, and September to November 2002. Consequently there were two main seasons of archaeological investigation. The development was divided into five 'Neighbourhood Units' (NU). Phase 1 of development and Season 1 of the archaeology were focused on NU 4–5 in the south of the development area, and the western parts of NU 1–3 in the north. The eastern parts of NU 1–3 were covered in Season 2.

These investigations have been fully reported elsewhere (Clough 1998; Clough and Campbell 2000; Campbell *et al.* 2001; Campbell and Clough 2001, 2002; Bickler *et al.* 2003). This paper summarises that material for a wider audience, supplements it with additional analysis, and draws further conclusions.

INVESTIGATION METHODOLOGY

Contrasting methods of investigation were employed in the two seasons (more comprehensive detail is given in Bickler *et al.* 2003). In Season 1 the methodology concentrated on examining the areal extent of each midden. As middens were exposed by heavy earthmoving machinery work ceased in the vicinity and the overburden of windblown sand was stripped away with a backhoe equipped with a weed bucket. For each midden an assessment of significance was made, which provided the basis for further investigation. Some smaller middens or isolated oven scoops were almost obliterated by the impact of heavy machinery and only minimal recording was carried out. Visible features were mapped and the middens were test pitted, sampled, described and photographed as appropriate. Artefacts, of which there were very few, were also described and photographed. Some, but not many, middens were trenched with the backhoe. Finally the midden material was removed with the backhoe, and any features visible at the base were recorded. Each midden was located with a central GPS point, generally accurate to ± 5 m. Each was numbered using an internal numbering system prefixed with OM, starting with OM1, rather than being assigned a separate NZAA site number — we regard the entire spit as a single site, and have subsequently recorded it as site R09/992. The covenanted middens retain the NZAA site numbers they were allocated in 1997 (Clough 1998).

The Season 2 methodology differed from that of Season 1 in two significant ways: middens were detected well ahead of heavy machinery operations through probing the dunes with a 1.2 m gum spear, though not all were discovered by this method; and their internal morphology was examined by trenching and recording them in profile. Some trenches were extended well beyond the shell deposit in order to examine the depositional history of the middens and their relationship to the wider landscape. Season 2 numbering of middens commenced with OM200.

In addition, when R09/888, intended for preservation, was badly damaged by heavy machinery, a brief rescue excavation took place between Seasons 1 and 2, largely following the Season 1 methodology.

Finally, a number of burials were uncovered during earthworks. In some cases these were dealt with by tangata whenua representatives, but three were excavated and examined by biological anthropologists with the approval of tangata whenua.

MIDDEN DISTRIBUTION

Middens often appear clustered together (Fig. 2), but no obvious pattern was discernible beyond the general fact that middens were usually located on the leeward side of dunes, although many of the larger middens covered the dune crests, and contributed to dune formation. These middens were probably quite exposed to the elements although manuka scrub may have provided some shelter. Many middens were located close to each other — they were generally defined as discrete features when a gap of 10 m or more occurred between them.

GENERAL STRATIGRAPHY

The middens were composed almost entirely of shell in a sand matrix, usually charcoal stained. Many, particularly the larger middens, contained internal stratigraphy, in the form of various lenses of shell differentiated by species composition, shell condition (burnt, fragmented, whole and clean, etc.), type and consistency of matrix, and density of midden deposit. These lenses result from differential exploitation of shellfish species, oven construction and rake out. Oven scoops were cut into the middens at various levels, ranging from the base to the surface, often clustered into general cooking areas. These were particularly evident in the bases of large middens when all shell had been removed. Lenses and layers of disturbance, associated with occupation and site use, were also present. What is notably lacking is any evidence of reuse of middens, such as clear delineation of internal layers, or layers separated by clean sand. Each midden seems to represent a single episode of occupation and deposition, even though some of these episodes might represent an occupation of some weeks or even months. Most middens were discrete deposits, except along the flat areas of NU 4–5, where midden material has been dispersed, probably in historic times by agricultural or quarrying activities.

Middens often contained hāngi stones, usually heat cracked and quite fragmented. These were usually scattered throughout the matrix; very rarely were they found still *in situ* in an oven scoop.

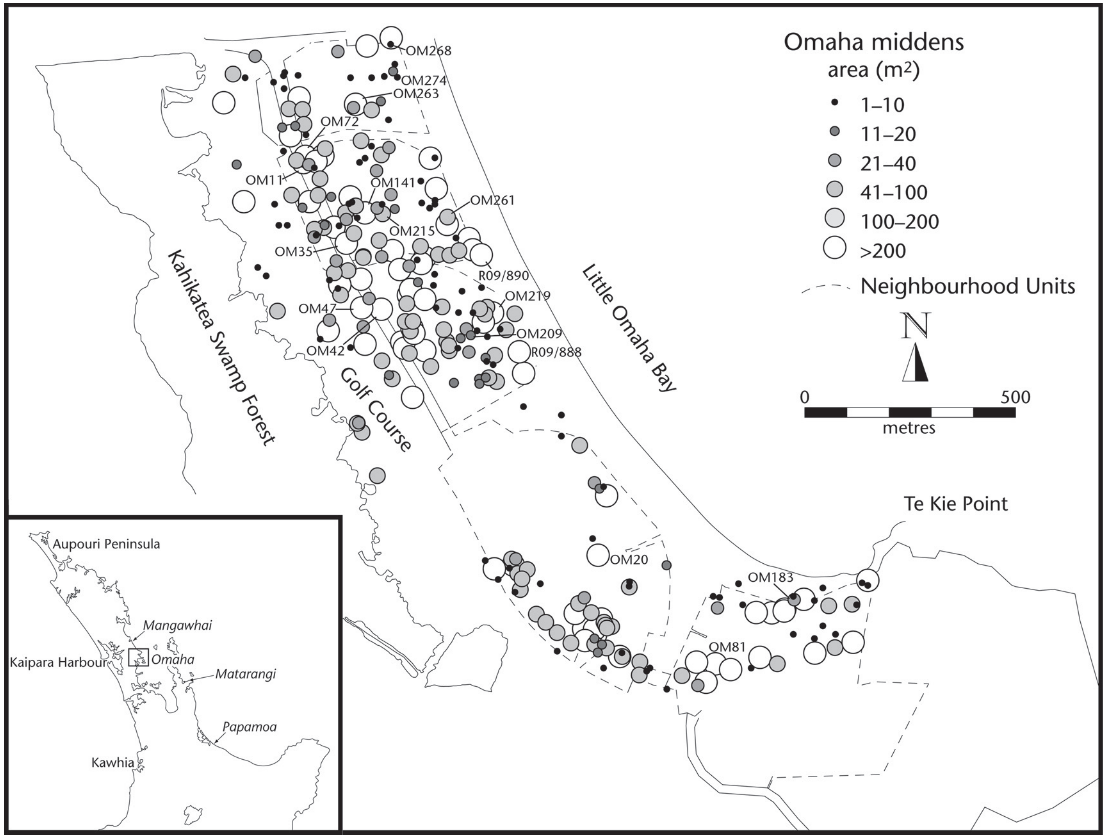

Figure 2: Middens recorded on Omaha Sandspit, 2000–2002. Middens mentioned in the text are numbered.

Most middens are located over a substrate of yellow limonite sand, which underlies most of the spit. Closer to the water table this yellow sand becomes a gleyed beige colour, that would seem to have been waterlogged for the greater part of the year. At the southern end of the subdivision, especially in NU 5, this gleyed sand formed the substrate for many of the larger middens.

An old topsoil horizon was located at varying depths beneath and within more recent wind deposited sand. These bands of dark sandy soil were usually only about 50–100 mm thick and were often incorporated into the upper midden layers. Their colour comes from organic material, but particularly from a general scatter of fine charcoal across much of the subdivision, especially at the northern end. This charcoal is largely associated with prehistoric occupation, but in places a similar soil may be associated with modern agricultural clearance. Other old compacted horizons extend around many of the larger middens at the northern end of the subdivision. They appear to be living or activity surfaces, but no features or artefacts were observed in association with any of them. These horizons were not so commonly observed in the southern half of the subdivision, which probably relates to the size of the middens, intensity of occupation and the relative stability of the dune system to the north.

In many instances the old topsoil predated the middens, which were generally cut into it. Two exceptions are OM11 and OM209, which were overlain by this topsoil. Radiocarbon dates from these two middens confirm that they are among the oldest on the spit, and it seems likely that the old topsoil originates with the initial occupation of the spit, or reoccupation after a hiatus, and its clearance by fire.

Associated with many of the larger middens was a disturbed soil with lenses and inclusions of topsoil, white and yellow sand, charcoal and shell underlying the main midden deposit and often extending around it up to 20 m or more. While this soil is associated with human activity, there is no reason to suggest that it was formed deliberately, for instance as a garden soil. It is not strongly mixed, as it would be if it had been deliberately dug over, and while it holds more moisture than the sand below it, it is unlikely to have retained enough moisture to make gardening feasible. We associate this soil with the preparation of the site by a small group of people ahead of a larger gathering. It results from vegetation clearance, often accompanied by burning and site levelling, and often contains evidence of small-scale food preparation.

Above the yellow sand more recent wind-deposited whiter sand was usually observed at varying depths, sometimes as quite high dunes up to 3 or 4 m, but also as a shallower layer in more level parts of the spit. Midden deposits were preserved when this white sand blew across and sealed them, and it forms much of the modern (pre-earthworks) topography of the area. It is still moving in a number of places, and middens visible prior to the earthworks were usually exposed by white sand blowout.

MIDDEN TYPES AND VARIATION

The middens ranged dramatically in size, from the smallest, representing the remains of a meal cooked and consumed by one or two people, through to very large middens representing an occupation by large groups for periods of days or weeks. For example, OM72 contained an estimated 100 m^3 of shell.[3] However, within this size range there is not a great deal of variation in midden composition. They are composed almost entirely of shell: there is very little fish bone, even less artefactual material and, as already noted, no stratigraphy indicating repeated occupation. The range of activities going on at Omaha was clearly limited, though those limited activities were often carried out intensively. Figure 3 shows OM42, a typical large midden that essentially demonstrates the limits of complexity at Omaha; not particularly complex, but containing a number of oven scoops, lenses of different shell species, burnt shell and rakeout. Test pitting revealed that the midden around test pits 3, 4, 5, 9 and 10 was underlain by the disturbed anthropogenic soil noted above. One midden, OM35, revealed evidence of high temperatures in the form of heat stained sand extending to some depth below a large oven scoop and shell burnt to lime, but this was an exceptional case (Fig. 4). Otherwise this is a typical midden, with a definable cooking area surrounded by rakeout and clean shell. Postholes were found in only one midden, OM47, though the use of heavy machinery probably obscured evidence of such features in the soft sand. These postholes may be evidence of a drying rack for fish: this midden contained probable evidence of fish preservation, which is discussed below. The largest midden by area was OM120, previously recorded as R09/890. This measured 80 x 50 m, but most of it was badly deflated. It also had the richest artefact assemblage, with a 2B adze of Tahanga basalt, several flakes of obsidian and some pieces of worked sea mammal bone, though the latter was fragmentary and the form of the original artefact is unclear. OM263 contained the only other significant artefact, a net sinker, as well as a modern rubbish pit with plastic bags and beer cans. Fortunately this kind of disturbance to middens was not common and was very localised when it did occur.

Most middens were very much less complex than those described above. Whereas the more complex middens may represent an occupation of either some months by a small group, or the short term occupation of a large group, most are very much smaller and consist of one or a few oven scoops and associated rakeout.

MIDDEN FORMATION

Site preparation, in varying degrees, is evident from the stratigraphic profiles observed in Season 2. A hole may be dug or a ledge cut into a sand dune, often on the leeward side, and often through the old topsoil that is evident in many parts of the spit. Figure 5 shows this process in profile in OM213. Preparation may also include levelling, which, if substantial enough, creates the mixed soil that underlies some of the middens. While hāngi stones were often found in the middens, their numbers indicate that they were probably not always used, depending on the food that was being prepared: fish and shellfish take little cooking, and are readily eaten raw. During fish or shellfish preservation a fire alone could have been sufficient, since preservation techniques generally involved steam cooking followed by smoke or sun drying. Shell acts as an efficient and disposable heat retainer, which may account for much of the very burnt shell that was frequently encountered. Once fires are lit and food cooked the ovens are raked out and shell is spread over the site. Oven scoops could be partially destroyed by this process, or they could be retained and reused.

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[3] Estimates of shell volume are only rough calculations, based on the dimensions of each midden, estimated average depth and estimated density of shell, useful for making comparisons, but not to be regarded as accurate.

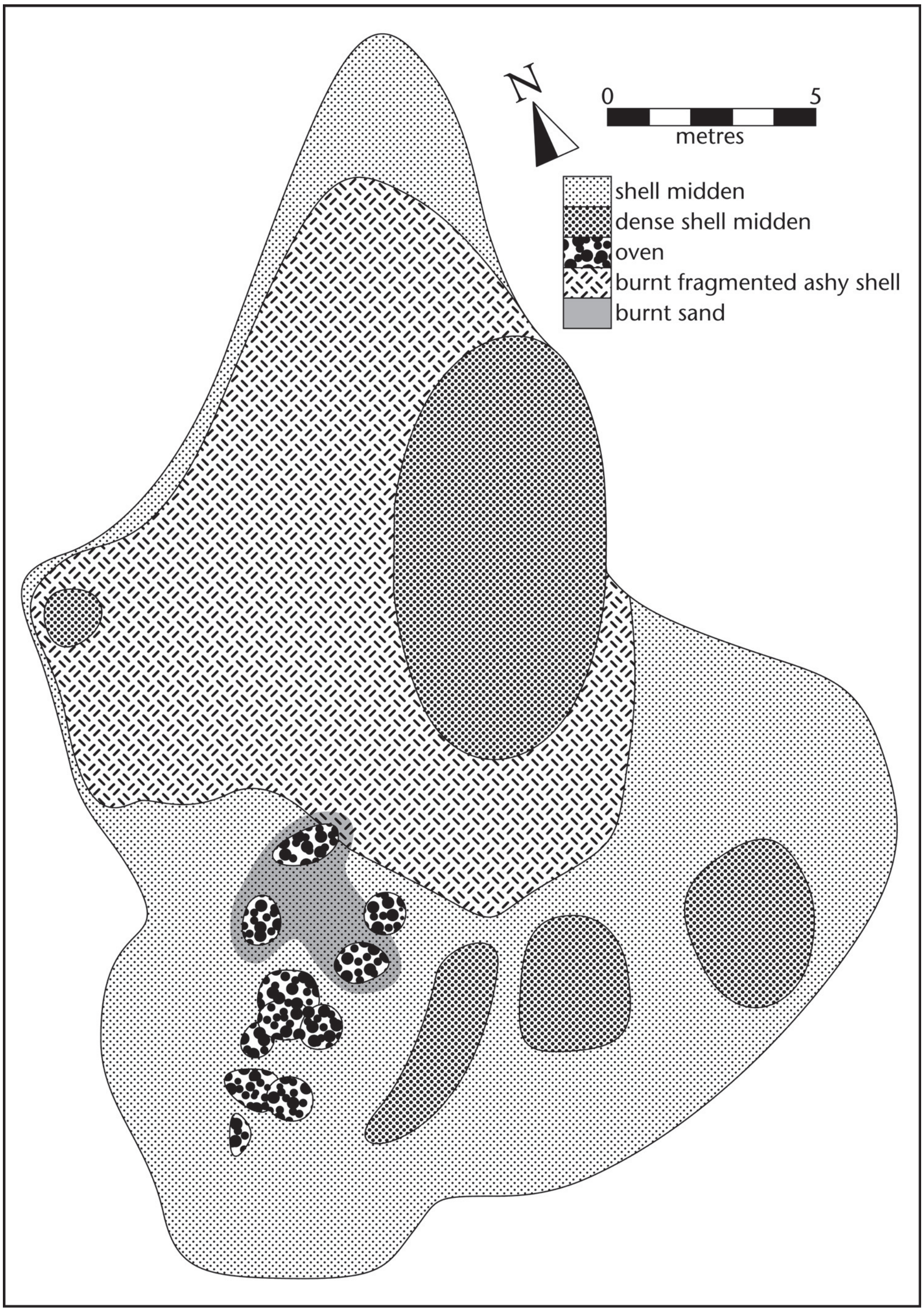

Figure 3: Plan of OM42.

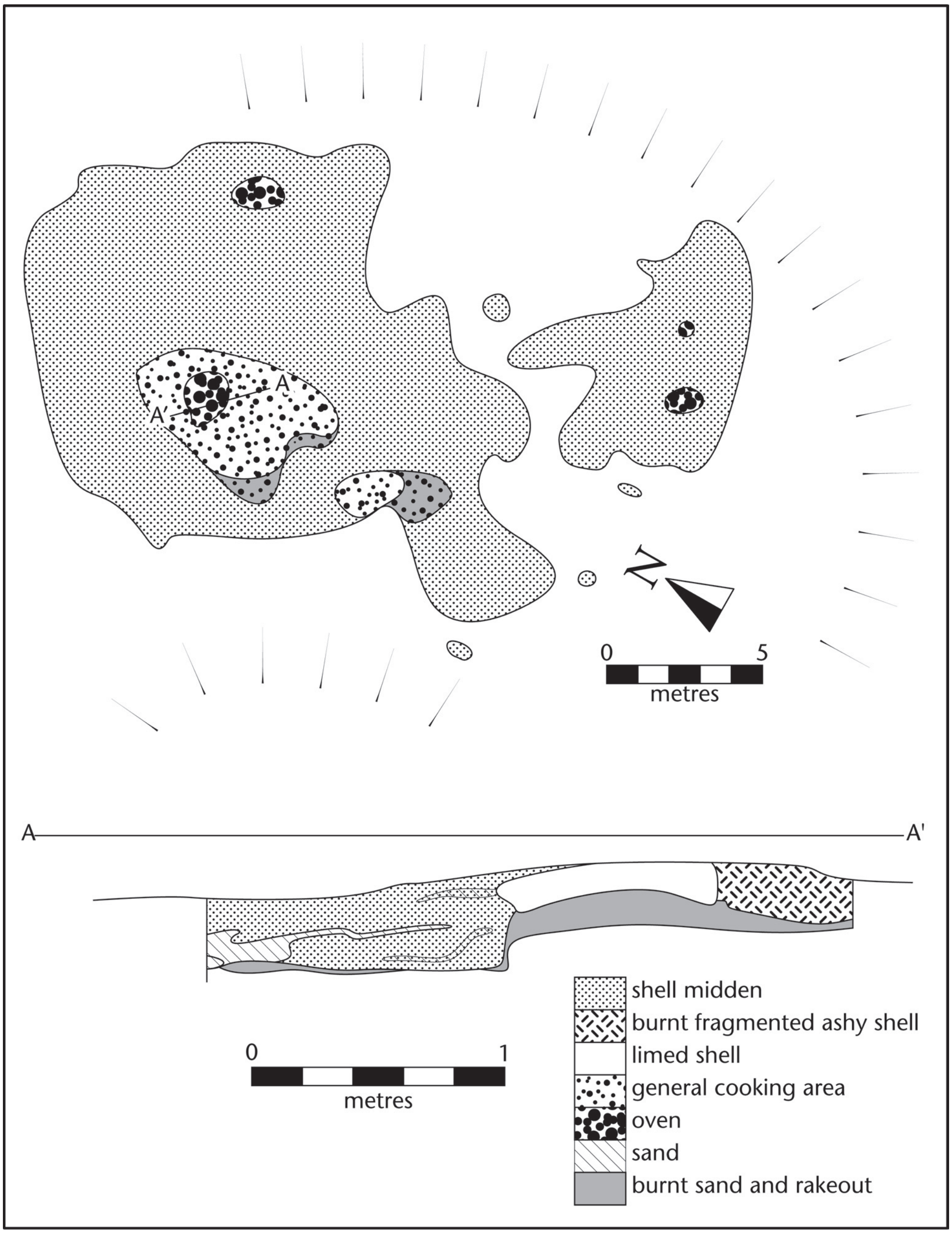

Figure 4: Plan and profile of OM35.

Larger middens, despite their simple first appearance, are formed by multiple events, and the process may be repeated many times as shell builds up and ovens are dug into it. As middens built up they spread out, capping large dunes and becoming a significant factor in dune formation. This also made them vulnerable to deflation processes.

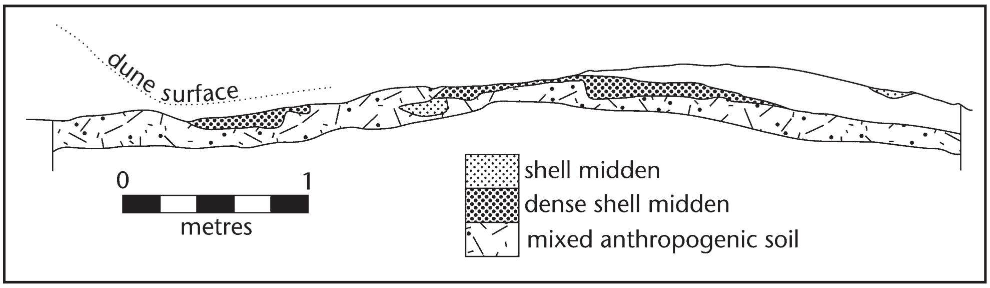

Figure 5: Profile of OM213.

MIDDEN PRESERVATION AND DESTRUCTION

Once the midden is created one or more of a series of processes then occur. Occupation of a site would have disturbed and indeed destroyed the local vegetation, and loose white sand quickly covered and sealed the deposits after site abandonment. However in the shifting dune environment of Omaha eroding banks of shell are common, particularly near the tops of some of the larger dunes, indicating the ongoing natural processes involved in midden destruction. Many middens may never have been covered with white sand, and so did not survive into the archaeological record.

The rescue excavation of R09/888 (actually five middens numbered together) allowed a close look at the process of midden deflation. Once a midden has been exposed, in this case by heavy machinery, but usually by wind, deflation can occur in two ways: on an advancing vertical deflation front that undercuts the slope which the midden overlies; or on a horizontal deflation surface. Combinations of the two may occur together. The difference relates to both landform and the density of the original shell deposit. Where the deposit is relatively sparse deflation occurs as the sand matrix is blown out, whereas for dense deposits the shell holds the matrix together, and so deflation occurs as the underlying sand blows out, pedestalling and eventually undercutting the deposit, which collapses. Contrary to expectation, the deflated midden deposit is destroyed in the process. Once the shell is removed from its matrix it seems to weather very rapidly, and only very sparse and fragmented shell can be seen below a deflation front.

BURIALS

A number of burials were found during earthworks. Two (OM183 and an un-numbered site) were not closely investigated by archaeologists, and were reburied by tangata whenua. During the second season three burials were located, two within 2 m of each other

(OM261–1 and 261–2), but it is unclear if they were contemporaneous. These were more closely investigated prior to reburial.

OM183 was a heavily disturbed burial of two to three individuals. One femur had an old healed break, and a partial mandible contained teeth with wear to the pulp cavity.

OM261–1 was a crouched burial of a young to middle-aged man. It was situated beneath a dense charcoal-rich sand matrix which was the remnant of a deflated midden. The hands were placed above the head while the legs were folded under the body with the feet together. The teeth were heavily worn but there were no obvious pathologies. Jaw fragments and teeth were submitted for radiocarbon dating at the request of tangata whenua.

OM261–2 was a young woman approximately 1.55 m tall, buried about 2 m west of burial 1, in a similar position. The teeth showed many dark stress lines, with the enamel not having formed properly.

OM274 was heavily disturbed, with only the lower body and right arm remaining *in situ*. It is likely that this was a similar burial to those of OM261. The body was probably buried in a crouched position. The head was placed towards the east with the body laid out to the west.

The placement of the burials indicated that they tended to be located on the foredune ridge looking over the sea. The bodies were laid out in a foetal position in roughly east–west direction with the heads looking across to the sea and possibly raised slightly. Hands were variably placed, either at the head or at the groin.

The sample of OM261–1 submitted for radiocarbon dating (see below) also revealed interesting information about diet. Two other measurements are relevant here: $\delta^{15}N$ = 15.11‰ and $\delta^{13}C$ = -16.3‰.

Isotopes are useful for looking at diet in the past. They can give an average view of what an individual ate during their lifetime, or part of their lifetime, depending on bone turnover rates. $\delta^{13}C$ and $\delta^{15}N$ isotopes are particularly useful in looking at subsistence strategies that incorporate both marine and terrestrial proteins. $\delta^{13}C$ is useful for situations where both marine and terrestrial sources of protein are present in the diet. It is possible to differentiate between the two sources because marine environments are usually enriched in carbon relative to terrestrial environments. $\delta^{15}N$ isotopes also have the potential to differentiate between terrestrial and marine proteins, but because of $\delta^{15}N$ depletion in some marine environments, the differences are often not clear. However, because $\delta^{15}N$ values increase as they progress up through the food chain, $\delta^{15}N$ is well suited to determining trophic levels (Ambrose 1993; Ambrose and Krigbaum 2003; Larsen 1997; Schoeninger and Moore 1992).

If the isotopic values of potential dietary sources are known it is possible to estimate the amount of marine protein present in the individual's diet. The average New Zealand marine and terrestrial values, based on Leach *et al.* (2003), are given in Table 1.

TABLE 1
Average isotope values for New Zealand (from Leach *et al*. 2003)

	Average Terrestrial value	Average Marine value
$\delta^{13}C$	-17.4‰	-24.7‰
$\delta^{15}N$	4.0‰	11.4‰

Figure 6 shows the projected diet of OM261–1 plotted against the average terrestrial and marine values for New Zealand. Since different components of the body (i.e., bone, muscle, skin, etc.) have different isotope values, and there is also a progressive enrichment in

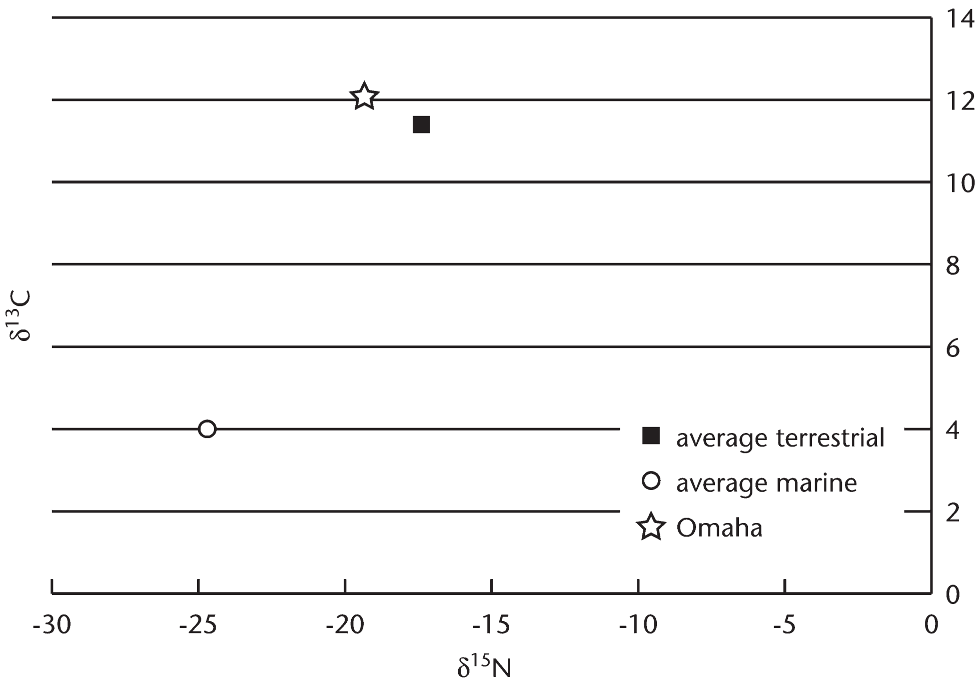

Figure 6: Projected diet of the individual from the OM261–1 burial, with +3‰ offset applied.

isotope values up the food chain, it is necessary to calculate the value of the flesh and/or plants the individual was consuming in order to compare it to the modern values. Most researchers (Ambrose 1993; Leach *et al.* 1996) agree that the $\delta^{13}C$ offset between diet and consumer is +5‰ for herbivores and +3‰ for carnivores (that is, the consumer will be more enriched in carbon by 3‰ over the diet) and for $\delta^{15}N$ it is approximately +3‰. In this case the offset of +3‰ has been used for both isotopes.

The graph appears to show that the diet of OM261–1 consisted entirely of marine protein. Given the potential nutritional deficiencies of such a diet this is unlikely. It appears that while collagen incorporates some carbon from non-protein sources, generally in diets where there is sufficient animal protein the majority of carbon comes from this source, leaving carbon from lipids and carbohydrates severely under-represented (Ambrose 1993: 82; Schoeninger and Moore 1992: 278). In this situation, an alternative hypothesis, based on the idea that the carbon from lipids and carbohydrates is not taken up by collagen, is that all of the carbon that was incorporated by the collagen came from marine foods. Situations like this where the isotopic signal is unrepresentative of the entire diet probably only occur "where an excess of protein is available and where sufficient calories are available" (Schoeninger and Moore 1992: 278). So while the isotopic signal may not reflect the whole of OM261–1's diet, it is clear that a significant proportion was marine based, and that there was an abundance of marine protein available to them during their lifetime.

MIDDEN ANALYSIS

Middens were bulk sampled in the field and samples were returned to the lab where they were wet sieved through 5 mm or 2.5 mm screens, and air-dried prior to analysis. For all middens the species composition was estimated, but only some were systematically sampled. Of these samples, only some were analysed. Most samples measured five litres.

SHELLFISH

In the lab samples were sorted, identified and counted to species level. Details regarding shell species identification and habitat follow Parkinson (1999). Hinges of bivalves and the terminal whorls of gastropods were counted, with the bivalve MNI based on the number of hinges divided by two, rather than counting left and right hinges separately. Incomplete hinges and undiagnostic shell fragments were excluded from the minimum number assessment.

Shellfish were generally of middling size; for instance, most pipi (*Paphies australis*) fell within the 40–50 mm size range. Occasionally some, generally isolated, very large specimens were recovered, and occasionally lenses of very small specimens were observed, particularly of cockle (*Austrovenus stutchburyi*). These would not have been useful as food, but may have served as a condiment, adding flavour to other foods cooked in the ovens. Often cockle and pipi of all sizes were observed to be still paired, indicating either very wasteful processing methods, or an alternative use: it would seem unlikely that such high percentages were already dead when gathered.

In the majority of middens pipi predominated, with other species playing an essentially minor role in the economy of Omaha. Cockle was the next most common species, with various mud whelks (*Cominella* sp.), tuatua (*Paphies subtriangulata*), mudsnail (*Amphibola crenata*) and scallop (*Pecten novaezelandiae*) occurring occasionally throughout the middens, and sometimes as concentrated lenses. Scallop, owing to its large size, seemed in the field to be more common than the analysis indicates, but their size means they have a higher food value. Whelks, scallops, tuatua and other less common species would probably have been deliberately targeted, but species that occur only very rarely would have been collected opportunistically, or as a bycatch during the targeting of main species.

Some middens had concentrations of unusual species, for instance substantial lenses of scallop were observed in OM72 and OM215. The latter also contained seven moderate sized toheroa (*Paphies ventricosa*) which are not thought to have been available on the spit itself. OM20 was composed primarily of scallop. Meat weight has not been calculated for any assemblages, but over 90% by meat weight of OM20 would have comprised scallop. These assemblages represent either shellfish deliberately targeted at low tide, or more likely washed up on the beach after a storm, as they still are on occasion today. The same may be the case for the toheroa, which may be found below low water mark in many places where they do not occur on the beach.

The identified species have been grouped according to the habitat in which they are found. Species that can be found in both sandy beach and muddy estuarine habitats predominate in almost all middens. The main species in this group is pipi, although a few ostrich foot (*Struthiolaria papulosa*) are also included. Figure 7 graphs these data for 20 selected representative middens (selected for the sake of clarity — analysis was carried out on 46 middens in total, see Bickler *et al.* 2003 for more complete data). The beach category is mostly made up of scallop and tuatua with occasional volute (*Alcithoe* sp.) or venus shell

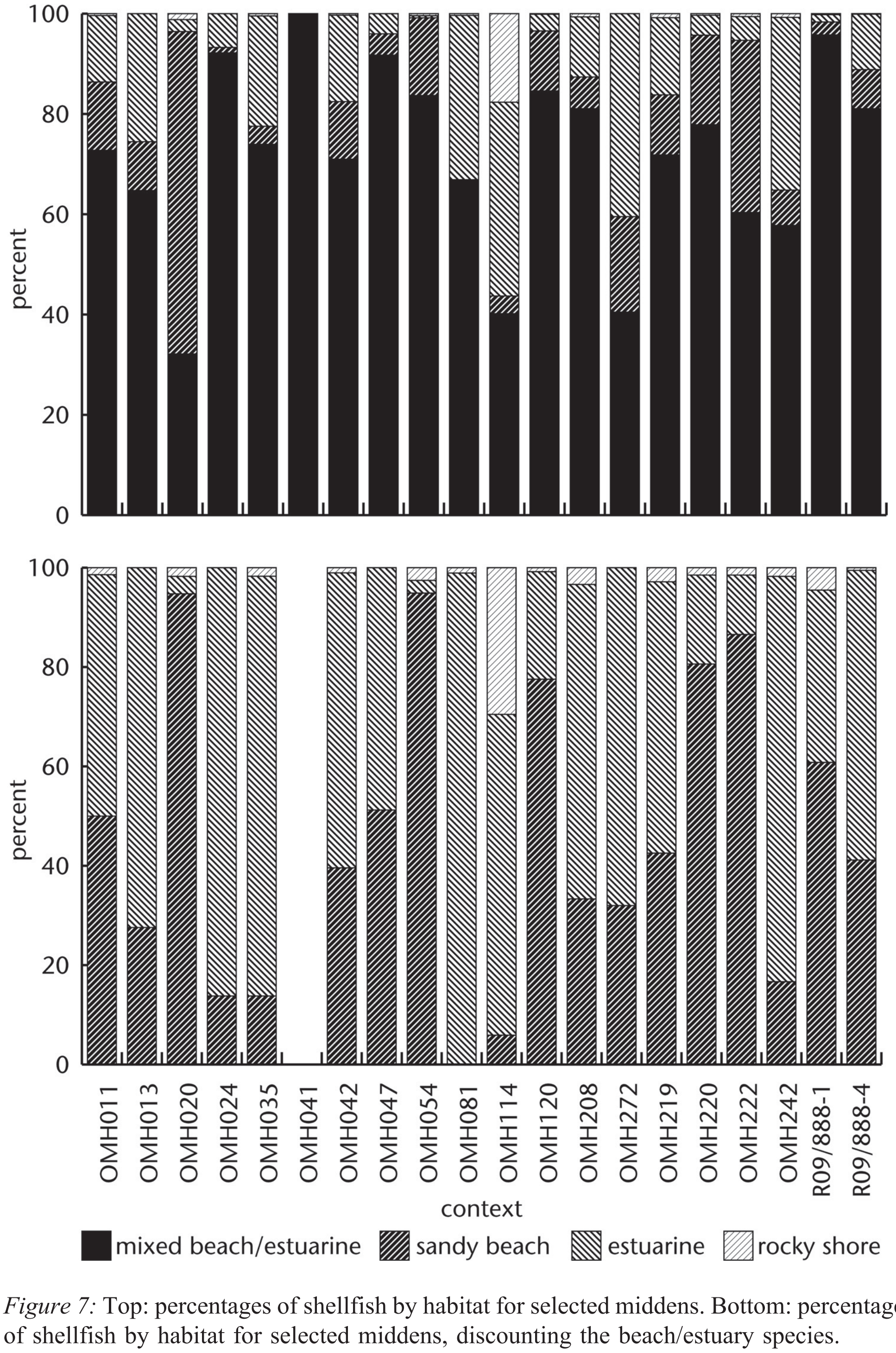

Figure 7: Top: percentages of shellfish by habitat for selected middens. Bottom: percentages of shellfish by habitat for selected middens, discounting the beach/estuary species.

(*Dosinia* sp.); the estuary category is mostly cockle, with some mud whelk and mud snail; while the rocky shore species include occasional cat's eye (*Turbo smaragdus*), paua (*Haliotios iris*) and oyster (Ostreidae). It should be noted that our categories are quite broad and are designed to reflect which part of the spit was exploited rather than anything about the ecology of the prey species; the habitats of cockle and mudsnail, for instance, do not always overlap, but both are to be found on the harbour side of the spit. Figure 7 (top) shows that, within the general pattern of the predominance of pipi, there is considerable variation in species composition.

Figure 7 also shows (bottom) the same data with the dominant "beach/estuary" category discounted. Here the picture is more varied, although the estuarine habitat tends to predominate in most middens. Cockles were more commonly gathered from the estuary than scallop and tuatua from the beach. There are exceptions such as the scallop midden, OM120, or OM141 where oysters and cat's eyes were numerous. There is no clear relationship between species composition and location. OM141 is 1.5 km from the nearest rocky habitat, at Te Kie Point at the south end of the beach. Beach and estuary species are found together in middens in all parts of the spit.

Very few controlled excavations were carried out, but 19 0.5 x 0.5 m test pits were excavated in 50 mm spits in R09/888. Comparison of the shellfish composition between spits is revealing. In test pit 19 overall numbers decline from a total MNI of 601 in spit 2 to 255 in spit 6. Pipi is generally dominant, but other species become more or less common with depth — tuatua decreases in number, while cockle increases until in spit 6 it is the dominant species. This indicates changing proportions of estuarine (cockle) and sandy beach (tuatua) species exploited either day by day as the midden built up, or raked out from different adjacent ovens. In test pit 1 number tends to increase with depth, though proportions do not change — pipi is at least 93% of every sample. This changing midden density is graphed in Figure 8 (top) while the bottom graph shows the normalised total numbers and weight of all shell by sample. There is generally a higher proportional weight of shell to number in test pit 1 (though this begins to change at spit 5), whereas in test pit 19 the reverse is true. Two things could account for this: in test pit 1 the shell could be more fragmented, and hence uncountable, than in test pit 19; or the shell could be larger. The latter in fact is the case. Not too much should be read into these patterns: the point is to demonstrate the variability in midden composition, even within a 300 mm vertical test pit within a layer that is visually undifferentiated. Variation within middens has long been recognised in New Zealand archaeology (Davidson 1964), but this does emphasise the difficulties inherent in characterising a midden from a limited number of samples: they are not homogeneous, even if they look as if they are.

FISHBONE

The analytical method for fish bone was adapted from that outlined by Leach (1997). The five 'standard' mouthparts along with otoliths were counted and identified to the lowest possible taxonomic level. Mackerel (*Trachurus* sp.) scutes were also retained for counting. Vertebrae were counted, but not identified to taxon, for some but not all samples. Species identifications and scientific names follow Paulin *et al*. (1989).

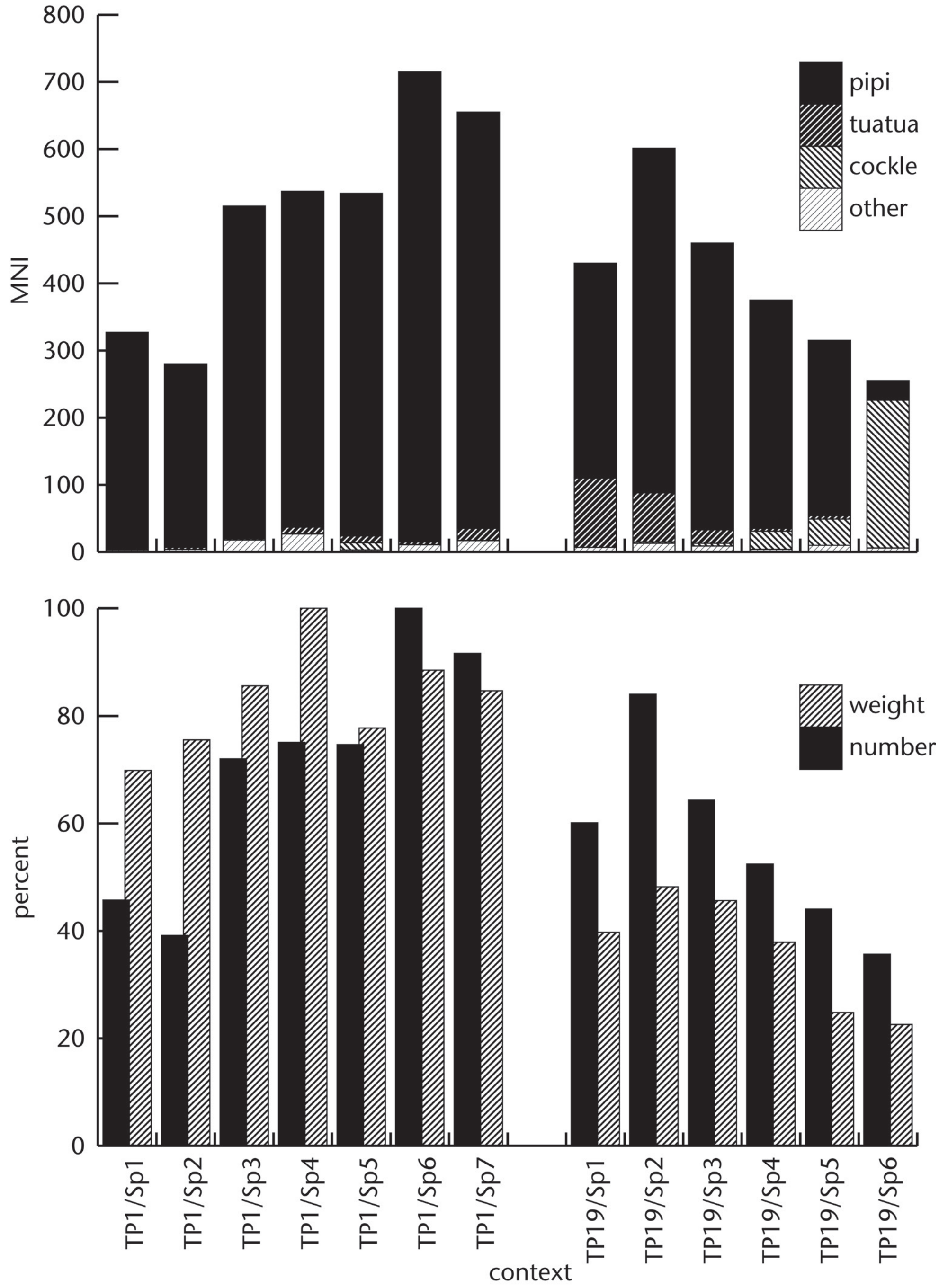

Figure 8: Top: numbers of shellfish by species by spit in R09/888 test pits 1 and 19. Bottom: weight and number of all shellfish by spit in R09/888 test pits 1 and 19.

TABLE 2

MNI of fish for all analysed middens.

Y indicates mackerel scutes but no countable diagnostic bone. 1=Kahawai; 2=Carangidae sp.?; 3=Red gurnard; 4=Fish sp.; 5=Snapper; 6=Flounder; 7=Blue mackerel; 8=Small fish sp.; 9=Barracouta; 10=Mackerel.

Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
OMH005	-	-	-	-	-	-	-	-	1	-
OMH011	-	-	-	-	1	-	-	-	-	1
OMH013	-	-	-	-	-	-	-	-	1	2
OMH014	-	-	-	-	-	-	-	-	-	Y
OMH017	-	-	-	-	-	-	-	-	-	-
OMH032	-	-	-	-	-	-	-	-	-	1
OMH035	-	-	-	-	-	-	-	-	-	Y
OMH042	1	1	-	-	1	-	-	-	1	3
OMH047	-	-	-	-	-	-	-	17	-	Y
OMH053	-	-	1	1	-	-	-	-	-	-
OMH054	-	-	-	-	-	-	-	-	-	1
OMH056	-	-	-	-	-	-	-	-	1	-
OMH081	-	-	-	-	-	-	-	-	-	-
OMH095	-	-	-	-	-	-	-	-	-	Y
OMH106	-	-	-	-	-	-	-	-	-	-
OMH114	-	-	-	-	1	-	-	-	-	4
OMH120	-	-	-	1	2	-	-	-	1	1
OMH160	-	-	-	-	1	-	-	-	-	-
OMH208	-	-	-	-	1	-	1	-	-	2
OMH209	-	-	-	-	-	-	-	-	-	Y
OMH213	-	-	-	-	-	-	-	-	-	Y
OMH215	-	-	-	-	1	1	-	-	-	1
OMH219	1	-	-	-	2	-	-	-	-	3
OMH220	-	-	-	-	-	-	-	-	-	1
OMH222	-	-	-	-	-	-	-	-	-	1
OMH228	-	-	-	-	-	-	-	-	-	Y
OMH242	-	-	-	-	1	-	-	-	-	1
OMH245	-	-	-	-	-	-	-	-	-	1
OMH251	1	-	-	-	4	-	-	-	-	4
OMH259	-	-	-	-	1	-	2	-	-	1
OMH261	1	-	-	-	3	-	1	-	-	11
OMH263	-	-	-	-	-	-	-	-	-	1
OMH268	-	-	-	-	-	-	-	-	-	Y
R09/888–1	-	-	-	-	-	-	1	13	2	2
R09/888–5	-	-	-	1	77	-	1	1	1	59

Table 2 summarises the results. Fish bone was recovered only in small quantities. A number of samples deliberately targeted fishbone, so that even this small quantity probably over-represents fishing at Omaha. Mackerel is the most commonly represented species, being found in all but five of the 35 middens from which fish bone was recovered. A total MNI of 101 was obtained for mackerel, and in a number of samples scutes but no countable diagnostic bones were found (marked Y in Table 2). The next most common species was snapper (*Pagrus auratus*), of which a total MNI of 96 was recovered, though from fewer contexts. The numbers are biased by the R09/888–5 sample, which was the only dense deposit of large fish bone observed at all in any midden. Other species included barracouta (*Thyrsites atun*), kahawai (*Arripis trutta*), red gurnard (*Chelidonicthys kumu*), blue mackerel (*Scomber australasicus*, a Scombrid unrelated to the Carangid *Trachurus*), an unidentified species of the Carangid family (trevallies) and a probable flounder (*Rhombosolea* sp.), as well as at least two unidentified species.

All these species may be caught on a trolling lure, or in the case of snapper, gurnard and trevally, with a baited hook. Mackerel may also be netted, particularly at creek mouths as they run with the tide (Best 1977: 53). The limited numbers of barracouta are not thought to indicate the specialised trolling methods that were used to catch this species in the South Island: we suspect that they were netted as they came inshore to prey on schools of mackerel. In general, however, there are too few fish to say anything meaningful about fishing methods or exploitation across the spit. What is most surprising is that there are so few fish given the very large amounts of shellfish observed, and the obvious marine focus of subsistence. Fish may be caught quite easily at Omaha today and no doubt could have been caught as easily in the past, indicating a subsistence strategy at the site that did not target bony fish, or preparation and preservation techniques that resulted in few bones being left on site. It is also possible that consumption by dogs contributed to under representation of fish in the middens. Netting fish is often a community activity and results in large quantities of fish being caught. Since mackerel are the most common species, it seems likely that they were targeted by netting but only on a small scale.

In those samples for which vertebrae were counted fairly high quantities were discarded alongside the identifiable mouth bones, indicating that whole fish were consumed on site. If fish were processed for preservation and later consumption elsewhere then unusual ratios of vertebrae to mouthparts might be expected, reflecting different body parts being treated and transported differently. However, Best (1977: 54) notes that often fish were preserved with their heads still on. If the latter is the case, then the small quantities of fish found at the site cannot be used to argue against preservation.

According to oral tradition, shark and ray species were targeted for consumption along this general area of the east coast, but they lack bones and have a cartilaginous skeleton, which tends not to be preserved in archaeological sites. Shark teeth preserve well, but none were identified. While shark and ray undoubtedly played a role in the economy of the area, this remains archaeologically invisible.

Two exceptions to the general pattern have been identified. Fish bone from OM47, OM219 and R09/888–1 are primarily from very small species or juveniles. OM47 contained a small dense deposit of very fine fishbone, of which only a small proportion, about 10% of the entire deposit, was analysed. This revealed only one species of unidentified fish and a single mackerel scute. An MNI of 17 was obtained for this unidentified species, indicating somewhere between 150 and 200 in the whole deposit. One explanation for the deposit is that it is the stomach contents of a large fish, but no bones from such a fish were recovered, and there is no obvious evidence of pitting on the bone associated with digestive processes.

Body parts are differently represented, indicating that a cultural explanation is more likely. A total of 83 mouthparts was identified, but only 33 vertebrae. These were neither particularly fragile nor difficult to identify, so the most likely explanation is differential treatment and transportation of body parts. The sample was taken from the base of an oven scoop, and two probable postholes were also observed close by. It is possible that these are evidence of a drying or smoking rack, but there is no clear indication that the postholes are not modern. They were evidently not cut with an iron tool, but they may have been driven into the soft sand. This is the only indication of fish preservation at Omaha, but is by no means conclusive. Another explanation is that the bodies of the small fish may have been consumed whole and the heads discarded. Alternatively, the bodies may have been used as bait, but given the overall lack of emphasis on fishing at Omaha, this is the least likely explanation.

The small fish from OM219 and R09/888–1 were a different species. In each case vertebrae were as commonly represented as mouthparts, indicating the treatment of fish as wholes. These small fish could not be identified to taxonomic level. Given that the harbour is fed by the Waikokopu Creek we had thought that they might be kokopu (*Galaxias* sp.), but this turned out not to be the case.

The second exception to the pattern is from R09/888–5. This is the only particularly dense deposit of fish bone recovered, and serves to underline the paucity of fish bone from elsewhere at Omaha. The samples contained large numbers of snapper and mackerel, and it was also noted that the size of the snapper bone was quite variable. Accordingly all major mouth bones of snapper were measured, following a protocol developed by Leach and Boocock (1995) to determine the size (fork length) of the live fish. They worked out their statistics on a sample from the Hauraki Gulf, which is presumably the same, or a very closely related, population as the Omaha population. Even so, several maxillae from the Omaha assemblage exhibited bony spurs at one measurement point, which was not noted by Leach and Boocock; this may represent a slightly different population. In general any bone from which two or more measurements were taken gave the same result within the standard errors reported by Leach and Boocock (1995: 21), so that it may safely be assumed that their statistics are fully applicable to the Omaha fish bone. A total of 269 measurements were made on 188 bones.

R09/888–5 comprises three samples: test pit 19, sample 2 and sample 3. Test pit 19 is the same deposit as sample 2, which was bagged when the backhoe removed the shell after excavation. The two samples are combined in the analysis that follows. It is the only fish bone assemblage large enough for useful discussion. There are clearly a few very large specimens in the assemblage, but unfortunately only one bone was measurable, a right maxilla. Otherwise eight further bones fell into the very large category. It is not clear why the largest, and hence presumably most robust, bones have survived so poorly. Perhaps being larger they were more in harm's way from excavation with heavy machinery, but not all broken/eroded edges appear fresh. The one measurable bone gave a fork length of 742 ± 14 mm, and of the other two right maxillae one was very nearly the same size, and one a little larger, say from a 760 mm specimen. Leach and Boocock (1995: 11) have determined that it is "normally acceptable to measure all bones … to arrive at a size-frequency histogram", but they also note that differential survival by bone size, as is the case here, might require a rethink. In order not to bias the final statistics against the very large specimens it was decided to employ a measure of MNI. The most frequent element is the left dentary, with a raw MNI of 19, of which 16 could be measured.[4] This is too

[4] An MNI of 77 was obtained from otoliths. It is not clear what has caused this differential survival. The probable reason is that this sample was sieved through a very fine kitchen sieve, the only one available at the time. Unfortunately, the majority of otoliths were too eroded at the margins to measure.

small a number to be statistically useful, and would anyway not include the very large specimens. However, by dividing the measured fish into 50 mm size classes we may obtain an MNI for each size class. This size-frequency distribution is graphed in Figure 9, top, which also includes the other two very large right maxillae as estimates. Combining all size class MNIs we arrive at a total MNI of 33, which seems far more acceptable. One thing is immediately apparent from the graph — this skewed distribution is not what we would expect in a living population. Up to the 400 or 450 mm size class the assemblage exhibits a, very roughly, normal distribution, but this is followed by a very long and very thick tail.

All other measurable snapper bone from all other assemblages was also measured. This included R09/888 sample 3, which, like sample 2, was a sealed deposit at the base of an oven feature. The two ovens were located within 2 m of each other. There are no very large snapper in sample 3 (MNI = 15), but for all other assemblages combined, including sample 3, the distribution is very similar to that of sample 2 — a near normal distribution in the low to medium size classes, but with an unusually long tail (Fig. 9, bottom, MNI = 27). This is, in part, due to sampling — samples tended to be targeted, taken from seemingly informative parts of the middens, including obvious lenses of fish bone, but this is unlikely to account entirely for the unusual distribution in the bottom graph, and is not a factor in the distribution shown in the top graph. Rather, these distributions reflect cultural preferences and technology. We have assumed that mackerel were caught in nets as they ran at the harbour mouth or in the bay — the only fishing gear recovered at Omaha was a net sinker. The smaller size classes of snapper may also have been netted at the same time, while the larger may have been deliberately targeted with baited hook. Snapper may have been common in the environment, as they fed on the same rich shellfish beds that made Omaha so attractive to people. These distributions are largely independent of the live snapper populations, and are interpreted here as the result of two related but independent fishing methods. Netting and baited hook capture will result in differing size-frequency distributions, which have combined to give the distributions in Figure 9.

Most of the middens from which fishbone was recovered were relatively large and complex. In almost all cases fishbone was recovered from middens that contain strong evidence of cooking, often in direct association with oven scoops and rakeout. Fishing was an activity that was opportunistic, and peripheral to the main use of the area. Shell is so much more numerous than fish that it is clear that shellfish exploitation was the major activity carried out at Omaha. Even accounting for scavenging of fish bone by dogs, or preservation and removal for off-site consumption, fishing is still under-represented. This only serves to emphasise the importance of shellfish in the Omaha economy.

ARTEFACTS

Very few artefacts were recovered, either during the excavations or from sieving. A reworked type 2B adze of Tahanga basalt was found on the deflated surface of R09/890, and a net sinker was found in OM263. Bone artefacts were also recorded in R09/890 adjacent to the adze but were in poor condition, and their original form could not be determined. A small number of obsidian flakes were found, and were probably from a variety of sources, particularly Mayor Island, Great Barrier Island, Fanal Island and the Coromandel Peninsula. Most were found on the deflated surface of R09/890, and five were recovered from R09/888. Of the latter, four were rather small, and were probably manufacturing debris, but one larger piece had evidence of use wear on two edges. Two pieces of green chert of a

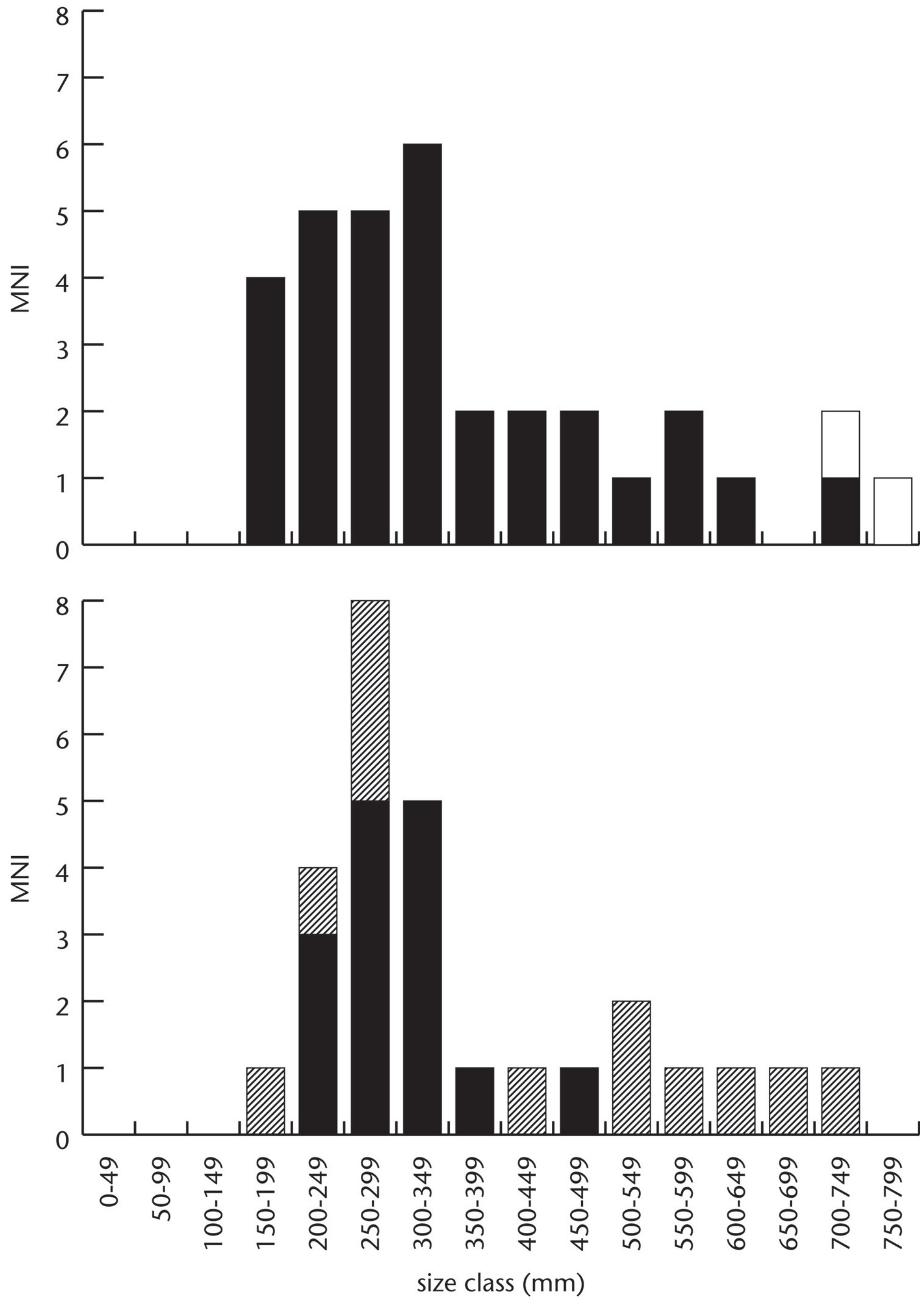

Figure 9: Top: graph of R09/888 sample 2/test pit 19 snapper by size class. The two estimated snapper maxillae are shown in white. Bottom: graph of all other snapper by size class. The R09/888 sample 3 snapper is shown in black.

type most commonly found on Motutapu Island, but also found locally, were recovered from R09/888. The larger piece has evident bruising at one end, and may have been used as a hammerstone, though it is of poor quality and the bruising could occur naturally.

HĀNGI STONES

Three types of hāngi stone, all of which have been imported into the spit, were observed in the middens. The most common of these was the Waipapa greywacke that outcrops on the hill to the south of the subdivision. This rock is of rather poor quality and seems to have shattered when heated. Another rock type used was water-rolled river or beach cobbles. These were not common, though some of the larger middens, especially at the northern end, contained quite a few, and some were quite large (>300 mm). Many were whole, though some had fractured. The largest of these at least were presumably transported by canoe. The final type of stone was the Waitemata sandstone, which seems to have fractured readily when heated and subsequently degraded. The nearest source is below Te Kie Point, where it can be seen eroding out of the rock shelf and can be picked up along the beach at the southern end of the spit. It was most commonly found in middens towards the south of the subdivision, but occurred throughout. It seems an unlikely hāngi stone given its poor quality, but was probably the most accessible.

CHRONOLOGY

A total of 18 dates were obtained from the Omaha middens, all from shell, except for two charcoal dates and a human bone date (Fig. 10 and Table 3). Calibrated ages ranged from *ca*. AD 1450–1700, which is older than we had expected. Much of the shell had appeared relatively fresh during excavation, with the periostracum (the outer membrane) still evident in many examples and this, combined with the traditional use of the spit in early historic times, led us to expect late dates. Its seems probable that the size and density of the middens resulted in self-buffering conditions that were ideal for shell preservation, but the possibility of an old carbon reservoir effect was also noted. A charcoal sample from OM42 was submitted for dating, and did not yield a significantly different date from the shell sample from the same midden, ruling out a reservoir effect.

Given the known use of the area during historic times, the upper boundary for its continued use for shellfish extraction is probably closer to 1850. After then, with European colonisation, different activities were carried out that altered the landscape significantly, but did not contribute to further midden formation.

The human bone from OM261–1 appears to have yielded the earliest date. Analysis of the $\delta^{15}N$ and $\delta^{13}C$ values for the bone sample indicated a mixed terrestrial/marine influence in the diet of this individual, which greatly complicates the calibration, as the discussion of the diet of OM261–1, above, shows. A percent marine diet was calculated, resulting in a percentage contribution to collagen from marine protein, but the accurate dating of human bone remains problematic (Fiona Petchey pers. comm. 2003). The date of the burial is clearly early but we cannot reliably say that it predates the main use of the spit for shellfish extraction, though stratigraphically it seems to predate the use of the area in which it was located.

The relatively early dates for OM11 and OM209, which were located beneath the old topsoil, allows a fairly tight window to be obtained for the build up of this soil; probably

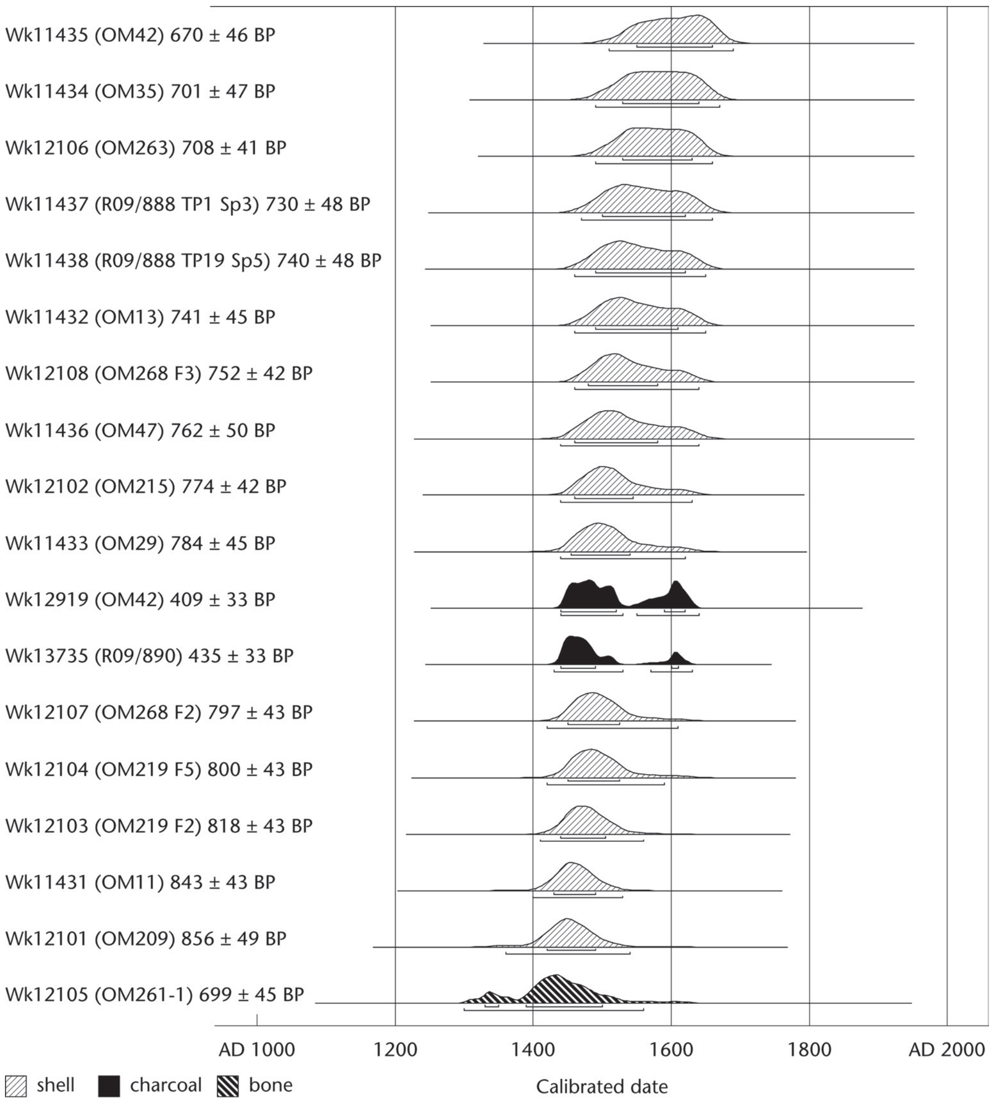

Figure 10: Plot of all radiocarbon dates from Omaha.

no later than *ca*. AD 1525. These are the earliest midden dates, but it is apparent from the environmental evidence (see below) that the vegetation of the spit had already been substantially disturbed by this time.

Two dates each were obtained from OM219 and OM268, where the internal stratigraphy was clearest. For both middens the dates are not statistically different, which is what was expected from the archaeology.

TABLE 3
Radiocarbon dates from Omaha

Lab No.	Context	Material	δ^{13}C‰	CRA yr BP	Cal AD 68%	Cal AD 95%
Wk-11431	OM11	shell	2.1 ± 0.2	843 ± 43	1430–1490	1400–1530
Wk-11432	OM13	shell	1.8 ± 0.2	741 ± 45	1490–1610	1460–1650
Wk-11433	OM29	shell	2.0 ± 0.2	784 ± 45	1455–1540	1440–1620
Wk-11434	OM35	shell	1.6 ± 0.2	701 ± 47	1530–1640	1490–1670
Wk-11435	OM42	shell	1.7 ± 0.2	670 ± 46	1550–1660	1510–1690
Wk-11436	OM47	shell	2.0 ± 0.2	762 ± 50	1460–1580	1440–1640
Wk-11437	*R09/888	shell	1.8 ± 0.2	730 ± 48	1500–1620	1470–1660
Wk-11438	†R09/888	shell	1.5 ± 0.2	740 ± 48	1490–1620	1460–1650
Wk-12101	OM209	shell	1.3 ± 0.2	856 ± 49	1420–1490	1360–1540
Wk-12102	OM215	shell	1.7 ± 0.2	774 ± 42	1460–1545	1440–1630
Wk-12103	OM219 F2	shell	1.5 ± 0.2	818 ± 43	1440–1505	1410–1560
Wk-12104	OM219 F5	shell	1.5 ± 0.2	800 ± 43	1450–1525	1420–1590
Wk-12105	OM261–1	bone	-16.3 ± 0.2	699 ± 45	1330–1350	1300–1560
					1390–1500	
Wk-12106	OM263	shell	1.8 ± 0.2	708 ± 41	1530–1630	1490–1660
Wk-12107	OM268 F2	shell	1.6 ± 0.2	797 ± 43	1450–1525	1420–1610
Wk-12108	OM268 F3	shell	1.6 ± 0.2	752 ± 42	1480–1580	1460–1640
Wk-12919	OM42	charcoal	-25.7 ± 0.2	409 ± 33	1440–1520	1440–1530
					1590–1620	1550–1640
Wk-13737	R09/890	charcoal	-24.9 ± 0.2	435 ± 33	1440–1490	1430–1530
					1600–1610	1570–1630

* = TP1 Sp 3, † = TP19 Sp 5
Marine ΔR = -25 ± 15 (Higham and Hogg 1995). Terrestrial ΔR = 27 ± 5 (McCormac *et al*. 1998). Marine calibration curve (Marine98) from Stuiver *et al*. (1998b). Terrestrial calibration curve (Intcal98) from Stuiver *et al*. (1998a). Wk-12105 calculated using a mixed curve: 52 ± 15% marine. OxCal 3.8 (Bronk-Ramsey 2002).

In summary, the major use of Omaha is placed firmly within the late (Classic) phase of New Zealand prehistory, ranging from its approximate beginning (*ca*. AD 1450) to near its end, but not, on this evidence, into the historic period. It may be that later occupations were less intensive and resulted in smaller and less complex middens, that were not dated.

ENVIRONMENTAL HISTORY

Reconstruction of the vegetation history at Omaha is based on the analysis of charcoal fragments recovered from the midden excavations (see Appendix 1). Pohutukawa (*Metrosideros excelsa*) and puriri (*Vitex lucens*) together represent 70 percent of the total charcoal in the assemblage. Pohutukawa occurs on most shorelines irrespective of the wider vegetation types so this tells us little of the local vegetation pattern. Puriri is a tree that survives vegetation clearance and persists on landscapes where other forest species have long been removed. Given that other broadleaf tree species are notably rare in this assemblage, these two species represent a remnant rather than part of intact coastal forest. The third most common species is kanuka (*Kunzea ericoides*), indicating regenerating scrub.

Conifers, such as matai (*Prumnopitys taxifolia*), kauri (*Agathis australis*) and kahikatea (*Dacrycarpus dacrydioides*), are not common. A mature coastal forest would contain mixed conifers and broadleaf species, but the latter are entirely absent. Conifers, apart from kahikatea, which is still found in the western edge of the spit, possibly entered the assemblage as relict wood burnt as firewood.

The charcoal assemblage suggests that an original matai-dominated coastal broadleaf podocarp forest had been cleared by the time these middens were occupied. The living vegetation appears to have consisted of pohutukawa, probably concentrated on the shoreline, along with abundant puriri in the form of scattered trees rather than coastal forest. Patches of fairly pure kanuka scrub were also present among stumps of former forest trees.

Omaha may be compared with the Aupouri Peninsula, a much larger dune system, where human impacts on the natural vegetation of the dunes were severe. A rich coastal forest environment containing abundant bird life was rapidly destroyed by fire. Early settlement was coastally oriented, though the economic focus is not known; it may have revolved more around hunting than horticulture. With the breakdown of dune productivity, horticulturally oriented settlement moved to the less fertile inland dunes around 500 BP. As these too declined they were abandoned. In the meantime, the old coastal dunes began to erode severely, so that little trace of early settlement remains. The western shore, Ninety Mile Beach or Te Oneroa a Tohe, served as a major route for travellers and was again exploited for its shellfish resources, though not permanently settled, resulting in numerous middens very similar in many respects to those of Omaha. Coastal sites, then, contain both the oldest and youngest dates, while inland sites yield dates in the middle range of occupation (Coster 1989).

This sequence is mirrored, on smaller spatial and longer temporal scales, at Omaha. If there was an early phase of occupation at Omaha (and it is a typical location for such an occupation) no archaeological evidence has survived. The lack of the broadleaf species that would be associated with a mature mixed coastal forest points to environmental disturbance predating any of the recorded middens, so a significant early occupation seems likely. Subsequently the spit was exploited almost purely for shellfish, but the dunes began to erode as the vegetation continued to be disturbed. This covered some middens in white sand, but deflated others. Much of this erosion may have been the result of, or at least exacerbated by, historic farming practices, but would have occurred locally around each occupation in prehistoric times as well.

SUMMARY — THE PHYSICAL AND SOCIAL LANDSCAPE

Omaha Sandspit is a complex and changing environment. Although the emphasis of the excavations was necessarily focused on individual middens, the broader use of the landscape was also addressed in these investigations.

The archaeology of Omaha consists entirely of a series of shell middens of varying sizes. The size of middens is largely a function of the size of the occupying group and the length of occupation. The main economic focus at Omaha was the exploitation of the rich shellfish beds of the beach and estuary, though there is some archaeological evidence of limited fishing, and oral tradition informs us that preserving shark was a major economic activity along this coast. However, what people consider important enough to remember or record — catching shark — is not necessarily what they do day to day — catching shellfish. The sheer quantity of shellfish indicates that most middens, and the ovens associated with them, derive from the preservation of shellfish for transport off site, rather than from on-site consumption. Given the obvious marine focus of subsistence at Omaha the paucity of fish bone is surprising. Many fish may have been preserved whole by drying or smoking, and transported whole off site, but this does not fully account for the low numbers. Fish remains may have been consumed by dogs, but if fishing was an important aspect of subsistence at Omaha we would expect to see it in the middens. Instead the economy of the spit revolved almost exclusively around shellfish, though naturally this was but one aspect of a much broader and wide ranging economic system.

Oral traditions suggest a number of variations both in the makeup of the people using Omaha and the focus of activities. Raiding and hunting parties would often have stopped off at the sandspit to replenish supplies. Larger groups probably also gathered at the spit for hui, as food for large numbers of people could be accessed easily. This was certainly the case historically. The evidence of differing sources of stone indicates the breadth of the social networks within which the Omaha people lived, ranging as far afield as Mayor Island, but also to nearby sources like Great Barrier Island.

It is clear that some of the larger middens in the south of the spit, such as OM81, could not have been occupied during a normal wet winter, when the sand becomes waterlogged. A summer occupation, when the ground would have been reasonably dry, is indicated. On the other hand a number of small middens just to the west are located on the low north-south ridge, which remains relatively dry during winter. These could have been occupied then. In the northern part of the subdivision, the tops of dunes are exposed to the elements, and unlikely to have been occupied in winter, though they were probably more sheltered by vegetation than they are now. Again a summer occupation seems most likely, with winter occupation in the sheltered swales. In heavy rain many of the swale areas are vulnerable to quick flooding so that if there was winter occupation of Omaha it may not always have been comfortable. On the other hand, the evidence of an old buried topsoil, that formed at the same time as the earliest middens were occupied, indicates that the dunes would have been lower and so drainage patterns may have been different. The evidence for seasonal occupation is limited, and beyond formulating such hypotheses, no seasonality studies have been carried out.

There is no internal stratigraphy indicating re-occupation of any middens after a period of abandonment, but lenses of different shell species, earth-ovens cut at varying levels and oven rake-out were evident within the middens. This suggests that most middens represent cooking areas used during a single episode of occupation lasting days or weeks.

The numbers of burials found at Omaha was not great and probably reflects the food preparation/cooking focus and the transitory nature of settlement on the spit. Any association between burial and midden, a food processing and disposal area, is problematic given the nature of Māori tapu systems. The date of OM261–1 places it early in the Omaha sequence, and it seems likely that the use of the spit for burials ceased early during the late phase.

Other similar dune midden complexes in the upper North Island from the same time period demonstrate a similar pattern of homogeneous, artefact-poor, single occupation shell middens, for instance Matarangi on the Coromandel Peninsula (Furey 1999; Sewell 2003). On the other hand, the middens on the Papamoa dunes in the Bay of Plenty demonstrate multiple occupation, more fish bone, more artefacts and are associated with garden soils (Fredericksen *et al.* 1995; Gumbley and Phillips 2000; Gumbley n.d.). These soils are based on the fertile Kaharoa Ash, and Papamoa is located in the heart of one of the densest precontact populations in New Zealand. Also, Papamoa is not located on a spit; its hinterland is directly accessible. Any or all of these factors may provide an economic and environmental explanation for the differences between Papamoa and the spits of Omaha and Matarangi, but social factors must also be taken into account.

OMAHA IN TIME AND SPACE

Middens from the early (Archaic) phase of New Zealand prehistory are typically rich in artefacts, varied faunal remains and the evidence of structures, unlike the Omaha middens which are almost boringly homogeneous. The early phase site of Houhora, one of the better known such sites in the upper North Island, has been interpreted as a semi-permanent village (Furey 2002), with many vital economic activities carried out in the same place. Mobility is evident in the early phase with major stone resources moving in quantity over large distances, and groups moving out from their home villages to seasonal resource extraction camps (see Anderson 1982 for a South Island example). In contrast, by the time of the late phase all the activities carried out in the early phase village are spread out across the landscape. The coastal midden is just one of a series of economic activity spaces tied together through a seasonal round. These contrasts reflect a change in settlement and subsistence patterns. Between the early and late phases population increased while major food resources, such as moa or seal, became depleted. Competition, therefore, increased and territories became more defined. People came to rely more on seasonal resources, and permanent settlements declined as people followed a seasonal round. Social and ritual factors became important in controlling access to resources and in defining territory. The ability to access resources outside the home range depended on the maintenance of kinship and social ties, and mobility became more bounded by tikanga. Boundaries emphasised external relations with other groups as much as they defined sets of resources.

Many essential economic activities, such as agriculture, storage, habitation, tool manufacture, even fishing, are barely represented at Omaha. There is good evidence only for the exploitation of shellfish and occasionally fish, and the inference from that of shellfish preservation and the coming together of different peoples for formal gatherings. In order to place Omaha within the context of late phase Māori society we need to examine the wider settlement patterns of the Omaha hinterland where these other activities now took place. Since Omaha is located in the middle of the R09 map sheet, this is a convenient scale for such an analysis.

Useful horticultural soils were determined by reclassifying the land use capability (LUC) data (Harmsworth 1996). Fertile soils are mostly LUC suite 3, older terraces; and suite 4, soils overlying sedimentary rocks other than greywacke. These soils, though fertile, are prone to erosion (at least under modern agricultural management regimes), and some are limited by wetness. Fertile wet soils were probably marginal in precontact times, their use limited to occasional taro. No drainage features have been recorded in this area, though they might be expected to have occurred; in what quantity we cannot say. Free draining soils would have been preferred. Figure 11 shows the distributions of these reclassified horticultural soils and recorded archaeological sites on R09.

Horticultural soils run in two east–west bands that follow major stream valleys such as the Mahurangi, Kourawhero and Whangaripo. It is clear from Figure 11 that recorded sites are not located with respect to horticultural soils. In fact all sites are located within 4 km of the coast. This is largely because they are only the *recorded* sites, which reflect the focus of field survey: initial survey on the coast, where returns would have been greater; and more recent survey driven by the commercial pressures of coastal development. We would certainly expect sites to be located with respect to horticultural soils and the Kourawhero

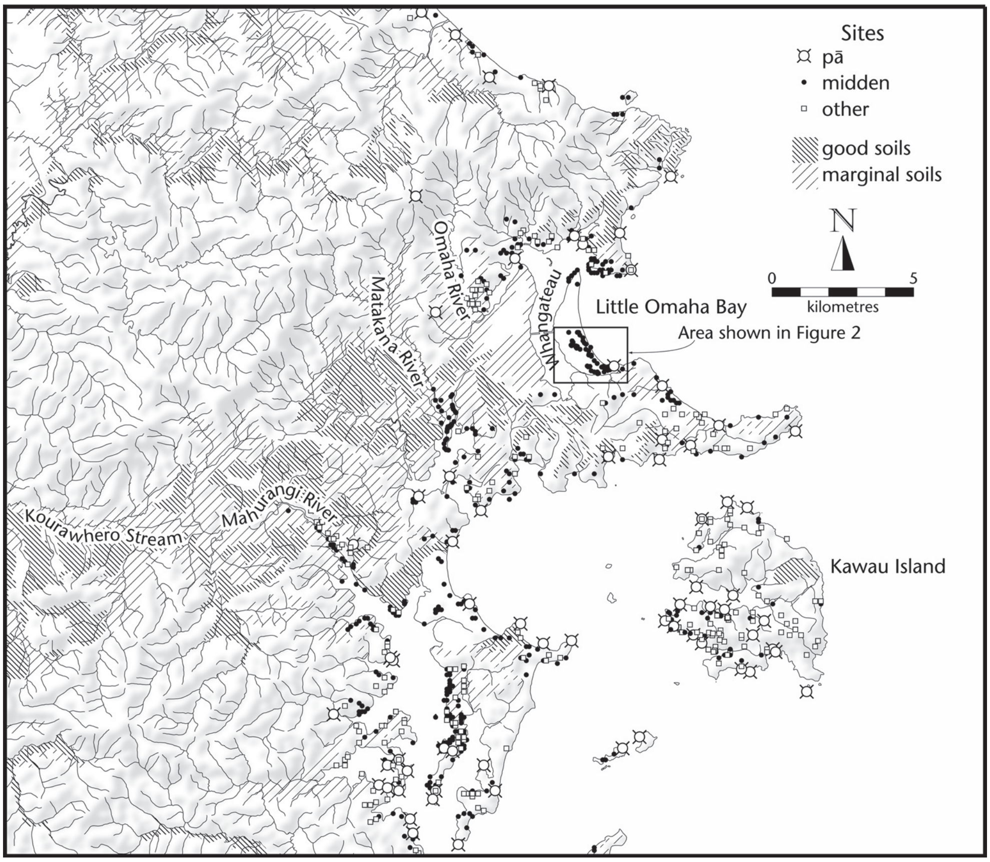

Figure 11: Sites on the R09 map sheet plotted with respect to agricultural soils.

Stream, which gives access to the Kaipara. Production and habitation sites would be located here, though modern agricultural practices may have impacted on them, and pā would be located on the hills nearby, but these have not yet been recorded archaeologically. Our settlement pattern, then, is incomplete.

Most sites are clustered near the coast, within 200 m of it. Numbers of sites, particularly middens and pā, diminish rapidly with distance from the coast; pā are mostly on coastal headlands. Sites of the 'other' category, mainly pit and/or terrace sites, are *relatively* more common inland (Campbell 2003), though they too are still clustered on the coast.

Omaha Sandspit then is located in a wider landscape of habitation and production. The sandy soils of the spit itself were unsuitable for prehistoric Māori agriculture and neither are they suited to permanent habitation. However suitable areas for these purposes are located not far away. Overland travel distances from the spit to 'mainland' sites are a few kilometres longer than for other coastal sites because of the spit's topography. This relative isolation may go some way towards accounting for the homogeneity of the sites — the longer the distance to be travelled, the more specialised the extraction strategy might be, for instance. However pit, terrace and pā sites are common both adjacent to the spit and a short canoe trip across the harbour mouth, replicating the regional distribution on a smaller scale. Though shell was moved from the coast it was not moved far, and people did not have to move far to obtain it. So while the activities that took place at Omaha were notably limited, the spit would still have been accessible as part of the daily round of people living close by.

The dominant material focus of this landscape, and the focus of late phase settlement patterns, is the pā. Not only do they loom largest in the archaeologist's research; they are also powerful social markers of status and mana, with a social (though not ritual) function related to that of the heiau and marae of tropical East Polynesia (Sutton *et al.* 2003: 237). Pā are particularly representative of changing settlement and subsistence patterns, inscribing late phase society on the landscape in a very visible way. Six pā are located in the immediate surrounds of Omaha Bay and the Whangateau Harbour, and more are recorded along the coast and up to 4 km inland. These small pā visibly advertised the rights and mana of the landholding corporate group, their readiness to protect what was theirs. They may not have the mana of the massive volcanic cones sites like Maungakiekie (One Tree Hill) or Pouerua, but their economic and social functions are essentially similar. In purely economic terms, pā protect resources — not only the marine resources of places like Omaha, but the agricultural resources of the hinterland, the timber and bird resources of the bush, and the human resources of the kāinga. Economy and subsistence were centred on these resources rather than on pā.

At the scale of the spit itself other factors must be invoked to explain midden distribution. The middens are, as noted above, often located in sheltered swales, though large middens spill over on to dune crests. The distribution of middens in the south of the spit, where they were found in areas that were wet in winter, is a good clue to the seasonal use of the area. Local environmental, and in particular climatic, conditions explain the general midden location. But two aspects of the middens are still unaccounted for — the avoidance of reoccupation and the lack of alternative activities. The explanation might be found in the nature of late phase Māori society and the settlement pattern itself, but must look beyond merely economic accounts. We end by briefly outlining one such alternative account.

Two points in particular have been made in the preceding paragraphs that are of relevance here. Firstly, economic functions in the late phase are spread out across the landscape — from this we might expect that the same applies to ritual or social functions. One of the social functions of tropical East Polynesian marae — as a marker of chiefly and group mana — has been seen to have been transferred to pā. (Alternatively, marae and pā have developed independently in different parts of East Polynesia, in order to accommodate similar social functions.) Marae and pā, of course, are far more than just this, and operate differently in different times and places. Just as the physical defensive role of pā has no equivalent in the marae, so marae have other social and ritual functions that are not part of the role of pā. These functions are spread across the late phase landscape in the same way that economic functions are — they may be linked to whare puni, urupā or other locations. Such a function may explain the non-economic aspects of the Omaha midden archaeology.

The second point is the changing nature of boundaries and their increased emphasis on external relations. Omaha is located at a boundary. Beaches and spits are important boundaries between land and sea, between the realm of the humans and the realm of the gods (Campbell 2003). The contrast between seaward and landward (tai : uta) is important in Oceanic systems of directional reference (Palmer 2002) and the seaward direction is associated with high status (Baltaxe 1975: 82). Hawaiki, the land of the founding ancestors, is across the sea, and Polynesian chiefs are often strangers from abroad (Sahlins 1985: 78). Supreme power comes from beyond the horizon (Helms 1988: 261). This is reflected in the placement of tropical East Polynesian (particularly Society Islands) marae in liminal boundary zones (Damon and Bickler n.d.), adjacent to beaches and between habitations and beaches. Dening (1992) shows how beaches were the meeting ground between Natives and (European) Strangers in the Society Islands, a place where the theatre of power was played out, a stage for rituals of status and sacrifice.

At Omaha natives and strangers (without Dening's capital letters) also met in social ritual. The focus of this perceptual boundary is again on relations between groups. Spit and beach were a stage for the theatre of formal hui and political powerplay. Behaviour on such occasions and in such places was governed by the rules of tapu. It is this, we propose, that helps explain the limitations on activities carried out here, and the avoidance of former sites of ritual. This explanation may be only partial. Clearly a primary role of Omaha was as a food procurement area, which would, on the face of it, preclude an association of tapu with the spit. However tapu may be applied to food resources in certain circumstances; the death of Marion du Fresne in 1772 after catching tapu fish is a well-known example (Salmond 1991: 387). Omaha seems to have been more than just an economic resource zone, but the attempt to locate Omaha within a wider social and ritual landscape has barely begun — the economic landscape is a far more developed concept. To do this will expand and, we are sure, modify if not completely rewrite our hypothesis, but will not invalidate the approach. Explanations of this kind, revolving around the place of the spit in society, are essential if we are to explain those aspects of the archaeology of Omaha for which there is no obvious economic explanation. The resources exploited at Omaha were not just economic, but social, political and ritual as well, though these leave no direct trace in the archaeological record.

APPENDIX 1: Charcoal Samples from Archaeological Middens at Omaha, North Auckland

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Thirty-five charcoal samples from seven separate archaeological middens on the sand spit at Omaha, north of Auckland, were submitted for species identification and for selection of radiocarbon dating samples. These are analysed in order to reconstruct the woody vegetation on the sand spit at the time of the occupation of the middens. Results are given in Table 4.

Seventy percent of the charcoal assemblage was supplied by only two species, pohutukawa and puriri. Pohutukawa occurs on most Northland shorelines irrespective of wider vegetation patterns. Puriri survives vegetation clearance, persisting on modern landscapes where other broadleaf forest species have long since vanished. The latter forest species, such as taraire (*Beilschmiedia tarairi*), tawa (*B. tawa*), mangeao (*Litsea calicaris*), karaka (*Corynocarpus laevigatus*), rewarewa (*Knightia excelsa*) etc., are notably absent from this assemblage.

The third most common species is kanuka, a small tree that dominates the regenerating scrub successions in the region. The assemblage also contains smaller amounts of mapau and mahoe and a range of smaller shrub species. All these are typically present in scrub successions.

TABLE 4
Charcoal identifications from Omaha midden samples

Common Name	**Species Name**	**Type (percent)**	**Pieces**	**Samples**
Hebe	*Hebe* sp.	Shrubs (8.7%)	2	2
Coprosma	*Coprosma* sp.		11	6
Lancewood	*Pseudopanax crassifolius*		1	1
Fivefinger	*Pseudopanax arboreus*		7	3
Manuka	*Leptospermum scoparium*		3	3
Pittosporum	*Pittosporum* sp.		9	1
Akeake	*Dodonaea viscosa*		2	2
Ngaio	*Myoporum laetum*		4	2
Mahoe	*Melicytus ramiflorus*	Scrub species (3.4%)	6	4
Mapau	*Myrsine australis*		6	4
Kanuka	*Kunzea ericoides*		48	12
Mangrove	*Avicennia marina*	Estuary (<1%)	1	1
Pohutukawa	*Metrosideros excelsa*	Broadleaf trees (70%)	144	26
Puriri	*Vitex lucens*		170	31
Matai	*Prumnopitys taxifolia*	Conifers (7.6%)	24	9
Kahikatea	*Dacrycarpus dacrydioides*		6	5
Kauri	*Agathis australis*		4	3
TOTALS			**448**	**35**

NOTES: Type = species grouped by plant type with % occurrence. Pieces = number of pieces identified. Samples = number of samples in which each species occurs (out of 35).

A final 10% of the assemblage consists of the conifers, kahikatea, matai and kauri. Stands of kahikatea are still present on the swampy inland margin of the sand spit today. The occurrence of the other two species is, however, somewhat anomalous in this assemblage. This is because, as has already been mentioned, the coastal broadleaf forest tree species we would expect to find accompanying them in a living forest are absent. It is quite possible that stumps and logs of these two large forest trees may have resisted decay long enough to have survived as relict wood on this landscape to be used as firewood by later inhabitants long after forest clearance.

In brief, this charcoal assemblage suggests the original matai-dominated coastal broadleaf-podocarp forest had been cleared before these middens were occupied. The living vegetation was dominated by pohutukawa and puriri and a smaller amount kanuka scrub growing around the dead stumps of some of the former forest trees.

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