Omaha Beach: Final Archaeological Report

Prepared for Omaha Beach Ltd

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Report Summary

Archaeology

The archaeology reported here is mitigation associated with earthworks on Omaha Sandspit, in two phases between July 2000 and September 2002. The spit encloses the Whangateau Harbour, which is fed by the Omaha River and the Waikokopu Creek, with alluvial and estuarine sediments forming tidal mudflats to the west, and dune sands to the east comprising old beach ridges and eroding dunes. The area was intensely used throughout the last few hundred years as a staging point for fishing and shellfish gathering, leaving behind major archaeological remains.

Omaha beach is a complex and changing environment. Although the emphasis of the excavations was necessarily focussed on individual midden, the broader use of the landscape was also addressed in these investigations. The radiocarbon dates obtained from the first season were earlier than expected as it was thought that that most sites would represent the historic and proto-historic periods. However, these earlier than expected dates were repeated in the second season results and confirm that the beach had been used from about 1450 to 1750 AD. Use continued until about the mid 19th century.

Site Preservation

It seems probable that many of the midden on the spit were destroyed prior to any archaeological investigation, and in particular that the more disturbed central-southern areas were mined for shell. However, more than 200 were recorded during field work, ranging from simple oven scoops surrounded by the remains of a single meal, to midden up to 2m deep with an estimated volume of 100m^3. It should also be noted that the area investigated did not included the northern half of the spit developed as a residential subdivision some years previously. Over 40 previously recorded sites were protected from development.

Use of the Sandspit

The midden contain almost nothing but quantities of shell debris. There is only a little fishbone, which is surprising given the marine orientation of subsistence here. Very few artefacts were recovered—one small adze, one net sinker, a few flakes of obsidian and some fragments of worked sea mammal bone. There is no direct evidence of long-term continuous habitation. Although a few possible postholes were seen in the sites, these did not suggest anything more than temporary structures.

There is no internal stratigraphy indicating re-occupation of any midden 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 midden. This suggests that most sites represent cooking areas used during a single episode of occupation that may have lasted days to a couple of weeks.

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Gardening

Exploitation of the marine resources is the obvious purpose of the Omaha sites excavated. Although there is some evidence of an older topsoil there was nothing definitive that suggested any major gardening in the areas excavated. However, to the south and the hills surrounding the harbour there are large areas in easy walking distance from the spit that could have been used for gardens.

Fishing

Jack mackerel, snapper and trevally species were the most common fish recovered from the midden along with smaller numbers of blue mackerel and kahawai. Overall, the range of species recovered suggests a variety of fishing techniques used, with netting evidenced by the net sinker, and a number of hook techniques used to catch the offshore species.

Shellfish

Pipi was heavily exploited at Omaha. Collections of other species, including cockle, scallops and tuatua as well as a range of rocky shore species, illustrate a wide range of collecting strategies. The small midden found in isolation containing cockle, in particular, and other scoops found within larger pipi midden also show purposeful targeting of these species as the interest or opportunity arose.

Occupation

Omaha can be seen as a specialised marine exploitation area occupied for relatively short periods of time as part of a general economic cycle. Fish and shellfish were probably preserved by smoking and removed from the sandspit as well as being consumed there. The historical information also indicates that large scale exploitation would at times have been used to provide large quantities of food for hui and other gatherings where feasting was an essential social component.

The quantity and size of midden found at Omaha demonstrate the importance of the landscape for Maori communities for at least 400 years before European settlement in the area. It seems likely that the rich marine resources acted initially as a magnet to groups wanting to exploit it but, as the oral history suggests, Omaha Sandspit also provided a useful venue for the social gatherings involving ritual feasting and meetings.

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INTRODUCTION

Project Background

Omaha Beach Development

The Omaha Beach development is a residential subdivision on the southern half of the Omaha Sandspit, 12 km north east of Warkworth, about an hour's drive north of Auckland (Figure 1). The sandspit encloses the Whangateau Harbour, which is fed by the Omaha River and the Waikokopu Creek. The sandspit is composed of a series of old beach ridges and eroding dunes and prior to development was largely in dairy pasture.

This report summarises the archaeological investigation of sites uncovered during the project from 2000 to 2002. This includes the Season 1 results from July to December 2000, the rescue excavation on site R09/887 and the Season 2 results from June to October 2002.

HPT Authorities

Six archaeological sites had been recorded in the development area prior to the current development and 44 during field assessment for the project. Owing to the shifting nature of the dune environment it was accepted that many more sites would be exposed during earthworks and an application to modify unrecorded archaeological sites was lodged with the Historic Places Trust.

The Season 1 work was carried out under an Authority from the Historic Places Trust (1998/141), granted under sections 14 and 15 of the Historic Places Act. An additional authority was granted for the rescue excavation on site R09/887 (2002/10) and covered other nearby recorded sites. Season 2 work was carried out under authority number 2002/68. This report is designed to fulfil the requirements of the authorities.

Initial Assessment

The initial survey was carried out by Rod Clough and Don Prince in 1997 (Clough 1998) at the request of Boffa Miskell, on behalf of Manapouri Developments Ltd, now Omaha Beach Ltd. It formed part of an assessment of effects for both a resource consent and plan change for an extensive coastal subdivision. The survey located 44 sites, only one of which was confidently identified as one of those previously recorded (R09/208). All were shell midden of varying size and condition, many typically deflated by wind erosion.

Although midden is the predominant site type on the sandspit, the spit and harbour are surrounded by six headland pa and numerous other settlement sites. Burials found in areas near the current development during previous earthworks also emphasised the usage of the harbour for a range of social activities, and protocols were developed with tangata whenua to provide for the possibility that koiwi might be exposed by excavation.

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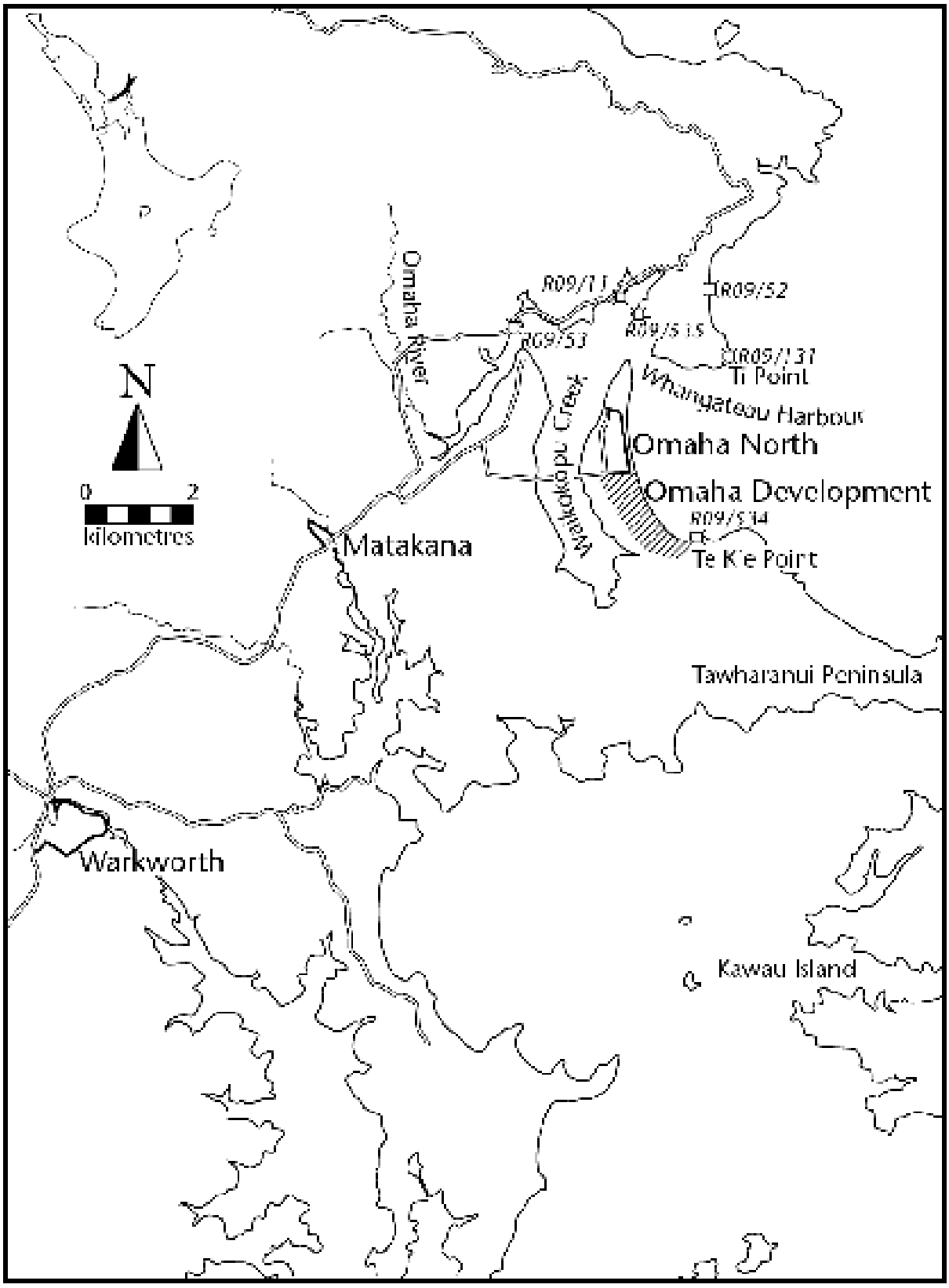
Figure 1. Location of Omaha subdivision



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Consultation

After extensive consultation with Ngati Wai and the local hapu, Ngati Manuhiri, preservation of over 40 of these recorded sites was incorporated in a Memorandum of Understanding between Ngati Wai and the developer and was a requirement of the resource consent. In addition, iwi were involved in monitoring of all earthworks.

Season 1

Earthworks starting in July 2000 involved the levelling of dunes in the north and infilling of low-lying areas. Archaeological investigation of midden was carried out when $15m^3$ motor scrapers or backhoes exposed sites. Smaller midden and isolated oven scoops were often fully exposed, though usually damaged, by the first pass of the machine. Large midden not fully exposed were carefully stripped with a 10 or 20 tonne backhoe and weed bucket, to remove any remaining sand overburden and expose the surface of the midden.

More than 150 midden were recorded during the 2000 season and a sampling strategy based on an assessment of significance was devised (see Campbell *et al.* 2001). Sites were investigated by either test pits or trenching. A hand-held GPS receiver with an accuracy of 2–5m was used to record the location of sites.

Some additional midden and some burials were recorded after the main field season and the results have been included in this report.

R09/887

In 2000 site R09/887, originally intended for preservation, was damaged by earthworks and the site was investigated to establish the extent of damage and maximise the information from the site. This offered a revealing view of one of the largest midden concentrations at Omaha.

Season 2

The second season in 2002 was focussed on the eastern, beach side of the development. Archaeological investigations were carried out prior to earthworks starting and a further 73 sites were exposed and investigated.

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Project Personnel

Project Director: Rod Clough (PhD)

Season 1
Supervisors: Matthew Campbell (PhD), Donald Prince (MA Hons)
Archaeologists: Kim Tatton (MA Hons), Mica Plowman (MA Hons), Barry Baquié (MA Hons)
Historian: Tania Mace (MA Hons)

Season 2
Supervisors: Simon H. Bickler (PhD), Donald Prince (MA Hons)
Co-ordinator: Mica Plowman (MA Hons)
Archaeologists: Vanessa Tanner (MA), Sally Burgess (MA Hons), Barry Baquié (MA Hons)

Ngati Manuhiri/Ngati Wai Representatives:
Ringi Brown
Aaron Brown

Other contributing specialists:
Dr Marianne Turner – Lithics
Dr Judith Littleton – Skeletal material
Dr Rod Wallace – Charcoal analysis
Charlotte Judge – Fishbone (2002)

A project supervisor was on the site with the archaeologists every day during the investigation.

Figure 2. Project personnel at OM268, September 2002

From left to right: Aaron, Mica, Simon, Vanessa and Ringi

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Structure of the Report

The report is divided into 4 sections:

- Introduction to the report
- Archaeology of Omaha
- Midden Analysis describing the artefacts and midden recovered
- Discussion – integrating the results of the archaeological work carried out.

A CD is also available and includes photographs, drawings and site record forms for the Omaha project.

The Introduction includes the background to the project and summarises the traditional history and land use of the Omaha sand spit and the initial archaeological assessment of the area. This background work was used to provide some research strategies for the major field seasons in 2000 and 2002.

The section on Archaeology at Omaha summarises the survey and excavation of sites found at Omaha. The methodology, general stratigraphy and location of sites are discussed along with details of each season's results. As more than 200 midden sites were found, example sites are selected to represent the social landscape uncovered.

The Midden Analysis section sets out the results for the main field seasons and the rescue excavation of R09/887. This included shellfish, fishbone and other items found in the excavations.

The Discussion section summarises the results of the archaeological investigation. It integrates the radiocarbon dates, environmental and burial information to construct a view of the prehistoric and historic social landscape at Omaha Sandspit.

Traditional History and Land Use

Environment

The coastal area and offshore islands were valued resources rich in marine life. Shark in particular was seasonally procured and preserved by drying to provide winter sustenance. As demonstrated archaeologically, a variety of fish and shellfish species were also exploited. A wide range of natural resources could be procured from the nearby swamps and forests, 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 (*Pteridium esculentum*).

Pre-European History

Given the available resources and the convenient location, it is not surprising that the area has a complex history. The traditional history describes migrations of groups in the area and the battles fought and their impact on the occupation of the region.

The history of Omaha is closely related to that of the larger coastal area between Mahurangi and Te Arai Point. Ngati Manuhiri, who occupied the area at the time of European contact in the 1830s, are the remnant of Te Kawerau, who had occupied a more extensive area until their defeat at the hands of Ngapuhi. The Omaha sandspit and surrounding area were occupied by the Ngai Tahuhu people, who traced their decent from Tahuhunui, commander of the Moekakara or Te Whakatuwhenua canoe that landed near Goat Island (ARC Parks 1992). Their origins are described below.

Around the 1620s a group of Ngati Awa migrated north from Kawhia to Tamaki. Led by Maki and his brother Mataahu, they conquered Tamaki and settled at Mt Smart. They then headed north. A battle was fought between Ngai Tahuhu and Maki's people at Pukenihinihi Pa to the southeast of the Omaha sandspit. Ngai Tahuhu were defeated. 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) (ARC Parks 1992).

Maki divided the land between his sons and followers. Maeaeariki was given land at Mangatawhiri and Tawharanui and his people became known as Ngati Raupo. Meanwhile Manuhiri's relatives, known as Ngati Manuhiri, settled the area between Whangateau and Pakiri. (ARC Parks 1992).

From the sixteenth century Kawerau were under attack from the Marutuahu confederation (Ngati Maru, Ngati Whanaunga, Ngati Tamatera and Ngati Paoa) from the Hauraki Gulf (Simmonds [in Keys] n.d.). Rights to fish for school sharks were fought over between Kawerau and the Marutuahu tribes. Battles continued until the 1790s, when a short-lived peace agreement was made (ARC Parks 1992).

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1790s-1825

During the 1790s Kawerau were part of a Marutuahu war party that travelled to the Bay of Islands, where they had engaged and defeated Ngapuhi at Waiwhariki near Puketona. In the 1820s Kawerau found themselves under threat from the musket armed Ngapuhi. Ngapuhi were defeated at a battle at Mahurangi in 1820, where the Ngapuhi leader Koriwhai was killed. In 1822 Ngapuhi sought to avenge the death of Koriwhai. They attacked Kawerau at Te Kohuroa (Matheson's Bay). After the initial attack Ngapuhi retired to the Omaha sandspit where fires were lit. The next day there was another brief engagement from which Ngapuhi emerged victorious (ARC Parks 1992).

In 1825 a large and important battle was fought at Auckland between Ngati Whatua and the musket armed Ngapuhi. The Ngati Whatua force included the Kawerau people of the east coast. The battle was fought at Mangawhai and then at Te Ika a Ranganui near Kaiwaka. Ngapuhi emerged victorious despite heavy losses. The Kawerau people living between Pakiri and Whangaparaoa lost many warriors and fear of further attack caused them to leave their homes. Ngati Manuhiri sought refuge north of Whangarei with their Ngati Wai relatives. Ngati Rongo went to the Bay of Islands to stay with Nga Manu relatives and Ngati Raupo headed for Whangarei, where Te Parawhau relatives took them in (Pritchard 1983).

Land Sales and History

In 1839 a block of around 10,000 acres of land was sold that stretched from Point Rodney to Tawharanui and included the Omaha Sandspit. William Webster, an American trader, purchased the land from Hauraki tribes rather than the traditional occupants of the land. In 1844 Webster's claim was found to be excessive and he was granted 1,944 acres 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 the Ngati Paoa and Ngapuhi tribes (ARC Parks 1992).

Hearing of the land sales Kawerau people began returning to their land unimpeded by the Crown. Chief Tawhiti lived on the 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 the block should be divided into three. The Mangatawhiri No 1 and No 2 blocks were granted to Kawerau for sale, while title to the neighbouring No 3 block was granted to Ngati Raupo (ARC Parks 1992).

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1874 Survey

A survey taken in 1874, when land was granted under the Native Lands Act, shows a band of forest along the western side of the sandspit and a small area of forest to the northeast end of what is now the Mangatawhiri farm development (Figure 3). The rest of the land block was covered in fern and ti tree (LINZ Deeds Plan 9).

The 1,957-acre Mangatawhiri block 1 was sold in 1874 to John James Atkinson of Dunedin. Two years later he sold block 1, along with neighbouring block 2, to John Cargill, also of Dunedin (Certificate of Title, LINZ).[1] In 1877 Cargill purchased the neighbouring Tawharanui block from Ngati Raupo. With this addition the property now measured 4,156 acres (ARC Parks 1992). These early owners appear to have purchased the land for speculative purposes.[2]

In 1877 Cargill sold the land to Antonio Martin of Auckland. Martin was initially interested in the land for its timber resources. The stands of kauri on the Tawharanui peninsula and at the headwaters of the Mangatawhiri valley were logged. Manuka, which cloaked other areas of the property, was harvested for firewood and Martin's several cutters conveyed the timber to Auckland (ARC Parks 1992).

By 1896 much of the timber had been removed and a flock of 900 sheep was grazing the newly established pasture. In 1899 Martin's heirs leased the land to David Jones of nearby Takatu. Though the property was farmed in the late nineteenth century, it is not clear whether the Omaha sandspit was converted to farmland along with the rest of the land (Figure 4).[3]

In 1907 Jones' widow sold Mangatawhiri block 1 and part of block 2 to John Wilson, owner of Wilson's Portland Cement Company, who purchased the property for its sand and shell resources.[4] In 1928 Wilson granted William Fraser McCallum, Alexander McCallum and Daniel Fraser McCallum the right to remove shell and sand from the property for a period of five years. In 1934 Wilson's heirs sold the land to Mangatawhiri Limited (Certificate of Title, LINZ).[5]

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[1]Certificate of Title, Vol. 11, Folio 245, Land Information New Zealand (LINZ).

[2]Atkinson and Cargill were from Dunedin and neither of them appear to have moved north to take up their land as they do not appear in the electoral roll for Rodney during the period of ownership.

[3]A plan of 1934 describes the land to the south of the sandspit as 'Hilly Open Country' with the sandspit having a large area of 'Flat Land under Light Bush and Manuka' and also an area of sand hills. The light bush may have covered an area that had earlier been converted to pasture but was now left to go wild. DP25193, LINZ, Auckland and Certificate of Title, Vol. 11, Folio 245, LINZ.

[4]Auckland Regional Council Parks Service, p.47 and Certificate of Title, Vol. 11, Folio 245, LINZ.

[5]Certificate of Title, Vol. 11, Folio 245, LINZ.

Figure 3. Omaha in 1874 (DP9 LINZ)

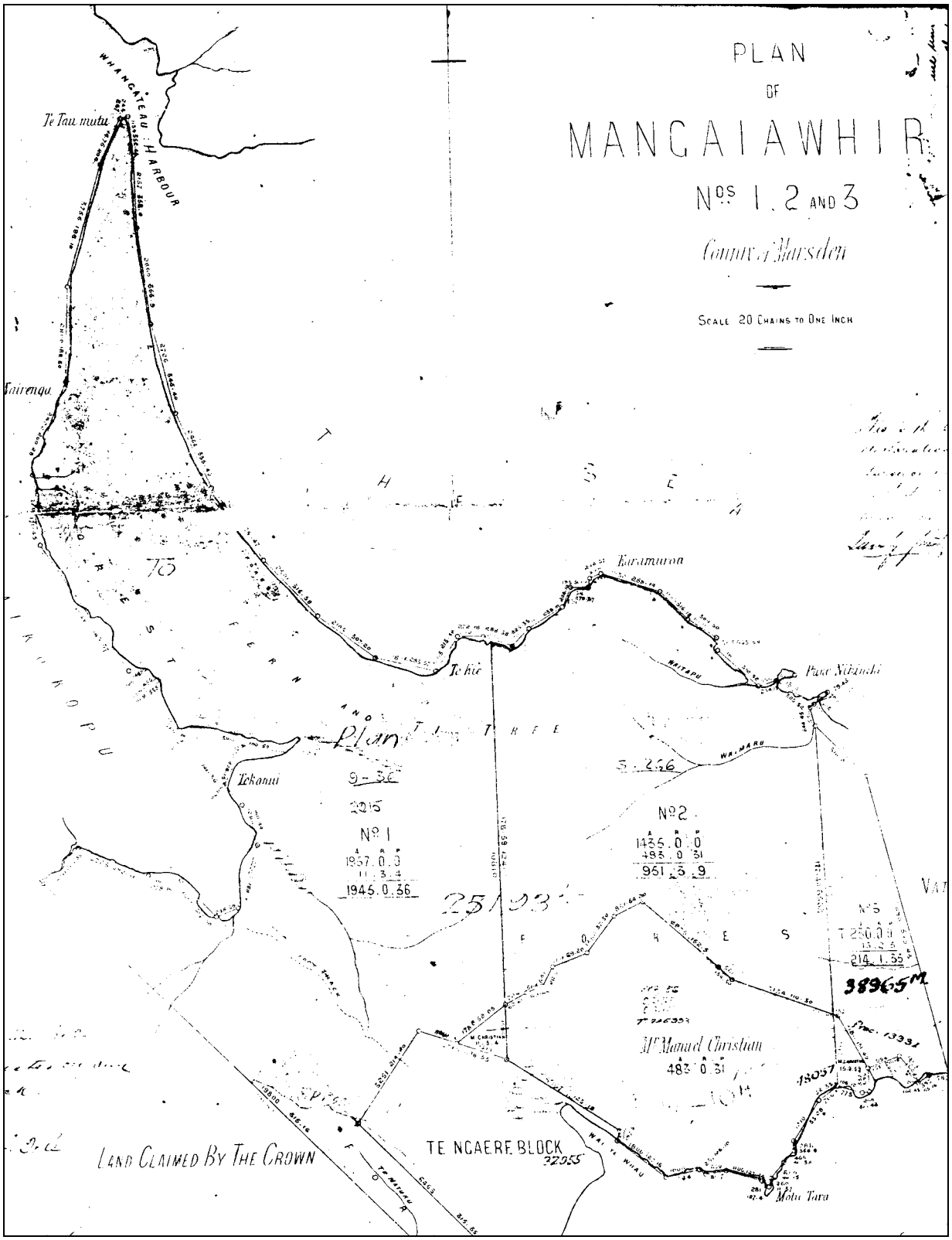

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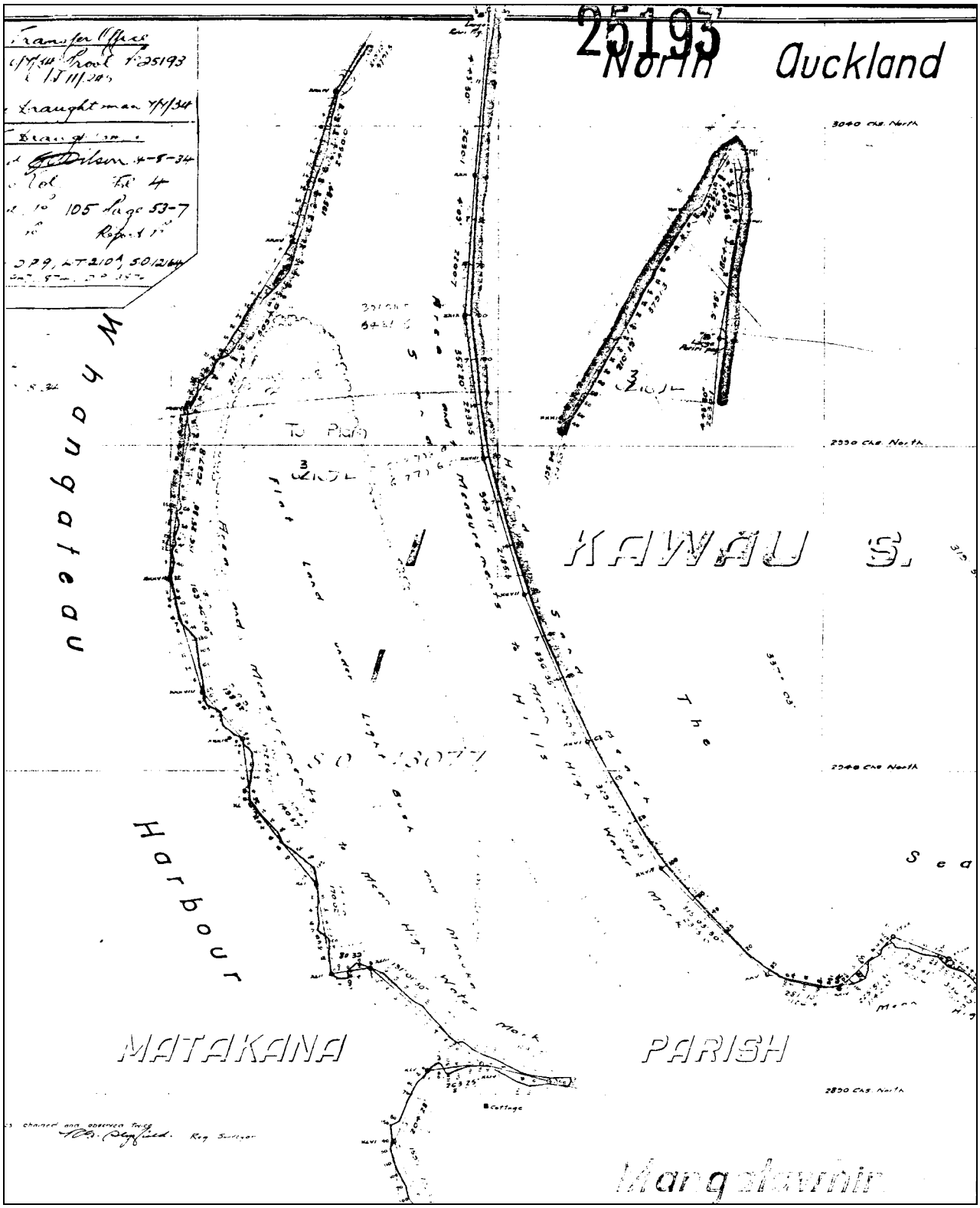
Figure 4. Omaha in 1934 (DP 25193 LINZ)



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1934 Survey

A plan drawn in 1934 shows that aspects of the landscape recorded in the survey of 1874 were still evident 60 years later (Figure 4). Though the areas of forest had disappeared by 1934, around half of the sandspit was covered in a large band of light bush and manuka. It may have been cleared for pasture in the late 19th century and then left to go wild some time before 1934. This area included the western edge of what is now the Mangatawhiri farm development site. The 1934 plan also shows the area of bush and manuka flanked by sand hills covering the eastern side of the sandspit. No sand hills were recorded in 1874 when fern and ti tree predominated (DP9 and DP25193 LINZ).

The sandspit has a long recorded history of exploitation that indicates both its complex social history as well as a dynamic physical environment. These changes have accelerated with the major housing development both in the northern half of the spit, prior to the current project, the building of a golf course and the current housing development in the southeastern half of the spit. Reviving this social and physical history represented an interesting challenge for the archaeologists working at Omaha.

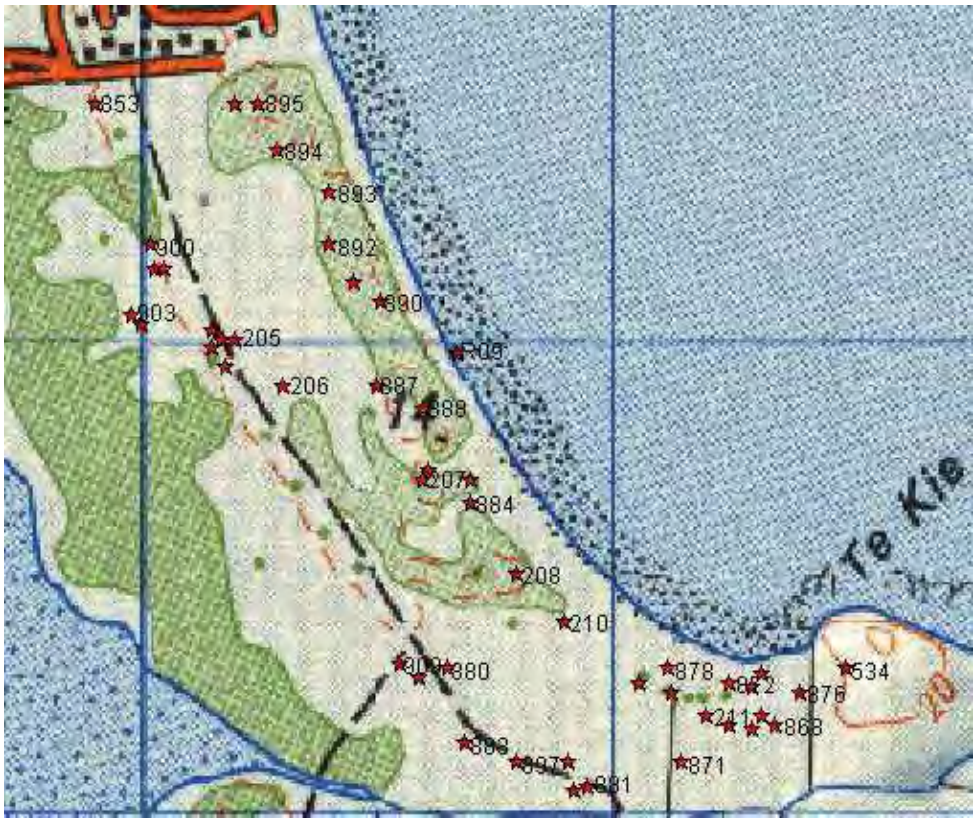
Previously Recorded Sites

Summary

Rod Clough and Don Prince carried out the initial survey of the project area in 1997 (Clough 1998). The property was then a dairy farm with stable pasture on old dune systems in the south and west parts of the property. The dunes were less stable to the north and in the eastern section, where they observed evidence of continuous dune blowout. On the western side of the spit is a special ecosystem of freshwater kahikatea swamp blending into brackish mangrove swamp and the Whangateau Harbour / Waikokopu Creek.

Prior to the 1997 survey 6 archaeological sites (all midden) had been recorded on the property (Table 1). Many more sites had been recorded in the general vicinity, including a small ring ditch pa on Te Kie Point (R09/534), which lies on the southern border of the property (Figure 5)[6]. The midden were of varying size, condition and content. All were reported in poor condition having been exposed by erosion, cattle damage and dune blowout. It is likely that some of these sites were no longer visible when the 1997 survey began.

Figure 5. Location of previously recorded sites at Omaha Beach



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[6] MS260 grid coordinates and the vagueness of site location provided make it almost impossible to accurately relocate these sites or equate them with midden recorded during the present survey.

Table 1. Previously recorded sites at Omaha Beach

Site No.	Type	Comment
R09/205	Midden	Recorded prior to 1997 survey
R09/206	Midden	Recorded prior to 1997 survey
R09/207	Midden	Recorded prior to 1997 survey
R09/208	Midden	Recorded prior to 1997 survey
R09/210	Midden	Recorded prior to 1997 survey
R09/211	Midden	Recorded prior to 1997 survey
R09/868	Midden	Area 15 x 5m thin scatter - deflated
R09/869	Midden	Area 12 x 7m x 10cm dense midden - stable
R09/870	Midden	Area 7m diameter 10cm midden exposed
R09/871	Midden	5m diameter, thin layer
R09/872	Midden	30 x 15m x 200mm dense midden - stable
R09/873	Midden	10 x 3 thin deposit stable under pasture
R09/874	Midden	5m diameter thin spread – probed only
R09/875	Midden	6 x 4m x 120mm thick – stock damage
R09/876	Midden	4 x3m x 150-200mm thick - disturbed
R09/877	Midden	10 x 5m x 150mm, fishbone. Stable
R09/878	Midden	5 x 7m d. heavily eroded. Previously recorded as R09/210 or 211??
R09/879	Midden	2 areas c.5m d. finely crushed midden - stable
R09/880	Midden	Thin 20-30mm spread over 5 x 8m - stable
R09/881	Midden	15 x 5m, thin deposit cut by road – deflated, partly destroyed
R09/882	Midden	12 x 5m cut by road, preserved on western side of road
R09/883	Midden	10 x 20m, cut by road, good preservation west of road
R09/884	Midden	Heavily eroded dune midden
R09/885	Midden	Deflated and eroded dune midden
R09/886	Midden	Extensively eroded dune midden
R09/887	Midden	Two deflated dune cap middens – heavy erosion
R09/888	Midden	Deflated and eroded dune cap midden
R09/889	Midden	Deflated and eroded dune cap midden
R09/890	Midden	Deflated and eroded dune cap midden
R09/891	Midden	Deflated and eroded dune cap midden
R09/892	Midden	Deflated and eroded dune cap midden exposed by blowout
R09/893	Midden	2-5m d. dune midden extensively damaged
R09/894	Midden	Deflated and eroded dune cap midden
R09/895	Midden	Large deflated and eroded dune cap midden
R09/896	Midden	2-3m d. concentration, cut by road, stock damage
R09/897	Midden	Thin lens of midden – stock damage, deflated
R09/898	Midden	8 x 4m area, thin lens, some cattle damage
R09/899	Midden	Single thin lens over 10m eroded, exposed in blowout
R09/900	Midden	Thin scatter exposed in cattle track
R09/901	Midden	2 x 4m deflated and exposed in blowout
R09/902	Midden	Thin lens in black soil matrix some stock damage
R09/903	Midden	3 x 3m 150mm thick lens exposed in cattle track
R09/904	Midden	7 x 3m 200mm thick intact, black soil matrix
R09/905	Midden	4m x 5m x 350mm thick, some stock damage, largely intact
R09/906	Midden	Similar to 905
R09/907	Midden	Badly eroded single lens 100mm thick
R09/908	Midden	Exposed by erosion, 120mm thick lens on dune flank
R09/909	Midden	150mm lens, badly damaged by stock
R09/910	Midden	2 x 3m thin spread over eroding dune

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Survey Results

During the survey 44 sites were recorded. One or two of these may relate to the sites previously recorded but accurate correlation of the older sites, with the exception of R09/208, was not possible due to the pre-GPS location information available.

All sites were midden, but varied considerably in state of preservation, contents and size. Those on the undulating and unstable dune system to the north of the farm manager's house and east of the access road were generally in poor condition, exposed and deflated by dune erosion and blow-out. In contrast, to the west of the road and/or south of the farmhouse, the more stable pasture had preserved the sites. A number of shellfish species were observed (Table 2) in the midden deposits, and although pipi and cockle predominated, there were also concentrations of scallop. Charcoal and hangi stones were also a common element in most midden and fishbone was observed in some.

Although not based on a detailed analysis there appeared to be some differentiation of the midden composition relating to their location. Towards the west of the property, particularly in midden bordering on the kahikatea swamp, cockle appeared to be the predominant species. In contrast, those midden on the beach side of the property were predominantly pipi with the occasional concentration of scallop. This seemed to reflect the sites' proximity to and exploitation of either the marine or the harbour/estuarine environment. However, it remained a goal of the excavation season to establish whether this pattern was borne out.

The density of archaeological sites clearly established the significance of the area to Maori. The recorded midden merely reflect one aspect of settlement; they do not record the full extent of it. For the most part, they represent short-term encampments and seasonal activities. However, it was thought that some of the more substantial middens might represent more permanent occupation, particularly nearer to Te Kie pa or the kahikatea swamp.

Table 2. Shellfish observed in midden

Arabic volute	*Alcithoe arabica*
Cockle	*Austrovenus stutchburyi*
Dog cockle	*Dosinia anus*
Mud cominella	*Cominella glandiformis*
Ostrich foot	*Struthiolaria populosa*
Oyster	*Ostrea* sp / *Crassostrea gigas*
Pipi	*Paphies australis*
Scallop	*Pecten novaezealandiae*
Tuatua	*Paphies subtriangulatum*
Whelk: speckled whelk	*Cominella adspersa*

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Range of resources

The swamp would be an obvious focus of settlement, as it would provide easy access to a considerable range of resources. While it is tempting to equate density or volume of shellfish with degree of permanence, the traditional use of the area for fishing grounds cautions against doing so. Many fish, particularly the cartilaginous ones such as shark and rays, do not leave durable remains in the midden and are consequently considerably under represented. Remains of birds and fish would have also been a constant part of the kuri's (Polynesian dog) diet, further reducing their likelihood of survival. It was thought that the shellfish might well be the only visible remnants of more permanent occupation or considerable activity such as the preparation of preserved food for the winter months.

Research Questions

The results of the initial survey provided a preliminary set of questions for the future investigations. These included:

1. Whether the distribution of midden across the landscape was uniform or followed the main ridges observed during survey?
2. What variables dictated the distribution of the sites?
3. Was there differentiation in midden contents based on proximity to sources of shellfish?
4. What is the range of dates represented by these midden?
5. What sort of occupation of the area is supported by the archaeology found at Omaha? Did the sites represent short or long-term, seasonal or continuous settlement?
6. What was the range of activities carried out at the spit?
7. How do the Omaha sites fit within the broader prehistoric settlement of the area?

THE ARCHAEOLOGY OF OMAHA

Introduction

Chapter Contents

This chapter summarises the results of the survey and excavations carried out at Omaha Beach. The chapter is divided into the following sections:

1. Overview
2. Season 1
3. R09/887
4. Season 2

The Overview provides a summary of the sites found at Omaha including descriptions of the distribution of sites across the landscape. It summarises the information regarding how sites were found and how they fit within the dune stratigraphy. A general description of the contents of the midden is also discussed briefly.

The Season 1 section describes the excavations carried out during earthworks between July and December 2000 which were part of phase 1 of the development, involving levelling of dunes to the north and infilling of low lying areas to the south (Figure 6). 15 cubic metre motor scrapers, with limited use of backhoes, carried out most of this work. Excavators were used when investigating most sites. An archaeologist and a representative of tangata whenua monitored all earthworks.

The results of this season have been published elsewhere (Campbell *et al.* 2001, Campbell and Clough 2001) but are incorporated here as part of the final report. Example sites are described and their interpretation used to provide detailed insight into midden use.

Additional visits to work on the nearby golf course in February 2001 added more midden sites and a burial site. These are included in the analysis presented in this report.

The section on Site R09/887 describes the rescue excavation carried out on this site after it was damaged by earthworks in 2001. The results of this excavation provide a detailed view of a large midden and in particular the deflation processes that have occurred at Omaha.

The Season 2 section presents results of the 2002 season, described in this report for the first time. As for Season 1, larger sites have been chosen to provide a range of information about the midden formation. In addition, burials (koiwi) found during subsequent earthworks are also described.

OVERVIEW

Site Recording

Earthworks and Areas Investigated

The northern half of the sandspit had already undergone development some years before, although without the requirement of major archaeology. The loss of this part of the site highlighted the importance of the work to be carried out on the southern half of the spit during the development. The earthworks required were substantial and included contouring the dune areas to allow building of houses including major levelling and re-deposition of fill. As a result a large area of dune was modified.

The development was divided into five 'Neighbourhood Units' (NU) and in the first season's archaeological notes this was the major guide. Season 1 work generally focused on the western side of NU 1-3 and south parts of the development (NU 4-5).

Somewhat confusingly during the second season, the remaining NUs were subdivided into Areas (1-5) reflecting the programme of earthworks and the site notes generally follow these Area designation. The areas covered the eastern half of NU1-3. Figure 6 shows these Neighbourhood Units and Areas.

Investigation Strategy

The strategy employed to find sites and deal with them included:

- Location of possible sites by intensive probe testing of areas prior to earthworks
- Marking these possible sites and exposing them by scraping to define their full extent
- Excavating sites either by trenching or test pitting
- Drawing of sections and plans
- Sampling the midden for later analysis
- Removal of midden.
- Sites exposed by subsequent earthworks were similarly examined.

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Figure 6. Neighbourhood Units and Areas

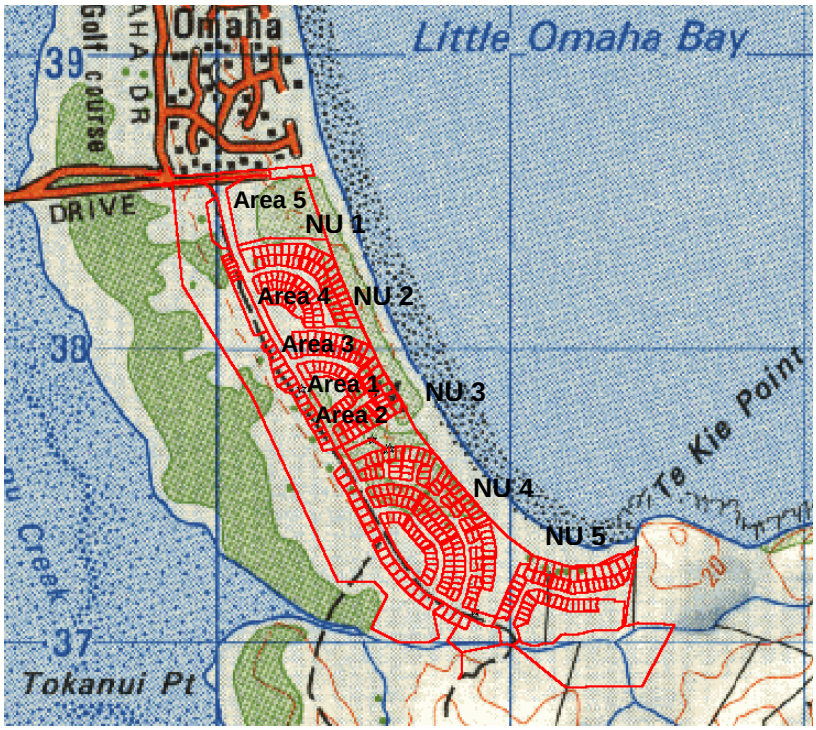

Figure 7. Preliminary earthworks in NU 4

Figure 8. Typical features exposed by machine and hand tools

Figure 9. Removal of midden after recording

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Site Recording, Continued

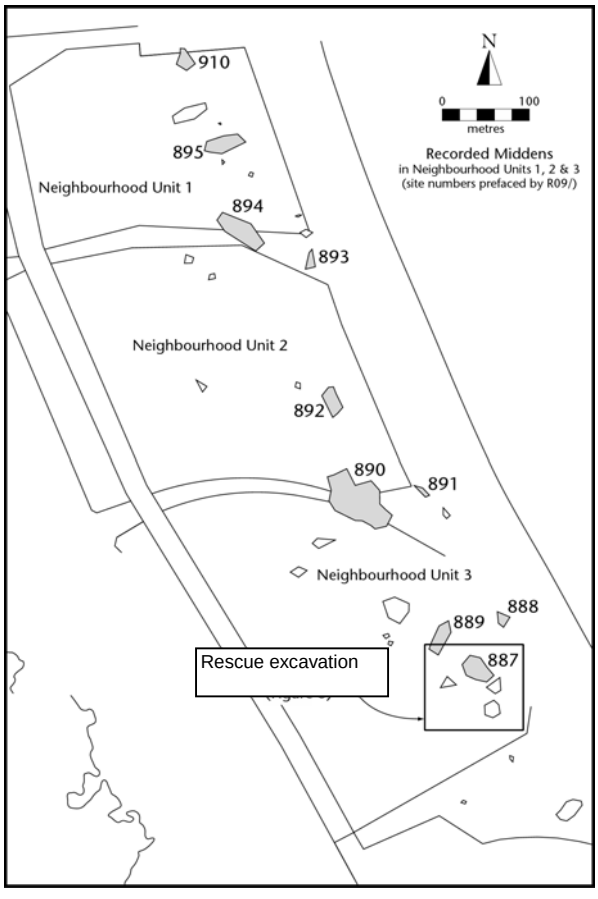
Methodology

There were differences in methodology employed between Seasons 1 and 2. Test pits were the predominant form of sampling strategy during the first season by request of iwi, while trenching the features was used almost exclusively during Season 2. These different methodologies reflect an emphasis on establishing internal site morphology in Season 2 as opposed to site location and distribution during Season 1, providing complementary sampling strategies.

Hand held GPS receivers were used to record the midden with an accuracy of 2-5m. Each midden was located as a single point. The GPS data was then downloaded into a PC and processed using Trimble Pathfinder Office software and converted to MapInfo format. MapInfo, a desktop mapping software package (a simple GIS — Geographic Information System), was used for primary data storage, display and analysis. Attribute data for each midden could then be integrated with the GIS for analysis.

Sites marked out for preservation were fenced off during earthworks and are shown in Figure 10 below. Fencing of these sites was carried out in 2002.

Figure 10. Major recorded midden, fenced off for preservation



Site Distribution

Midden Locations

Midden locations were collated from the varying sources and plotted on the NZ260 map (see Figure 11-16). The data in this series include:

1. Pre-1997 sites
2. 1997 Survey sites
3. 2000 Season 1 sites
4. 2001 Additional sites
5. 2002 Season 2 sites

Sites often appear clustered together, but no obvious pattern was discernible beyond the general fact that midden were usually located on the leeward side of dunes, although many of the larger sites in fact covered and formed some of the larger dunes areas. These midden were probably quite exposed to the elements although scrub coverage would probably have provided some shelter.

The sites are shown in the figures below as single point locations (most commonly taken from the centre of the site). Sites were generally defined by having a gap of around 10m between their boundaries or being separated by some physical feature (a different dune). Overlapping features and those within 5m of another feature were considered to be part of a single site.

The maps below show the site locations. Detailed maps (Figures 12-16) start from the north and move southeast along the beach line, covering the development. Different symbols represent the different seasons listed above (1-5).

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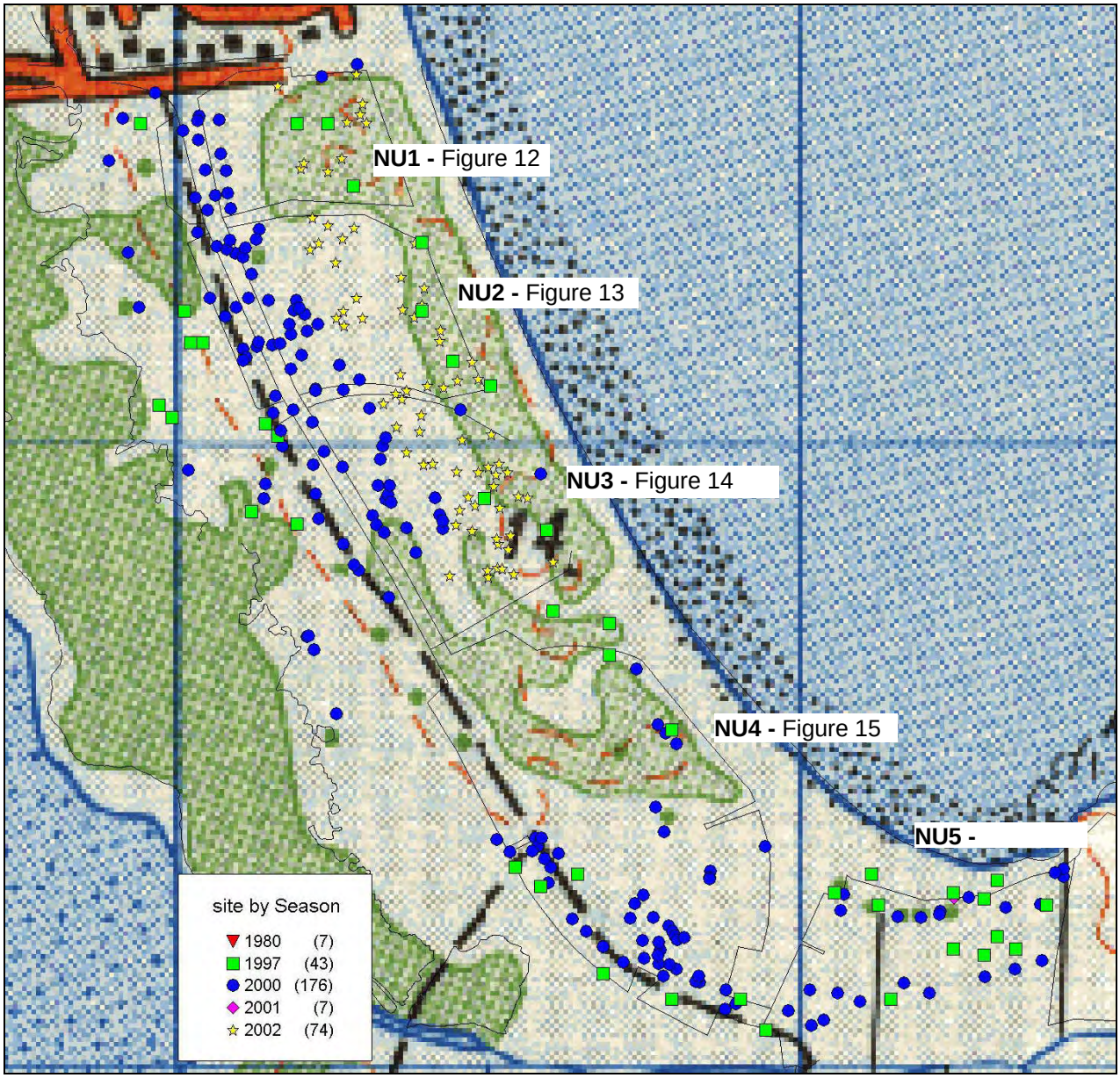
Site Distribution, Continued

Figure 11. Distribution of recorded sites by year recorded (1980 = all pre-1997 sites; 1997 = 1997 assessment sites; 2000 = Season 1; 2001 = sites recorded following Season 1; 2002 = Season 2)



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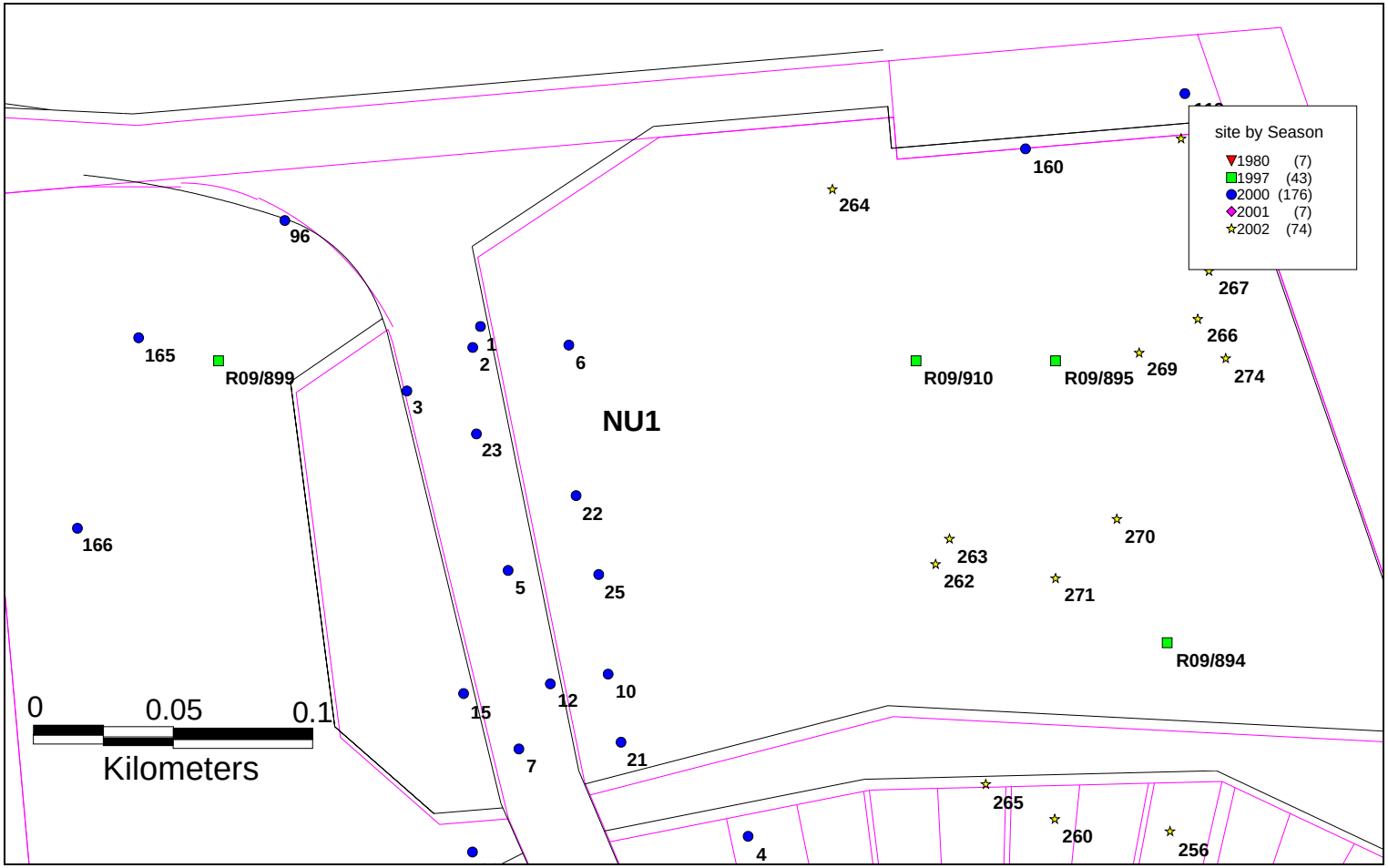
Site Distribution, Continued

Figure 12. Sites in NU1 by Season



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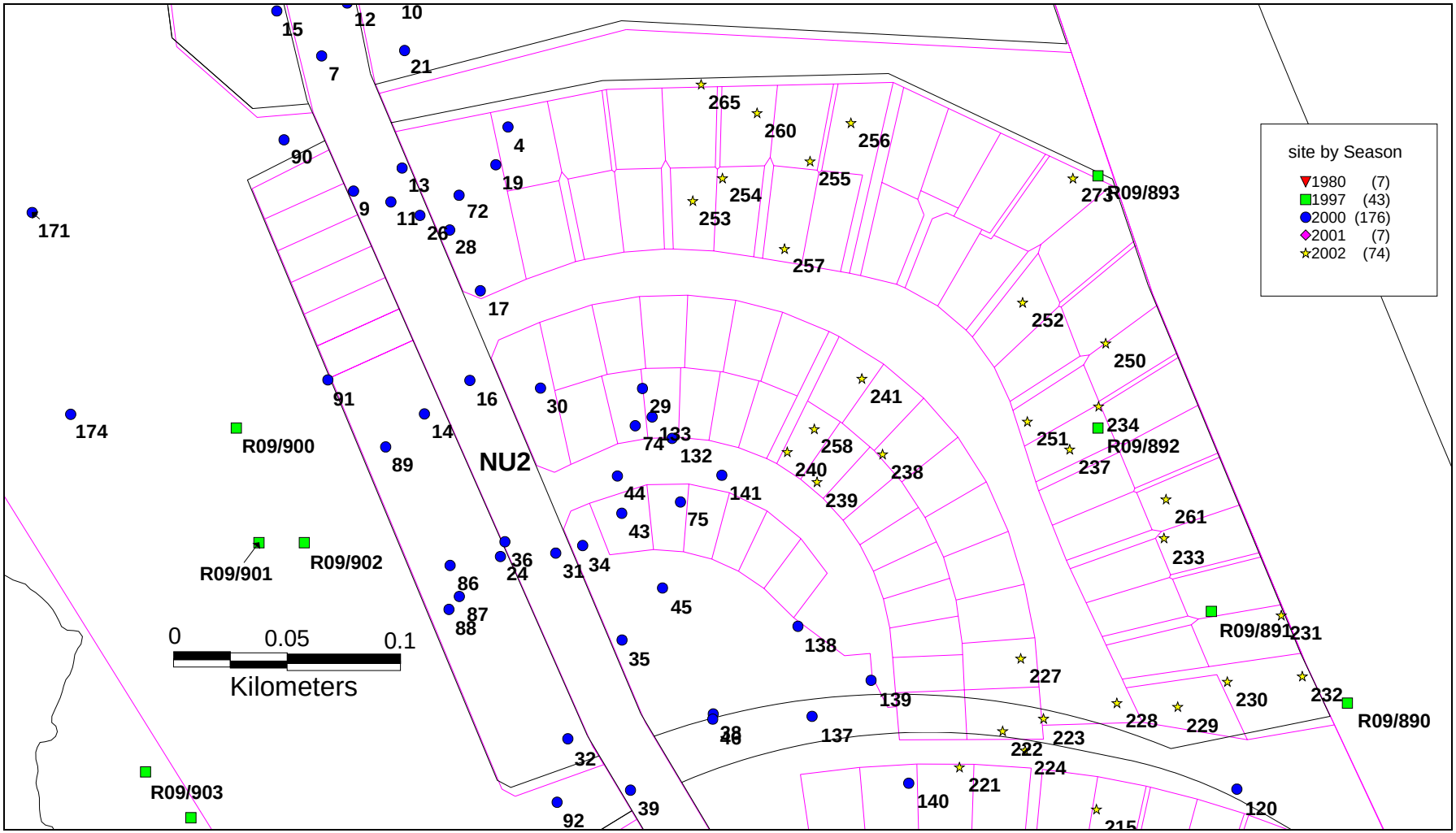
Site Distribution, Continued

Figure 13. Sites in NU2 by Season



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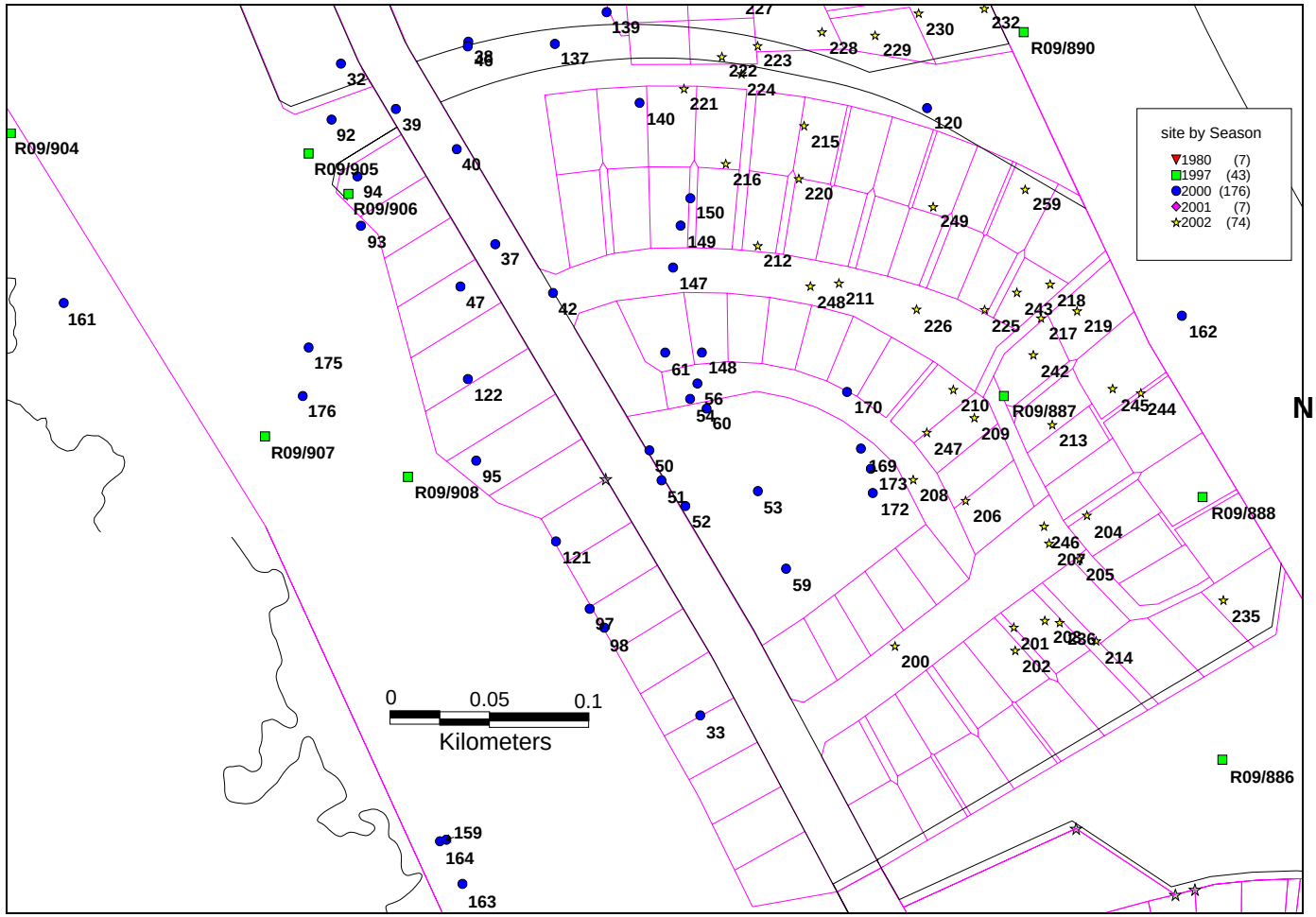
Site Distribution, Continued

Figure 14. Sites in NU3 by Season



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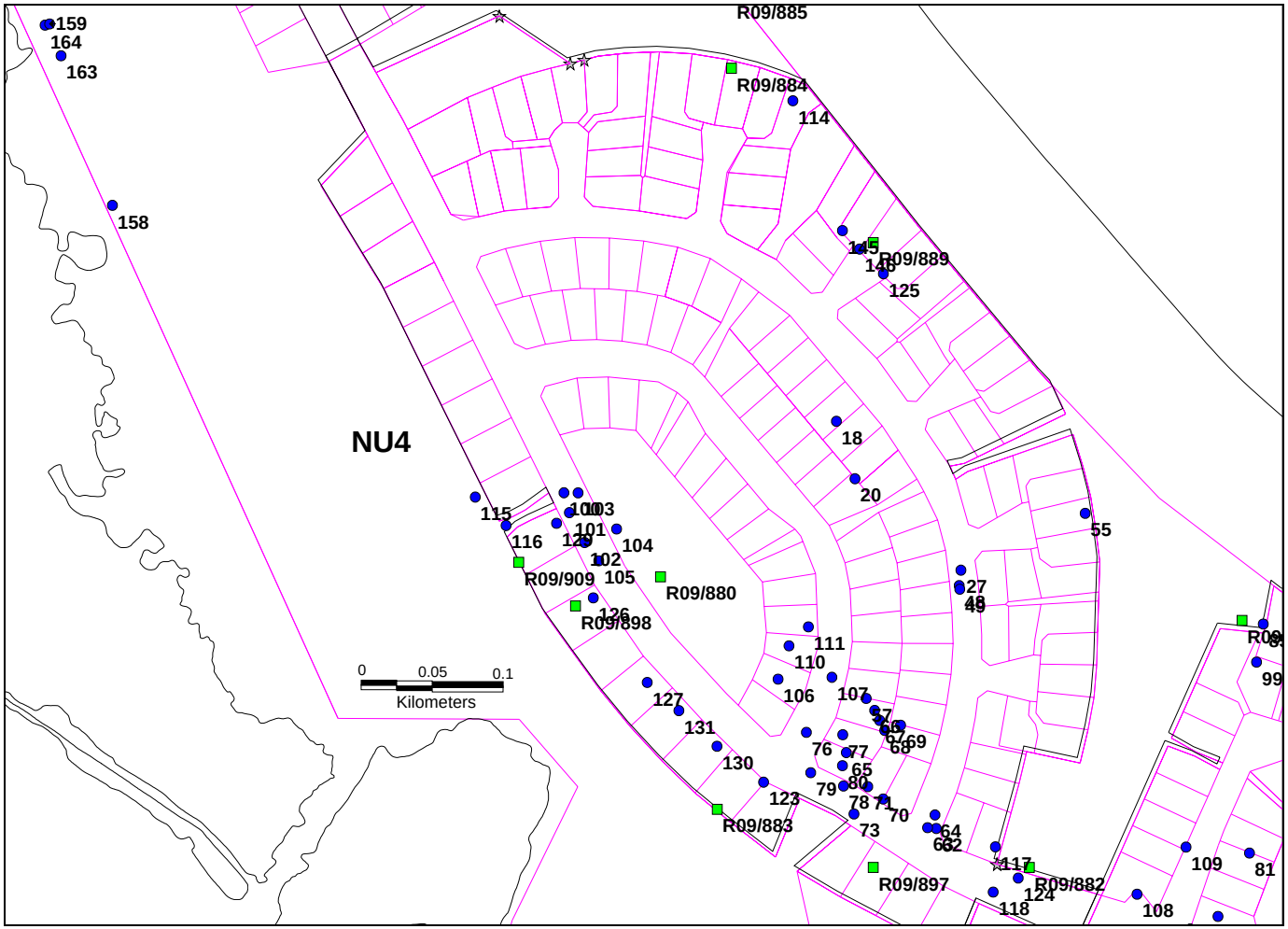
Site Distribution, Continued

Figure 15. Sites in NU4 by Season



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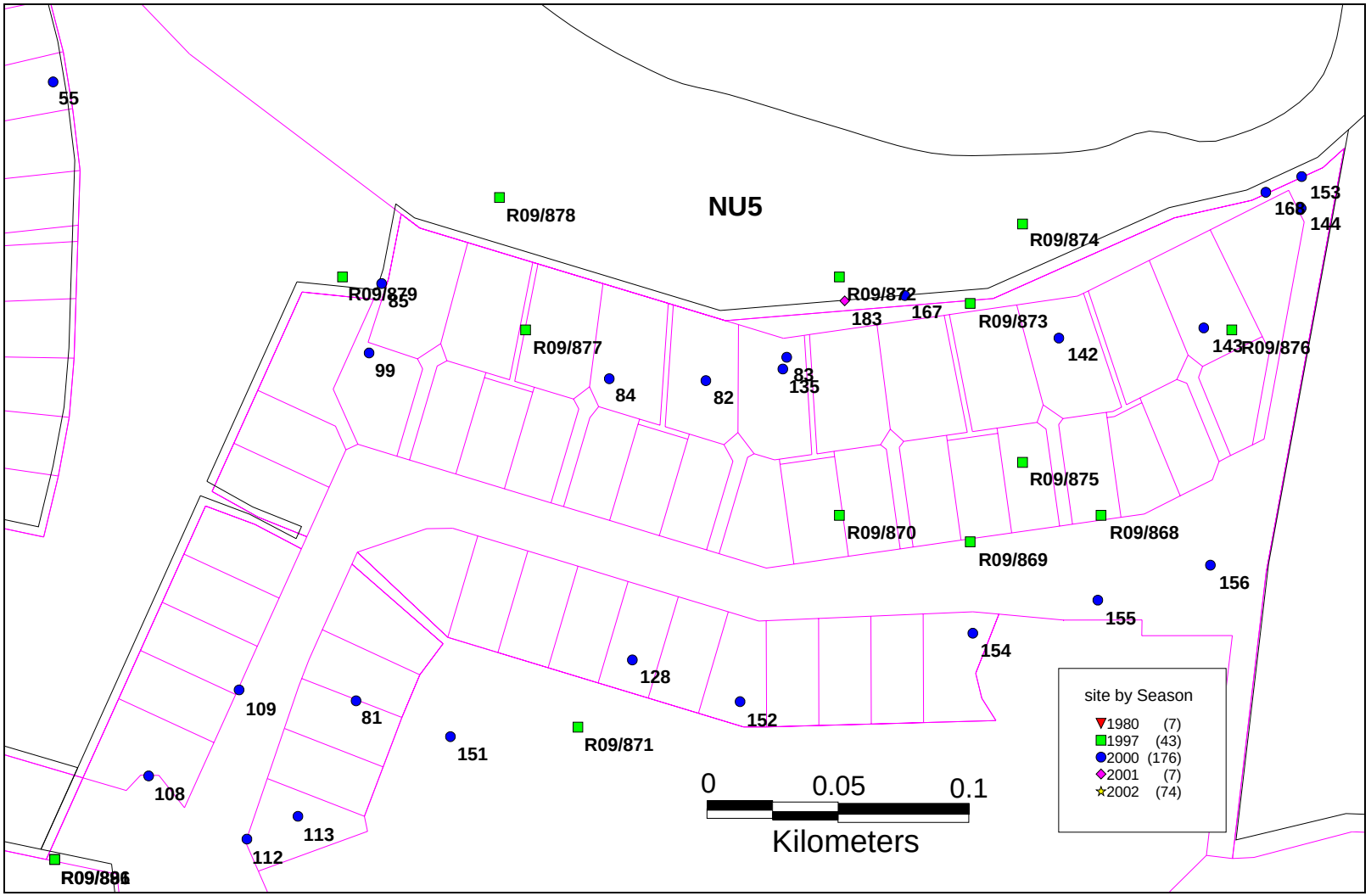
Site Distribution, Continued

Figure 16. Sites in NU5 by Season



Overview of Stratigraphy

Deposits

Most sites are located over a substrate of yellow sand, which underlies most of the spit. The colour of the sands varies according to the presence of organic and other material, such as clay and limonite (iron salts) (Harrison Grierson 1999). When the yellow sand is incorporated into the midden matrix it becomes brown with varying amounts of charcoal staining; this is referred to as charcoal stained sand throughout this report (Figure 17). Closer to the water table this yellow sand becomes a gleyed beige sand, that would seem to have been waterlogged for the greater part of the year. At the southern end of the subdivision, especially in Neighbourhood Unit 5, this gleyed sand formed the substrate for some of the larger midden (Figure 17).

An old topsoil horizon was located at varying depths beneath and within more recent wind deposited sand. These bands of dark sandy soil are usually only about 50–100 mm thick and are often incorporated into the upper midden layers. Much of their colour would appear to come from a general scatter of fine charcoal across much of the subdivision, especially at the northern end, in addition to the humic material. The origin of this charcoal is often associated with the midden and food preparation, but some of this may also be associated with the clearance of the area for agriculture. In places, particularly in the northern end of the subdivision, clear tree root stains of charcoal could be observed in the topsoil or buried topsoil layers.

Some of these old horizons are quite compact and extend around many of the larger midden at the northern end of the subdivision. These would appear to be living or activity surfaces, but no features or artefacts were observed in association with any of these surfaces. Such horizons were not so commonly observed in the southern half of the subdivision. The reason for this would seem to be related to the size of the midden, indicative of intensity of occupation and the relative stability of the dune system at the northern end. While this horizon of stained soil covered much of the area and to a greater or lesser extent may have formed a previous topsoil (depending on local conditions), its usefulness, particularly in Season 2, was that almost all of the midden were cut into it. The one clear exception to this was OM209 (see below), which appeared to be overlain by the stained material. This indicated that OM209 may have been an older site and radiocarbon dating confirmed this (see final section for the results).

Associated with many of the larger midden was a disturbed soil with lenses and inclusions of topsoil, white and yellow sand, charcoal and shell. This often underlay the main midden deposit and often extended beyond and around it for some distance, up to 20m or more. While this soil is certainly 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 desirable (cf Papamoa, [Gumbley n.d.; Gumbley and Phillips 2000]).

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Martin Jones and Mark Horrocks of the Centre for Archaeological Research, University of Auckland, confirmed these impressions during a site visit. Most likely it was associated with the preparation of the site by a small group of people ahead of a larger gathering, and results from vegetation clearance, site levelling and the preparation of small amounts of food.

Above the yellow sand more recent wind deposited whiter sand was often observed at varying depths, sometimes as quite high dunes up to 3 or 4m, but also as a shallower layer in more level parts of the spit. This sand is still moving in a number of places and forms much of the recorded topography of the area (Figure 18). As much of the dune system had been converted to pasture, a thin, sandy topsoil covered much of the development with dense grass. Patches of trees, some substantial, were also present. In the east, nearer the beach, the long grass growing in this topsoil disappeared and a variety of dune plants predominated.

Erosion and Stability

Up until approximately the 1930s the spit was covered with manuka scrub, which would have served to slow the rate of wind erosion, but since it was cleared for farming a number of sand blows have formed, stabilised and reformed. Many are active today. Being sealed beneath at least a thin layer of white sand and topsoil preserved most midden, but many have subsequently been exposed and are actively deflating. The dune stratigraphy is discussed in the final chapter of the report.

Figure 17. Site OM19 showing typical stratigraphy

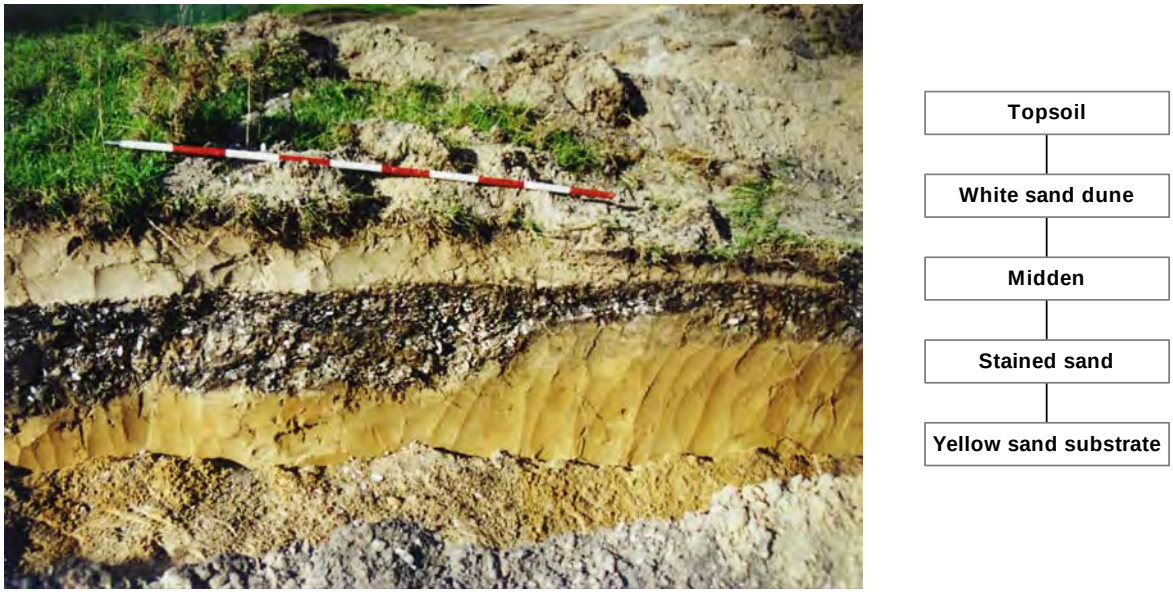
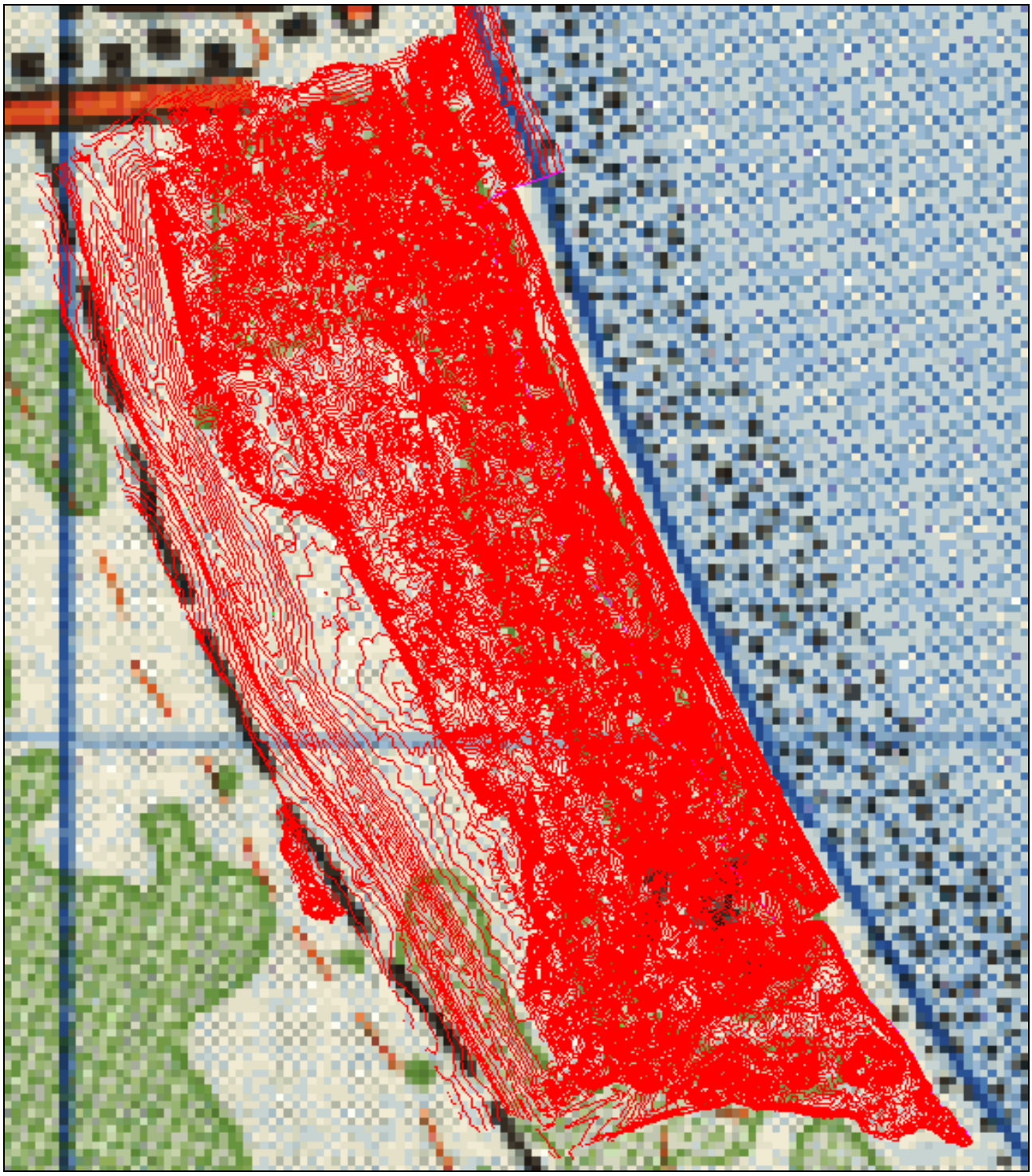


Figure 18. Topography of area prior to development



Types of Sites

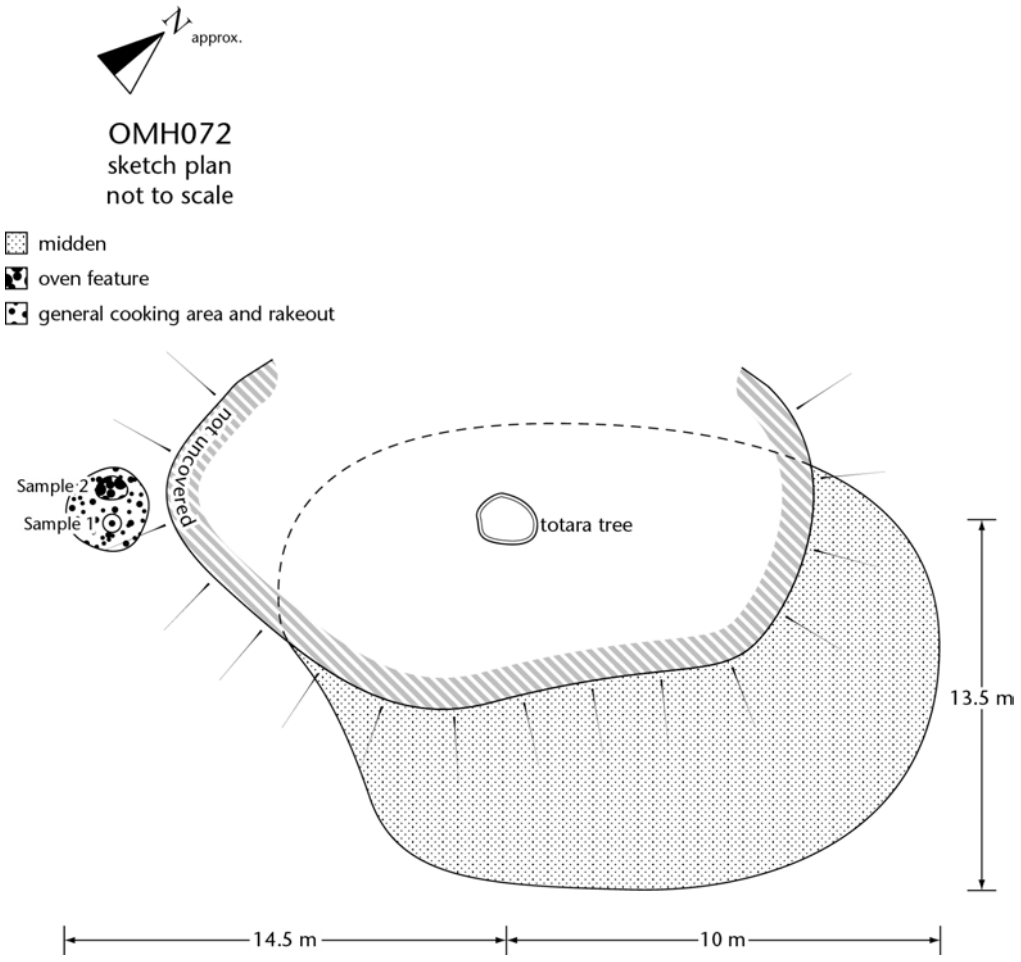
Sites and Features

Most of the sites were shell midden but some koiwi (burials) were also found. The middens contained the following types of features apart from the ubiquitous shell deposits:

- Rake out
- Fire scoops
- hangi
- koiwi

The midden ranged dramatically in size, with the smallest representing the remains of a meal cooked and consumed by one or two people, through to very large midden representing large groups for longer periods of time. For example, site OM72 contained an estimated 100m^3 of shell (Figure 19). Estimates of shell volume are only rough calculations, based on the dimensions of each midden, estimated average depth and estimated density of shell. OM72 was a dense midden (20.5 x 17m) with an estimated average depth of 400mm. The resulting figure is useful for making comparisons, but should not be regarded as accurate.

Figure 19. Sketch plan of site OM72



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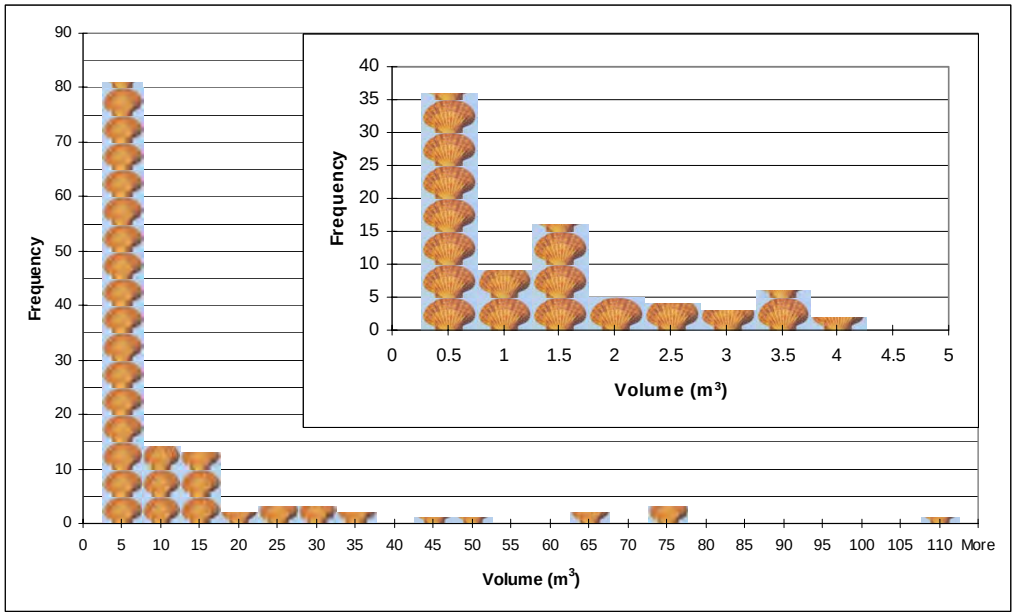
Size Distribution

The distribution of the midden volumes calculated for 146 sites from Season 1 are shown in Figure 20. The chart illustrates that most midden were relatively small (less than $20m^3$) and in fact most were less than $1m^3$. These smaller sites probably represented single small events, but there are several explanations for the larger sites observed. These include:

- Large single events with multiple small fires used and then the midden raked out together
- Multiple events over a period of time overlapping in space
- Post depositional spreading of midden.

We will return to these scenarios in the final chapter on midden construction.

Figure 20. Frequency of midden of different sizes. (Inset chart showing detail the number of midden <5m^3 by volume)



Internal Midden Stratigraphy

Midden Characteristics

Many midden contained some internal structural stratigraphy, particularly the larger midden. This stratigraphy took the form of various lenses of shell interspersed throughout the bulk, differentiated by species composition, shell condition (whether burnt, fractured, whole and clean, etc.), and type and consistency of matrix, along with lenses of oven rake out. Recognition of these elements was part of the recording strategy.

Oven scoops were cut into the midden at various levels, ranging from the base to the surface. The burnt charcoal sand matrix clearly visible in sections and plans identified these features. They were often clustered into general cooking areas. Lenses and layers of disturbance, associated with occupation and site use, were also visible in places.

What is notably lacking is any evidence of reuse of sites. Such evidence would take the form of clear delineation of internal layers and separation of layers by lenses and layers of clean sand, but this has not been observed in any of the 200 odd sites. 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 midden consisted entirely of shell and tended to be discrete deposits. Along the flat areas of Neighbourhood Units 4 and 5 midden tended to be more dispersed, with a thin scatter of shell visible between the individual concentrations that were recorded. This scattering of shell may relate to ploughing in historic times or quarrying of shell and sand deposits.

Midden sometimes contained hangi stones (often heat-cracked), and very occasionally fish bone. These stones could either be scattered throughout the matrix or less often the remains of a base of stone upon which food would have been place was left partially intact. This can be seen in sites such as OM213 discussed below.

The matrix in which the shell was located often incorporated the old topsoil horizon and in NU 4 and 5, where sites were close to the surface, was mixed with the modern topsoil. In many sites, scrub clearance in recent times appears to have removed or dispersed the topsoil, if it ever existed in any quantity in the first place. In NU 4 and 5 the matrix was the natural yellow or white sand, charcoal stained to varying degrees. Most often it was a dense black, and in the larger midden to the north of the site this often appeared rather greasy.

Towards the southern end of the spit this greasiness was not observed. Since the northern end was recorded during winter the greasiness of the matrix may also relate to the dampness of the soil at the time it was observed. In many sites shell was very dense and very little sand matrix was observed. This shell tended to be whole and very clean.

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Internal Midden Stratigraphy, Continued

Most midden were dense and homogenous, though some are characterised as sparse, or only of medium density, and often patches or lenses of particular shellfish species were observed. These patches included scallop, cockle and occasionally toheroa amongst the pipi.

The next section details the contents of the midden.

Midden Contents

Shellfish Species

Midden were generally made up of varying deposits of shell, with pipi (*Paphies australis*) dominating the species composition. A few midden contained significant proportions of:

- Cockle (*Austrovenus stutchburyi*)
- Tuatua (*Paphies subtriangulata*)
- Scallop (*Pecten novaezelandiae*) (up to 5 or 10% in many deposits, rarely more than 50%).

In a few individual cases, small cockle and scallop midden were also identified. For example OM240 consisted of some small cockle midden just below the modern topsoil surface and there was a scallop midden at OM20. A toheroa concentration was also excavated in OM215 (see next section).

Commonly found but not in such high volume were:

- Whelk (*Cominella* spp.)
- Mud snail (*Amphibola crenata*)
- Ostrich foot (*Struthiolaria papulosa*).

Some of the species appeared in concentrated lenses within the main pipi deposit.

Fish Species

Relatively little fishbone and no shark or ray remnants were recovered, partly as a result of preservation issues but probably indicating that the main emphasis was on shellfish. However, when fishbone was recovered it was frequently in small lenses within the shell and less often scattered through the matrix.

Fish species most commonly represented included:

- Jack mackerel (*Trachurus* spp.)
- Snapper (*Pagrus auratus*)
- Unidentified species of the *Carangidae* family (trevallies)
- Barracouta (*Thyrsites atun*).

Also represented were:

- Blue mackerel (*Scomber australasicus)*
- Kahawai (*Arripis trutta*)
- Red gurnard (*Chelidonicthys kumu*).

Continued on next page

Midden Contents, Continued

Other bone

Almost no other bone was recovered except for some sea mammal, possibly worked from site OM120 (R09/890), unidentified bird bone from OM208, and rat bone from OM215. These fragments probably represent minor opportunistic exploitation of other food sources. Some unidentified bird bone was also found on the surface of sites and a rat bone inside one excavated site.

SEASON 1

Investigation Methodology

Introduction

During Season 1, midden were exposed by backhoes and usually cleared away. Test pits were then used to sample the exposed site. When possible, trenches were also used. This methodology proved effective in showing the areal aspects of the site. One negative aspect of this keyhole methodology was that less emphasis could be placed on building up a clear picture of the internal structure of some of the sites.

Sites were numbered using an internal numbering system starting at OM1 for the first major season at Omaha (the format was originally OMH100, but this was simplified during Season 2, and sites previously referred to as OMH in the interim report are now referred to as OM and numbered from 1). No NZAA numbers were obtained for sites destroyed by the earthworks.

Investigation of sites not located during probe testing was also carried out when sites were exposed during the earthworks.

Sampling

Midden samples were taken to provide the following information:

- Contents of individual midden including shellfish and fish present
- Charcoal samples to establish wood species present
- Radiocarbon samples from shell and charcoal samples
- Any artefacts found described and photographed.

Continued on next page

Procedure

Site investigation used the following general procedure:

Step	Action
1	As midden were exposed by earthworks stripping ceased in their immediate vicinity.
2	Site probed with a gum spear to reveal extent.
3a	**Smaller sites:** The impact of heavy machinery in exposing smaller midden and isolated oven scoops was often enough to expose them fully, though in doing so they could be seriously damaged.
3b	**Large sites:** carefully stripped off with a 10 tonne excavator and weed bucket, to remove any remaining sand overburden and expose the surface of the midden.
4	**Large sites:** After stripping off the sand the exposed sites were: • Sectioned by machine • Test-pitted by spade to reveal the depth and nature of deposit.
5	**Site significance:** An assessment was then made on the potential significance of the midden, based on: 1. The size, depth, density and homogeneity of the deposit 2. Presence or absence of features or stratigraphy 3. Relationship to other sites or landforms.
6a	**Low significance:** Midden not deemed overly significant were described and sketch mapped as appropriate. These were usually fairly homogenous and contained few or no obvious features.
6b	**High significance:** More significant midden contained numerous features, usually evidence of cooking in the form of oven scoops, and also some evidence of internal stratigraphy. These were accurately planned and extensively sampled.
7	Additional options: Some sites were trenched or sectioned with the backhoe in order to examine the profile more closely. These were also accurately drawn where appropriate.
8	GPS point taken on each site.
9	Photographs taken of the site and sections.
10	Samples were taken for species identification, environmental analysis and dating where appropriate.
11	After the archaeological investigation was complete, the midden was removed by machine and re-deposited within the golf course, where it was landscaped into the dune formation.
12	Any remaining features in the base were drawn on the plan.

Example Sites

Introduction

Sites Examined

Some sites are examined here in greater detail than others because they were large and more complex, containing numerous features, evidence of cooking or evidence of stratigraphy. These midden demonstrate the range of activities going on at Omaha, but also demonstrate that this range was quite restricted. Descriptions are available for all sites on the CD.

Descriptions of the site include plans and section drawings, along with the list of major features of each site. In addition, the results of the shellfish and fish analysis of samples found on the sites are presented. This in part pre-empts the results of the next section of the report describing the midden analysis, but the focus of that section is on the patterns across the Omaha landscape. In this section, the results are presented as part of the individual site descriptions, where similarities and differences in the results are described with regard to the structure of each example site.

The locations of the example sites discussed in the report (for both seasons) are shown below.

Figure 21. Location of example sites discussed in report

OM35

Summary

This site contained a number of features suggesting an integrated cooking area used over a relatively short duration. An oven pit was sectioned, revealing lenses of burnt sand within the midden fill, indicating episodes of rake out and reuse. Adjacent to the oven was shell that had clearly been exposed to high temperatures, since it converted to lime. This lime was clean and white. The sand beneath was heat stained for some depth, and the midden next to it was very burnt and fragmented. It is not clear what process caused this lime to form, but the absence of any roots in the lime or root stains above it indicates that it may not be connected with historic scrub clearance.

Key element:

- This midden is in some ways a typical example of a large midden with a 'cooking area' consisting of a number of oven scoops, rakeout and burnt and fragmented shell contained within a greater mass of shell.

Midden Contents

Feature	Description
1 – Hangi	This feature contained highly burnt and fragmented shell and a large quantity of shell burnt to lime. It was sectioned by hand. The lime was up to 180 mm deep, and the layer of burnt shell up to 220 mm.
3 – Fire scoop	The base of an oven scoop, only a small piece remaining, 30 mm deep.
4 – midden	A large, generalised area of cooking and rakeout, with lenses of burnt sand (sometimes burnt red), burnt and fragmented shell, ash and charcoal interspersed through the shell midden. Below the deposit is burnt, charcoal stained sand. Feature 4 includes feature 1.
5/6 – midden	A smaller, generalised area of cooking and rakeout, containing lenses of burnt and fragmented shell, dark burnt and red burnt sands, up to 150 mm deep with the area of rakeout up to 80 mm deep.
7 – midden	A shallow oven scoop, 50 mm deep, containing some whole pipi and cockle, but mostly burnt and fragmented shell, in a matrix of black charcoal stained sand.
8 – Fire scoop	A shallow but well-defined oven scoop, 30 mm deep, containing whole pipi and cockle, often small, and some still paired, in a matrix of black charcoal stained sand. Heat blackened sand was visible around and below the feature.

Continued on next page

Table 3. MNI of shellfish in OM35 Features

Sample	Name	MNI
General	PIPI	135
	COCKLE	100
	SCALLOP	8
	SPECKLED WHELK	5
	CAT'S EYE	4
	OYSTER	1
	OSTRICH. FT.	1
Feature 4 Sample 1	PIPI	255
	TUATUA	3
	OSTRICH. FT.	1
	SCALLOP	1
Feature 4 Sample 2	PIPI	100
	TUATUA	4
	COCKLE	2
Feature 5/6	PIPI	190
	TUATUA	10
	KNOBBED WHELK	1
	OSTRICH. FT.	1
	COCKLE	1
	RINGED VENUS	1
	SIPHON WHELK	1
	SPOTTED WHELK	1
Feature 7	COCKLE	45
	TUATUA	4
	SPOTTED WHELK	1
Feature 8	PIPI	140
	COCKLE	85
	TUATUA	6
	SPECKLED WHELK	4
	SCALLOP	2

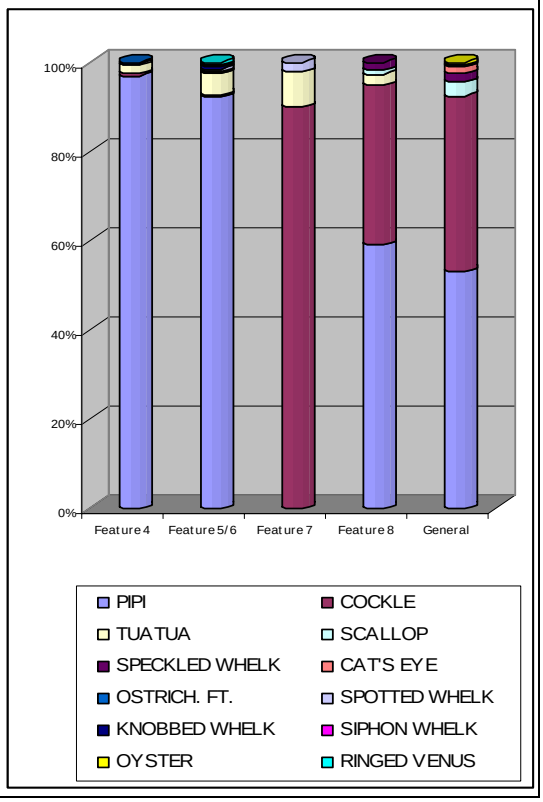

Table 4. Fish from OM35

Feature	Species		Type	Side	Count
Feature 4	Unidentified	Fish sp.	Element	—	4
Feature 8	Jack mackerel	*Trachurus* spp.	Scute	—	1
	Unidentified	Fish sp.	Element	—	2
			Vertebrae	UP	1
General	Jack mackerel	*Trachurus* spp.	Scute	—	1
	Unidentified	Fish sp.	Element	—	7

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Figure 22. Plan of OM35

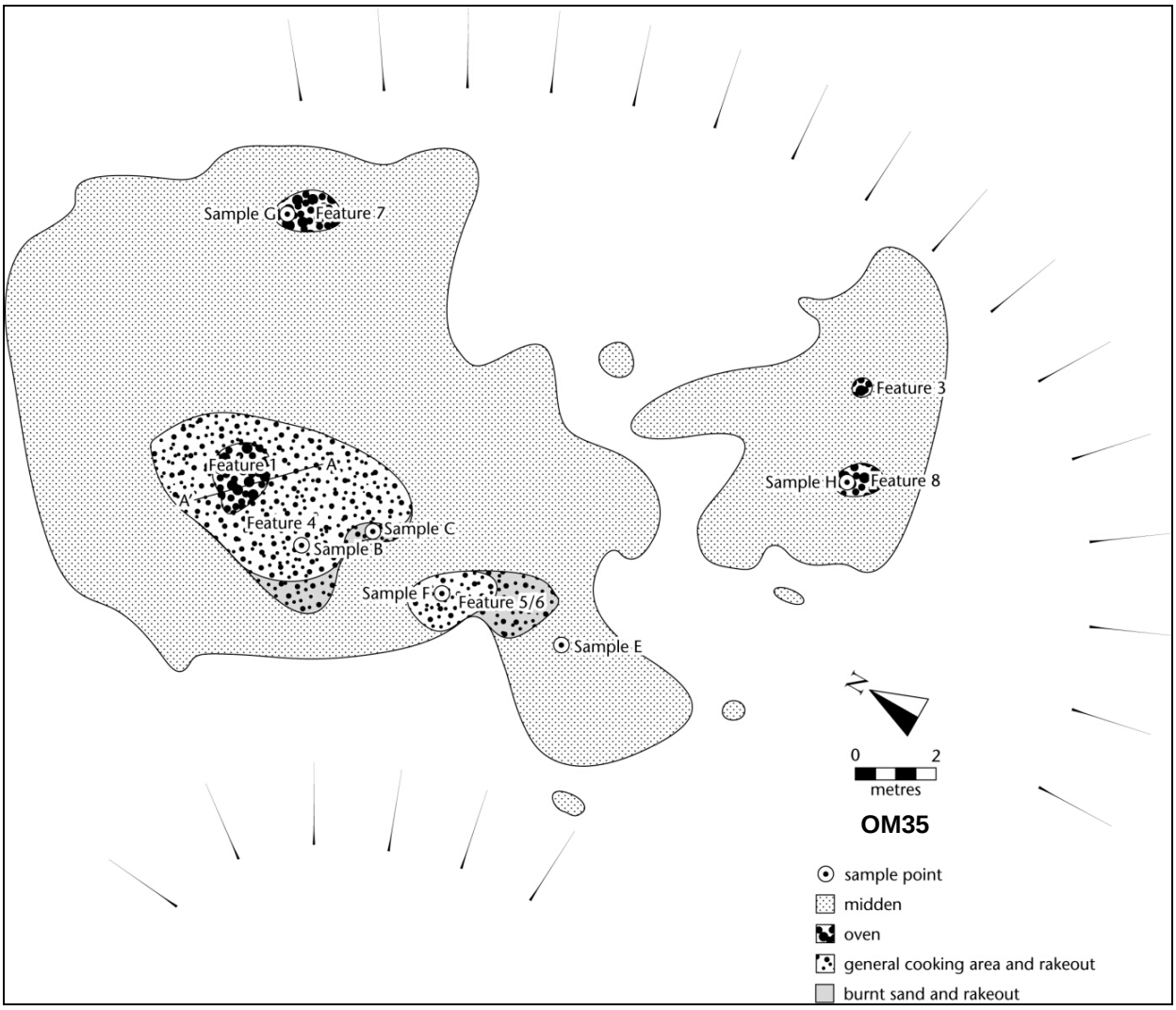
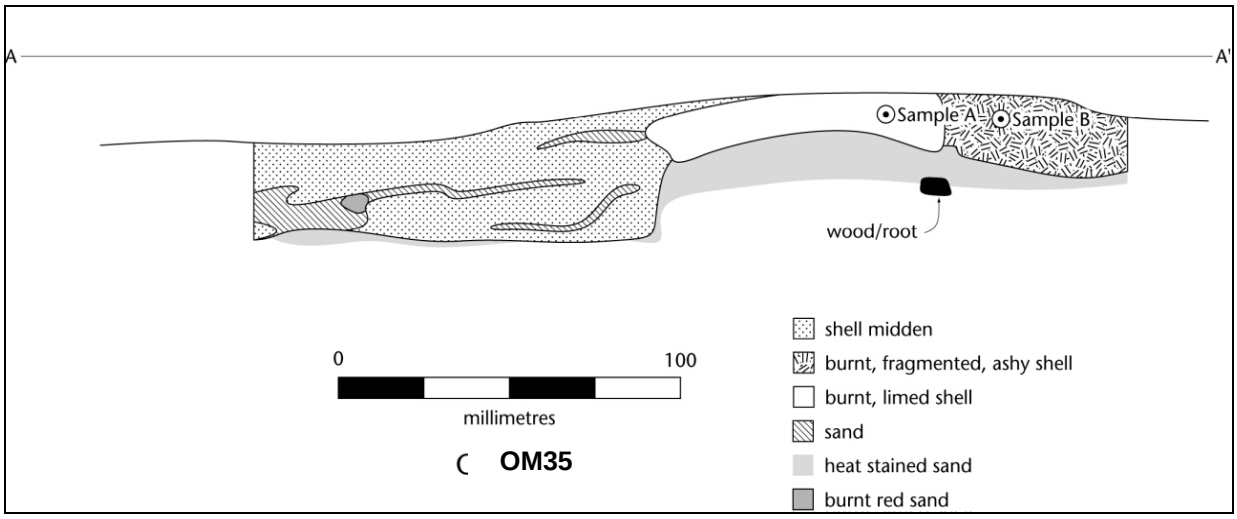


Figure 23. OM35 in section



OM42

Summary

This is typical of a large and complex midden, and demonstrates the limits of complexity at Omaha — basically the midden are fairly simple, though they may contain a number of oven scoops and patches of different shell species, or burnt and fragmented shell. Test pitting in this midden revealed that the midden around test pits 3, 4, 5, 9 and 10 was underlain by the disturbed anthropogenic soil. This soil tended to be associated with larger more complex midden. A radiocarbon date from the site returned a result of between 1520AD -1750AD (at 2s.d. but see below for more details on dates).

Key element:

- Typical of large and complex midden at Omaha
- Shows how an area was used over a period of time.

Table 5. Shellfish in testpits, OM42

Sample	Name	MNI
TP 2	PIPI	350
	MUDSNAIL	34
	COCKLE	27
	TUATUA	6
	SPOTTED WHELK	5
	CAT'S EYE	1
	SIPHON WHELK	1
	RINGED VENUS	1
TP 11	PIPI	95
	TUATUA	40
	COCKLE	30
	SPECKLED WHELK	10
	SCALLOP	3
TP 13	TUATUA	43
	UNIDENTIFIED	40
	COCKLE	40
	PIPI	15
	OSTRICH. FT.	1
	SPECKLED WHELK	1
TP 14	PIPI	30
	COCKLE	3
	TUATUA	2
	OSTRICH. FT.	1
TP 9	PIPI	210
	TUATUA	17
	COCKLE	12
	SPECKLED WHELK	7
	UNIDENTIFIED	2
	OSTRICH. FT.	2
	RINGED VENUS	1
	SIPHON WHELK	1
	SLIPPER SHELL	1
	CAT'S EYE	1
	SCALLOP	1

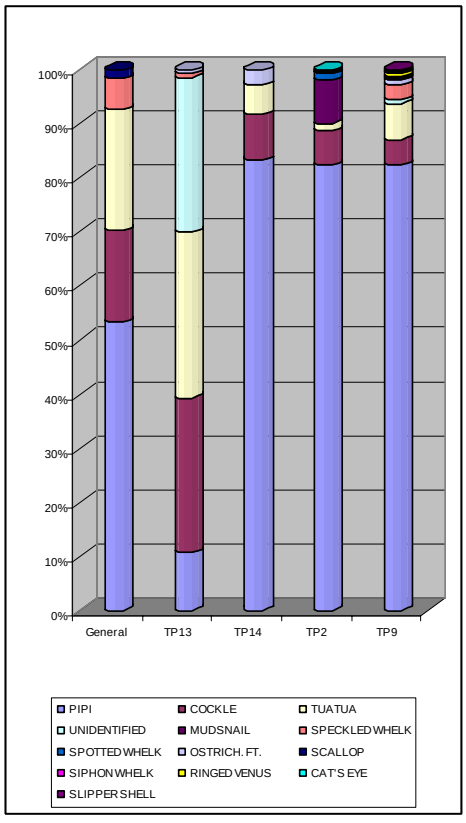


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Figure 24. Fish from OM42

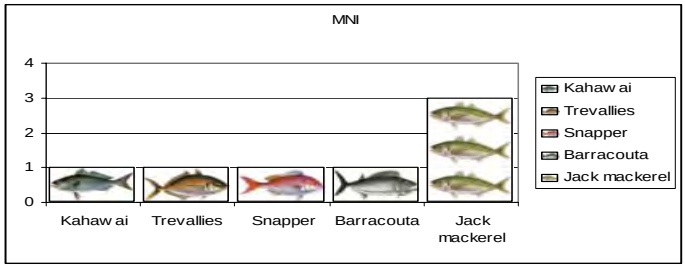

Figure 25. Plan of OM42

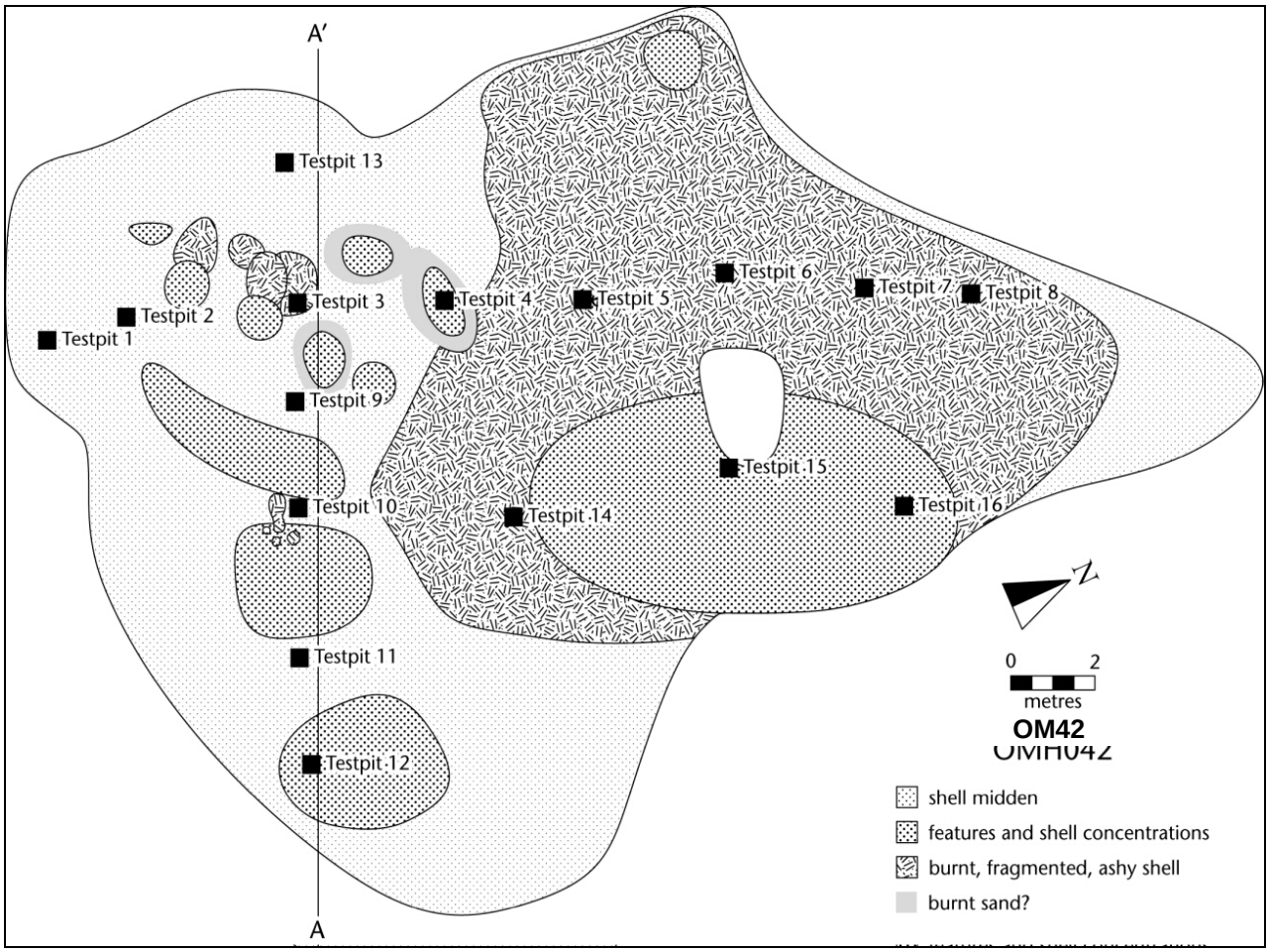

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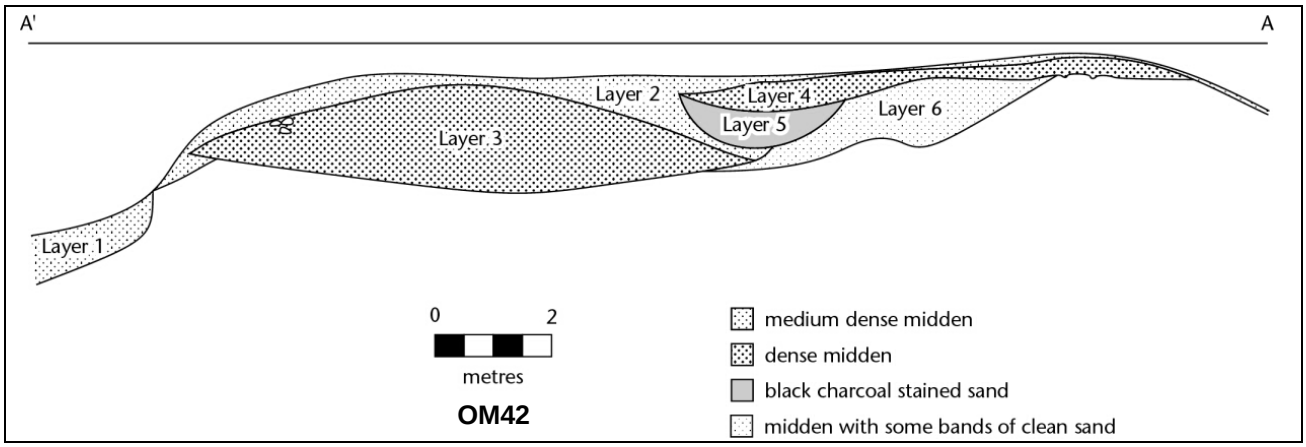
Figure 26. Section of OM42



OM47

Summary This is another midden that showed a number of oven features, one of which contained the assemblage of small fishbone discussed later. This site also contained two postholes, and while it is possible that these posts are modern, it is equally possible that they are pre-European, and may be associated with drying racks used for the preservation of the fish (Figure 27). A radiocarbon date from the midden returned a date of between 1470AD -1660AD at 2s.d. (see below for more details on the dates).

Figure 27. Plan of OM47

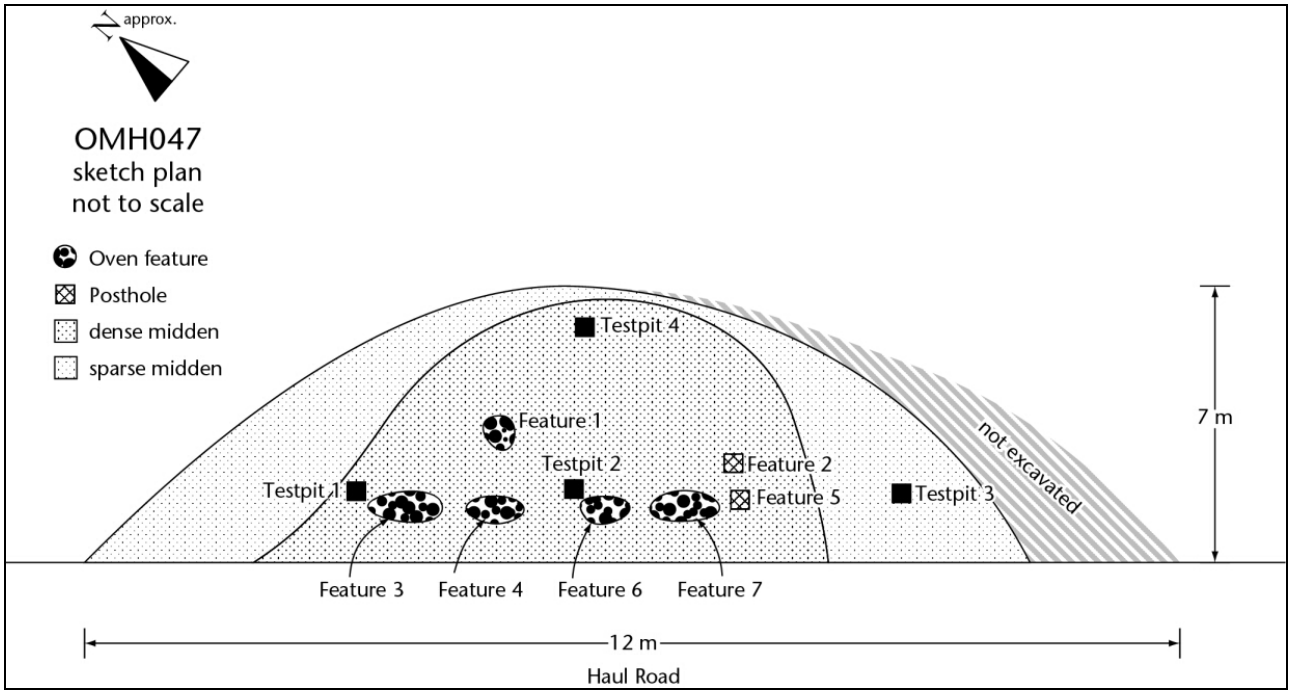


Table 6. MNI of shellfish, OM47

Species	MNI
PIPI	455
TUATUA	16
COCKLE	15
SPECKLED WHELK	5
SCALLOP	3
UNIDENTIFIED	2
RINGED VENUS	1
DOG COCKLE	1

Continued on next page

Table 7. Fish species found at OM47

Species		MNI	NISP	Vertebrae
Jack mackerel	*Trachurus* spp.	1	1	
Unidentified (small)	Small fish sp.	17	64	
Unidentified (small)	Small fish sp.			33
Red Gurnard	*Chelidonicthys kumu*	1	1	

OM120

Summary

This very large midden is located in the phase 2 area of the subdivision. Here a small adze and a number of flakes of obsidian (probably from both Great Barrier Island and Mayor Island) and pieces of worked bone were located on the deflated midden surface. The adze is discussed in more detailed in the next chapter.

This was the only midden on the sandspit so far found to contain any such material. Much of the obsidian was found on the deflated surface of the midden, where shell was no longer present. The bone artefacts are made from the bone of a small sea mammal (either a seal or a small whale). It seems likely that this animal was either captured or became beached and was subsequently butchered at this site using obsidian for flensing, and perhaps the adze for jointing. Some of the bone was subsequently worked, but the artefact or artefacts made have broken and the remnants are insufficient to indicate what type of artefact was manufactured.

It is also notable that this is one of the largest midden (80 x 50 m), although it has been badly deflated in places. Even at the most conservative estimate of average depth (100 mm), it is still more than three times as the majority of midden uncovered in Season 1. It is possible that this midden is made up of several midden together, but given that it is largely destroyed by deflation, and that no further subsurface archaeological investigation will take place, there is no way of knowing this for sure.

Key elements:

- Adze and obsidian found
- Worked bone.

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Table 8. MNI of shellfish from R09/890 (OM120) testpits

Sample	Name	Total
-TP1-Sp1	PIPI	5
	SCALLOP	1
-TP1-Sp2	PIPI	13
	SCALLOP	2
	SPECKLED WHELK	1
	SIPHON WHELK	1
-TP1-Sp3	PIPI	8
	SCALLOP	2
-TP1-Sp4	PIPI	80
	TUATUA	9
	SPECKLED WHELK	2
	SCALLOP	2
	COCKLE	1
-TP1-Sp5	PIPI	245
	TUATUA	22
	SPECKLED WHELK	3
	COCKLE	1
	SCALLOP	1
	CAT'S EYE	1
-TP1-Sp6	PIPI	230
	TUATUA	18
	COCKLE	7
	SPECKLED WHELK	7
-TP1-Sp7	PIPI	290
	TUATUA	40
	COCKLE	6
	SPECKLED WHELK	3
	OPERCULUM	1
	SCALLOP	1
	CAT'S EYE	1
-TP1-Sp8	PIPI	212
	TUATUA	47
	COCKLE	6
	SPECKLED WHELK	4
	UNIDENTIFIED	2
	SCALLOP	2
	RINGED VENUS	1
	OPERCULUM	1
-TP1-Sp9	PIPI	262
	TUATUA	40
	COCKLE	7
	SPECKLED WHELK	4
	UNIDENTIFIED	1
	SCALLOP	1
	RINGED VENUS	1

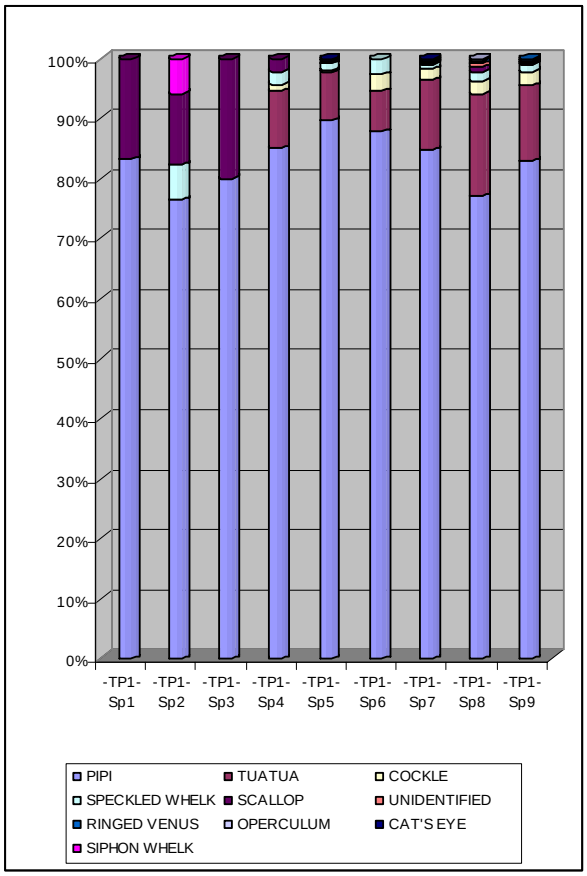

Table 9. MNI of fish species from OM120

Species	MNI
Snapper	2
Barracouta	1
Jack mackerel	1

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Figure 28. Section of OM120

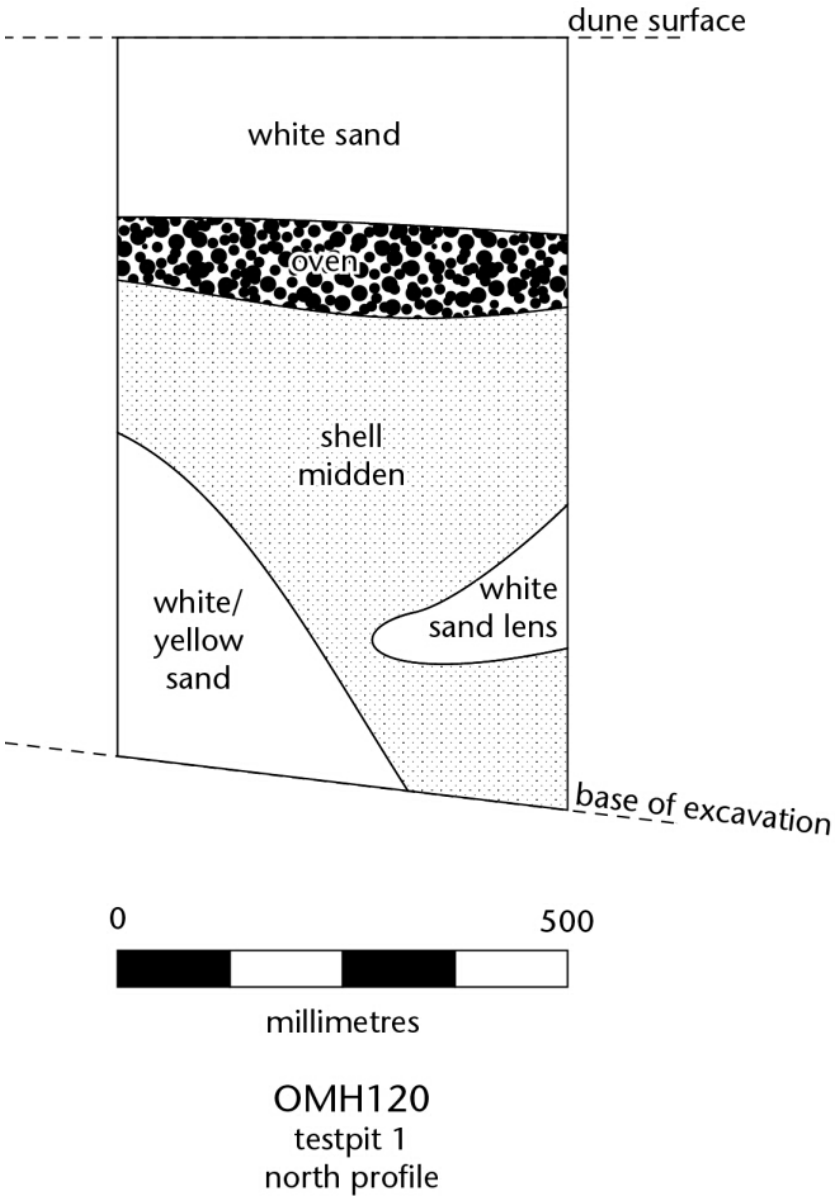

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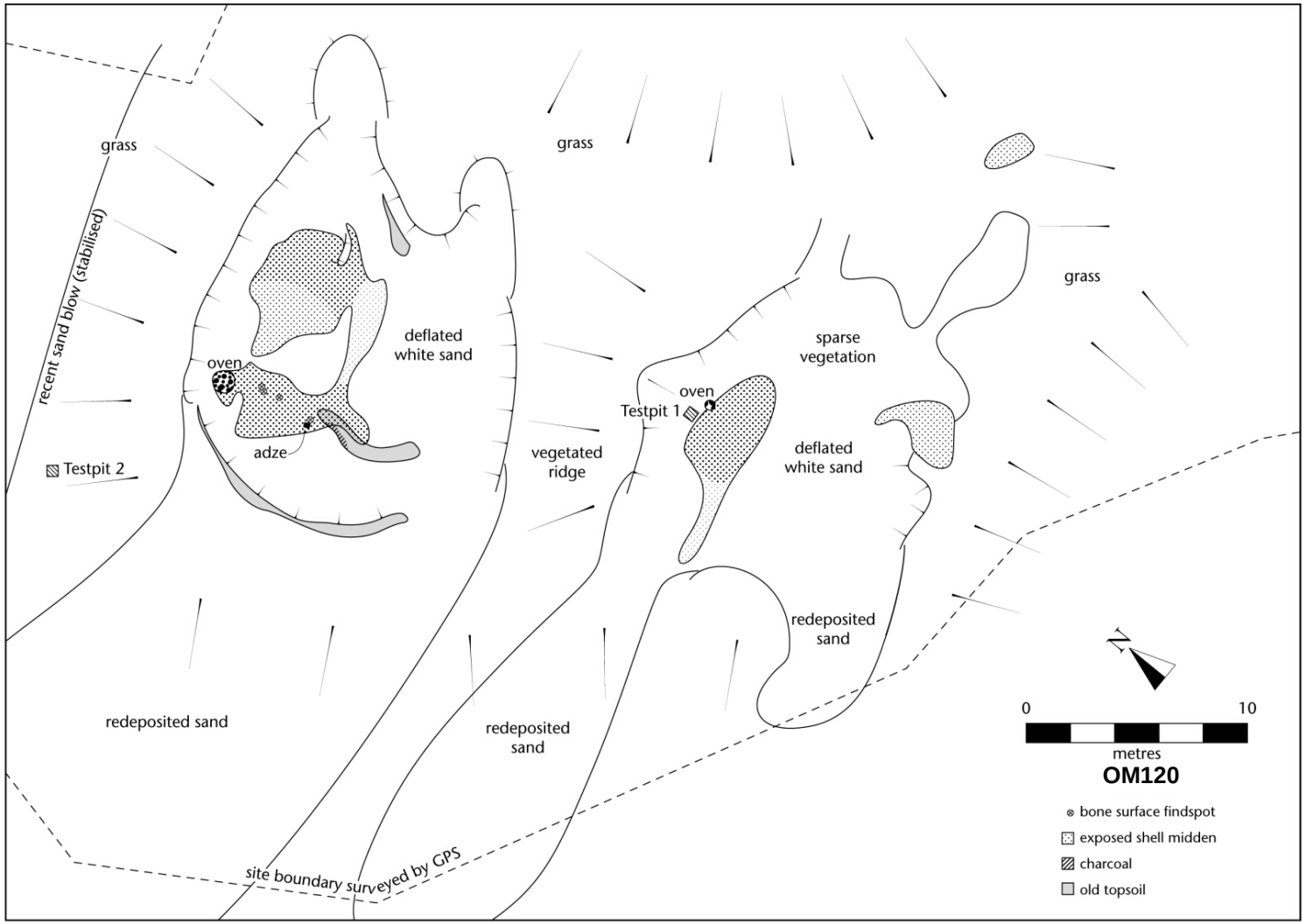
Figure 29. Plan of OM120



R09/887

Site Description

Introduction

R09/887 is one of the larger midden sites at Omaha and had been identified during the initial archaeological assessment and designated for preservation (see Figure 30). Large areas of the midden were actively deflating and surface survey indicated fishbone and small numbers of artefacts amongst the shell. Significant deposits, though within the site, were also noted.

On 8 November, 2001, Dr Matthew Campbell, in the company of Dr Rick McGovern-Wilson, Senior Archaeologist at the New Zealand Historic Places Trust, and Dr Stuart Bedford, Auckland Regional Archaeologist for the Trust, visited the Omaha Beach development. Considerable damage to an archaeological site (R09/887) was noted (Figure 31), evidently caused by heavy machinery. This damage had occurred subsequent to a previous visit on 14 August, in the company of Marcus Bird of Omaha Beach Ltd. On 20 November the site was examined again at the request of the Historic Places Trust to assess the damage and to devise suitable protocols of recording and mitigation (Campbell and Clough 2001). Between 10 and 13 December a mitigation excavation was carried out by Matthew Campbell and Mica Plowman in the damaged area.

Methodology

The excavation required a different approach to that of the previous investigations during Season 1 described earlier. During the first phase of site development earth moving was monitored and any exposed midden (the majority small in size) were investigated by spade testing, sampling where appropriate and mapping or sketch mapping. A standardised recording form was developed to deal with this relatively standardised data.

The site, including all the area disturbed by heavy machinery, was mapped at a scale of 1:100. In order to facilitate this work a 10 x 10 m grid was pegged out across the entire area using survey grade DGPS[7] using the New Zealand Geodetic Datum 1949, Mt Eden Circuit. Grid squares were numbered A – J north-south and 1 – 12 east-west. All maps and plans for the site are presented in New Zealand Map Grid, where the Mt Eden north bearing runs at 1° 10´ 34˝.

All visible surface features were mapped (Figure 32), and at the end of the excavation all subsurface features visible in the subsoil were mapped. Mapping included all visible machine and natural disturbance. All artefact find spots, test pits and sample points were also recorded.

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[7] We are grateful to Stephen Cowan of Buckton & Associates, Warkworth, for his assistance.

Figure 30. Map of R09/887 before damage

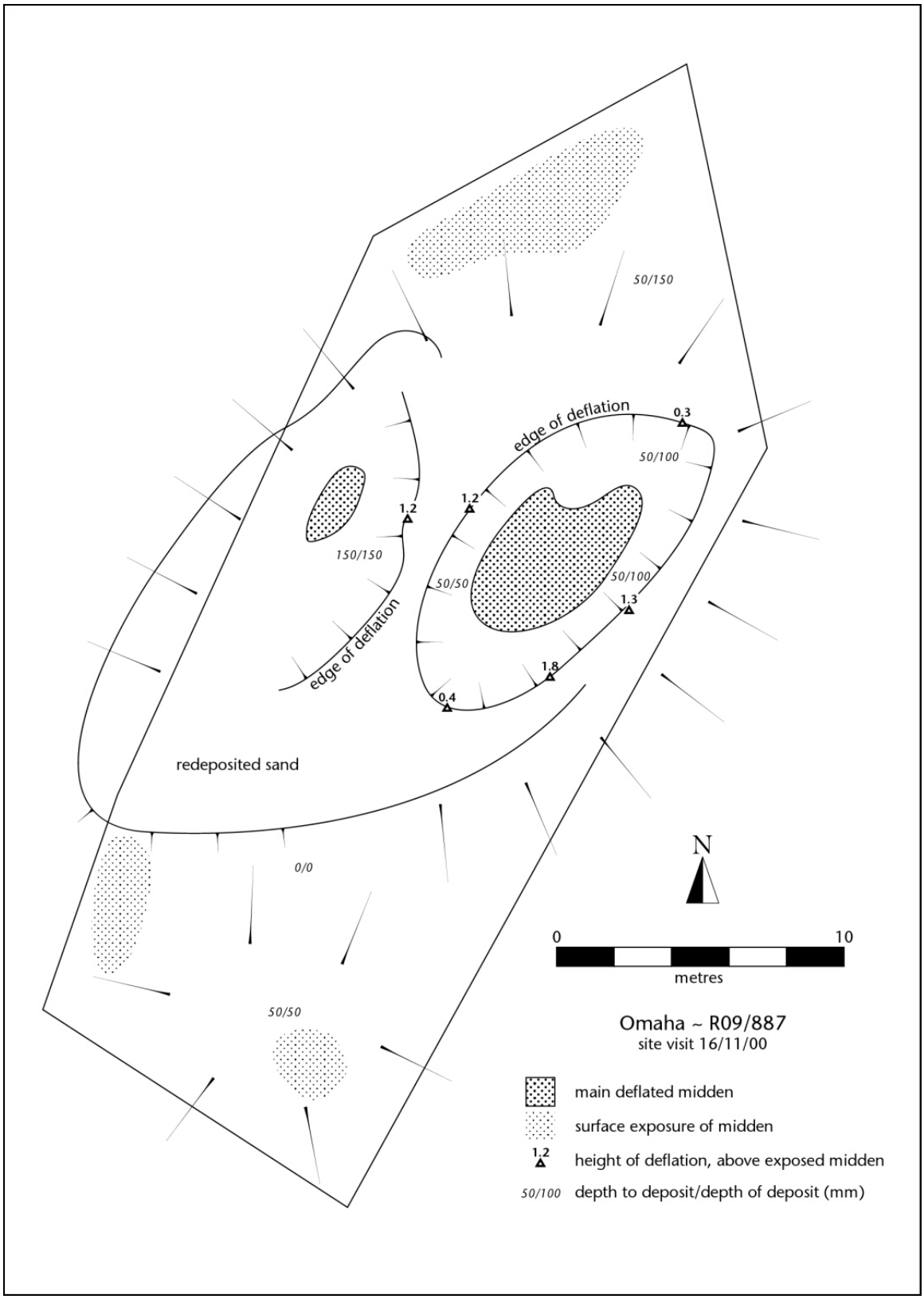

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Figure 31. Area of R09/887 damaged by earthworks

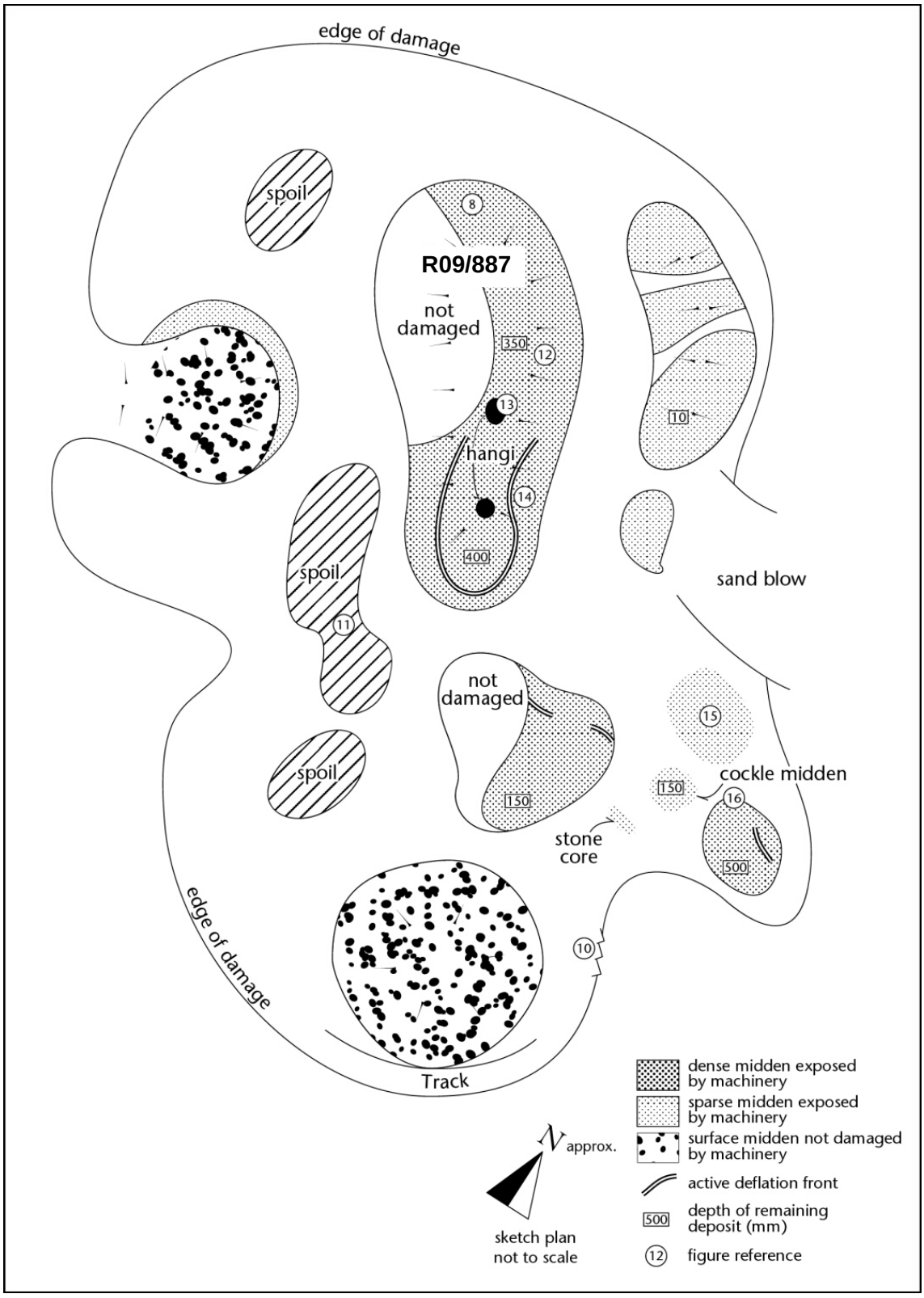

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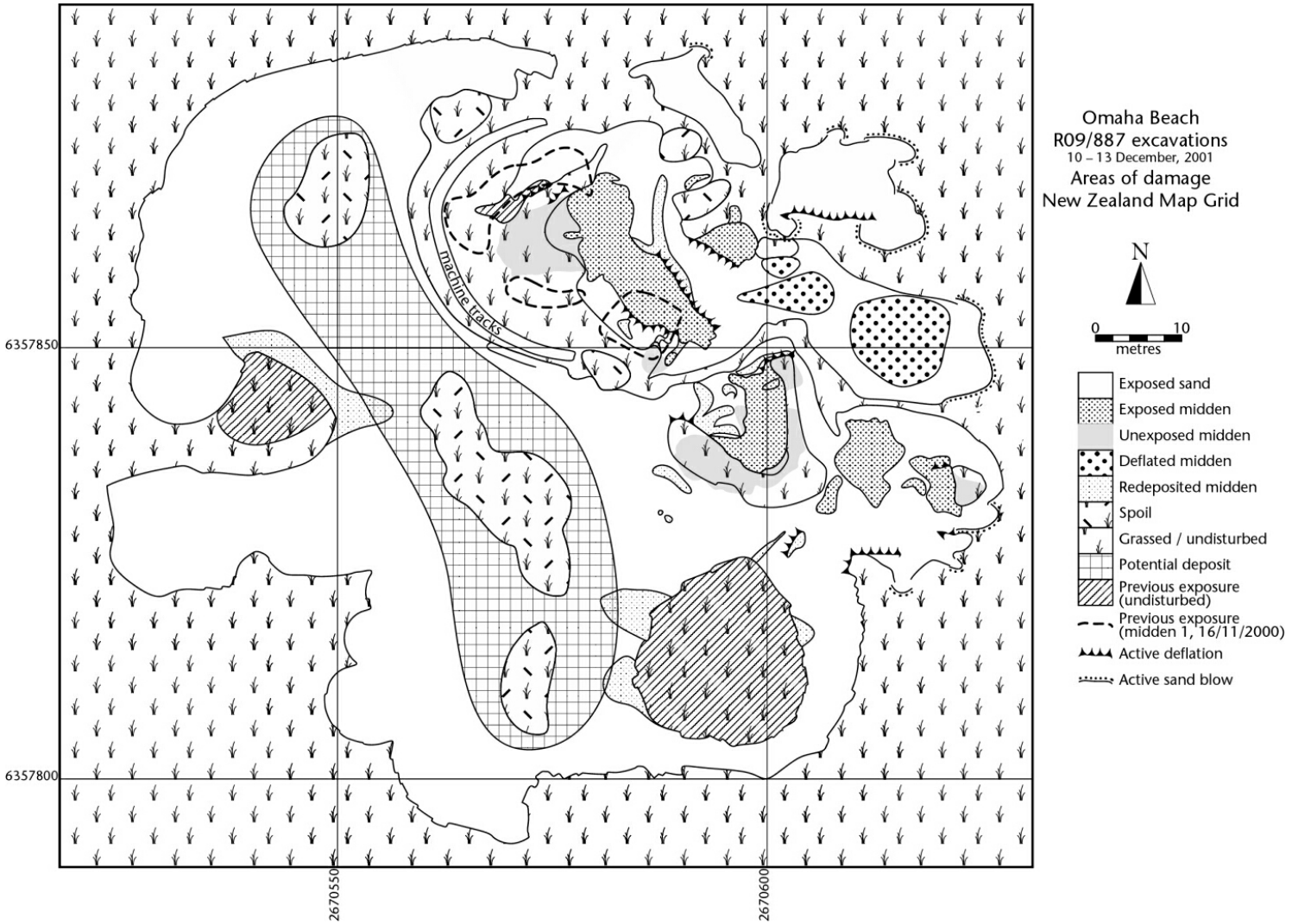
Figure 32. R09/887, plan of site showing midden location and damage



Investigation

Machine disturbance covered an area of approximately 100 x 90 m. Not all of this area had been disturbed, but five substantial midden had been exposed, which have been identified as Midden 1-5.

The only midden that had been visible in 1997, at the time of the original survey, was part of midden 1. This was the exposure originally recorded as R09/887 (Clough 1998:4), and described as 'a badly deflated dune cap midden'. At the time of excavation midden 1 was exposed as a dense, and in places deep, midden on the brow and southern flank of an approximately 4 m high dune, measuring 23 x 8 m. While the machine had removed the upper surface of the midden and the exposed surface had been crushed, much of the deposit appeared to be fairly intact. Part of the midden on the top of the dune, measuring 10 x 9 m, was not exposed. Some of the exposed midden were seen to be more damaged than others. Some of this damage appeared to be a direct result of machine disturbance, while others had deflated subsequent to their exposure by the machine. Some may have been deflated prior to machine disturbance (subsequent to the last close examination of the area in October 2000), but if so machine disturbance had exacerbated the deflation.

Some evidence of ovens was visible on the surface in the form of heavily charcoal stained soils and deposits of heat-cracked stones. The southern part of the midden was actively deflating as two 'deflation fronts' ate into it from the east and west sides. Sparse midden was redeposited below these deflation fronts. This midden had been recorded in more detail in November 2000 when it was first suggested that it might be destroyed under a section 11 authority. At that time only part of it had been exposed. Probing revealed up to 450 mm of overburden on top of the dune. The full extent of the midden had been determined the previous month, staked out and surveyed with DGPS.

Excavation, recording and sampling sought to ascertain the extent of damage and so targeted undamaged as well as damaged/deflated areas in order to obtain comparative data that might be useful in characterising site damage.

When investigation of surface features was complete any unexposed midden was uncovered with a 20 tonne backhoe and mapped in the same way as previously exposed features. Then all midden was removed to the base of the deposit with the backhoe and any visible features such as oven scoops mapped. Where concentrated lenses of fishbone were observed, these were sampled.

The deposits were sampled by excavating 0.5 x 0.5 m test pits, which proceeded by 50 mm spit. Test pits were placed across each midden in targeted areas (i.e. not randomly) in order to examine specific questions about each deposit relating to the nature of the midden deposit itself as well as how intact it remained.

Continued on next page

Midden Contents

Feature	Description
Midden 1	Dense, and in places deep, midden on the brow and southern flank of an approximately 4 m high dune, measuring 23 x 8 m. Part of the midden, measuring 10 x 9 m, on the top of the dune was not exposed.
Midden 2	Originally identified and surveyed in October 2000. About a quarter of this midden, measuring 13 x 5 m, was exposed by the machine, with the south and east flanks of the low, approximately 1 m high, dune on which it was located remaining undisturbed. The total dimensions for the midden were 16 x 15 m. There was considerable evidence of cooking visible on the surface in the form of heat-cracked stones and charcoal stained soil.
Midden 3	A small, largely deflated deposit measuring 5 x 2 m, notable for two broken chert hammerstones and an obsidian flake found on the exposed surface. Stone artefacts have only rarely been found at Omaha, and these are the only two pieces of chert so far observed.[8] Some heat-cracked stones were also observed on the surface, but the original matrix had completely deflated and only clean white sand and sparse shell remained.
Midden 4	A rather scattered and largely deflated midden measuring 10 x 8 m. It contained areas of dense charcoal staining, evidence of ovens and of heat cracked stones on the surface, and two obsidian flakes were found on the surface.
Midden 5	A dense, deep midden measuring 7 x 5 m. This appeared to be very badly disturbed by the machine with the deposit along the western edge partly removed. A very large oyster (*Saccostrea cucullata*) and two very large dog cockle (*Tucetona laticostata*) were located on the surface, indicating that the local environment was largely undisturbed at the time the midden was deposited. To the east an area 3 x 3 m remained undisturbed. Adjacent to midden 5, and analysed as part of it, was a deflated deposit of scallop (*Pecten novaezelandiae*) measuring 3 x 2 m. Midden 3 and 4 may have originally been components of midden 5, but it is no longer possible to be certain. If this is the case the entire midden may have measured about 20 x 12 m.

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[8] One obsidian flake was also found on deflated surfaces during the initial damage assessment survey, and five more during the excavation. A small reworked type 2B adze of Tahanga basalt and several obsidian flakes were found on the deflating surface of R09/890 from October 2000 onward, and a single obsidian core was found in October 2000 in a midden some 300 m further north. Notably all these midden are in the same situation as R09/887, on loose actively moving dunes close to the coast.

Sampling

Each excavated 50 mm spit level was sampled. Each sample filled a 5-litre ziplock plastic bag. These samples were taken in bulk (i.e. not sieved on site) in order not to bias any potential data relating to midden and species density (e.g. by targeting unusual or large shells), and to allow a closer examination of the midden matrix in the laboratory. The standard size of each sample makes it possible to obtain firm comparative data on density of deposit, extent of fragmentation, etc. When dense lenses of fishbone were encountered these were sampled separately.

Note that test pits previously excavated in the actively deflating site at R09/890 (OM120) showed that species composition and midden density were virtually unchanging from top to almost bottom and then only density changed (shell became less dense). Experience across the sandspit has shown that this will probably be the case for most midden (Campbell *et al*. 2001:21).

Two other midden, previously observed to have been deflated dune cap midden, remained largely undisturbed except for some damage at their margins. One was at the western edge, the other at the southern edge, of the machine disturbance. Both had been recorded, pegged and surveyed with DGPS in October 2000. In the north east of the machine disturbance several scattered and deflated deposits adjacent to moving sand blows were observed. On one of them three obsidian flakes were found on the surface. Though not numbered, two of these midden were test pitted. It is not possible to say how extensive or dense these deposits were prior to disturbance.

In the north east edge of the mapped area direct machine disturbance was limited to the dumps of spoil, but extensive dune deflation and sand blows were visible, and sand could be seen blowing in many places along the eastern edge of the area. This sand movement would have been exacerbated by machine disturbance and topsoil removal, further damaging the midden in this part of the site.

Most spoil from the machine disturbance was dumped in a sheltered flat area to the west of the main exposed midden. This area had previously been noted as having potential for locating undisturbed subsurface features, such as postholes outlining buildings or shark drying racks. Since such structures, though expected, have not yet been located at Omaha this is possibly a very informative area. While sand has blown over this area and spoil has been dumped on it, it is quite possible that it has not been disturbed below the surface.

Excavation Results

Summary A total of 19 test pits was excavated. The locations of the test pits are shown in Figure 33. The results indicate that the site is made up of a sequence of oven scoops of various sizes with large areas used and reused over a short period of time. As with most Omaha sites, pipi was the most common species represented in the debris with lenses of tuatua and cockle also observed. A concentration of fishbone in Test pit 19 was also noted.

Testpits

Test pits 1-7 were opened up in midden 1. Because this was the largest deposit to be excavated initial investigations were concentrated here, sampling the midden in several places and also investigating surface features. Test pit 1 was located near the top of the hill in order to test the apparently densest part of the deposit and test pits 3, 4 and 7 were placed in the central area of the deposit to test the midden in general. These four revealed varying densities of shell, mostly pipi (*Paphies australis*), to depths ranging from 100 mm for test pit 3 to 350 mm for test pit 1. Test pit 3 was the most centrally located, but the least dense. The north and south ends of the deposit were denser, but not discrete, concentrations. Stripping of the midden to its base with the backhoe revealed a dense concentration of cooking features to the north, on the high point of the dune (12 oven scoops of various sizes and a 'general cooking area' of mixed, disturbed oven scoops and rakeout) accompanying this densest part of the deposit. To the south 4 large oven scoops were located in an area of dense shell.

Test pit 2 was located in an area of particularly dark charcoal stained sand and heat-cracked rocks near to test pit 1. It revealed a shallow oven scoop less than 150 mm deep, with little shell deposit. Test pit 5 was located on the western edge of the midden, where a patch of charcoal was visible on the surface, but this feature did not extend below the surface and no countable shell was recovered. Test pit 6 was located adjacent to a surface scatter of heat-cracked rocks and charcoal. Again this feature did not extend below the surface, and it is probable that the rocks were heat-cracked stones redeposited from a nearby oven scoop or one higher up the slope.

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Test pits 8-10 were located in midden 2. The eastern and southern margins of midden 2 remained covered in grassed topsoil, and test pit 8 was located in this undisturbed area. Unfortunately this was the edge of the deposit and only a sparse layer of shell was uncovered, less than 50 mm deep, although a deeper denser deposit was visible in section in the deflation front nearby. Test pit 9 was located in the machine-disturbed area at the north end of the midden near test pit 8. This revealed a denser deposit, but again it was less than 50 mm deep. Test pit 10 was located at the south end of the midden. Here the deposit was deeper, and of similar density and composition to that in test pit 9. It seems likely, given the density of these deposits, that the machine removed an unknown depth of the surface of midden 2.

Test pits 11 and 12 were placed in the deflated midden to the east of midden 1. Again, very little was recovered from these midden, and all of it on the surface.

Test pits 13-15 were opened up in midden 4. Test pit 13 was located on an apparent oven feature near the centre of the midden. Most heat-cracked rocks were located on the surface, indicating some measure of surface deflation subsequent to the machine disturbance. Occasional heat cracked rock continued to a depth of 100 mm, with very sparse shell. Test pits 14 and 15 were opened up in the densest parts of the midden. These revealed dense midden to depths of 150 and 100 mm respectively, which, while dominated by pipi, contained higher proportions of tuatua (*Paphies subtriangulata*) than most other test pits.

Test pit 16 was located in the surface exposure of scallop between midden 4 and 5. This deposit was entirely located on the deflated surface.

Test pit 17 was the only one placed in midden 3, a 1 x 1 m square near where two broken chert hammerstones had been located on the deflated surface. This midden had completely deflated. No further evidence of stone artefacts was found, and no countable shell was recovered.

Test pits 18 and 19 were opened up in midden 5. These were 400 and 300 mm deep respectively, and revealed dense deposits of shell containing fish bone, in a matrix of black charcoal stained sand. Test pit 19 was located on the edge of an oven scoop, which was later sampled when the midden was removed to base. The test pit and sample revealed the densest concentration of fish bone yet observed at Omaha. The lowest spit of test pit 19 was unusual in that it contained more cockle (*Austrovenus stutchburyi*), probably from a lens, than pipi.

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Midden Analysis

Every sample from test pits 1 and 19 was analysed, in order to test the possibilities of change from bottom (earlier) to top (later) of the midden. It is worth noting, however, that no gross stratigraphy was observed during the first season that would indicate any long term occupation in any of the midden (this has been the case for every midden observed on Omaha Sandspit, Campbell *et al*. 2001:43), so that any observed changes relate only to short term episodes. The results from the second season (see below) did, however, turn up more complex structural midden build-up.

One sample from every test pit except test pit 17 was analysed. This test pit was excluded because its excavation had been designed to look for evidence of stone tools, such as the two broken chert hammerstones that were found nearby, and no samples were collected. Analysis of midden samples is presented below.

Continued on next page

Figure 33. Map of R09/887 showing test pit locations and subsurface features

{A3 Landscape Image}

SEASON 2

Investigation Methodology

Introduction

Fieldwork in 2002 consisted of investigation of the eastern (beach) side of the dunes. Previously recorded sites were fenced off for preservation along with reserve areas, which included archaeological sites. The dunes were probed systematically with a 1.2m hand probe and probable sites marked out with pegs. Sites were then cleared of topsoil and overlying dune sand and the extent of the shell midden recorded. Investigation of sites not located during probe testing was also carried out when sites were exposed during the earthworks.

The methodology in season 1 was focused on determining the areal extent of the sites and establishing the structure of the midden largely by test pits. The test-pit methodology had restricted archaeological interpretation of the internal morphology of the sites. Despite this limitation, the results of Season 1 and the R09/887 investigation had established the range of sites at Omaha and provided a good sample of midden for analysis. It was decided therefore that trenching the sites to be destroyed during the 2002 season was required to understand two aspects of the midden:

1. The internal morphology of midden sites
2. How the midden concentrations created a social landscape in the broader physical landscape of the spit.

Recording and Sampling

Sites were numbered using an internal numbering system starting at OM200 for the second major season at Omaha. As in the first season, no NZAA numbers were obtained for sites destroyed by the earthworks. Samples were taken of major features found on the sites, and where more complex stratigraphy was identified, samples were often taken to reflect the range observed. Midden samples were taken to provide the following information:

- Contents of individual midden including a breakdown of species of shellfish and fish present:
- Charcoal samples to establish wood species present
- Radiocarbon samples from shell and charcoal samples
- Any artefacts found described and photographed.

It was not possible, or considered necessary, to fully sample all sites, so samples were examined according to an assessment of significance of the site excavated, based on the degree of complexity of the site and recognition of any special attributes, such as the presence of more unusual species of shellfish, observed during excavations. This was mostly established from visual inspection in the field.

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As in the first season's results, the decision to analyse the more complex sites might be seen as creating bias that would affect the final interpretation of the midden data. However, there was little to be gained in detailed analysis of what were quite small uniform pipi midden at the expense of some more complex or unusual sites.

Procedure

Investigation used the following general procedure:

Step	Action
1	A NU was probed by archaeologists 5-10m apart with 1.2m probe.
2	Possible sites pegged out.
3	Marked out sites cleared of turf and sand dune overburden.
4	The extent of site established through further probing.
5	Site photographed.
6	Small sites containing a single feature half-sectioned either with a digger or with a spade.
7	Large sites sectioned with a digger usually creating a 2m wide trench. These trenches were designed to: • Establish the structure of the midden complex including the number and size of structures • Establish the sequences of events that created the site • In some cases trenches were extended considerable distances beyond the edge of a shell deposit to ascertain the nature of the original landscape.
8	Other trenches might be cut on some sites to further explore the internal features of the sites. These were usually perpendicular to the initial trench.
9	Site plans created.
10	Sections drawn of the trenches and internal stratigraphy established.
11	Photographs taken of the site and trench sections.
12	GPS point taken on each site.
13	Bulk samples of midden taken from individual features.
14	Notes of sites created.

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Example Sites

The following section summarises information regarding six sites excavated during Season 2. The sites described here illustrate most of the range of the features found and the key elements are highlighted in the summary.

The midden contained combinations of the following types of features:

1. Rake out
2. Fire scoops
3. Hangi
4. Koiwi

Locations are shown in Figure 21.

Example Sites

OM209

Summary

The main concentration of midden (Midden 1) was identified under a layer of charcoal-stained sand approximately 5-10cm thick. This layer, identified on many of the sites but almost always underlying them, probably represents an old topsoil surface. The fact that the midden underlay this surface suggested that the midden might be a relatively early feature, as almost all other midden at Omaha were found cutting into this old topsoil layer. This was borne out by a radiocarbon date (see final chapter for details) which placed this midden at around 1400AD - 1580AD. No artefacts, though, were recovered from the site.

Midden 1 was predominantly made up of pipi, although the initial impression had been of cockle concentrations. 9m southwest of the GPS point marking out the midden 1 was a small scatter of midden measuring 2.5m x 1.5m containing whole and fragmentary shell, predominantly pipi and hangi stone. The midden was 12 cm deep at its deepest point with an average depth of 6cm. (Figure 33).

After scraping away the topsoil and upper layer of dune sand, two trenches were excavated to expose the main concentration of midden.

Analysis of the fishbone recovered from two samples from OM209 provided evidence of a single trevally species (*Carangidae* spp.) and some unidentifiable verterbrae.

Key element:

- Underlay old topsoil layer, unlike most other midden
- Early date.

Midden Contents

Feature	Description
Midden 1	Consists predominantly of pipi; patchy whole fragmentary shell some articulated. Also charcoal, fishbone, burnt shell, tuatua, cockle. Fire-cracked rock was found up to 0.5m deep.
Midden 2	A small concentration of midden, mainly pipi.

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Table 10. MNI of shellfish species found in OM209 midden

Name	MNI
PIPI	559
COCKLE	8
CAT'S EYE	5
WHELK	3
TUATUA	2
TURRET SHELL	1

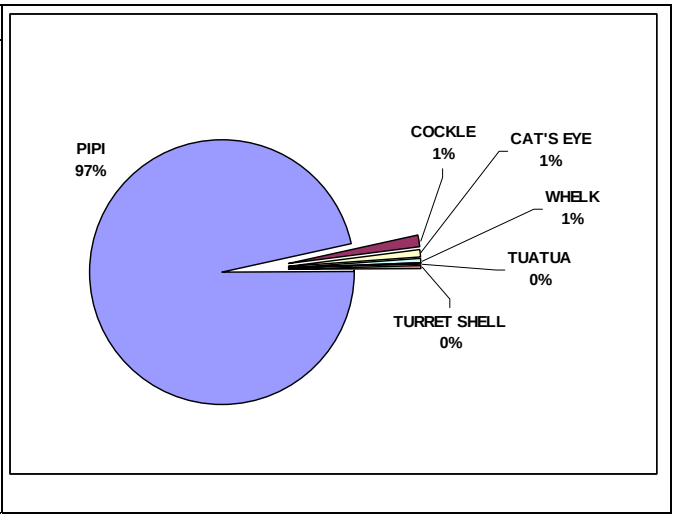

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Figure 34. Plan of OM209 (shaded areas midden deposits)

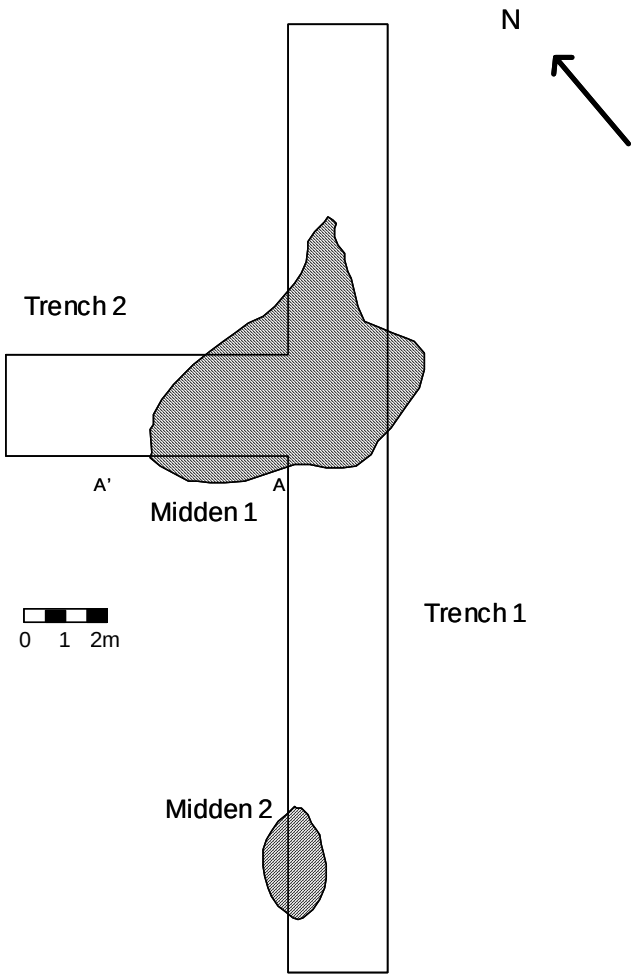
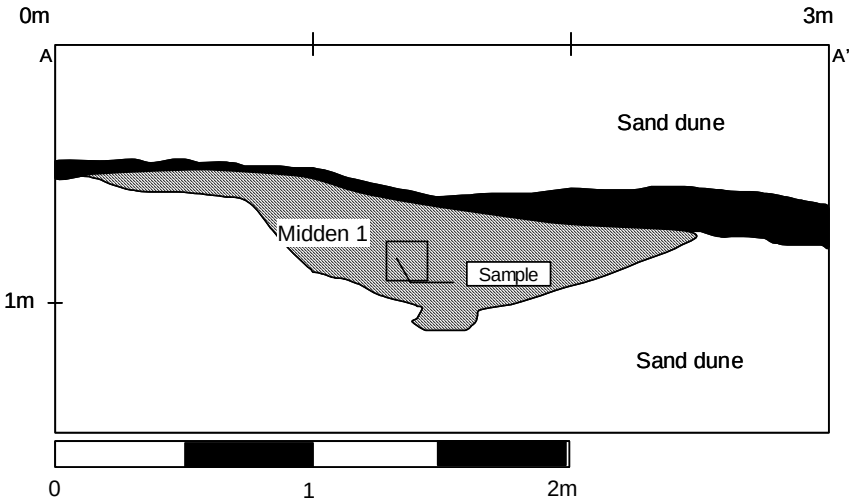


Figure 35. Trench 2 West section, OM209



Striped area – midden 1 concentration

Black area – stained sand layer

OM213

Summary

This midden was in a small sand dune in Area 1. There were patches of midden/fire scoops throughout area, with inter-cutting scoops and at least 3 scoops exposed in section (Figures 38-39). Features were cut into each other and into stained soil, probably from a burnt off area. The burnt off layer continues across the dune especially in the north, although no further features were seen in that direction.

The mound was cleared of up to 3m of sand over the cultural layer. A 2m wide trench running approximately north–south was then cut through the western end of the site. This exposed a number of interconnecting scoops. The profile shows the scoops. Samples were taken from three of them.

Key elements:

- Complex of inter-cutting pits
- Clear indication of perpendicular cut edges in pits.

Figure 36. Closeup of eastern section Trench 1, OM213. Line indicating midden Feature 3

Continued on next page

Midden Contents

Feature	Description
Feature 1 midden	Midden composition is fairly dense with a black greasy sand matrix. Shell is primarily intact with evidence of burning on fragment. Large pieces of charcoal evident and some fish bone. Some humic material and hangi fracture. Pipi predominates, some tuatua, cockle and whelks.
Feature 2 midden	Small pocket of fairly dense shell in a brown sandy matrix. Shell is predominantly intact with a weathered appearance. Matrix contains humic material. No charcoal or bone evident. Pipi dominant with some tuatua, cockle and whelks.
Feature 3 midden	Very dense shell in a sparse black sand sooty matrix. Shell is primarily intact although matrix comprises 50% very fragmented shell. Several articulated shells evident along with some large pieces of charcoal. No bone evident or burning of shell.

Continued on next page

Table 11. Shellfish MNI for OM213 midden

Midden	Name	MNI
Feature 1	PIPI	218
	WHELK	21
	COCKLE	8
	CAT'S EYE	6
	TUATUA	5
	KINA	1
	PAUA	1
	OSTRICH. FT.	1
	SCALLOP	1
	OYSTER	1
Feature 2	PIPI	114
	WHELK	5
	COCKLE	3
	MUDSNAIL	1
	OYSTER	1
	CAT'S EYE	1
	SCALLOP	1
	TUATUA	1
Feature 3	PIPI	617
	TUATUA	10
	WHEEL SHELL	5
	LIMPET SHELL	3
	COCKLE	2
	WHELK	1
	RINGED VENUS	1
	CAT'S EYE	1

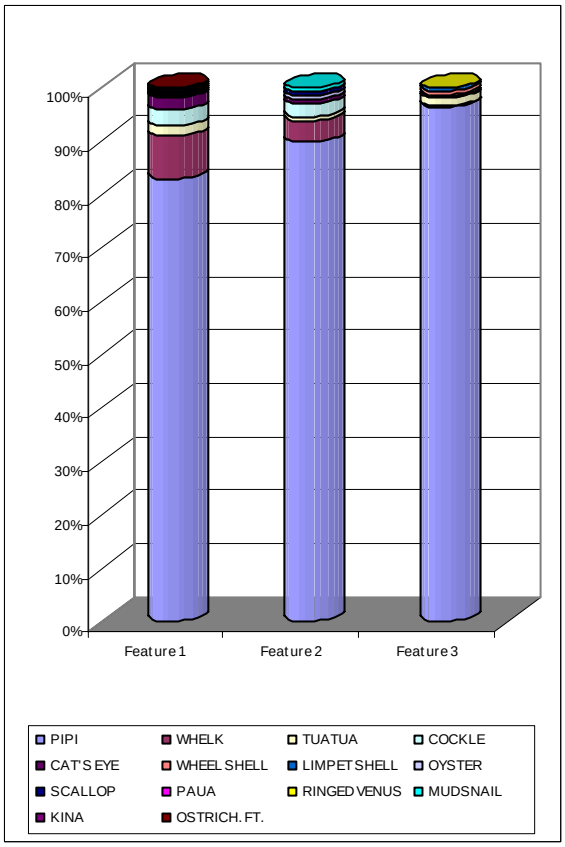


Figure 37. MNI of fish species by Feature, OM213

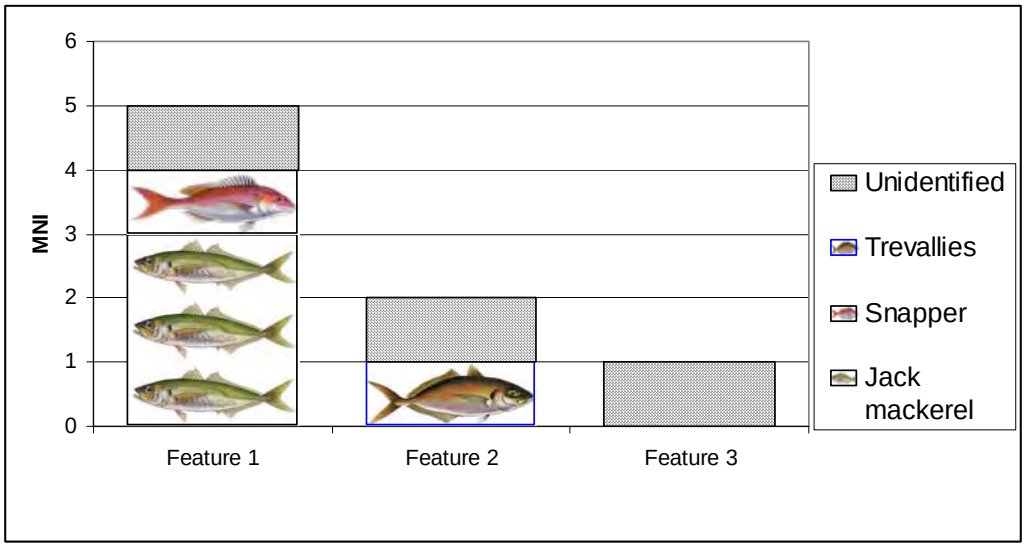


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Figure 38. Plan of OM213

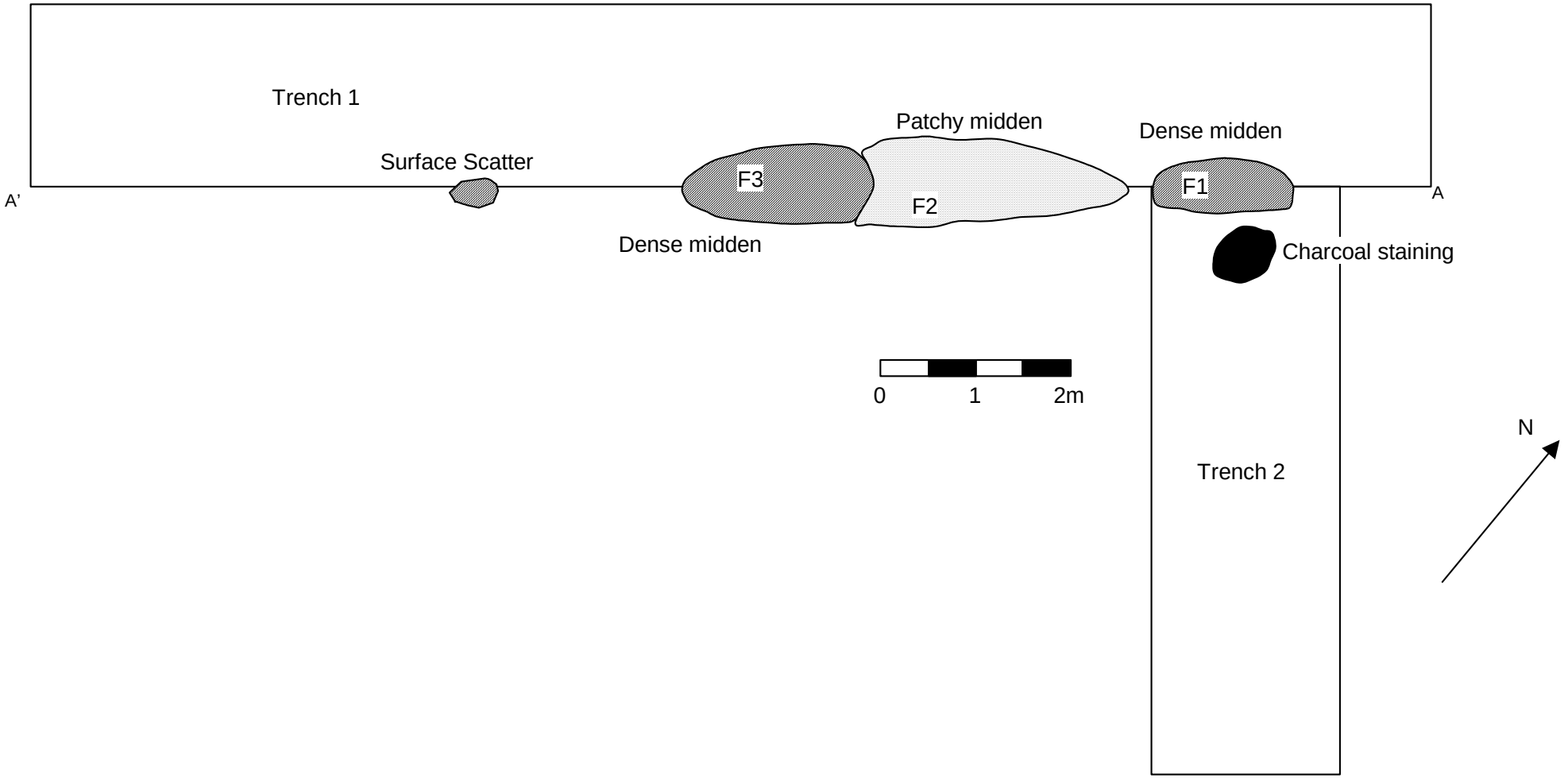

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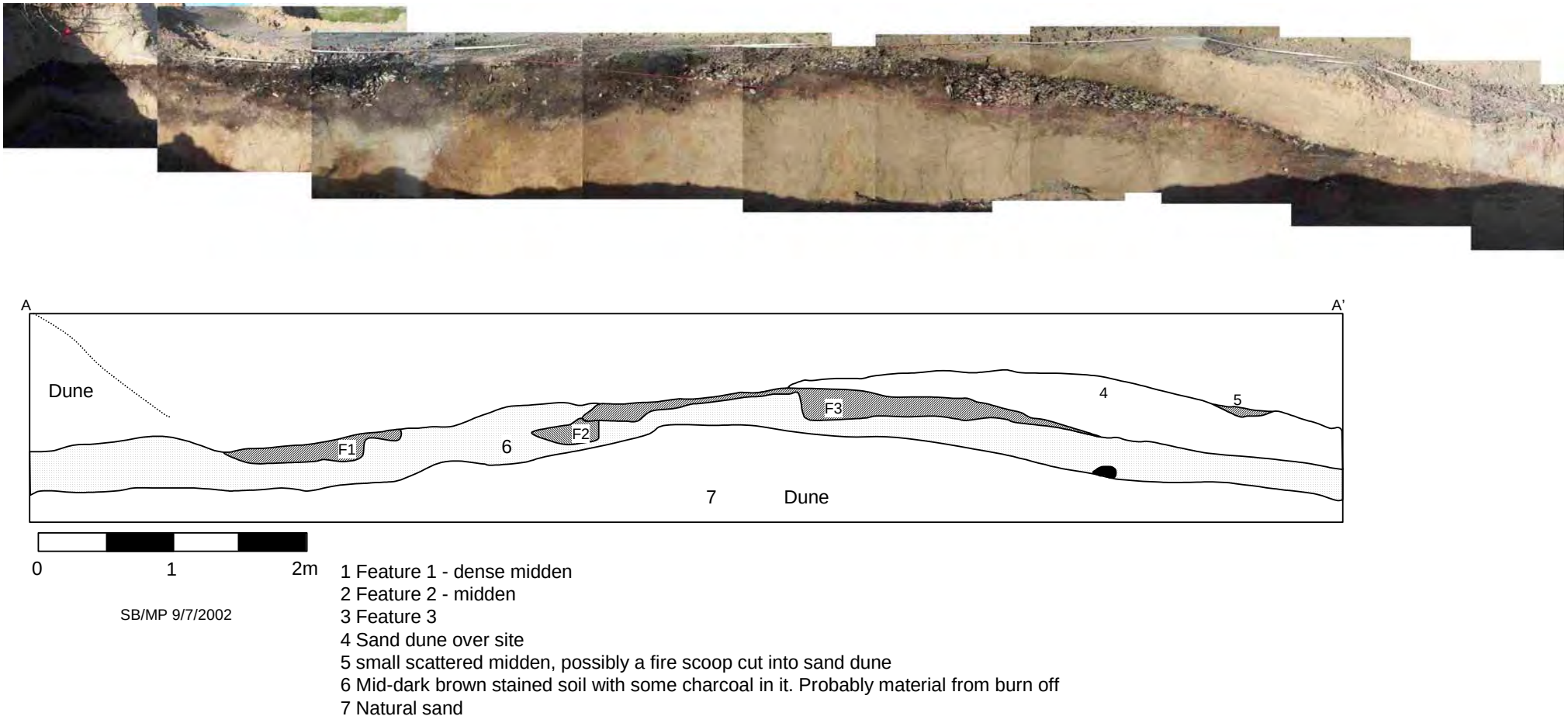
Figure 39. OM213, south section Trench 1



1 Feature 1 - dense midden
2 Feature 2 - midden
3 Feature 3
4 Sand dune over site
5 small scattered midden, possibly a fire scoop cut into sand dune
6 Mid-dark brown stained soil with some charcoal in it. Probably material from burn off
7 Natural sand

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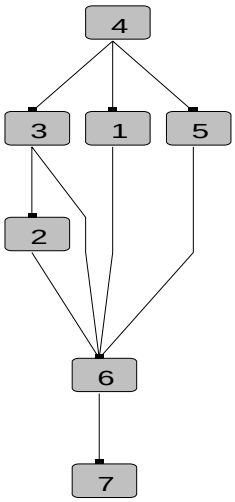
Interpretation

To assist in interpreting the stratigraphy shown in the Trench 1 section the results are summarised using a Harris Matrix diagram. The three large midden concentrations (Features 1, 2, and 3) are all overlain by the dune sand (layer 4) and probably with rake out from Feature 3 dragged over the remains of the earlier midden 2. Feature 1 lies to the north of the site.



Although it is not possible to establish what the stratigraphic relationship is between Feature 1 and Features 2 and 3, between Features 2 and 3 there is an increasing proportion of pipi recovered in the later features (Table 11).

Apparent in the section are the vertical edges at the base of Features 1-3. These edges illustrate something about the construction of the original hangi. The edges illustrate how the ovens were cut into the side of a dune rather than necessarily cut straight down on all sides to make a fully enclosed pit. A fire could then be built at the base of the partial pit and the shellfish cooked on that.

An alternative explanation for this stratigraphy was that the non-preserved side of the hangi was destroyed as the food was removed from the hangi or the shell debris thrown back into pit. We will examine these possibilities in more detail below.

OM215

Summary

This large area of midden, over 20m x 20m, was located under >0.5m of dune sand. A very dense area of midden over 0.5m thick was found in the centre of the site (Feature 2), made up of a series of fire scoops and backfill of shell. Fire pits were clearly visible at the base of many of the features. The large midden also contained concentrations of scallop and toheroa. Toheroa is not considered to be available locally.

The large area of the midden scatter was scraped off after probing identified the extent of the site. A 2m wide trench was dug approximately north-south to expose the stratigraphy, leaving the base of the midden features exposed. After trench 1 was recorded, a second trench was dug through the major concentrations perpendicular to the first to expose the extent of the features.

Key elements:

- Hangi stones in situ in upper layer of site
- Clear indication of fire scoops built at base
- Large size of midden
- Concentrations of scallop and moderately large toheroa.

Figure 40. Trench 1 through OM 215 looking south

Continued on next page

Midden Contents

Feature	Description
Feature 1 hangi	Small compact hangi consisting of compacted small stones including local orange coloured sandstone. Whole and fragmented shell on top. Located 2m to the east of trench 1 and surrounded by midden.  **Figure 41. Feature 1 hangi at OM215**
Feature 2 firescoop	Exposed in ditch immediately under the uppermost scrapings and contiguous with upper midden (feature 3).
Feature 3 midden	Northern end of trench immediately south of Feature 2 removed shell midden in dark sand matrix. Consists mainly of densely packed pipi but concentrations of other species also found including scallop and toheroa. Also noted whelk, tuatua, and unidentified species; Sample 1 taken of uppermost levels of feature 3, centre of trench 1. General sample of midden; Sample 2 taken from layer 7 trench 1 dense midden in a sparse black matrix; Sample 3 from layer 9 trench 1; Black sooty matrix, very compact with fragmented midden.

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Table 12. Shellfish species for OM215 midden (Feature 3)

Name	MNI
PIPI	1383
TUATUA	134
COCKLE	55
SWOLLEN TRUMPET	20
TOHEROA	7
SCALLOP	6
WHELK	5
WHEEL SHELL	4
MUDSNAIL	3
SIPHON WHELK	2
VOLUTE SHELL	2
TRUMPET	2
LIMPET SHELL	2
TOP SHELL	1
TURRET SHELL	1
OYSTER	1

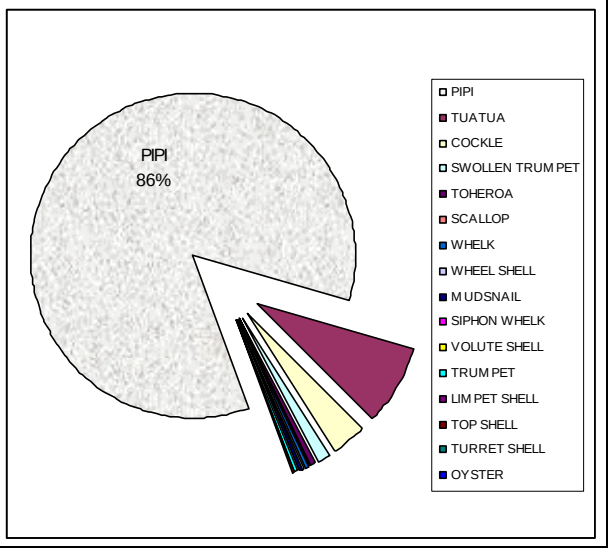

Figure 42. MNI of fish species found in OM215 (Feature 3)

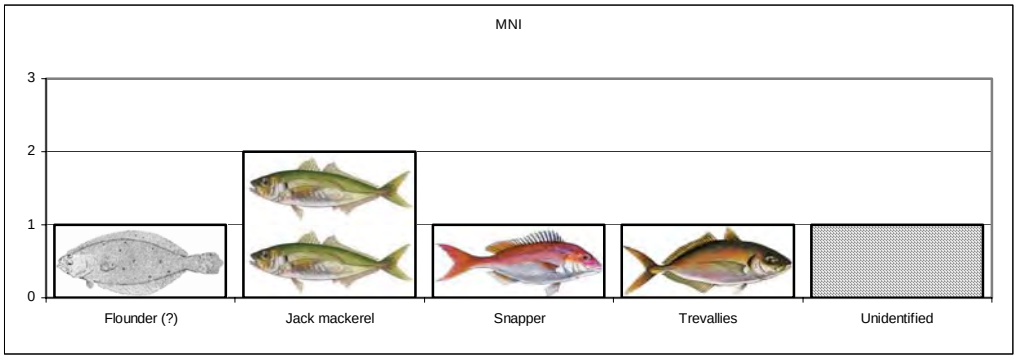

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Figure 43. Plan of OM215

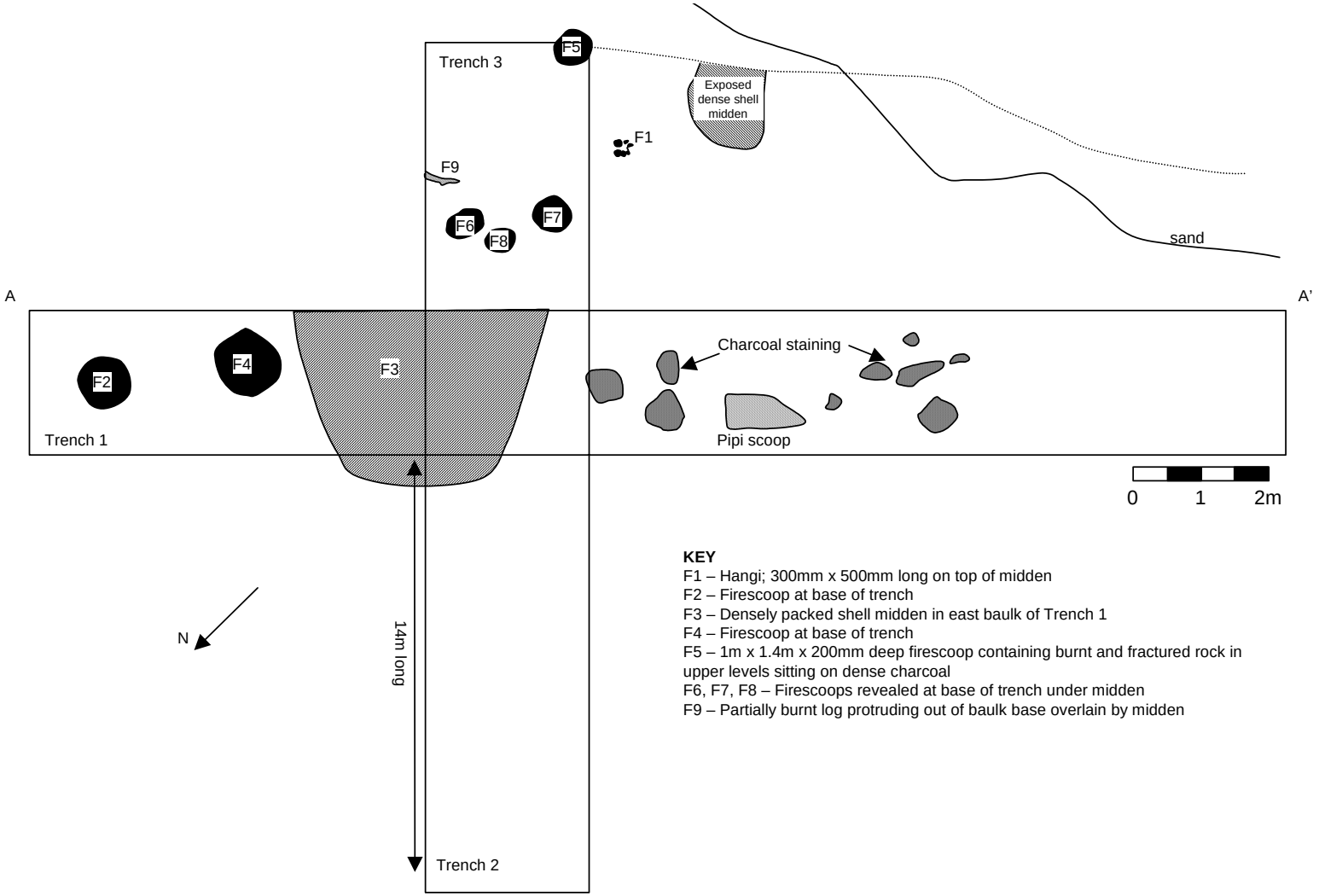
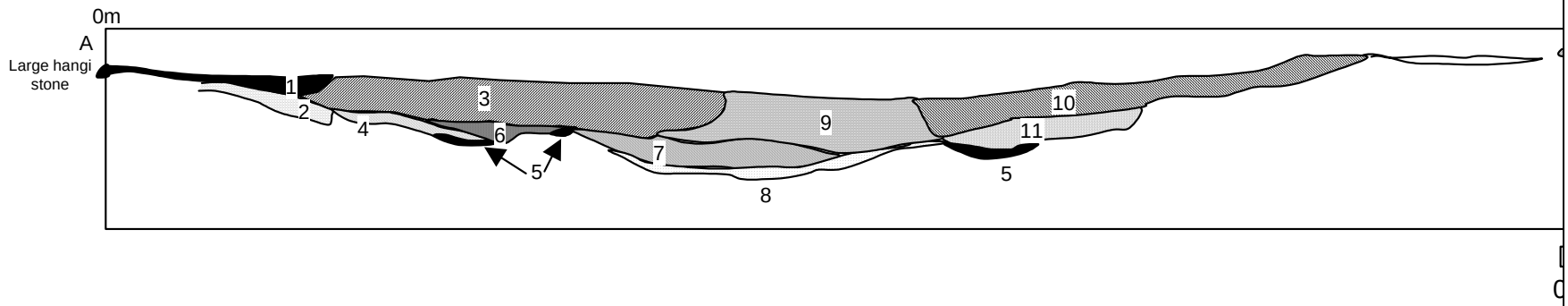


Figure 44. East section, Trench 1, OM 215



KEY
1 – Charcoal len
2 – Brown sandy matrix with shell
3 – Black greasy matrix with dense midden including scallop and toheroa (Feature 3)
4 – Burn off layer
5 – Charcoal lens
6 – Lens or rakeout; brown matrix with dense shell and charcoal
7 – Midden in sparse black sooty matrix
8 – Pinkish sand layers – no shell
9 – Compacted black matrix with midden fragments
10 – Dense pipi scoop – blackish sooty matrix
11 – Brown matrix with sparse shell like 2
12 – Midden in blackish sooty matrix

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Interpretation

This site is one of the larger midden. The dense concentration of midden does include a variety of structures. Underlying the shell, several firescoops were visible. A variety of intercutting shell layers indicates that the area was used over a period of time. However this use was relatively continuous as no sterile layers divide the various features. The toheroa concentration is also indicative of the movement of shell resources across a large region as toheroa was probably brought to the feast from west coast beaches.

OM219

Summary

The area consists of several large midden deposits along with surface scatters and charcoal staining (see midden contents below). This included a few large pits that were backfilled with shell and then reused subsequently. The midden showed evidence of burning and a range of species. Another large complex of midden lay about 30m west (OM208).

Three trenches were dug through the site after initial identification and scraping. Trench 1, dug approximately north-south, exposed the main concentration of midden with a perpendicular trench dug to the east to follow the extent of the main large midden. Trench 3 was excavated towards the west to see whether the site extended as far as site OM218 10m away (it did not).

Key elements:

- Complexity of inter-cutting pit features
- Variety of identified species
- Concentrations of fish bone in some features

Continued on next page

Midden Contents

Feature	Description
Feature 1 midden	Trench 2 - midden consists of dense midden with charcoal scoops and fish lenses. Matrix is black and sooty. Pipi predominates but ostrich foot, mudsnail, cockle, oyster and tuatua, evident (Samples 1 and 2 taken from midden including cockle concentration). Little evidence of burning on shell. Shell is mostly intact with hangi rock evident. Volume: 3m *x* 6m *x* 750mm.
Feature 2 midden	Trench 2 - Feature 2 midden cuts into side of feature 1 midden. Midden consists of dense shell with some fish bone evident. Species include pipi, cockle, tuatua, whelk and mudsnail. Matrix is black and sooty. Shell intact with little or no evidence of burning charcoal deposits. Hangi feature present. Sample 3 feature 2. Volume: 3.5m *x* 4.5m *x* 800mm.
Feature 3 midden	Small midden deposit situated at the eastern extent of trench 2 profile. Matrix is mid brown and sandy matrix is sparsely populated with shell. Pipi predominate; some cockle; shell predominantly intact with no evidence of burning. One rounded hangi stone present. No fish bone evident. Volume: 1m *x* 1m *x* 500mm.
Feature 4 midden	Trench 2 - feature consists of a small shallow midden deposit; it extends 1.5m behind section profile of trench 2. Matrix is black and sooty with charcoal. Pipi predominates, largely fragmented and with considerable evidence of burning. No bone evident. Volume: 1m *x* 1.5m *x* 250mm.
Feature 5 midden	Trench 1 – large patch of dense midden in dark brown sandy matrix. Matrix is very sparse with lots of humic inclusions. Pipi predominates with tuatua, cockle, whelk, ostrich foot, oyster, toheroa. Sample 4 taken from profile trench 1. Volume: 6m *x* 6m *x* 700mm.

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Table 13. MNI of shellfish by Features in OM219

Feature	Name	MNI
Feature 1 (cockle concentration)	COCKLE	112
	PIPI	68
	TUATUA	44
	MUDSNAIL	10
	OSTRICH. FT.	1
	OYSTER	1
	SCALLOP	1
	TRUMPET	1
Feature 1	PIPI	63
	TUATUA	28
	COCKLE	5
	WHELK	1
Feature 2	PIPI	251
	TUATUA	44
	COCKLE	23
	WHEEL SHELL	3
	WHELK	1
	LIMPET SHELL	1
	MUDSNAIL	1
Feature 5	PIPI	334
	TUATUA	2
	OSTRICH. FT.	2
	LIMPET SHELL	2
	COCKLE	1
	CAT'S EYE	1

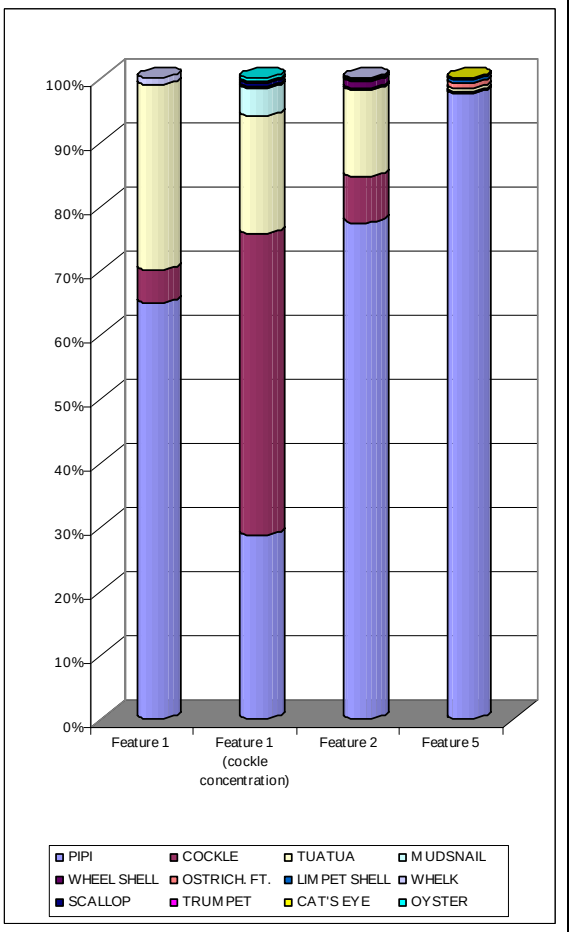

Figure 45. Fish species found in OM219 midden

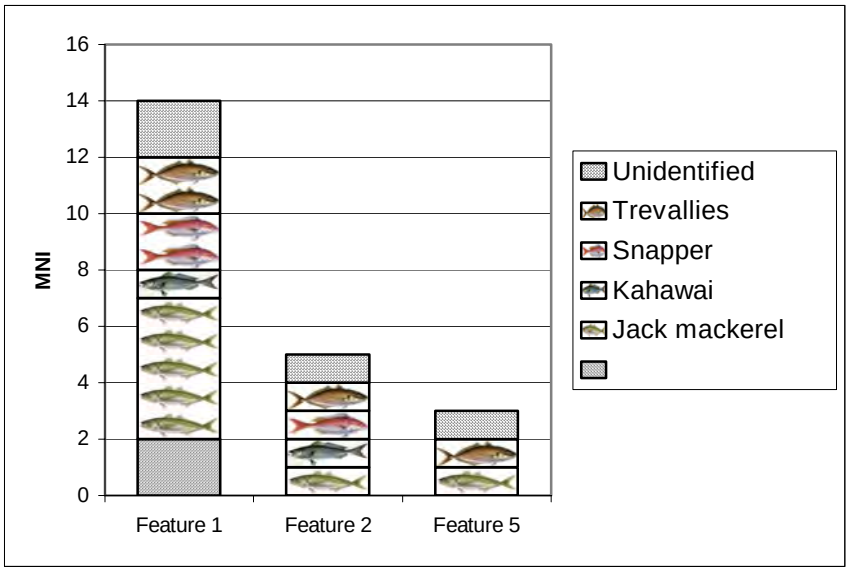

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Figure 46. Plan of OM219

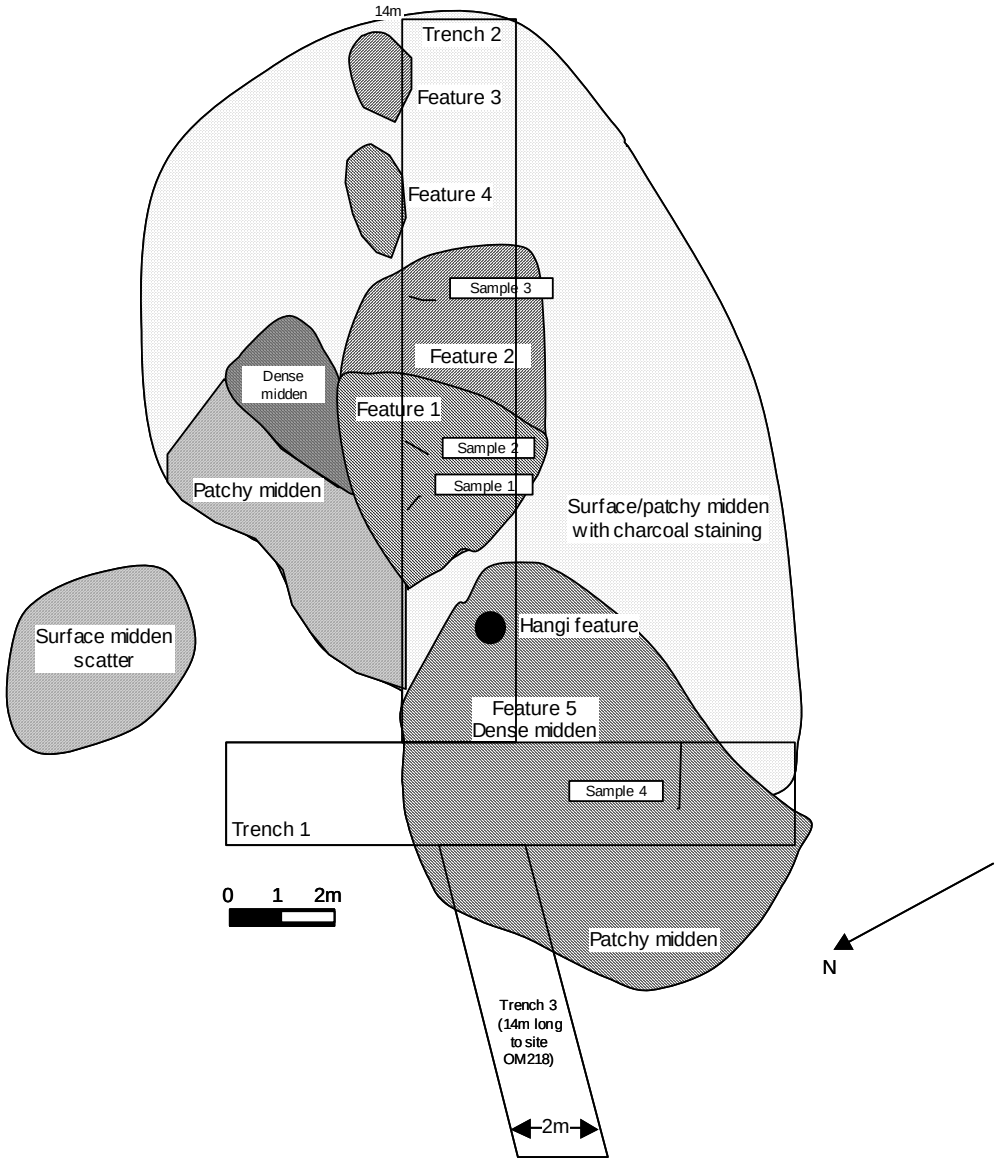
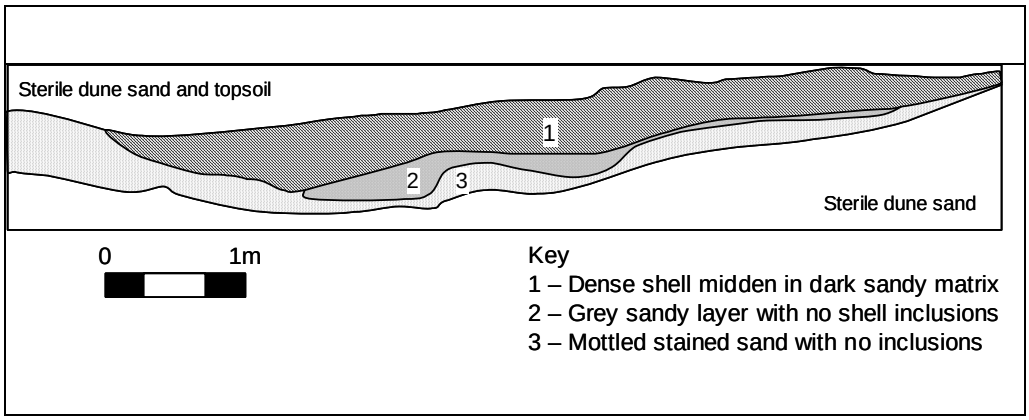
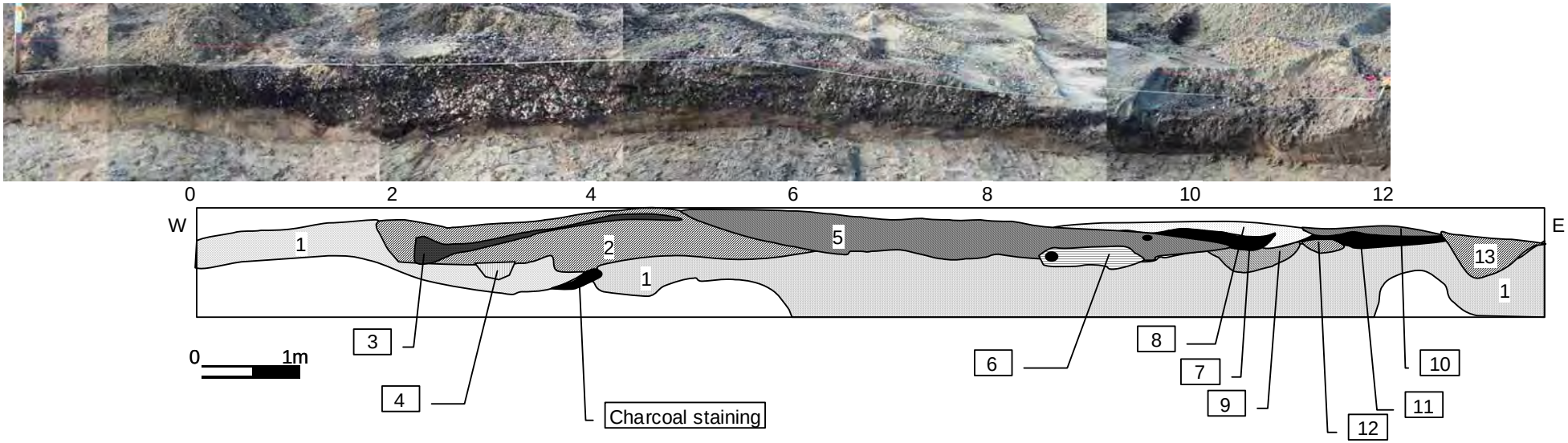


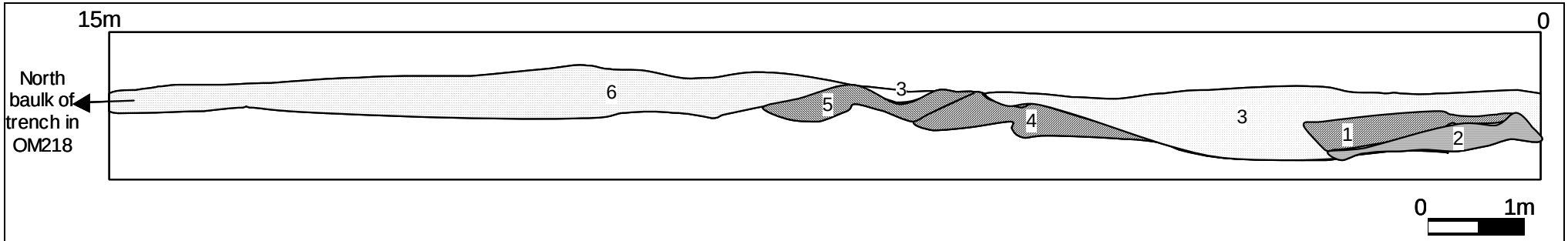
Figure 47. East section Trench 1 (Layer 1 = Feature 5), OM 219





KEY
1 – Stained sand layer
2 – Feature 1 – dense midden (bulk sample with fishbone and cockle in middle
3 – Black charcoal concentration, crushed midden layer in feature 1
4 – Mid-brown soil, fire scoop with burnt wood fragments
5 – Feature 2 – dense midden cutting feature 1
6 – Charcoal stained layer with hangi rock; part of feature 2 with crushed midden
7 – Charcoal stained layer (no midden)
8 – Sand dune on top
9 – Charcoal stained brown scoop (no midden)
10 – Charcoal stained layer with midden (shallow midden behind section) Feature 4
11 – Charcoal stained layer (sterile)
12 – Small concentration of pipi midden
13 – Mid-brown sand midden (Feature 3) with pipi and rounded hangi pebbles

Figure 48. North section Trench 2, OM219



KEY

1 – midden predominantly pipi, patch in a black sooty/sandy matrix with charcoal and fishbone evident

2 – Pale brown matrix “stained’ with charcoal and some hangi stone inclusions

3 – Mid-brown sand matrix with stained charcoal and some shell inclusions (shell patchy)

4 – Mid-brown sandy matrix with patches of dense shell charcoal; shell is whole and fragmented. Predominantly pipi and some cockle

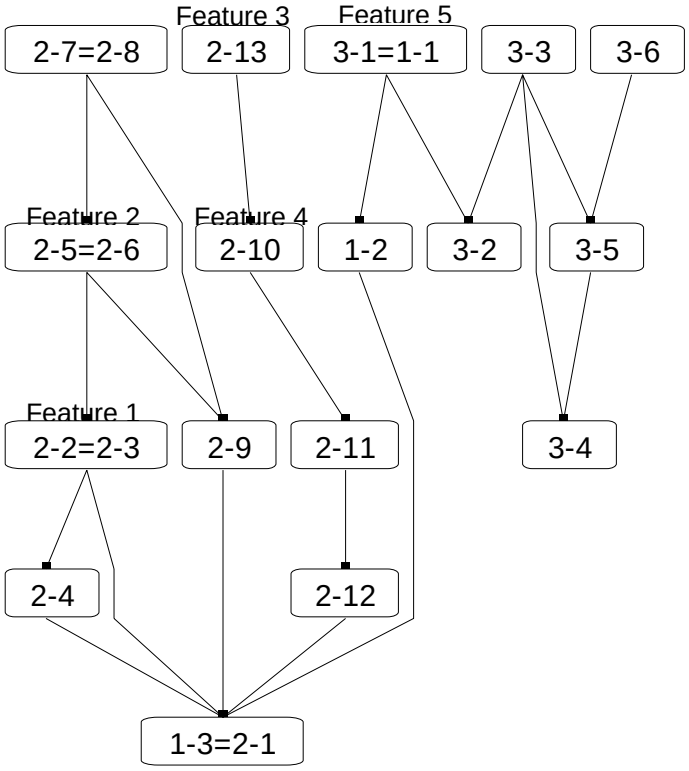
5 – Mottled bornw and black sand matrix with dense inclusions of shell and charcoal. Shell is predominantly pipi with some cockle; whole and fragmented

6 – Pale grey sandy matrix with shell and charcoal inclusions

Figure 49. North section Trench 3

Interpretation

Relating all the strata was carried out using a Harris Matrix. The first digit refers to the trench number, the second digit refers to the layer number. Younger layers are above earlier layers.



This was a large cooking area with dense midden concentrations. There were apparently three stages to the building up of the site, with Feature 1 midden dug first, then Features 2 and 4 excavated, and the last big midden, Feature 5, dug last. Fishbone was present in some of the features in reasonable numbers (Figure 45). The numbers suggest an apparent decline in the amount of fish taken at the area, although the dense fishbone layer found in Feature 1 was sampled specifically during the excavation. However, the apparent dominance of pipi shell is most marked in the later features (Table 13).

The site is located between some larger dunes offering a relatively sheltered spot.

OM263

Summary

The midden consists of a large dense midden deposit of predominantly intact clean shell. Pipi predominates but other species were noted. There was little or no evidence of burning on shell fragments.

Two trenches were dug (NNW and SSW) 2m wide. Trench 1 was dug through the large midden structure (probably two large midden features) to expose the stratigraphy. Trench 2 was set perpendicular to Trench 1. There was a modern rubbish bag with beer cans and bottles in the south-western baulk. Feature 1 cuts Feature 3 and Feature 2.

Key elements:

- Netsinker
- Modern rubbish bag.

Midden Contents

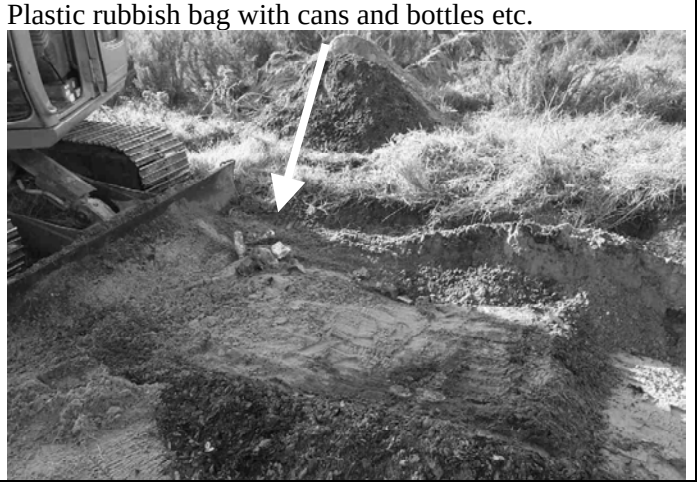
Feature	Description
Feature 1 midden	Sample 1 taken from here. Dark black matrix with dense shell lens over the top. Pipi, cockle etc. On SE corner shell overlays possible earlier firescoop (Feature 3) containing only sparse shell but some charcoal. See section drawings for more information. 1 stone fishing sinker found at the base of this feature.
Feature 2 midden	Matrix midbrown sand sparser shell than 1, with scoops. See section. Probably cut into old top soil that creates a layer in the southern part of site (dark brown sand material).
Feature 3 Fire scoop	Sparse shell in dense charcoal rich black sand. Fire scoop(s) evident in section of trench 1, layer 1.
Feature 4 midden	Plastic rubbish bag with cans and bottles etc. 

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Table 14. MNI shellfish species for Features in OM263

Feature	Name	MNI
Feature 1	PIPI	329
Feature 1	TUATUA	20
Feature 1	WHELK	9
Feature 1	COCKLE	8
Feature 1	WHEEL SHELL	4
Feature 1	TOP SHELL	4
Feature 1	MUDSNAIL	2
Feature 1	RINGED VENUS	1
Feature 1	SCALLOP	1
Feature 1, East baulk	PIPI	358
Feature 1, East baulk	TUATUA	22
Feature 1, East baulk	WHELK	8
Feature 1, East baulk	COCKLE	6
Feature 1, East baulk	LIMPET SHELL	1
Feature 1, East baulk	CAT'S EYE	1
Feature 1, East baulk	RINGED VENUS	1
Feature 1, East baulk	SCALLOP	1
Feature 1, East baulk	OSTRICH. FT.	1
Feature 1, East baulk	WHEEL SHELL	1
Feature 2	PIPI	337
Feature 2	TUATUA	43
Feature 2	COCKLE	10
Feature 2	WHELK	1
Feature 2	MUDSNAIL	1

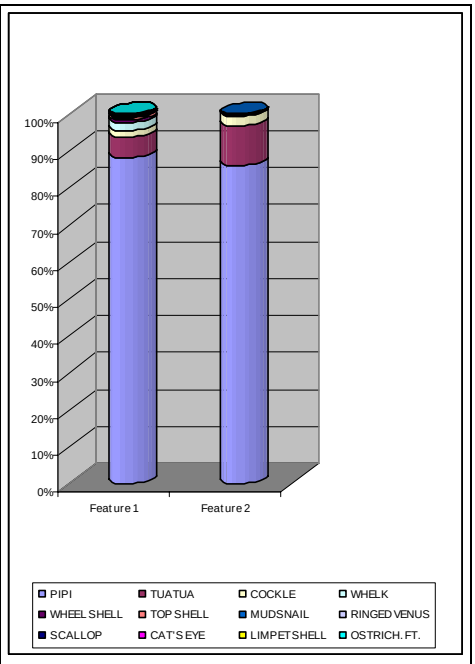
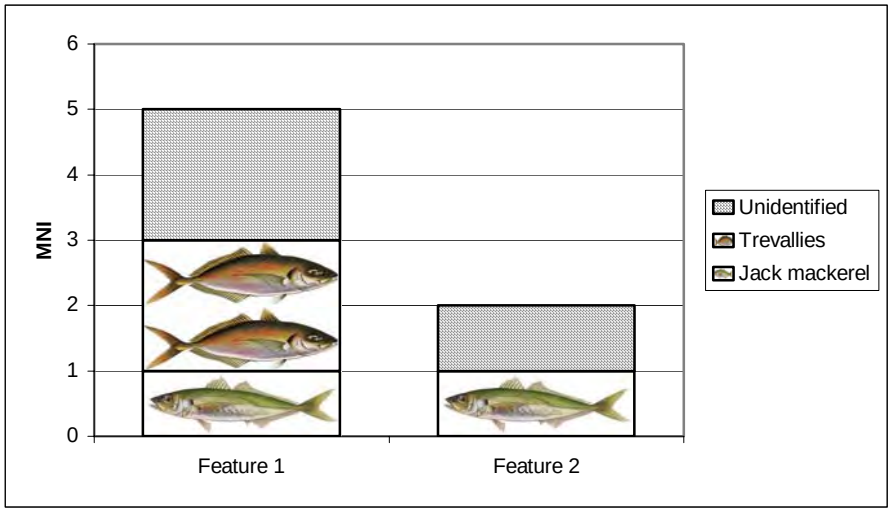


Figure 50. MNI counts of fish from Features in OM263



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Interpretation A series of three inter-cutting midden and a fire scoop but with a modern bag of rubbish dug into part of the area.

Figure 51. Plan of OM263

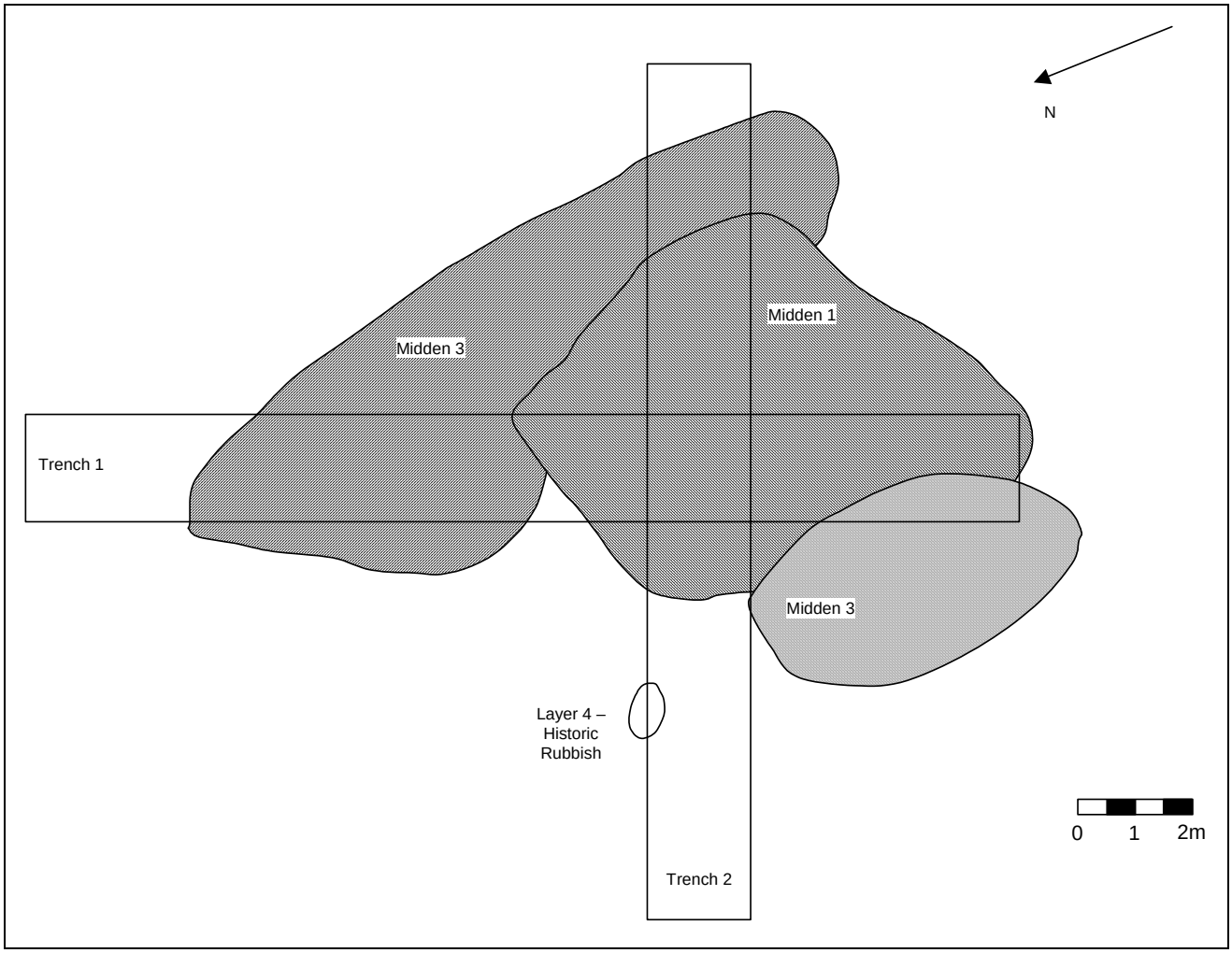

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Figure 52. East Section Trench 1, OM263

1 – Dense shell midden in dark black sooty matrix. Predominantly intact pipi with lots of univalves, scallops, fishbone, charcoal, crushed lens (dotted line) showing upper level of midden
2 – Fairly dense shell midden in dark brown sandy matrix. Predominantly pipi, cockle and tuatua evident

OM268

Summary

The site was just behind the Surf Life Saving hut in the northern corner of the development (NU1). The north-eastern end extends towards dune reserve area behind the beach. The site consists of three overlying midden features varying in content (see below). Two perpendicular trenches were excavated through the area. Trench 1 (roughly east-west) exposed the main midden areas and hangi stones. Trench 2 was dug to determine the extent of Feature 2 in the southern side of the site. The midden was located in the northern end of trench 1.

Key elements:

- Dense very burnt matrix overlying part of main feature midden
- Hangi feature in western end of Feature 3.

Midden Contents

Feature	Description
Feature 1 midden	Black charcoal stained sand layer with charcoal chunks, hangi stones (+1 hangi), fragmented shell but not as fragmented as Feature 2. Feature 2 is cut into Feature 1. Area 3m *x* 3m.
Feature 2 midden	Concentrated shell midden in charcoal stained sand matrix. Little matrix, predominantly whole pipi shell and 1 large siphon whelk. Area ~9m *x* >6m.
Feature 3 firescoop	Very black charcoal layer with very fragmented shell, hangi stones up to 10cm in fatness, raked out across Feature 2. Area 5m *x* 3.5m, max 70mm thick

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Table 15. Shellfish MNI for Features in OM268

Feature	Name	MNI
Feature 1	PIPI	44
	SCALLOP	6
	COCKLE	2
	TUATUA	1
Feature 2	PIPI	225
	COCKLE	5
	TUATUA	2
	OYSTER	1
	RINGED VENUS	1
Feature 3	PIPI	20
	TUATUA	5
	COCKLE	1
	SCALLOP	1

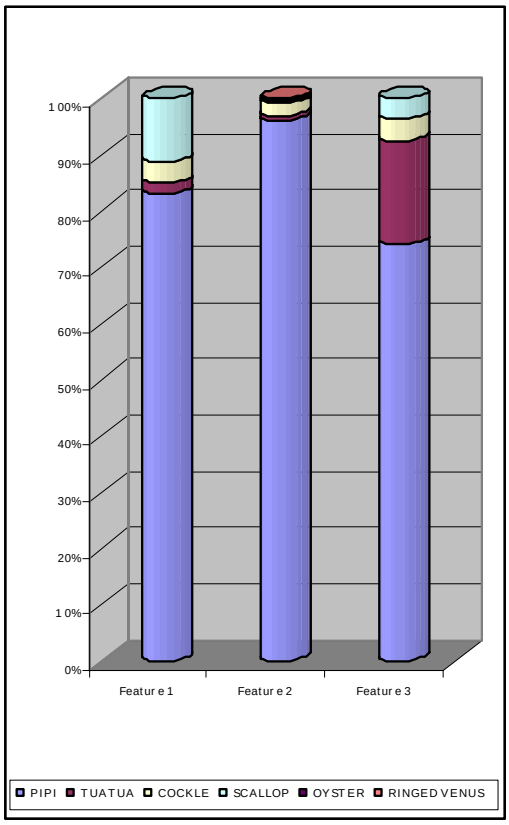

Figure 53. Fish MNI for Features in OM268

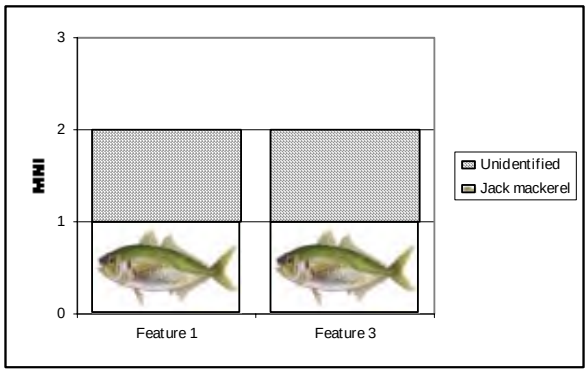

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Figure 54. Plan of OM268

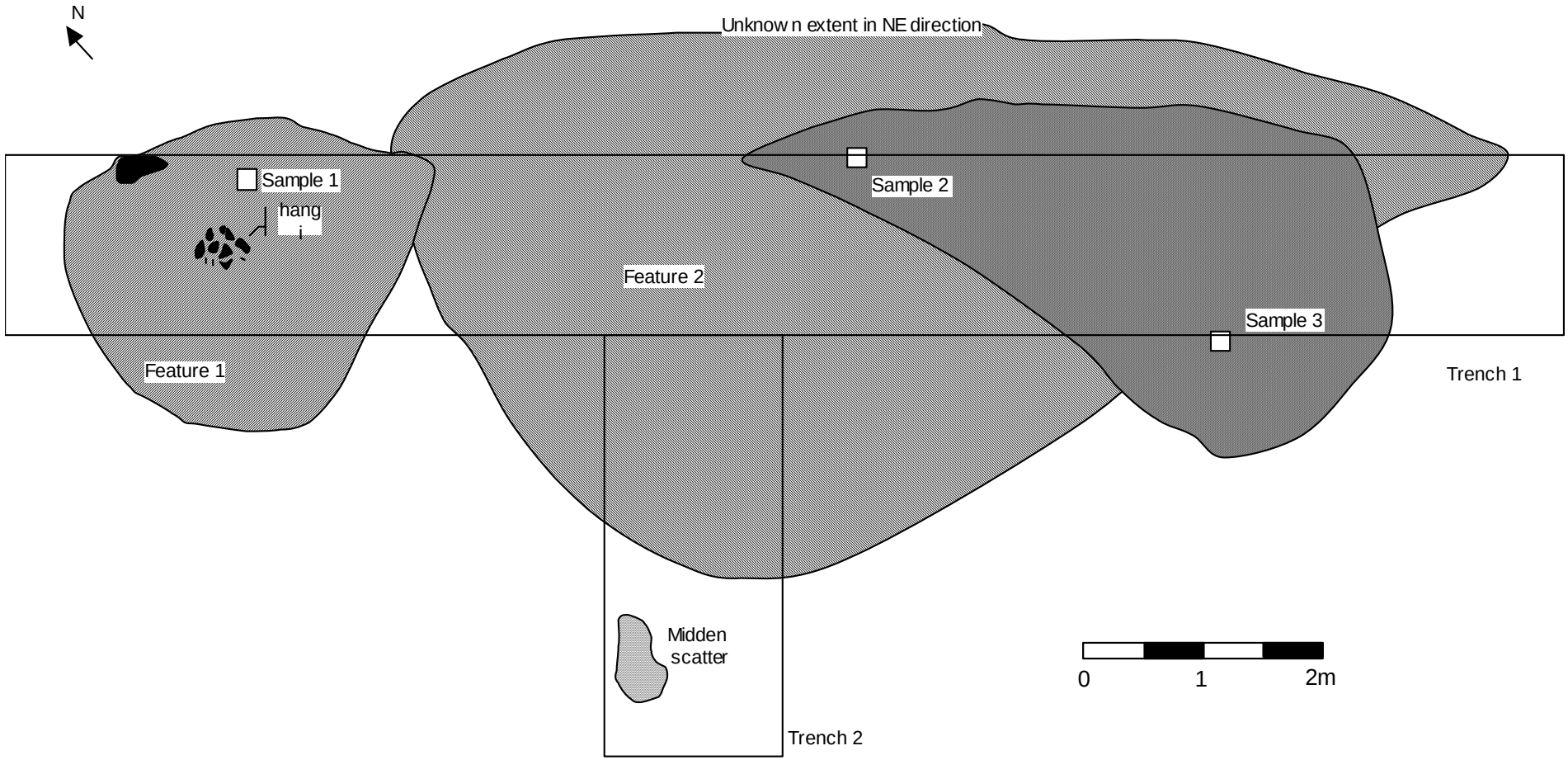
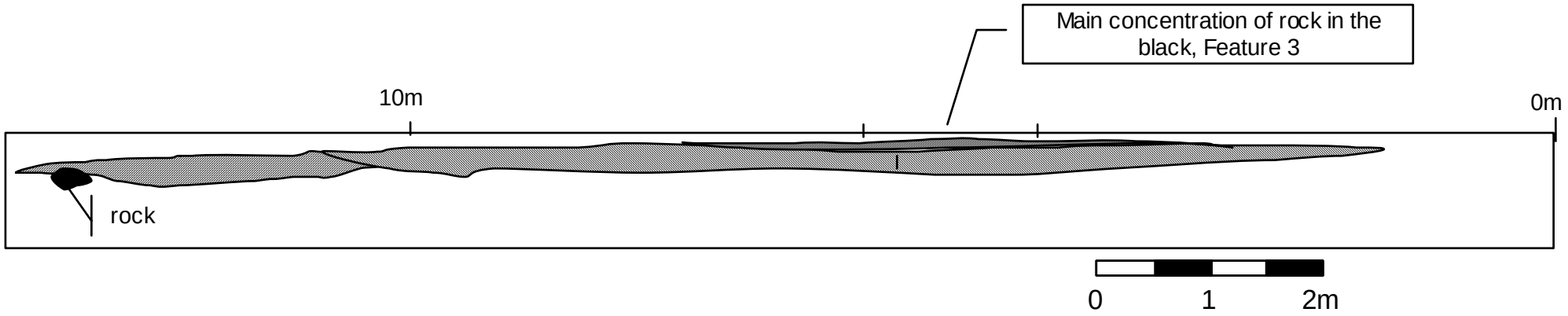


Figure 55. North section Trench 1, OM268



KEY

Feature 1: Black charcoal stained sand layer with charcoal chunks, hangi stones (+1 hangi), fragmented shell but not as fragmented as Feature 2. Feature 2 is cut into Feature 1

Feature 2: Concentrated shell midden in charcoal stained sand matrix. Little matrix, predominantly whole pipi shell and 1 large siphon whelk

Feature 3: Very black charcoal layer with very fragmented shell, hangi stones up to 10cm in fatness, raked out across Feature 2. Max 7cm thick.

Interpretation

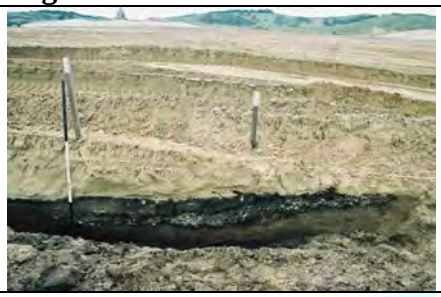
The site is simpler than OM219 described earlier, but there are some interesting properties. Feature 1, the earliest of the midden, has a well-defined hangi structure associated with it. This included the fractured small stones and 1 large river cobble at the side perhaps used in creating the oven. The thick black charcoal layer, Feature 3 that sits over the large Feature 2, suggests a rake out from a high temperature fire. The depth of dune sand overlying much of the site (>3m in parts) also provides a guide to the speed at which such dunes can build up.

Summary

Example Sites

The sites described above represent the more complex end of the Omaha midden spectrum. They represent occupation spans of a relatively short period of time (probably months at the outside). They contain sequences of hangi, with fires cut into either the dunes or old midden. Some of the other types of midden are illustrated briefly below and give a broader view of the range encountered at Omaha.

Other Types of Midden

Site	Image
OM246 – Under 4m of sand uncovered by sandeater. Small 4x1m concentration of crushed shell midden. Some whole shell (mostly pipi). Single cooking event by a small group.	
OM243 – Sally Burgess excavating a very small amount of shell midden distributed in a 0.5 m area. Predominantly scallop also some pipi and cockle. Probably representing a small meal.	
OM240 – Dispersed scatter of mostly cockle midden. Possibly a number of small fires/meals with the shell scattered afterwards.	
OM232 – Deep pit cut into sand for hangi. Cut in a flat area whereas most others were cut into the side of dune rises. Mostly pipi.	

KOIWI

Burials at Omaha

Description

The burials were found during earthworks in 2000, early 2001 and in 2002. Ngati Manuhiri were monitoring the earthworks, which were halted while the tangata whenua representative (Ringi Brown) made appropriate arrangements. Ngati Manuhiri reburied the 2000 burial. Don Prince recorded the remains seen in 2001 (OM183), but the burial was heavily disturbed. However at least two and possibly more individuals were buried there. Four burials were exposed during the 2002 (OM261) season, two of which were relatively intact.

The two intact burials (OM261) were within 5m of each other in the eastern part of NU 2, although the stratigraphy was not clear enough to establish whether they were contemporary:

- **Burial 1:** A single crouched burial of a young middle-age man in a dense charcoal rich sand matrix. Some midden including shell and fishbone was also present and probably relates to a later very deflated use of the area. The hands were apparently placed above the head while the legs were apparently folded back over, and under body with the feet together. The skull was partially damaged by the digger when discovered. The teeth were heavily worn but there were no obvious pathologies.
- **Burial 2:** A young woman buried about 2m west of burial 1, in a similar position. The teeth showed many dark stress lines, with the enamel having not formed properly.

A final burial was found in the north east of the development (OM274), but was heavily disturbed. 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 high dune ridge above the beach and looking over to 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.

Continued on next page

Burial Site Contents

Burial	Description
OM 183	Human bone - 1 complete femur with old break and 2 other femur parts (heads and shaft) indicates 2-3 individuals. Small number of teeth and partial lower plate (frontal) with teeth intact. Fragments of skull, vertebrae, pelvis and numerous unidentified parts. Teeth show signs of wear to pulp cavity. Small number of shell (pipi), fractured rock, charcoal and charcoal stained soil suggest remains separated from midden at time of deposition.
OM 261-1	Jaw fragments and teeth also retained for submission for C-14 dating at Ngati Manuhiri request. Skeleton was buried into previous midden site within the burnt area. No sign of burning on bones or other damage including marks on skull. Bones were in good condition with no obvious signs of osteo-arthritis or other pathologies.
OM 261-2	Second burial found of a young woman (aged between 18-24) and about 5'1" tall (1.55m). The burial was approximately 2m W of Burial 1. The burial was in a similar position to the first with the body in crouched position with legs folded over the chest of the body. Large number of dark stress lines on teeth.
OM 274	Skeleton in foetal position aligned east - west with head to east, lying on right side. The digger removed the upper body including the skull leaving in situ and articulated the left leg, feet etc below the knee, entire right leg, most of the pelvis and right arm and left hand. Hands positioned in the vicinity of the groin.

Continued on next page

Figure 56. OM261 Burials

OM 261. Burial 1 looking NE

OM 261. Burial 1 looking SSW

OM 261. Burial 1 Close-up of mandible

OM 261. Burial 2 looking SSW

OM 261. Burial 2 – Skull showing stress ridges on teeth (closeup)

OM 261. Burial 2 – Incomplete fusing of iliac crest

OM 261. Burial 2 – Robust femur showing bowing

Continued on next page

Figure 57
OM271 burial

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Diet

The sample of Burial 1 from OM261 submitted for radiocarbon assay (see below) also revealed interesting information about diet. While the dating result is described in the final section of the report, 2 other measurements are relevant:

$\delta^{15}N = 15.11$ ‰ and
$\delta^{13}C = -16.34$ ‰.

The combination of $\delta^{15}N$ and $\delta^{13}C$ values is indicative of the food sources consumed by the OM261-1 individual. Marine plants use dissolved bicarbonate during photosynthesis, which is substantially more enriched in $\delta^{13}C$ compared with atmospheric CO_2. Furthermore marine plants also utilize enriched nitrate and ammonium (e.g., Trimble and Macko 1997:138) and these get passed on to marine animals and on to humans.

The values are useful for indicating a variety of dietary changes including shifts in the domestication of various plants, but the focus here is interpreting the results with respect to the contribution of marine resources. Studies of Alaskan Eskimos and Northwest Coast Indians with a majority marine component in their diet have $\delta^{15}N$ values ranging from 17-20‰, compared with agricultural-based populations with values between 6-12‰ (Schoeninger *et al*. 1983 cited in Trimble and Macko 1997:138). The intermediate value from OM261 suggests approximately 50% or higher marine contribution to diet, which is also indicated by the intermediate $\delta^{13}C$ value, where heavily terrestrial based diets with C-3 pathway plants provide a value of around –20-21‰ and C-4 pathway which includes heavily marine based diets of around –11-12‰ (Petchey, pers. comm. 2003).

While comparative data in NZ is not available, this single result raises some interesting questions for future research on diet. Most prominent would be tracking the geographical and temporal dimensions of dietary changes.

Summary

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. The burials were generally located near to the beach and may predate the most concentrated use of the area. The two burials at OM261 were probably roughly contemporary, although the stratigraphic relationship was not clear. Both individuals were probably young adults but the cause of their death is not known. Intriguingly while the young woman shows a large number of periods of high stress regarding diet, the young man appears not to have suffered the same way. We will return to the context of the burials in the concluding section.

MIDDEN ANALYSIS

Method

Introduction

Midden analysis examines the exploitation of specific species, many of which relate to specific habitats, seasons or extraction technologies. This data can then be used to reconstruct some aspects of a broader social, environmental and economic history of the area.

The analysis was carried out to provide an interpretation of the economic and social practices related to the site. For example:

1. Where were the shellfish gathered from, the estuary or the beach?
2. What was the role of shellfish in providing food at the site relative to other food sources?
3. What evidence of the length of occupation – was it seasonal, permanent or repeated seasonal occupation of the same site over many years?
4. Was shellfish consumed on site or preserved off site for later consumption?
5. How large were the groups using the sites?

Many questions can only be answered in conjunction with other analyses and lines of evidence. This analysis begins by examining the species composition of the midden and relating it to the habitats from which the shellfish were collected.

Procedure

It was decided not to sieve the samples in the field as the quantity of material was so great, and the paucity of artefactual material observed suggested that this would have poor returns. This was confirmed after analysis of the bulk samples collected in the first season and no sites located in the second season suggested that this practice should be changed. The bulk sampling strategy from the second season was similar to the first.

In the field, the species composition for each midden was estimated and recorded. In addition a number of midden, and features and test pits within them, were systematically sampled for faunal and environmental analysis (specifically fish, shellfish and charcoal). Soil and sand samples were also taken for analysis. Most samples filled a 5-litre ziplock plastic bag, although on occasion, where a specific feature or lens was sampled, these could be smaller. Samples were returned to the lab for specialist identification, counting and analysis.

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Standardised Analysis

Samples retrieved during excavation were subject to a standardised analysis:

Step	Action
1	**Drying:** Since the moisture content of the samples differed they were first dried in order to provide secure comparisons.
2	**Basic description:** Midden and matrix were examined in order to determine the composition and basic characteristics of each sample.
3	**Detailed description:** Relevant features such as the colour, texture, size, and composition of the midden material and matrix were recorded, as well as fragmentation and extent of burning of shell.
4	**Fragile material retrieved**: At this stage any obvious fragile material such as bone or charcoal was retrieved.
5	**Dry screening:** The samples were then dry screened through 5 mm and 2.5 mm sieves. It was noted that most diagnostic shell fragments were retained in the 5 mm sieve, and that most burnt fragments fell through to the 2.5 mm sieve.
6	**Fish vertebrae recovery:** Occasional fish vertebrae were recovered from the 2.5 mm sieve, but most of this fraction was discarded and only the 5 mm fraction analysed.
7	**Washing, drying and sorting.**
8	**Analysis:** Shellfish, fish, stone and charcoal were separated out and analysed by experts in each field.

Shellfish Analysis

The samples were then sorted, identified and counted to species level.[9] Incomplete hinges and undiagnostic shell fragments were excluded from the minimum number assessment.

Initially, two methods of MNI analysis were applied to the bivalve species of six different samples: the identification of left and right hinges; and the division of the total number of complete hinges/shells by two. As a result of this work, the decision was made to ascertain the minimum numbers of bivalve species simply by dividing the total number of complete hinges/shells by two. Three reasons justify this decision:

1. The differences in the MNI results for all six samples using these two methods were minimal.
2. Many of the samples in the collection comprised extensively burnt shell, often making identification based on the left and right hinges impractical.
3. Given the quantity of material examined (over 150 samples) it would have been impractical to use hinge data for minimal additional information obtained.

Continued on next page

[9] Details regarding shell species identification and habitat were taken from Parkinson 1999.

Method, Continued

The various shell species were also divided into size categories, with the smallest and largest shell sizes recorded. However, the vast majority of shells within each species fell within an easily identifiable size range that was estimated (e.g. 4-5cm for pipi).

To test the accuracy of these estimations, the length of each shell for all species was measured individually in eight of the midden samples. The average length of pipi in all these samples fell between 4.2cm and 4.8cm. The averages for each species in these samples confirmed what was readily apparent: that visual estimation was an accurate gauge of the dominant size class in each sample.

Shellfish

Season 1

Results

In the majority of midden, pipi (*Paphies australis*) predominated, with other species playing a minor role in the diet. Cockle (*Austrovenus stutchburyi*), was the next most common, again reflecting field observations. Other common species included various whelks (*Cominella* sp.), tuatua (*Paphies subtriangulata*), mudsnail (*Amphibola crenata*) and scallop (*Pecten novaezelandiae*). Scallop, owing to its large size, seemed in the field to be more common by number 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 while targeting main species.

The data from each midden analysed has been grouped according to the habitat in which the species is found[10] (Figure 58). Species that can be found in both sandy and muddy habitats predominate in almost all midden. The predominant species is pipi, although a few ostrich foot (*Struthiolaria papulosa*) are also included in this group. When asking the question whether the estuary or the beach was the preferred area for gathering shellfish, pipi cannot answer the question, since they may be gathered from both areas.

Figure 59 shows the same data without the 'beach a/o estuary' category, that is to say discounting the pipi. Here the picture is more varied, although the muddy habitat tends to predominate in most midden. Cockles were more commonly gathered from the estuary than scallop and tuatua from the beach. The exception to this general rule is OM20, which was a unique scallop midden (Figure 60). It is possible that the scallop were specifically targeted for a feast for a particular occasion or for an honoured guest. They may have been gathered from the beach after a storm had washed them ashore, but are more likely to have been collected during low tides.

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[10] OM13 discounts a sample from a lens of small cockle (Feature V), from which 1050 specimens were counted.

Table 16. MNI of shellfish species by habitat found in Season 1 sites

Site number	Number of samples	Pipi (*Paphies australis*)	Other mixed habitat species	Sandy shore species	Cockle (*Austrovenus stutchburyi*)	Other estuarine species	Rocky shore species	Unidentified
OM5	3	749	4	20	23	4	4	
OM9	1	338	2	4	12		1	
OM10	1	314	1	10	2	1	1	
OM11	15	1888	41	354	291	14	10	10
OM13	9	684	48	104	1274	8		2
OM14	1	6	1		3			
OM17	1	145			9			
OM20	2	24	4	54	1		1	
OM24	2	342		4	25			
OM25	1	315		4	3	2	1	
OM26	1	281	3	9	26			
OM29	2	253	1	2				
OM35	6	820	15	40	233		5	6
OM41	1	90						
OM42	5	700	29	114	112	34	3	42
OM47	2	455	5	21	15			2
OM53	4	396	2	7	14	1	1	
OM54	1	200	1	37			1	
OM56	2	490	4	55	80	1	1	2
OM65	2	325	2	4				1
OM81	2	187	84		9		1	3
OM83	1	245	4	12			4	2
OM95	1	210	6	43	36	8	10	4
OM106	2	383	2	5	9			
OM114	2	179	14	16	46	118	80	11
R09/890(OM120)	9	1345	25	190	28		2	5

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Figure 58. Shellfish species from sampled midden in Season 1

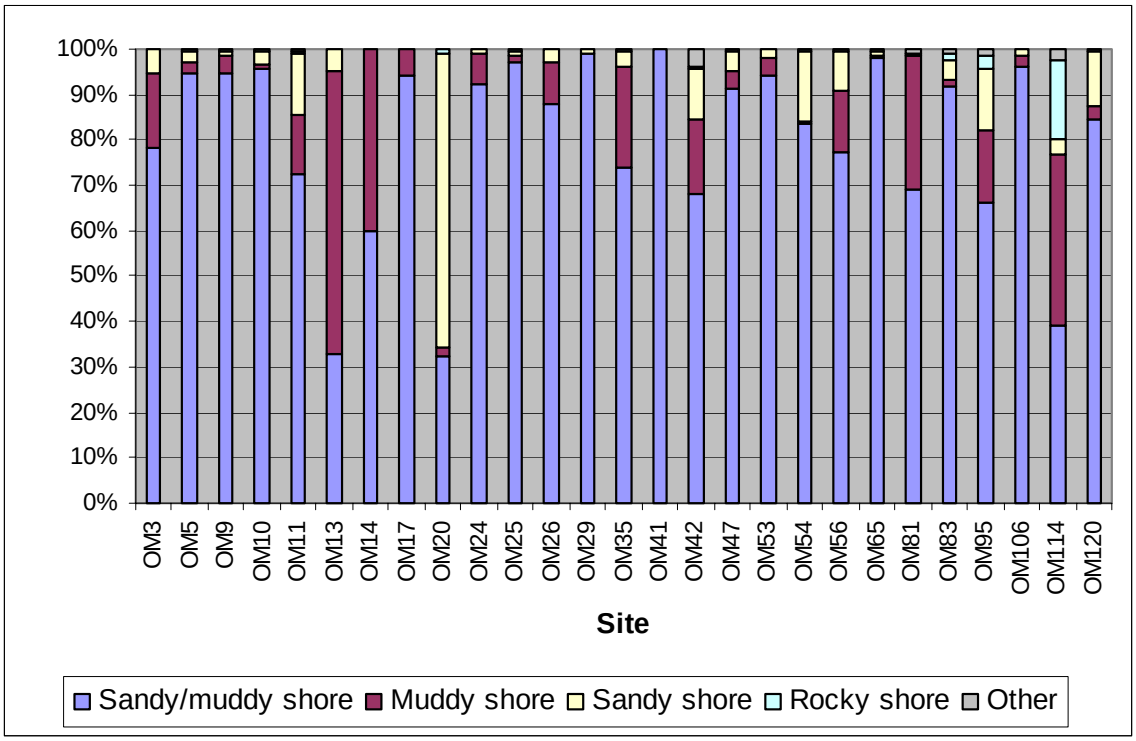

Figure 59. Shellfish species from sampled midden in Season 1 excluding sandy/muddy shore species

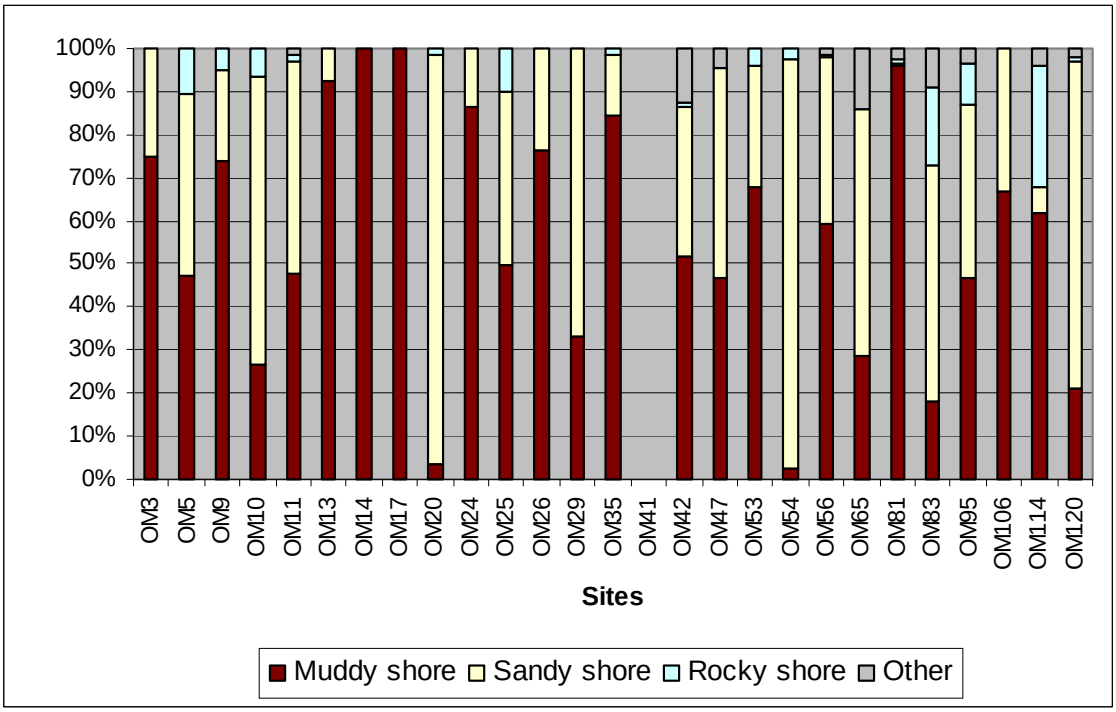

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Figure 60.
Scallop midden OM20

Results

Shellfish samples were sorted, identified and counted to species level. Species identifications follow Parkinson (1999). Numbers are based on counting complete hinges of bivalves and complete terminal whorls of gastropods. Identification based on the separating of left and right hinges was considered impractical (see previous section). As a result, the minimum numbers of bivalve species were ascertained simply by dividing the total number of complete hinges/shells by two. Cleaning and preliminary analysis were carried out by Mica Plowman and final analysis by Dr Matthew Campbell.

Shellfish counts are given in Table 17 by number and percentage. No shellfish were recovered from test pit 5, which contained only sparse and fragmented shell that could not be counted.

It is clear from the table that in all except two samples pipi is by far the most dominant species. In one of these (TP16/S1) the test pit was aimed at sampling a deflated scallop midden, and also the counts are very low and statistically unreliable. It is worth noting, however, that scallops have a much higher meat weight than pipi, so that even a relatively small count of scallop could represent as much food as a much higher count of pipi. The same is true for other large species such as tuatua, though it must be noted that in TP19/S1, where tuatua were present in fairly large numbers (representing 24%), they were the same size as the pipi. This analysis is based entirely on the raw numbers of shell, and does not take meat weight into account.

In other midden the percentages of pipi range from 42.6% to 98.8%. There are three local environments where shellfish can be obtained at Omaha — the nearby sandy beach, the Waikokopu estuary and the rocks at Te Kie Point. Pipi can be found in both the beach and estuarine environments, and so it is difficult to know which environments are being targeted.

Shellfish counts are graphed by habitat in Figure 61, which graphically shows the preponderance of pipi in the majority of samples. In most samples the second most common habitat is the sandy beach, which tends to indicate that the pipi were also taken from the beach. Tuatua represent the majority of the beach habitat shells, and their method of capture is the same as that of their close relative the pipi. Despite a rock outcrop at the southern end of the beach about 1km distant, there are no significant quantities of shellfish from this habitat.

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As for the estuarine habitat, the only significant quantities of shell are from spits 4 – 6 of test pit 19. The stratigraphy of this test pit shows that it was located at the edge of an oven scoop that was subsequently uncovered with the backhoe. Here we see the deposition of a lens of cockle representing the exploitation of the estuary, which is at least 800m distant, followed by the construction of an oven, followed by the deposition of a lens of pipi and tuatua representing the exploitation of the nearby beach environment. All the layers are somewhat mixed into each other, and it is almost certain that, although this is the only well documented stratigraphic change recorded so far in any of the Omaha midden, these events occurred within one or two days, and do not represent a repeated occupation.

Pipi, and in one case cockle, were evidently being deliberately targeted, but other, less common species may only have been an incidental bycatch, taken when the opportunity presented itself. The small scallop midden in midden 5, sampled in test pit 16, is the only example of scallop being deliberately targeted at R09/887, perhaps an opportunistic harvest of shells tossed up onto the beach in a storm.

While each sample was of a standard size, filling a 5 litre plastic bag, the proportion of shell in each sample differed. Some test pits, such as 11 and 12, were located in order to test the heavily deflated areas and since there was no midden below the surface exposure very few shells were obtained. Other test pits, such as 1 or 18, were placed in order to sample denser and deeper midden deposits, and so contain a higher proportion of shell.

Figure 61 and Figure 62 show two measures of midden density — number of identifiable shell specimens per sample, and weight of all shell per sample. In each case the scores are normalised to allow comparison, that is the highest score is expressed as 100% — 715 shells per sample in TP1/S6, and 4315 gm per sample in TP1/S4. Some patterns are fairly clear. In the seven samples from test pit 1 there is, in general, a higher proportional weight of shell than number of shell, while in the six samples from test pit 19 the reverse is true. This indicates one of two things, or a combination of both — either in test pit 1 there is more fragmented, hence uncountable, shell adding to the overall weight, or the shell is larger. An examination of the samples shows that for test pit 1 shell size is generally larger than in most other samples, whereas for test pits 2, 4 and 7, where normalised weight was also higher than normalised number, there is greater fragmentation (estimated at 50%, as against 5 – 25% in test pit 1).
Another noticeable pattern is that in test pit 1 density increases with depth, while the opposite is true in test pit 19. This seems to be related to the changing proportions of estuarine vs. beach species being exploited, but as noted, not too much should be read into this pattern.

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Table 17. Shellfish results for all analysed samples from R09/887, by count and percent

	Beach and / or Estuary						Beach						Estuary				Rock							
	Pipi (*Paphies australis*)		Ostrich Foot (*Struthiolaria papulosa*)		Mud Whelks (*Cominella* sp.)		Tuatua (*Paphies subtriangulata*)		Venus Shell (*Dosinia subrosea*)		Scallop (*Pecten novaezelandiae*)		Cockle (*Austrovenus stutchburyi*)		Mud Snail (*Amphibola crenata*)		Paua (*Haliotis iris*)		Cat's Eye (*Turbo smaragdus*)		Oyster (*Saccostrea cucullata*)		Slipper Shell (*Crepidula costata*)	
Context	MNI	%	MNI	%	MNI	%	MNI	%	MNI	%	MNI	%	MNI	%	MNI	%	MNI	%	MNI	%	MNI	%	MNI	%
TP1/S1	323	98.78	1	0.31	1	0.31	1	0.31	1	0.31														
TP1/S2	273	97.5			1	0.36	3	1.07	3	1.07														
TP1/S3	495	96.12	1	0.19	14	2.72	2	0.39	2	0.39	1	0.19												
TP1/S4	500	93.11	5	0.93	22	4.1	10	1.86																
TP1/S5	510	95.51	1	0.19			10	1.87	1	0.19	1	0.19	11	2.06										
TP1/S6	700	97.9	1	0.14	8	1.12	4	0.56											1	0.14			1	0.14
TP1/S7	620	94.66	1	0.15	5	0.76	18	2.75	5	0.76							1	0.15	5	0.76				
TP2/S2	89	93.68			1	1.05	4	4.21					1	1.05										
TP3/S2	190	93.6			1	0.49	9	4.43	1	0.49			2	0.99										
TP4/S2	342	98.56			2	0.58	1	0.29	1	0.29									1	0.29				
TP6/S2	71	98.61							1	1.39														
TP7/S2	371	89.83					42	10.17																
TP8/S1	20	42.55			1	2.13	15	31.91					11	23.4										
TP9/S1	345	90.55			2	0.52	23	6.04					11	2.89										
TP10/S2	290	95.39			3	0.99	7	2.3	3	0.99					1	0.33								
TP11/S1	8	72.73					1	9.09					1	9.09	1	9.09								
TP12/S1	9	90			1	10																		
TP13/S2	12	85.71					2	14.29																
TP14/S2	490	88.61			1	0.18	58	10.49	1	0.18					3	0.54								
TP15/S2	192	69.31			1	0.36	76	27.44					7	2.53	1	0.36								
TP16/S1	4	20									9	45			7	35								
TP18/S2	480	98.56			1	0.21	4	0.82			1	0.21	1	0.21										
TP19/S1	320	74.42			6	1.4	103	23.95							1	0.23								
TP19/S2	513	85.36			9	1.5	73	12.15	3	0.5			2	0.33					1	0.17				
TP19/S3	427	92.83			2	0.43	20	4.35	7	1.52			4	0.87										
TP19/S4	340	90.67			1	0.27	4	1.07			1	0.27	27	7.2	1	0.27					1	0.27		
TP19/S5	261	82.86			3	0.95	5	1.59	2	0.63	1	0.32	39	12.38	3	0.95			1	0.32				
TP19/S6	28	10.98			3	1.18	1	0.39			3	1.18	220	86.27										

Figure 61. Proportion of shellfish by habitat

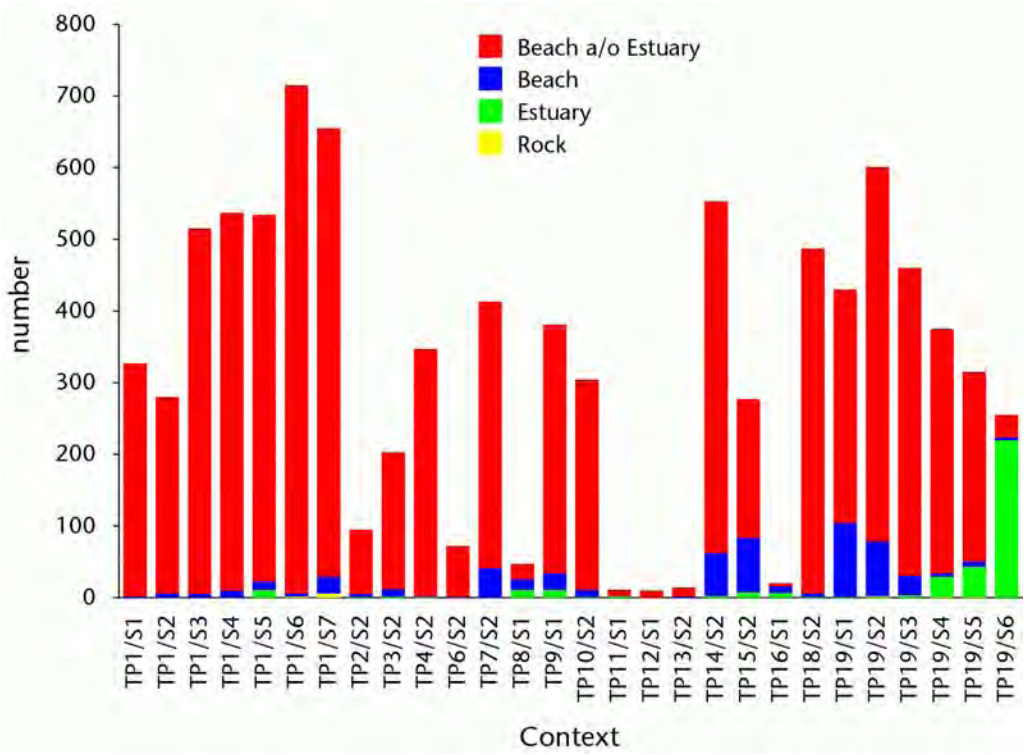
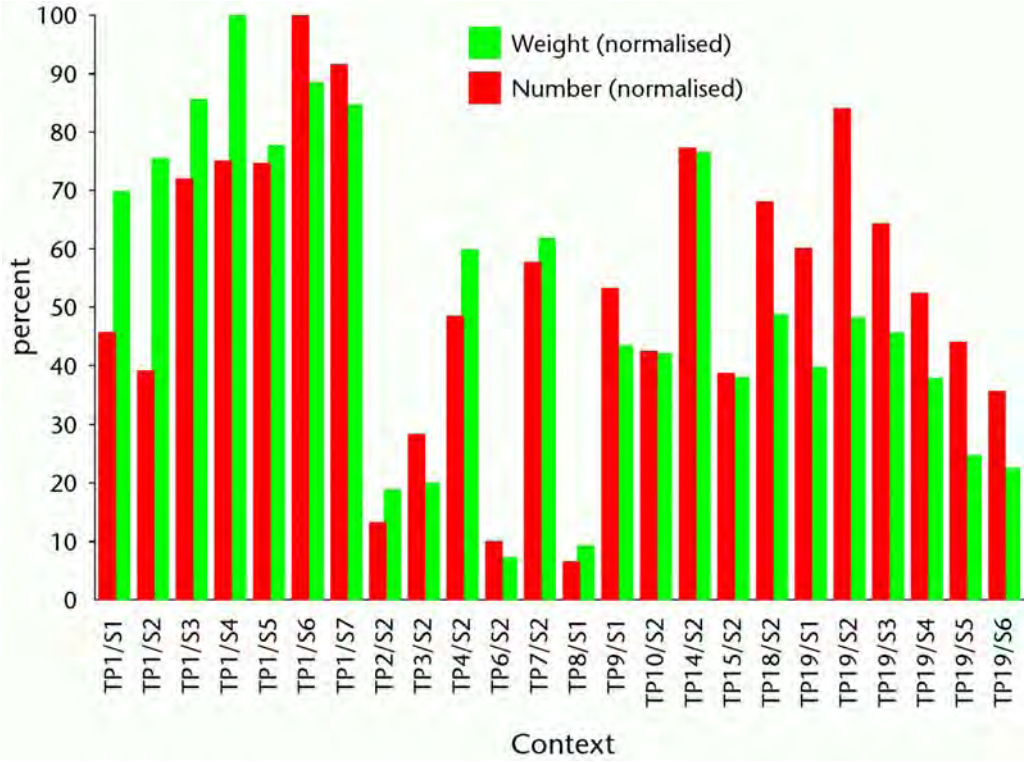


Figure 62. Weight and number of shellfish by test pit



Season 2

Results

The shellfish analysis carried out by Vanessa Tanner included 41 samples from 15 sites. The samples were chosen on the basis of both the size and complexity of the site (the larger and more complex were preferred) and then on the basis of any special features such as the burial site, OM271, and the putative early site, OM209.

Site	Total
OM208	5
OM209	2
OM213	3
OM215	7
OM219	4
OM220	3
OM222	1
OM228	1
OM242	1
OM245	2
OM251	1
OM259	4
OM263	3
OM268	3
OM261	1
Grand Total	41

As the trenching used in Season 2 allowed for greater stratigraphic control than available for Season 1, multiple samples from sites could be taken from the features and compared. The results (as shown in the Example sites in the previous section), however, suggested very little difference between features relating to 'time' and rather reflected the selection of pipi in most cases with occasional concentrations of other species usually at the same time.

The species identified in the samples are shown in Table 18 and percentages of shellfish by habitat in Table 19. Pipi, cockle and tuatua again dominate the assemblage. Pipi was found throughout the sites, although there were occasional small cockle and scallop dominated midden (but were not included in this current sample).

The variability of species identified in Season 2 was more extensive than in Season 1, but these represented very minor components of the assemblages. Of the minor species, whelks and mudsnails were common, while small concentrations of trumpet shells and toheroa were found on particular sites.

The results tend to bear out the data from the previous season's analysis with exploitation of the nearby estuary (muddy shore) and sandy shore shellfish species. Smaller numbers of rocky shore species were probably not specifically targeted but picked up at opportune times.

There was no obvious change through time in the selection of species and differences between individual features tended to reflect more specific collections made during the use of a particular site. These targeted species, such as scallop, toheroa, and cockle, might be cooked up separately in the midden zone and either eaten or preserved. Frequently, though, small numbers of a range of species were probably just cooked along with the pipi.

Continued on next page

Table 18. MNI counts for shellfish from Season 2 by site and habitat

[Sandy/muddy shore and Sandy shore species)]

		Sandy/muddy shore		**Sandy shore**							
		PIPI	OSTRICH. FT.	WHEEL SHELL	VOLUTE SHELL	TUATUA	TOHEROA	SCALLOP	RINGED VENUS	LACE COCKLE	KNOBBED WHELK
Site	Sample	*Paphies australis*	*Struthiolaria papulosa*	*Zethalia zelandica*	*Alcithoe arabica*	*Paphies subtriangulata*	*Paphies ventricosa*	*Pectin novaezelandiae*	*Dosinia anus*	*Divaricella huttonia*	*Austrofusus glans*
208	bulk sample 1	252				2		1			
	bulk sample 2	369	1			48		1			
	bulk sample 3	41	4								4
	bulk sample 4	285				21		1		1	
	Feature 3, sample 5	190				5		1			
208 Total		1137	5			76		4		1	4
209	- RC 1	308				2					
	- RC 2	251									
209 Total		559				2					
213	Feature 1	218	1			5		1			
	Feature 2	114				1		1			
	Feature 3	617		5		10			1		
213 Total		949	1	5		16		2	1		
215	Feature 3	251			2		7	2			
	Layer 7	321		2		38					
	Layer 9	48				3					
	Sample 6, Trench 2, Layer 5	238		2		51					
	Trench 3, Sample 12	44				3					
	Trench 3, Sample 13	363				27					
	Trench 3, sample 4	118				12		4			
215 Total		1383		4	2	134	7	6			
219	Trench 1, Feature 5, Sample1	334	2			2					

		Sandy/muddy shore		Sandy shore							
		PIPI	OSTRICH. FT.	WHEEL SHELL	VOLUTE SHELL	TUATUA	TOHEROA	SCALLOP	RINGED VENUS	LACE COCKLE	KNOBBED WHELK
Site	Sample	*Paphies australis*	*Struthiolaria papulosa*	*Zethalia zelandica*	*Alcithoe arabica*	*Paphies subtriangulata*	*Paphies ventricosa*	*Pectin novaezelandiae*	*Dosinia anus*	*Divaricella huttonia*	*Austrofusus glans*
	Trench 2, Feature 1, Sample 1	68	1			44		1			
	Trench 2, Feature 1, Sample 2	63				28					
	Trench 2, Feature 2, Sample 1	251		3		44					
219 Total		716	3	3		118		1			
220	Feature 2, Sample 4, Midden Layer	70				4					
	Feature 3, Sample 1	184				80		1			
	Layer 2, Sample 7	216	1	1		14		9			
220 Total		470	1	1		98		10			
222	Sample 6, Layer 1 midden	101	1			49		9			
222 Total		101	1			49		9			
228	Sample 2, Layer 2	50				1		1			
228 Total		50				1		1			
242	Sample 1	156				19					
242 Total		156				19					
245	bulk sample 1	325				2					
	Sample 2, Midden Layer 2	41						1			
245 Total		366				2		1			
251	Trench 1, Sample 1	460				2	1	1			
251 Total		460				2	1	1			
259	Profile 1, Sample 1	9				1		1			
	Profile 2, Sample 2	44									
	Profile 2, Sample 4	469									
	Trench 3, Layer 3	484				82		3			
259 Total		1006				83		4			
263	Feature 1, Sample 2	329		4		20		1	1		
	Feature 2	337				43					
	Trench 1, East Baulk,	358	1	1		22		1	1		

		Sandy/muddy shore		Sandy shore							
		PIPI	OSTRICH. FT.	WHEEL SHELL	VOLUTE SHELL	TUATUA	TOHEROA	SCALLOP	RINGED VENUS	LACE COCKLE	KNOBBED WHELK
Site	Sample	*Paphies australis*	*Struthiolaria papulosa*	*Zethalia zelandica*	*Alcithoe arabica*	*Paphies subtriangulata*	*Paphies ventricosa*	*Pectin novaezelandiae*	*Dosinia anus*	*Divaricella huttonia*	*Austrofusus glans*
	Sample 2										
263 Total		1024	1	5		85		2	2		
268	Bulk Sample 3, Feature 3	20				5		1			
	Bulk Sample 1, Feature 1	44				1		6			
	Bulk Sample 2, Feature 2	225				2			1		
268 Total		289				8		7	1		
271	Burial Sample 1	17				8					
271 Total		17				8					
Grand Total		**8683**	**12**	**18**	**2**	**701**	**8**	**48**	**4**	**1**	**4**

Continued on next page

Table 18 **(continued) Muddy and Rocky shore species**

		Muddy shore						**Rocky shore**								**Other**	Grand Total
		WHELK	TURRET SHELL	SPECKLED WHELK	SIPHON WHELK	MUDSNAIL	COCKLE	TRUMPET	TOP SHELL	SWOLLEN TRUMPET	PAUA	OYSTER	LIMPET SHELL	KINA	CAT'S EYE		
Site	Sample	*Buccinidae family*	*Maoricolpus roseus*	*Cominella adspersa*	*Penion sulcatus*	*Amphibola crenata*	*Austrovenus stuchburyi*	*Cabestana spengleri*	*Trochidae family*	*Argobuccinum pustulosum tumidum*	*Haliotis iris*	*Saccostrea cucullata*	*Limpet superfamily*	*Evechinus chloroticus*	*Turbo smaragdus*		
208	bulk sample 1				1	1	1					1				1	260
	bulk sample 2					16	3						1		2		441
	bulk sample 3			90	3		1			4							147
	bulk sample 4	1				3	2		1				2				317
	Feature 3, sample 5	1					46					1	1				245
208 Total		2		90	4	20	53		1	4		2	4		2	1	1410
209	- RC 1	1					2										313
	- RC 2	2	1				6								5		265
209 Total		3	1				8								5		578
213	Feature 1	21					8				1	1		1	6		263
	Feature 2	5				1	3					1			1		127
	Feature 3	1					2						3		1		640
213 Total		27				1	13				1	2	3	1	8		1030
215	Feature 3				2		1	2		20							287
	Layer 7	3					14		1								379
	Layer 9		1			1	6										59
	Sample 6, Trench 2, Layer 5					1	13						2				307
	Trench 3, Sample 12						6										53

		Muddy shore						Rocky shore								Other	Grand Total
		WHELK	TURRET SHELL	SPECKLED WHELK	SIPHON WHELK	MUDSNAIL	COCKLE	TRUMPET	TOP SHELL	SWOLLEN TRUMPET	PAUA	OYSTER	LIMPET SHELL	KINA	CAT'S EYE		
Site	Sample	*Buccinidae family*	*Maoricolpus roseus*	*Cominella adspersa*	*Penion sulcatus*	*Amphibola crenata*	*Austrovenus stuchburyi*	*Cabestana spengleri*	*Trochidae family*	*Argobuccinum pustulosum tumidum*	*Haliotis iris*	*Saccostrea cucullata*	*Limpet superfamily*	*Evechinus chloroticus*	*Turbo smaragdus*		
	Trench 3, Sample 13	1					11										402
	Trench 3, sample 4	1				1	4					1					141
215 Total		5	1		2	3	55	2	1	20		1	2				1628
219	Trench 1, Feature 5, Sample1						1						2		1		342
	Trench 2, Feature 1, Sample 1					10	112	1				1					238
	Trench 2, Feature 1, Sample 2	1					5										97
	Trench 2, Feature 2, Sample 1	1				1	23						1				324
219 Total		2				11	141	1				1	3		1		1001
220	Feature 2, Sample 4, Midden Layer	1				1	10										86
	Feature 3, Sample 1	1					3										269
	Layer 2, Sample 7	3					5					1					250
220 Total		5				1	18					1					605
222	Sample 6, Layer 1 midden	7					1								1		169

		Muddy shore						Rocky shore								Other	Grand Total
		WHELK	TURRET SHELL	SPECKLED WHELK	SIPHON WHELK	MUDSNAIL	COCKLE	TRUMPET	TOP SHELL	SWOLLEN TRUMPET	PAUA	OYSTER	LIMPET SHELL	KINA	CAT'S EYE		
Site	Sample	*Buccinidae family*	*Maoricolpus roseus*	*Cominella adspersa*	*Penion sulcatus*	*Amphibola crenata*	*Austrovenus stuchburyi*	*Cabestana spengleri*	*Trochidae family*	*Argobuccinum pustulosum tumidum*	*Haliotis iris*	*Saccostrea cucullata*	*Limpet superfamily*	*Evechinus chloroticus*	*Turbo smaragdus*		
222 Total		7					1								1		169
228	Sample 2, Layer 2					1			1								54
228 Total						1			1								54
242	Sample 1	7				1	85					1	1				270
242 Total		7				1	85					1	1				270
245	bulk sample 1	5			2		4		3								341
	Sample 2, Midden Layer 2	3					12										57
245 Total		8			2		16		3								398
251	Trench 1, Sample 1	20			1		3										488
251 Total		20			1		3										488
259	Profile 1, Sample 1						3					2	1				17
	Profile 2, Sample 2						1					1					46
	Profile 2, Sample 4	1					3										473
	Trench 3, Layer 3	7					15		2			1					594
259 Total		8					22		2			4	1				1130
263	Feature 1, Sample 2	9				2	8		4								378
	Feature 2	1				1	10										392
	Trench 1, East Baulk, Sample 2	8					6						1		1		400
263 Total		18				3	24		4				1		1		1170
268	Bulk Sample 3,						1										27

		Muddy shore						Rocky shore								Other	Grand Total
		WHELK	TURRET SHELL	SPECKLED WHELK	SIPHON WHELK	MUDSNAIL	COCKLE	TRUMPET	TOP SHELL	SWOLLEN TRUMPET	PAUA	OYSTER	LIMPET SHELL	KINA	CAT'S EYE		
Site	Sample	*Buccinidae family*	*Maoricolpus roseus*	*Cominella adspersa*	*Penion sulcatus*	*Amphibola crenata*	*Austrovenus stuchburyi*	*Cabestana spengleri*	*Trochidae family*	*Argobuccinum pustulosum tumidum*	*Haliotis iris*	*Saccostrea cucullata*	*Limpet superfamily*	*Evechinus chloroticus*	*Turbo smaragdus*		
	Feature 3																
	Bulk Sample 1, Feature 1						2										53
	Bulk Sample 2, Feature 2						5					1					234
268 Total							8					1					314
271	Burial Sample 1	1				1	15										42
271 Total		1				1	15										42
Grand Total		**113**	**2**	**90**	**9**	**42**	**462**	**3**	**12**	**24**	**1**	**13**	**15**	**1**	**18**	**1**	**10287**

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Table 19. Percentage of shellfish by habitat, Season 2 sites

Site	Sandy/muddy shore	Sandy shore	Muddy shore	Rocky shore	Other
208	80.99%	6.03%	11.99%	0.92%	0.07%
209	96.71%	0.35%	2.08%	0.87%	0.00%
213	92.23%	2.33%	3.98%	1.46%	0.00%
215	84.95%	9.40%	4.05%	1.60%	0.00%
219	71.83%	12.19%	15.38%	0.60%	0.00%
220	77.85%	18.02%	3.97%	0.17%	0.00%
222	60.36%	34.32%	4.73%	0.59%	0.00%
228	92.59%	3.70%	1.85%	1.85%	0.00%
242	57.78%	7.04%	34.44%	0.74%	0.00%
245	91.96%	0.75%	6.53%	0.75%	0.00%
251	94.26%	0.82%	4.92%	0.00%	0.00%
259	89.03%	7.70%	2.65%	0.62%	0.00%
263	87.61%	8.03%	3.85%	0.51%	0.00%
268	92.04%	5.10%	2.55%	0.32%	0.00%
271	40.48%	19.05%	40.48%	0.00%	0.00%

Fishbone

Season 1

Introduction

Questions to be asked from the analysis included:

1. What species were targeted?
2. By what methods were they caught?
3. What was the role of fishing at the site?
4. What evidence is there of bulk preparation for preservation?
5. Many questions can only be answered in conjunction with other analyses and lines of evidence.

Fishbone was separated from midden samples during initial sieving, cleaning and sorting. It was then passed to Matthew Campbell for analysis. The analytical method was adapted from that outlined in Leach (1997). Fishbone was sorted according to anatomical element, with dentaries, articulars, quadrates, maxillas, premaxillas (the five 'standard' mouthparts commonly used, separated into lefts and rights) retained for species identification and counting, and vertebrae retained for counting only. It is possible to identify vertebrae to species level, but this is time consuming, and given the low numbers of fish it was decided just to count them. The ratio between vertebrae and mouthparts gives an indication of how different parts of the body were treated. Mackerel (*Trachurus* spp.) scutes, small bones beneath the skin along the lateral line, especially near the tail, were also retained for counting. Identifications of elements were carried out using the comparative collection at the Anthropology Department, University of Auckland. Species identifications and scientific names were confirmed from Paulin *et al.* (1989).

Results

Table 20 summarises the results. Two counts are given in the table, MNI and NISP. MNI refers to the Minimum Number of Individuals and is the same as the number of the most frequent element for that species. Thus, if left dentaries are the most commonly identified element of a species, and there are 17 of them, then there must be at least 17 fish represented. MNIs in Table 20 are totals for each midden with the MNI of each assemblage (sample bag) added together. NISP refers to the Number of Identified Specimens, and is the sum of all the identified bones for that species.

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Fishbone results

Fishbone was not commonly observed in the midden. Of a total number of 80 samples from 28 midden analysed to date, only 41 samples from 17 midden yielded fishbone, and then only in small quantities. A number of samples deliberately targeted fishbone, so that even this small quantity probably over-represents fishing at the site. Table 20 shows a summary of the identified fishbone. The most numerous identified species is jack mackerel (*Trachurus* sp.) for which a total MNI of 17 was obtained. Five barracouta (*Thyrsites atun*), five snapper (*Pagrus auratus*), one kahawai (*Arripis trutta*), one red gurnard (*Chelidonicthys kumu*) and one unidentified species of the Carangid family (trevallies) were also identified. 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). In general, however, there are too few fish to say anything meaningful about fishing methods or exploitation. 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 more easily in the past, indicating a subsistence strategy at the site that did not target bony fish, or preparation techniques for preservation that resulted in few bones being left on site. It is also likely that consumption by dogs contributed to under representation of fish in the midden. 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 perhaps only on a small scale. From the analysis, fishing may only have been a sporadic activity, and not central to the main use of the spit.

Generally there are fairly high quantities of vertebrae 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.

Shark and ray species were targeted for consumption along this general area of the east coast (based on oral traditions – see review in the introduction of the report), but they lack bones and have a cartilaginous skeleton, which tends not to be preserved in archaeological sites. Shark teeth preserve well, but none have been identified to date. While shark and ray undoubtedly played a role in the economy of the area, the analysis cannot answer any questions about this role.

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Exception to the pattern

The exception to this general pattern is the fishbone from OM47. This midden contained a small dense deposit of very fine fishbone, of which about half the deposit was sampled. Only a small proportion was analysed, perhaps 10% of the entire deposit, and this revealed only one species of unidentified fish and a single mackerel scute. The fishbone here is very small and represents either an unknown juvenile or small species of fish, almost certainly netted. An MNI of 17 was obtained for this 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. Also body parts are differently represented.

A total of 83 mouthparts was identified,[11] 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. The postholes may be modern, since they have vertical sides, but in plan they are oval or subrectangular. They were evidently not cut with an iron tool, but they may have been driven into the soft sand.

This combination of differential treatment of body parts and possible drying racks is the only indication that some sort of fish processing was being carried out here, with heads being discarded and bodies processed and preserved, but it is circumstantial, and may as easily indicate a specialised method of food preparation.

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[11] Not counting premaxilla, which were not identified, and 10 dentaries which were only tentatively identified.

Table 20. Summary statistics for fishbone from Omaha midden, Season 1

Site	number of samples	number with fishbone	Species	MNI	NISP*	Vertebrae
OM5	4	2	*Thyrsites atun*	1	2	
OM11	15	6	*Pagrus auratus*	1	2	
			Trachurus sp.	1	2	
			Fish sp.			53
OM13	11	4	*Thyrsites atun*	1	2	
			Trachurus sp.	2	6	
			Fish sp.			11
OM14	2	1	*Trachurus* sp.	1	1	
			Fish sp.			1
OM17	1	1	Fish sp.			2
OM32	1	1	*Trachurus* sp.	1	5	
			Fish sp.			12
OM35	8	3	*Trachurus* sp.	1	2	
			Fish sp.			1
OM42	10	8	*Arripis trutta*	1	2	
			Carangidae sp.*?*	1	1	
			Pagrus auratus	1	3	
			Thyrsites atun	1	2	
			Trachurus sp.	3	33	
			Fish sp.			174
OM47	2	1	*Trachurus* sp.	1	1	
			Small fish sp.	17	83	
			Small fish sp.			33
OM53	4	2	*Chelidonichthys kumu*	1	1	
			Fish sp.			3
OM54	1	1	*Trachurus* sp.	1	2	
			Fish sp.			6
OM56	2	1	*Thyrsites atun*	1	1	
			Fish sp.			2
OM81	3	2	Fish sp.			2
OM95	1	1	*Trachurus* sp.	1	1	
			Fish sp.			43
OM106	2	1	Fish sp.			1
OM114	2	2	*Pagrus auratus*	1	4	
			Trachurus sp.	4	11	
			Fish sp.			148
R09/890	9	4[§]	*Pagrus auratus*	2	4	
OM120			*Thyrsites atun*	1	2	
			Trachurus sp.	1	1	
			Fish sp.			12

Notes:

* NISP for *Trachurus* includes scutes (25 out of total NISP of 65)

[§] Not including isolated finds on the surface of the deflated midden

Introduction

Fish bone was collected from the site by three different methods:

1. Firstly, any fish bone recovered from test pit spit samples during screening was separated out for later analysis. The screen size used was 5 mm.
2. Secondly, any clearly dense deposits of fish bone observed during test pit excavation were sampled separately.
3. Lastly, four 5 litre samples were taken from dense fish bone deposits observed when the midden were removed by back hoe after test pit excavation was completed.

Samples collected by methods 2 and 3 were wet screened through an approximately 1 mm kitchen sieve, which enabled the collection of many smaller elements and bone from smaller species than the 5 mm screen. The method of collection is indicated in Table 21.

Dr Matthew Campbell carried out the fish bone analysis. The analytical method was adapted from that outlined in Leach (1997). Fishbone was sorted according to anatomical element, with dentaries, articulars, quadrates, maxillas, premaxillas (the five 'standard' mouthparts commonly used, separated into lefts and rights) and otoliths (bony structures in the ears) retained for species identification and counting. Vertebrae were not counted in this instance (cf. Campbell *et al.* 2001:29). Identifications of elements were carried out using the comparative collection at the Anthropology Department, University of Auckland. Species identifications and scientific names were confirmed from Paulin *et al.* (1989).

Results

Table 21 summarises these statistics. Two counts are given in the table, MNI and NISP. Counts for all fish bone from each test pit were combined. Although the bone from test pit 19 refers to the same deposit as sample 2, this was counted separately because of the smaller screen size used.

Only four fish species were identified, the majority of which were snapper (*Pagrus auratus*) or jack mackerel (*Trachurus* sp.). Barracouta (*Thyrsites atun*) and blue mackerel (*Scomber australasicus*) were recovered in significantly lesser numbers and at least two species of fish were not identified. One of these, referred to as small fish sp., was recovered in large numbers in the 1 mm sieve from one of the post-excavation samples. Very few bones at all were recovered from the test pits, either during excavation or in the sieve.

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Fishing at R09/887

The exception is test pit 19, which, as has been noted, represents the same deposit as sample 2. Samples 2 and 3 contain the majority of identified fish bone. Like test pit 19 these were located in midden 5, and represent the only particularly dense deposit of fish bone recovered from anywhere in Omaha to date. This only underlines the conclusions reached in the previous fish bone analysis (Campbell *et al*. 2001:37), that fishing at Omaha was an activity that was opportunistic, and peripheral to the main use of the area, which seems to have centred on shellfish exploitation. It must be noted, of course, that fish bone is considerably more fragile than shell, and that often it has been observed in the midden but has crumbled away when exposed. However, this is not a particularly common occurrence and makes no difference to the general observation. If shark were being exploited, as has been suggested (Campbell *et al*. 2001:36), their cartilaginous skeleton would not be expected to survive (their teeth might, but no shark teeth have been recovered).

Given the importance of the site to the project, it was decided to conduct a further analysis of the fishbone from R09/887. The initial analysis had been carried quickly as part of the damage assessment project and the relative paucity of fishbone from the Omaha midden at the end of the second season justified the analysis of additional samples that could assist in interpretation. Charlotte Judge carried out the additional analysis and the results are presented in the table below.

The results matched that of the initial analysis. Three of the four species identified initially were found in these samples: jack mackerel, blue mackerel, and snapper. Barracouta was not found and no other species were identified.

The dense concentration of snapper and jack mackerel in midden 5 is in itself quite instructive of the types of fishing activity carried out at Omaha, and perhaps of the overall exploitation of the area through time. Some of the snapper bone is very large indeed — an initial estimate puts two individuals at only just short of 1 metre in length. While there are a few of medium size there are also a great many that are rather small;[12] in fact they compare in size to the majority of the mackerel. Normally we would expect most snapper to be of medium size, with some small individuals and very few, if any, of the exceptional size of the largest.

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[12] A full size analysis of the snapper is possible, but does not form part of this report. Any statements about the size of fish bone from midden 5 are based on subjective impressions only.

Implications

There are two implications of this. Firstly it seems likely that two fishing technologies are being employed in this instance — the large and medium sized snapper are being caught on baited hooks or trolling lures, which is also the case for barracouta and blue mackerel. Jack mackerel (actually a type of trevally or kingfish [family *Carangidae*] and not closely related to blue mackerel) may also be caught with hooks, but were also taken in nets as they ran with the tide (Best 1977:53). It seems most likely that this is how the jack mackerel in midden 5 at least were caught, and that the small sized snapper were taken with them. A further implication regarding technology follows from this — that lure or hook fishing was carried out from canoes. Barracouta are best caught with a specialised trolling technology. Their exploitation is particularly important on the east coast of the South Island, where relatively calm waters facilitate easy capture (Anderson 1981:155).

While no comparison with other Hauraki Gulf/North Auckland fish assemblages has yet been made, the presence of barracouta in this assemblage indicates trolling from canoes on the calm seas of Omaha Bay, sheltered by the Barrier Islands.

The second implication of this analysis is more speculative at present, but the size distribution and the inclusion of at least two very large individuals indicates that midden 5 was occupied at a time when the local environment had not been so heavily exploited as to wipe out all the largest individuals. In fact it seems an attractive interpretation that midden 5 represents a return to Omaha, where a previous occupation had removed some of the largest individuals from the environment, but enough time had elapsed for a number of medium sized fish to come to maturity — in other words enough time had elapsed for a partial recovery of the population. This points to at least one earlier occupation of R09/887 than that represented by midden 5, but this could only be confirmed through radiocarbon dating.

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Table 21. Fish species identified in R09/887

Context	Sampled during excavation	Extracted from sieve	Sampled after excavation	Species	MNI	NISP
Test pit 1	x	x		*Scomber australasicus*	1	2
				Thyrsites atun	1	2
				Trachurus sp.	2	4
Test pit 2		x		*Trachurus* sp.	1	1
Test pit 18	x			*Pagrus auratus*	1	1
				Trachurus sp.	1	1
				Fish sp.	1	1
Test pit 19	x	x		*Pagrus auratus*	7	30
				Thyrsites atun	1	4
Sample 1			x	*Thyrsites atun*	1	4
			x	*Pagrus auratus*	1	48
			x	Fish sp.	1	67
				Small fish sp.	13	46
Sample 2			x	*Pagrus auratus*	62	380
				Thyrsites atun	1	1
				Trachurus sp.	40	211
			x	Fish sp.	3	96
Sample 3			x	*Pagrus auratus*	16	191
				Scomber australasicus	1	1
				Thyrsites atun	1	1
				Trachurus sp.	20	115
				Fish sp.	11	134
Sample 4			x	*Pagrus auratus*	5	35
				Trachurus sp.	8	22
				Scomber australasicus	1	1
				Fish sp.	3	41
				Small fish sp.	1	1

Season 2

Results

Recovery of fishbone was similar to that of Season 1. The fifteen sites chosen for shellfish analysis also provided fishbone (Table 22). Most of the same species found in Season 1 were represented in Season 2 samples. Trevally was found everywhere, with Jack mackerel and Snapper found at most sites as well. The only marked difference between the results was the preponderance of trevally identified.

Although not all fishbone can be identified, analysis identified a large quantity of small fishbone that was diagnostic but whose characteristics could not be matched to the comparative collection. Fourteen small quadrates (12 left, 2 right) from OM219 features were identified and considered to be similar to species of the family *Oreosamatidae* (common name Oreos).

These quadrates were unusual, as they were not identified in other samples examined in Season 2. They possibly represent juvenile fish.

As in Season 1, the indications are that the fish was predominantly gathered by trolling and/or baited hook. However, we note the presence of the netsinker in OM263 which demonstrates that netting was also an option.

Table 22. Identified fish species from Season 2 sites

Site	Blue mackerel	Carangidae	Fish	Flounder (?)	Jack Mackerel	Kahawai	Snapper
OM208	X	X	X		X		X
OM209		X					
OM213		X			X		X
OM215		X		X	X		X
OM219		X			X	X	X
OM220		X			X		X
OM222		X			X		
OM228		X			X		
OM242		X			X		X
OM245		X			X		X
OM251		X			X	X	X
OM259	X	X			X		X
OM263		X			X		
OM268		X			X		
OM261	X	X			X	X	X

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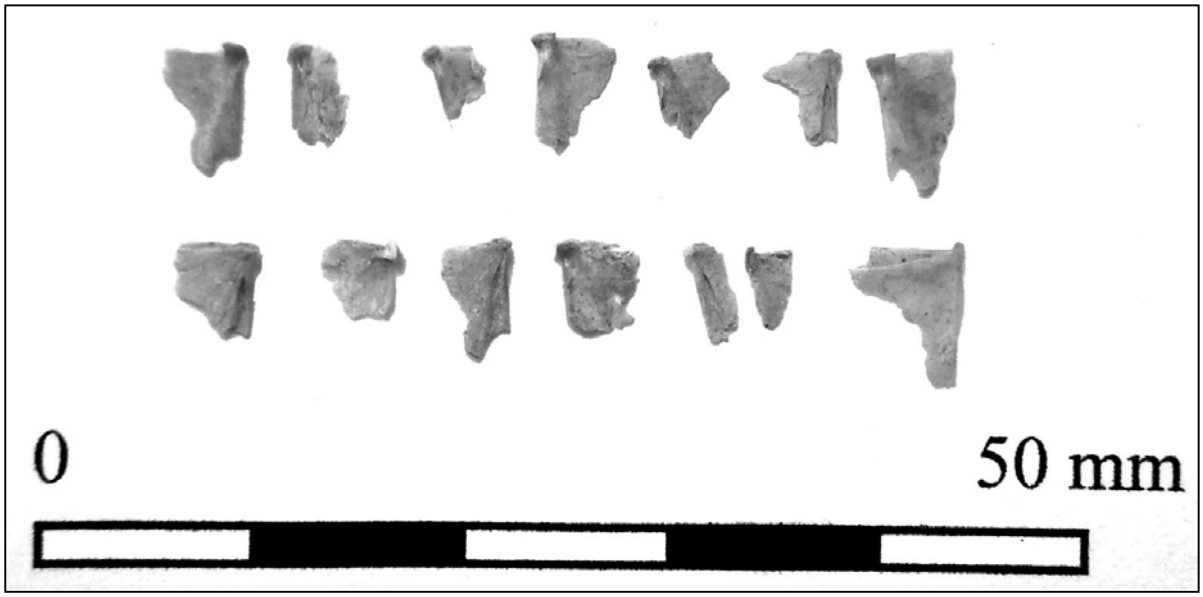
Figure 63. Quadrates from OM219 from unidentified fish



Discussion

Results

The results of the fishbone analysis are summarised in Table 23. Most of the midden from which fishbone was recovered were relatively large and complex. In almost all cases fishbone was recovered in midden that contain strong evidence of cooking, often in direct association with oven scoops and rakeout. Again, the small numbers might indicate that fishing was a peripheral activity, with perhaps individuals catching their own fish within the wider context of shellfish exploitation. Shell is so much more numerous than fish that it is clear that shellfish exploitation was the major activity carried out at Omaha.

However, one other strong possibility is that preservation of fishbone may be significantly underrepresented because of dogs scavenging and eating the fishbone. Large quantities of such bone may therefore be deposited away from the midden and lead to its under-representation in excavations. Preservation and removal of fish from the area is also likely to have been a factor.

Furthermore as mentioned earlier, the traditional history relating to shark fishing along this coast cannot be overlooked, and along with the poor archaeological preservation of shark, should be taken into account in the interpretation of events at Omaha. The analysis indicates that both beach and estuary were targeted, with some indication that pipi and cockle from the estuary were exploited more regularly. This would make sense, as the harbour/ estuarine environment would have more extensive shellfish beds than the beach. It is also a more sheltered environment facilitating easier collection. Occasional other species, such as scallop or oyster, could also be specifically targeted, but this seems to be in the same class as fishing — a peripheral activity carried out when the opportunity presented itself, within the context of pipi and cockle gathering.

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Table 23. MNI and NISP for fish counts for all sampled sites

Site	Data	Jack mackerel	Snapper	Unidentified (small)	Unidentified	Trevallies	cf. oreo-somatidae	Barracouta	Blue mackerel	Kahawai	Red Gurnard	Flounder (?)	Total
5	MNI							1					1
	NISP*							2					2
11	MNI	1	1										2
	NISP*	2	2										4
13	MNI	2						1					3
	NISP*	6						2					8
14	MNI	1											1
	NISP*	1											1
17	MNI												
	NISP*												
32	MNI	1											1
	NISP*	5											5
35	MNI	1											1
	NISP*	2											2
42	MNI	3	1			1		1		1			7
	NISP*	33	3			1		2		2			41
47	MNI	1		17									18
	NISP*	1		64									65
53	MNI										1		1
	NISP*										1		1
54	MNI	1											1
	NISP*	2											2
56	MNI							1					1
	NISP*							1					1
80	MNI												
	NISP*												
95	MNI	1											1

Site	Data	Jack mackerel	Snapper	Unidentified (small)	Unidentified	Trevallies	cf. oreo-somatidae	Barracouta	Blue mackerel	Kahawai	Red Gurnard	Flounder (?)	Total
	NISP*	1											1
106	MNI												
	NISP*												
114	MNI	4	1										5
	NISP*	11	4										15
120	MNI	1	2					1					4
	NISP*	1	4					2					7
208	MNI	2	1			1			2				6
	NISP*	29	3		181	6			1				220
209	MNI					1							1
	NISP*				3	1							4
213	MNI	1	1			1							3
	NISP*	3	1		10	1							15
215	MNI	2	1			1						1	5
	NISP*	3	1		101	65						1	171
219	MNI	5	3			2	12			1			23
	NISP*	31	9		467	134	14			2			657
220	MNI	1	1			1							3
	NISP*	2	1		24	1							28
222	MNI	1				1							2
	NISP*	3			32	32							67
228	MNI	1				1							2
	NISP*	1				4							5
242	MNI	1	1			1							3
	NISP*	5	2		43	8							58
245	MNI	1	1			1							3
	NISP*	2	4		27	5							38
251	MNI	4	4			1				1			10

Site	Data	Jack mackerel	Snapper	Unidentified (small)	Unidentified	Trevallies	cf. oreo-somatidae	Barracouta	Blue mackerel	Kahawai	Red Gurnard	Flounder (?)	Total
	NISP*	16	14		118	15				2			165
259	MNI	1	1			1			2				5
	NISP*	2	1		36	8			3				50
263	MNI	1				1							2
	NISP*	3			80	5							88
268	MNI	2											2
	NISP*	7			3								10
271	MNI	11	3			1			1	1			17
	NISP*	48	24		129	66			6	2			275
R09/887	MNI	75	92	14	16			5	3				205
	NISP*	450	685	47	243			12	4				1441
Total Sum of MNI		126	114	31	16	16	12	10	8	4	1	1	339
Total Sum of NISP*		670	758	111	1497	352	14	21	14	8	1	1	3447

Other Items

Artefacts

Results

Very few artefacts were recovered from the archaeological sites at Omaha, either during the excavations or from sieving of the midden samples. The dearth of artefacts is also noted on similar sites excavated nearby such as Matarangi (Sewell 2003).

An adze (Figure 64) was found on the surface of the deflated midden R09/890 (OM120). It had been manufactured from Tahanga Basalt (from Opito on the Coromandel) and is a reworked type 2B adze (Marianne Turner pers. comm.).

A netsinker (Figure 65) was found at the base of Feature 1 midden in site OM263. While one of only two major artefacts to be found in two seasons of work, this was found *in situ* and radiocarbon dates place it around 1600 AD (see below).

Bone artefacts were also recorded in R09/890 (OM120), as mentioned earlier, but were not in good enough condition to determine function.

A small number of obsidian flakes were found in Omaha midden and were probably from Mayor Island, Great Barrier Island and Coromandel sources. The deflated midden, R09/890 (OM120), was also the source of the majority of flakes seen during survey. Excavations at R09/887 provided the majority described here.

Six obsidian flakes from three different sources were identified in R09/887. Three small flakes from the deflated midden where test pit 11 was located were probably from Fanal Island or Great Barrier Island. All three are a streaky grey with remnants of cortex, indicating that they came from small irregular nodules. None of them showed signs of use and they were probably debris from manufacturing larger flakes, or in the case of one piece, possibly the broken top half of a useable flake (identification by Marianne Turner).

Figure 64. Adze at deflated midden R09/890 (OM120), Trowel 250mm long.

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Figure 65. Netsinker from OM263

Obsidian and Chert

Two pieces of obsidian were found in, or just next to, midden 4 R09/887 (Figure 66). One was a larger flake than any of the others, weighing 4 gm. This had two good working edges, one fine lateral edge, which seems to have been used to cut soft materials, and a distal edge, which may have been used on harder materials. This obsidian is cloudy grey with inclusions, indicating a Coromandel source. The other piece was a small olive green flake, probably debris from manufacturing larger flakes, though it may have been used to cut soft materials. It is from Mayor Island.

Another, very small, Mayor Island flake was picked up on the surface of midden 3 R09/887 during the preliminary damage assessment on November 20, 2001. It is a fragment shattered off a larger flake when the latter broke.

Two pieces of green chert of a type most commonly found on Motutapu Island, but also found locally, came from midden 3 R09/887. Water rolled chert pebbles were commonly used as hammerstones, despite being a brittle, poor quality material. The chert has bruising that indicates use as a hammerstone, though such bruising may occur naturally. Also the point and edges have some chipping, indicating further use after they were split, probably for targeted pecking or reaming. These were not, as we claimed in a previous report (Campbell and Clough 2001:4), cores.

The evidence of differing sources of stone indicates the breadth of the network of hapu, iwi and allies within which the Omaha people lived, ranging as far afield as Mayor Island, but also to nearby sources like Great Barrier Island. The presence of Mayor Island obsidian also indicates a relatively early date for the midden in which it was found, though this in itself does not mean that the deflated midden containing the three flakes from Great Barrier or Fanal was necessarily later.

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Figure 66. Obsidian Flakes from Omaha Sites

Hangi Stone Types

Hangi Stone Types

Three types of hangi stone were observed in the midden. The most common of these was the Waipapa greywacke that outcrops on the hill to the south of the subdivision and has been quarried in historic times. This rock is of rather poor quality and seems to have shattered quite readily when heated.

Another rock type used was water rolled river or beach cobbles. These were not common, though some of the larger midden, especially at the northern end, contained them in some numbers, and some were quite large (>300 mm). Many were whole, though some had fractured. These rocks may have been picked up off the beach, though they have not been observed there. However, given the size of some it is unlikely that they were moved far, unless transported by canoe.

The final type of stone was the Waitemata sandstone, which seems to have fractured from heat, and subsequently degraded. The nearest source is seen eroding out of the rock shelf below Te Kie Point, and can be readily picked up along the beach at the southern end of the spit. It was most commonly found in midden towards the south of the subdivision, but occurred throughout. It seems an unlikely hangi stone, since it is likely to shatter quite readily. The Feature 1 hangi at OM215, for instance, contained both this sandstone and river cobbles (Figure 41).

Often hangi stones were observed in clear association with oven scoops or rake out, and also as fragments spread throughout the deposit. They have been deliberately brought onto the spit and are certainly associated with food preparation activities. None were native to the spit itself.

ARCHAEOLOGY SUMMARY

Season 1

Results

Preliminary earthworks for the Omaha Beach subdivision exposed 157 previously unrecorded archaeological features. With the exception of the hangi or oven scoops, these features were all midden of varying size and complexity.

The contents of the midden indicate that both the harbour/estuarine and beach environments were being exploited and that while some fishbone was present, shellfish appear to be the primary target. There is a clear bias towards exploitation of the harbour and some indication of netting, which would work well in the estuarine environment. There are some indications of fish preservation, which could account for some of the lack of fishbone if it was all being transported off the site (as could consumption by dogs), but nonetheless fishing does not seem to have been an important activity at Omaha.

Additionally, the likelihood of shark and ray fishing occurring and playing a significant role in the local economy cannot be overlooked, particularly because evidence of such activity does not tend to be preserved in the archaeological context, and because of evidence of exploitation in oral traditions. Many areas along the east coast were breeding grounds for sharks and ray (e.g. Te Muri, Sandspit) and traditionally these resources were highly regarded and protected and often the focus of intertribal conflict.

Analysis of the midden provides several lines of evidence, which allow tentative interpretation of social group size, and patterns of behaviour on the sandspit. For most part, the midden are all simple in structure and have little evidence of stratigraphy. They can therefore be interpreted as short term events representing activities ranging from a few hours to weeks or perhaps months, rather than permanent occupation or cycles of returning to the same midden site. The size range suggests that some relate to the activities of one or two people (a fire scoop and a meal), while others are the result of large groups congregating perhaps for a hui or hakari (feasting) over several weeks. Some of the larger midden have remnants of numerous hangi, which in themselves also have evidence of reuse.

There is some, albeit limited, evidence for seasonal occupation provided by the location of some of these midden on beach ridges raised above areas prone to winter flooding and others in areas too damp for winter occupation. This evidence suggests occupation of the sandspit intermittently throughout the year, though it is likely that spring and summer would be the most favourable time for larger groups to gather.

Results

Unlike the general pattern for the wider sandspit (Campbell *et al.* 2001), where shellfish exploitation occurred at a variety of local environments, at R09/887 most seems to have occurred on the nearby beach, with pipi predominating in almost all samples, and tuatua and scallop being the next most important species. The single exception of a lens of cockle midden in test pit 19 is merely the exception that proves the general rule. There are some indications that R09/887, or at least some parts of it, could have a relatively early date. These include the unusually dense fishbone midden in sample 3 / test pit 19, and the unusual population that the size of the bones seems to represent. The other indicator of an early date is the presence of Mayor Island obsidian.

In short, given the lack of variability which is the general rule for the midden so far observed at Omaha, R09/887 is by far the richest and most varied deposit so far investigated, apart from R09/890 (OM120), where a number of stone artefacts, including a small adze, and some worked bone, have been picked up from the deflating midden surface. This again is further indication that something different was happening in this area, but whether this is related to a possibly earlier date, or to a prime location close to the beach, is not yet known.

Season 2

Results

A further 70 midden were located during the second season of archaeological investigation at Omaha. These midden generally conform with and confirm the nature of the sites described in the previous work carried out.

The second season's investigations were focussed on further supporting the results of the first season and providing particular information. This included:

- Getting multiple dates from individual sites
- Dating the netsinker found in OM263
- Dating OM209 with a midden below the ancient soil layer
- A date from one of the burials.

Obtaining multiple dates from individual sites was designed to establish whether sites were being used relatively soon after their initial use or whether midden from a later date were simply cut into earlier ones on an ongoing basis.

OM209 seemed a likely choice on stratigraphic grounds as it would assist in establishing an early bracket date for some of the soil build-up in the area which later midden were cut into. Finally dating the netsinker was useful as so few artefacts were recovered from the excavations that dating the best one we had was imperative.

Trenching of most of the midden during the second season has added to our understanding of the internal structure of the larger midden sites. While the pattern from Season 1 indicated relatively short term cooking areas as the most probable explanation of the build-up of shell deposits, there is clearly continual use of areas over a short period of time. Inter-cutting pits and fire scoops at sites illustrate this. In some cases, such as OM215, hangi were apparently made over the top of earlier shell deposits.

The artefacts recovered in Season 2 were extremely few in number, as was the case in Season 1. A single net sinker confirms the suggestion made earlier that net fishing was being carried out at Omaha and a few obsidian flakes also were collected.

The burials (koiwi), however, provided additional information. A burial found in 2001 contained a number of individuals but was severely damaged. The two bodies that were well preserved were buried relatively close to the beach, one inside an old midden deposit. They appeared to be relatively young, the woman probably only about 20 when she died. As the radiocarbon dating bears out, these individuals may pre-date the main use of the midden (see final chapter for more discussion on this).

Summary

General

The midden analysis suggested the following points about Omaha sites:

1. The predominant species exploited was pipi from the nearby area with tuatua and cockle and a range of other species also eaten.
2. Both estuary and marine habitats were used with different sites and features within sites usually showing mixed exploitation.
3. Fishing was also apparent although the midden indicates less emphasis on this activity. The removal of smoked fish and possible consumption of fish remains by dogs may partly explain the paucity of fishbone found.
4. The midden had few artefacts.
5. Both artefactual information and the presence of non-local shellfish species are indicative of the regional interaction sphere of Maori communities using Omaha.

As discussed earlier sampling strategy was biased to the larger and more complex sites. However, smaller sites contained much the same material as the larger sites. The lack of artefacts recovered in midden appears to reflect the actual paucity of material present rather than a methodological bias.

The exploitation of pipi (obtained from both muddy and sandy shore environments in close proximity to the sites) dominates the results (Figure 67). With the exception of some sites in NU3 and occasional small sites elsewhere, pipi far outweighs any other species both in number and nutritional contribution to the Omaha diet. However, opportunistic collection of a wide range of other shellfish species was clearly also carried out.

Taken as a group there is no obvious pattern to the distribution of fish species found across the landscape (Figure 66). However, particular sites do show a preference for particular species. Jack mackerel, trevally, kahawai and blue mackerel are the species targeted.

Neighbourhood Units 1 – 2

Neighbourhood 1 (Figure 12) contained relatively few midden. Although some large midden were noted, these appear to be rapidly disappearing. There is no obvious explanation for this in terms of deliberate selection and it probably reflects 20th century activities in the area.

A significant number of midden were located in Neighbourhood 2 (Figure 13), showing a range of size and types.

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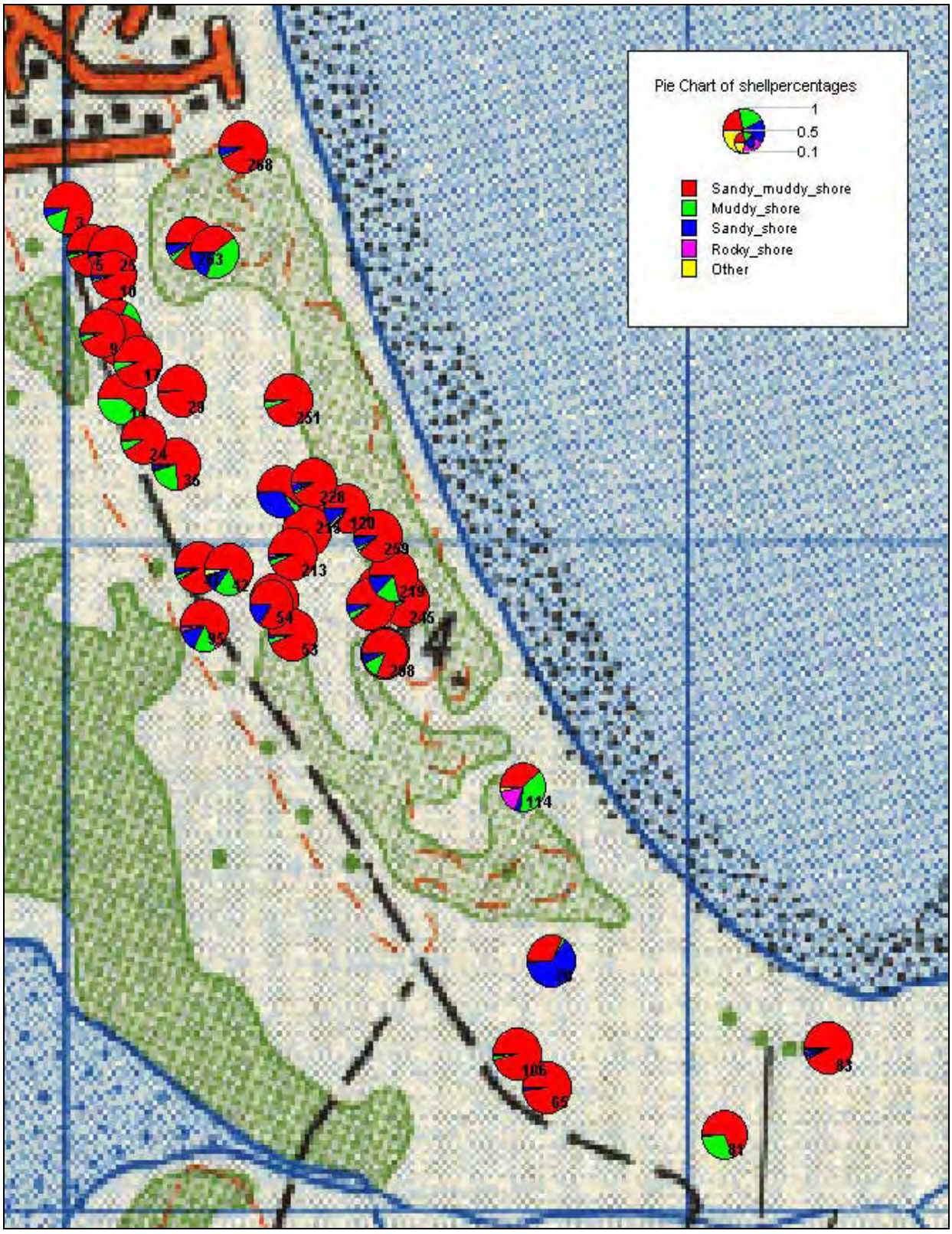
Figure 67. Pie charts of sampled sites showing percentage of the sources of the shell found



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Neighbourhood Unit 3

In the southern half of Neighbourhood Unit 3 and the northern half of Neighbourhood Unit 4 very few sites were located (Figure 14). Four midden found in the first season along the eastern edge of this area were all located beneath white sand. It seems possible that many midden may remain at a lower level, covered by white sand, in a distribution similar to that in Neighbourhood Units 4 and 5.

Alternatively, sites here may have deflated and been destroyed in the past as the dune system moved, but it seems unlikely that such a process could have destroyed all midden evidence in this area. Another alternative explanation is suggested by archival research, which indicated that the general area had been mined for sand and shell for the Wilson's lime/cement industry at Warkworth. It is possible that midden in some areas, particularly the large ones, had been completely quarried out leaving little more than a scatter of shell on the surface. The occurred during the early decades of the 20th century – a time period which could have seen the removal of large volumes of material.

Neighbourhood Units 4 & 5

In Neighbourhood Units 4 and 5 **(**Figure 15-16) there are two quite separate groups of sites — a line of midden just behind the beach dune and another line 200–300 m to the west along the low ridge. This distribution may be explained by taking the seasonal occupation of the spit into account.

Neighbourhood Units 4 and 5 are largely flat areas. Behind the beach dune ridge, close to the natural drainage path, the spit is quite damp in winter. During the 1997 survey, which took place in winter, most of this area was under water. Midden located here would indicate a summer occupation. On the other hand the low ridge along the western edge of this area is drier. Middens located here possibly indicate a winter occupation, with food carried further from the beach in order to find a dry spot for cooking and consumption. Most of the midden in both these areas are of small to medium size, although a thin but almost continuous scatter of shell covers most of both areas between the marked midden.

The largest site here is OM 81, which at 30 x 30 m is as large as many sites in Neighbourhood Units 1 and 2, though at 200 mm is shallower than the largest. This site lies so close to the water table that the soil beneath it has become waterlogged, changing from a yellow sand to a beige colour. It could only have been occupied during a dry season. The four nearest sites to the west and south are all on dry ground, though they are only 30 – 40 m distant.

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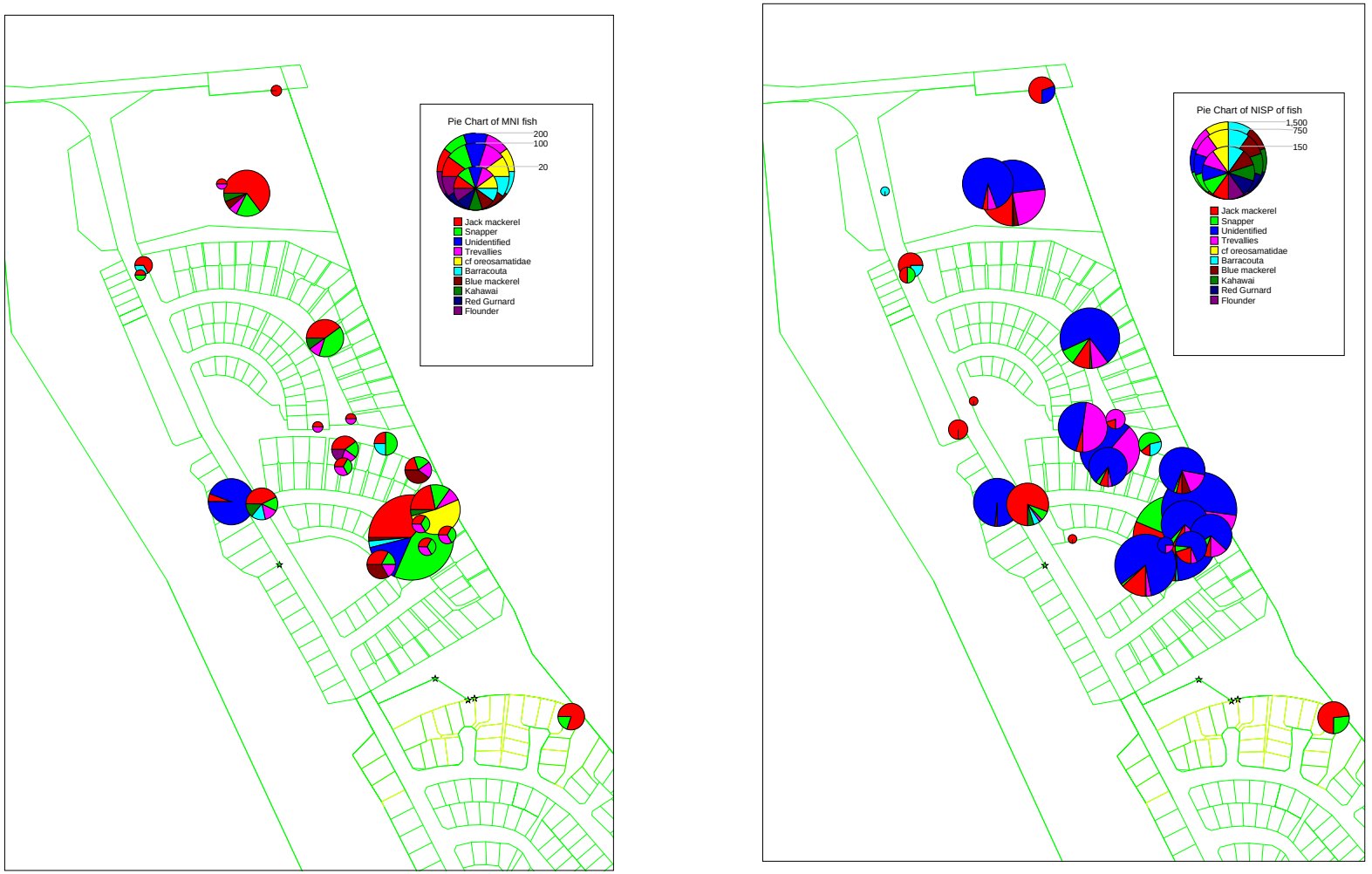

Figure 68. Percentages of fish species identified in sites by MNI and NISP

DISCUSSION

Introduction

Introduction

This section provides a broader perspective on the archaeological results from the Omaha project. The number and variety of midden in such a relatively concentrated area illustrate the importance of the sandspit during both pre-European and historic times.

The results presented so far follow the site-by-site, or point, sampling strategy required by the considerations of the project. In this section, we extend this strategy to construct a view of the prehistoric and historic landscape at Omaha. This is carried out by combining an environmental model of the dune system with the results of the excavations and midden analysis.

The first part of the chapter provides a model based on the geological and geomorphological data obtained as part of the development preparation. We integrate this with results of the archaeological investigations that include the stratigraphy observed and a reconstruction of the vegetation history based on the charcoal samples from the midden fires.

We then take a broader look at the use of the Omaha beachfront using the results of the midden excavations. We provide a model of:

- The formation of the midden
- The lifecycle of midden and the erosion process that affected the midden
- The resource exploitation at Omaha Beach.

Finally, we re-examine some of the information of the social context of the area in light of the new information. This includes an examination of the project results in light of investigations of similar archaeological landscapes in the upper North Island.

The Dune Environment in the Past

Geomorphology

Geology

The site 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 Whangateau Harbour (an estuary) to the south and west. The whole of the site is located within a valley or basin that opens into Whangateau 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) (Figure 69). 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 site was quarried in historic times.

Figure 69. Aerial view of Omaha Sandspit

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Dune Stability

Tonkin & Taylor (1998:2) characterise the spit as being in dynamic equilibrium, with the net gain and loss of sediments both in the estuary and along the beach cancelling each other out. They note a tendency to accretion of the dune system, particularly at the southern end of the site, but this is balanced by major episodes of storm-induced erosion in recent times (July 1978 and April 1981). 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 archaeological trenches also supported this with suggestion of an old topsoil layer (see below). The geotechnical reported suggested that midden and the sites in general would be well preserved.

The overall stability of the dune system does not apply to individual dunes, which have been subjected to various agents of erosion. In particular, dunes, and hence midden sites, have been subject to serious wind deflation (blowout), in many cases visible, which was undoubtedly exacerbated by dune clearance for agriculture and stock.

Tree Coverage

The 1874 survey plan (Figure 3) shows a band of forest along the western side of the sandspit and a small area of forest to the northeast end of what was until recently the Mangatawhiri farm development. The remainder of the land block was covered in fern and ti tree. The 1934 plan (Figure 4) indicates that the forest had disappeared and around half the sandspit was covered with light manuka bush and flanked by sandhills. No sand hills were recorded in 1874 when fern and manuka predominated. This suggests at least two cycles of clearance with the latter in particular exposing the dunes to significant sequences of erosion observed today. Samples of charcoal have been submitted for analysis and dating and the results described below.

The Dune System

Neighbourhood Units 1 & 2

In Neighbourhood Units 1 and 2 and the northern half of Neighbourhood Unit 3, at the north end of the subdivision, the dunes are generally older and more stable. The dunes observed prior to machine excavation tended to correspond with the prehistoric dune formations. However, in some places new dunes are present and probably relate to dune formation after the late 19th or subsequent 20th century land clearance, but prior to pasture formation. These dunes can be clearly seen as ridges running along the sandspit in Figure 69 above.

Neighbourhood Unit 3

In the southern half of Neighbourhood Unit 3 and the northern half of Neighbourhood Unit 4 the dunes are less stable, and probably younger. Very few midden were observed in this area and there are two possible explanations. Midden may have been removed by quarrying for sand and shell as noted in the historic records, although there is no precise indication of where on the spit this occurred. Alternatively, this area in the past may have been more like the flat area to the south of it, and dunes of white sand have since blown up across it, burying any midden. Buried topsoil was observed in various locations up to 2m or more deep.

Neighbourhood Units 4 & 5

The dunes are of marine origin and have formed along with the spit within the last 4,000 years (Tonkin & Taylor 1998:1). The dune system within phase 1 of the subdivision falls into three distinct areas. The southern half of Neighbourhood Unit 4, together with all of Neighbourhood Unit 5, comprises a flat area of ground that rises gently by about 2 m from a natural drainage path running north–south behind the beach dunes to a low ridge approximately 600 m long. This is low-lying swampy ground, with water dammed by the beach ridge. It consists of alluvial sands that are reworked dune sands (Harrison Grierson 1999). Behind this low ridge the land drops away again 2 m to the kahikatea swamp and the Waikokopu Creek. This flat area is generally damp, especially in winter, and especially close behind the beach ridge, although the low ridge is drier.

In a backhoe hole in Neighbourhood Unit 5, directly behind the beach dune, a stratigraphic profile was observed (Figure 70). The lowest stratum above the sterile grey beach sand is a solid raft of fine pumice, and pumice was also mixed throughout the upper layers. (Large pieces of pumice can be observed throughout Neighbourhood Unit 5 when the topsoil is removed, commonly up to 100 mm in size, occasionally 200 mm or more). Samples of pumice have been taken for analysis.

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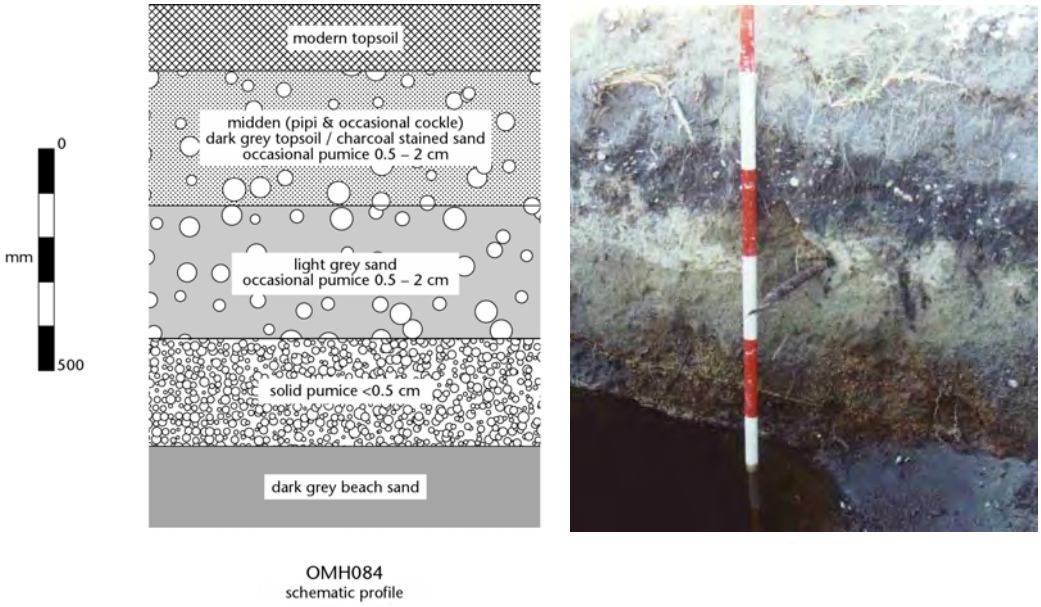
Figure 70. Soil profile behind the beach dune in Neighbourhood Unit 5, showing layers of pumice



Vegetation History

Charcoal Analysis

Reconstruction of the vegetation history at Omaha is based on the analysis of charcoal fragments recovered from the midden excavations. As firewood is likely to be collected near the site, the species composition of these samples can indicate what the local vegetation was when the site was occupied. We cannot, unfortunately, assume that the charcoal assemblage always derives entirely from contemporary vegetation as the trunks and stumps of certain large conifers, such as matai, can survive on land surfaces for hundreds of years after the death of the trees. In dunes that are often mobile such relict wood can be exposed and used as firewood by later inhabitants. We can also assume that driftwood from the nearby beaches would also have added to this material collected for cooking. These factors must be taken into account when making environmental interpretations.

Charcoal from six excavations carried out in 2000 was given to Dr Rod Wallace, Department of Anthropology, University of Auckland, for species identification. As these samples were chosen from sites to be radiocarbon dated it is possible that Dr Wallace's model of the local vegetation history of the dunes covers the period from around 1450 to 1750 AD (see below). Unfortunately more samples would be required to extract information regarding any changes that may have occurred during that time. The results of the identification are presented below.

Table 24. Summary of charcoal identifications by species

Common name	Species name	# Pieces	%	Type	# Samples
Coprosma	Coprosma sp.	6	11	Shrub	2
Lancewood	*Pseudopanax crassifolius*	1			1
Fivefinger	*Pseudopanax arboreus*	5			2
Manuka	*Leptospermum scoparium*	1			1
Pittosporum	*Pittosporum* sp.	9			1
Akeake	*Dodonaea viscosa*	2			2
Ngaio	*Myoporum laetum*	4			2
Mahoe	*Melicytus ramiflorus*	5	21	Scrub	3
Mapau	*Myrsine australis*	2			2
Kanuka	*Kunzea ericoides*	48			10
Tarairi	*Beilschmiedia tarairi*	3	59	Broadleaf Tree	1
Pohutukawa	*Metrosideros excelsa*	52			14
Puriri	*Vitex lucens*	102			22
Matai	*Prumnopitys taxifolia*	22	10	Conifer Tree	7
Kahikatea	*Dacrycarpus dacrydioides*	3			2
Kauri	*Agathis australis*	1			1
	Total	**266**			**25**

Notes: (1) # Pieces = total number of pieces of each species identified in the assemblage: **(2)** % = Percentage of these totals in the assemblage: **(3) Type** = Type of plant each species forms: **(4) # Samples** = How many of the 25 samples each species occurs in.

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Results

The predominant species represented by over half of the total charcoal in the assemblage comes from only two species, pohutukawa and puriri. 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 must have been scattered trees rather than part of intact coastal forest.

The third most common species is kanuka. This small tree forms almost pure stands when regenerating after vegetation clearance. At 21% of the total assemblage it suggests that regenerating scrub was relatively abundant locally. Smaller shrub species form only 10% of the samples, suggesting that the kanuka scrub was relatively pure.

A final 10% of the assemblage consisted of the conifers, matai, kauri and kahikatea. Apart from kahikatea, stands of which occur on the inland margin of this sandspit today, these species are somewhat anomalous in this assemblage. This is because the coastal broadleaf forest tree species we would expect to find accompanying them in a living forest are generally absent. The conifers probably entered the assemblage as relict wood burnt as firewood.

In summary, this charcoal assemblage suggests that an original matai dominated coastal broadleaf podocarp forest had been cleared by the time these sites were created. 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.

Site Chronology

Radiocarbon Dates

Samples

A total of nine dates was provided from samples selected during the first season and the investigation of R09/887. They were surprisingly early and clustered around 1600AD. All dates were from shell samples except for one, provided by charcoal samples submitted to assess the accuracy of the shell dates, given that there is limestone in the surrounding catchment that might contribute older carbon to the harbour. Our expectations were that most midden would date to the proto-historic period and later in the historic period (after 1800AD), when there is documented information of the use of the area. This was in part due to the preservation of membrane on the some of the shell.

The selection of samples for dating during the second season was motivated by a number of factors:

- Getting confirmation of the Season 1 results
- Obtaining dates from different features in the same site to establish whether observed stratigraphy represented a discernible time period or not
- Dating the possible anthropogenic soil layer found across much of the area
- Dating the net sinker.

In addition, we were given the opportunity by tangata whenua to date one of the burials found on the site. We were particularly interested to see whether the burials were broadly contemporary with the main period of use of the site or, as we thought more probable, represented later use of the area.

Fiona Petchey carried out the dating.

Table 25. Samples sent for dating

Site	Layer/ Feature	Reason for selection	Material
OM11	Feature A2 sample 2	A very large site, the largest that we fully uncovered in Season 1, though OM72, was probably larger.	Pipi
OM13	M2 Feature U	A quite large midden.	Pipi
OM29	Bag 1 & 2	A medium density pipi midden.	Pipi
OM35	Sample	A midden with limed shell in it, fairly large.	Pipi
OM42	Sample 2	A large midden.	Pipi
OM47	Sample 1	A fairly large midden.	Pipi
OM209	Midden	Below modified topsoil: possibly earlier site.	Pipi
OM215	Layer 3	Large unusual midden with toheroa and scallop concentrations.	Pipi
OM219	a) Feature 2 b) Feature 5	Large dense midden – Feature 5 cuts feature 2.	Pipi
OM261	Koiwi	Bone sample from mandible/teeth.	Human teeth/bone
OM263	Feature 1	Midden – dating of netsinker.	Pipi
OM268	a) Feature 2 b) Feature 3	Early large midden in stratigraphy. Later midden cut into Feature 2.	Pipi

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Radiocarbon Dates, Continued

Table 26. Radiocarbon dates (uncalibrated)

Site	Lab code	δC13		% Modern		Results ± (yrs BP)	
OM11	11431	2.1	0.2	90.0	0.5	843	43
OM13	11432	1.8	0.2	91.2	0.5	741	45
OM29	11433	2.0	0.2	90.7	0.5	784	45
OM35	11434	1.6	0.2	91.6	0.5	701	47
OM42	11435	1.7	0.2	92.0	0.5	670	46
OM42, Charcoal	12919	-25.7	0.2	95.0	0.4	409	33
OM47	11436	2.0	0.2	91.0	0.6	762	50
R09/887 TP1, Sp3	11437	1.8	0.2	91.3	0.5	730	48
R09/887 TP19, Sp5	11438	1.5	0.2	91.2	0.6	740	48
OM209 Midden	12101	1.3	0.2	89.9	0.5	856	49
OM215, Layer 3	12102	1.7	0.2	90.8	0.5	774	42
OM219, Feature 2	12103	1.5	0.2	90.3	0.5	818	43
OM219, Feature 5	12104	1.5	0.2	90.5	0.5	800	43
OM261, Burial 1	12105	-16.6	0.2	91.7	0.5	699	45
OM263, Feature 1	12106	1.8	0.2	91.6	0.5	708	41
OM268, Feature 2	12107	1.6	0.2	90.6	0.5	797	43
OM268, Feature 3	12108	1.8	0.2	91.1	0.5	752	42

Table 27 Calibrated samples

Site	Uncalibrated	Calibrated Date ranges 68.2% probability	Calibrated Date ranges 95.4% probability
OM11	**843 ± 43BP**	1450AD -1515AD	1420AD -1580AD
OM13	**741 ± 45BP**	1530AD -1640AD	1490AD -1670AD
OM29	**784 ± 45BP**	1480AD -1590AD	1460AD -1650AD
OM35	**701 ± 47BP**	1560AD -1670AD	1510AD -1690AD
OM42	**670 ± 46BP**	1590AD -1690AD	1520AD -1750AD
OM42, Charcoal	**409 ± 33BP**	1440AD - 1620AD	1440AD - 1640AD
OM47	**762 ± 50BP**	1510AD -1630AD	1470AD -1660AD
R09/887 TP1, Sp3	**730 ± 48BP**	1530AD -1650AD	1490AD -1680AD
R09/887 TP19,Sp5	**740 ± 48BP**	1530AD -1640AD	1480AD -1670AD
OM209 Midden	**856 ± 49BP**	1440AD - 1515AD	1400AD - 1580AD
OM215, Layer 3	**774 ± 42BP**	1490AD - 1610AD	1470AD - 1650AD
OM219, Feature 2	**818 ± 43BP**	1455AD - 1540AD	1440AD - 1620AD
OM219, Feature 5	**800 ± 43BP**	1465AD - 1565AD	1450AD - 1640AD
OM261, Burial 1	**699 ± 45BP**	1400AD - 1480AD	1310AD - 1530AD
OM263, Feature 1	**708 ± 41BP**	1560AD - 1660AD	1520AD - 1680AD
OM268, Feature 2	**797 ± 43BP**	1470AD - 1570AD	1450AD - 1640AD
OM268, Feature 3	**752 ± 42BP**	1520AD -1630AD	1480AD - 1660AD

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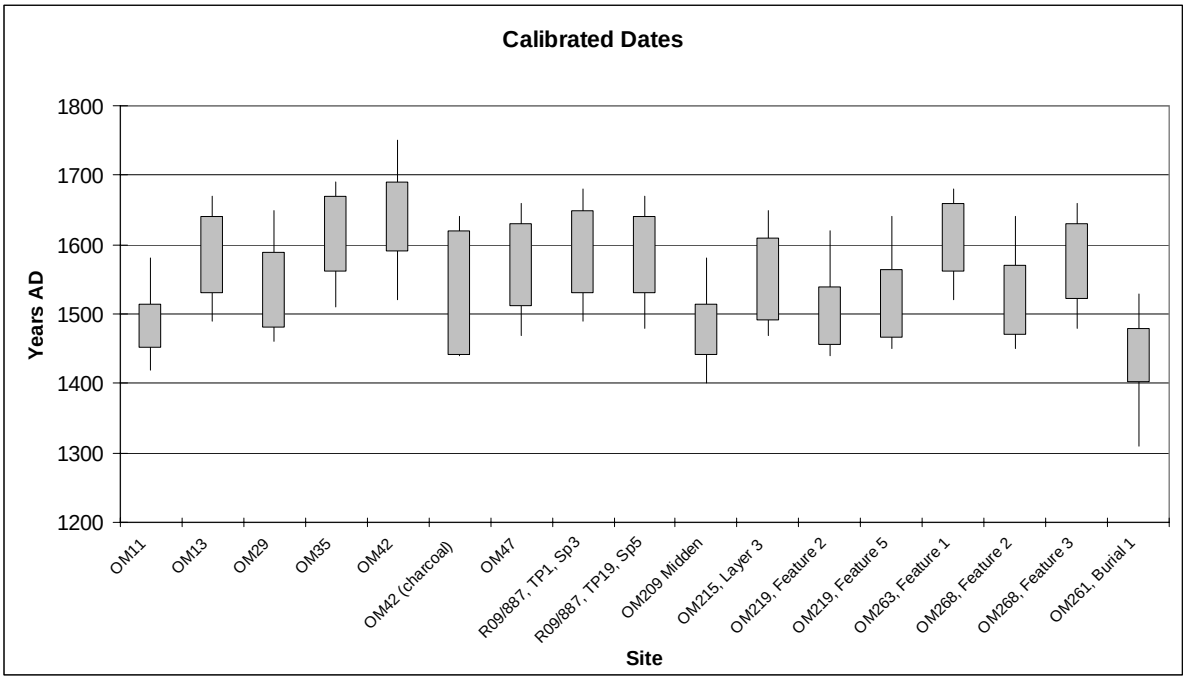

Figure 71. Graph of calibrated radiocarbon dates from Omaha showing 1 standard deviation (grey box) and two standard deviation (lines) age ranges

Interpretation

The dates suggest use of the Omaha sandspit from around 1450 to 1750 AD. Given the known use of the area during historical times the upper boundary is probably closer to 1850 for its continued use for shellfish extraction. After that point, with European colonisation, various other major activities were carried out that altered the landscape significantly.

The charcoal date from OM42 correlates fairly well with the shell date. There does not appear to be a reservoir effect and the shell dates are considered reliable.

The koiwi date from OM261 is very early. If accurate it may indicate that the burials predated most of the midden on the sandspit. The relatively early date for OM 209, which was covered by the layer of old topsoil that covers much of the area, allows a fairly tight window to be given to this 'topsoil' as almost all the nearby sites are cut into it. The upper window for the build-up of this material is probably around 1550 AD.

The dune sand also rapidly sealed most of the midden found which certainly aided preservation of the sites. While later processes, discussed below, subsequently came into play and midden eroded away, the speed of dune build-up preserved most sites even if the area was mostly covered in scrub as suggested by the vegetation history.

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Trends in the distribution

There is no obvious trend in the distribution of sites in time with the sites scattered across the landscape covering the range of dates. Indeed OM209, the earliest of the sites, was found near to a large midden (OM208) to the south that clearly post-dated OM209. It is perhaps a leap to suggest that the earliest sites were small and the larger sites occur some 100 years later, but this is a possibility. Small sites probably occur throughout the overall sequence and larger sites after an initial period. We tended to date the larger sites.

Two dates each were obtained from OM219 and OM 268, where stratigraphy of features was recognised. At OM219 Feature 2 was stratigraphically earlier than Feature 5 and the raw radiocarbon dates supported this. At OM263, Feature 3 was younger than Feature 2 but the radiocarbon dates indicate the reverse. However, at both sites, the error margins clearly overlapped and so radiocarbon dates probably do not reliably separate out the features. This does, however, support the notion that the midden areas were used for relatively short periods of time and that the pattern at Omaha was not about reusing sites after long breaks. Given the large amount of space available and long time periods this is perhaps not surprising.

The date of the first settlement of New Zealand remains disputed. Until 1990 the general consensus was for colonisation by an East Polynesian population, who subsequently became the Maori, at around 1200 BP. Anderson's (1991) subsequent re-examination has concluded that first settlement occurred around 700 BP. Most archaeologists appear to favour a date somewhere between these two extremes (based on discussion at the 2003 NZAA conference). If we accept the Anderson date, then this has wide ranging implications for rates of cultural change and the duration of the 'Archaic', which comes to an end, in the upper North Island, at around 600/550 BP. After this sites show increasing specialisation, wild resources become scarcer, agriculture becomes more important, and territories become more bounded while mobility within these territories is more frequent. The major use of Omaha is placed firmly within the Classic period, but from early on in the period.

Omaha Middens

Midden Formation

Introduction

This section contains a summary of how some of the sites were constructed, showing the structural interpretation of some of the features and explaining the basic stratigraphic elements observed at the Omaha midden.

The trenches through most of the midden showed that the majority were dug through the topsoil of an old land surface apparent across much of the surface of the dune system (Figure 72). The cross sections through this layer illustrate that the topography of the old surface in many places was unlike the modern surface. Given the dynamic nature of the dune systems, this is not surprising but does need to be taken into account when interpreting where the midden were positioned in the landscape.

Figure 72. Trench 3, OM222 - southern baulk showing old topsoil layer cut into midden showing even base (inset showing close-up of old topsoil)

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Midden Construction

Construction of the midden can be a complex affair with multiple events making up what might at first glance appear to be straightforward stratigraphy. To better understand the stratigraphy recovered at Omaha, some of the processes can be outlined. Midden were created in the following fashion:

Step	Action	Example
1	Either a hole is dug or a ledge cut into a sand dune.	OM232 for pit midden OM213 (Figure 36)
2	Stones might be set out at the base of this hole/ledge and a fire built.	OM215 and OM268 hangi stones (see Figure 74)
3	Once the fire is substantial and the flames have died down shellfish might be piled up around the embers and then covered with finer fuel and probably a small amount of seawater sprinkled on for steaming the shellfish.	
4	Once cooked the shellfish would be removed and eaten or preserved.	
5	Debris from the midden, along with embers of the fire, could be raked back into the pit.	

Further complications arise as some sites might have been constructed with multiple fires set out and the large mounds of shellfish piled around them.

Midden Location

The midden were dug in most locations on the old surface. Some sites were apparently dug on flat areas where shelter from the bush would have been sufficient. Others such as OM213 (Figure 36) were clearly cut into small dunes with the rise used to provide some shelter both for people and the fire.

Although many sites were located in the swale of the dunes, many of the largest midden, including many of the midden described in the initial assessment such as R09/887, R09/888 and R09/890 (see Figure 73) were on the higher dune areas and capped the dune mound. This in turn made them vulnerable to later deflation processes (see below).

It is interesting to speculate that there may be seasonal differences between the use of certain areas of the landscape, with the higher large sites used during summer, while the swale area provides some additional shelter during colder months. However, in heavy rain, many of the swale areas are vulnerable to quick flooding. Further research into the contents of the different midden may assist in determining whether this was the case.

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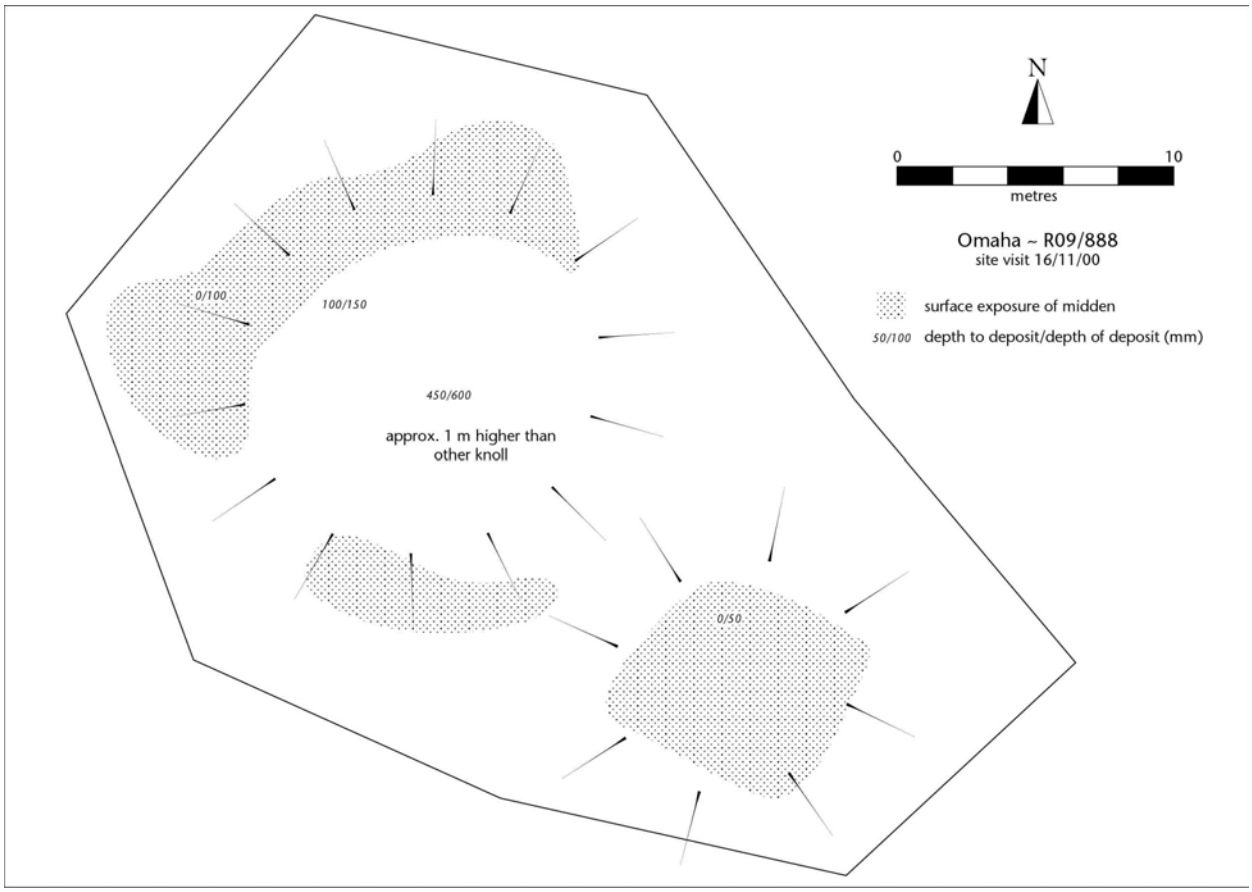
Figure 73. Plan of R09/888



Later Processes

The next stage involves what happens to the site once it has been used. A number of possible alternatives are:

1. Material is not raked back into the midden but would be left as scattered shell which would relatively quickly be spread out and the site might not be preserved.
2. The site might be used again for later cooking activities which could occur the following day or centuries later. Usually at Omaha, however, this would probably have been a matter of days rather than any longer time, since there is no evidence of any lapse of time.
3. Dune sand may be blown over the site relatively quickly, preserving the debris.

Later changes in the dune could expose the shell and organic material in the midden to the elements and the features would erode.

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Hangi stones

Hangi stones are not a requirement for cooking shellfish, which do not require particularly lengthy preparation. Their presence most likely indicates cooking of larger fish, marine mammals and vegetables such as kumara.

Interestingly, though, hangi stones were also often used on the upper surfaces of midden (as mentioned at OM215 and OM268 [Figure 75]).

Figure 74. Site OMH019, oven scoop/hangi at base of midden

Figure 75. Hangi feature in upper layers of Midden 3, OM268

Lighting the Fires

Firewood

Pohutakawa and puriri were the most common species of firewood identified in the Omaha beaches, but a variety of other species was also used. The distribution of species found by site is shown below.

It is not known specifically what the distribution of tree species was in the prehistoric dune environment. The range of species found in midden features reflects a general foraging model of gathering firewood rather than any obvious targeting of species for its specific properties. However, fires lit for smoking of shellfish or fish may have required the selection of specific types of firewood, but these have not been identified at Omaha. Kanuka and manuka were often selected for this purpose for the flavour added to the food.

Species Present

Common name	Species name	OM11	OM13	OM29	OM35	OM42	OM47
Coprosma	*Coprosma* sp.				X	X	
Lancewood	*Pseudopanax crassifolius*		X				
Fivefinger	*Pseudopanax arboreus*	X					
Manuka	*Leptospermum scoparium*	X				X	
Pittosporum	*Pittosporum* sp.	X					
Akeake	*Dodonaea viscosa*	X			X		
Ngaio	*Myoporum laetum*				X	X	
Mahoe	*Melicytus ramiflorus*	X				X	
Mapau	*Myrsine australis*	X			X		
Kanuka	*Kunzea ericoides*	X	X		X	X	X
Tarairi	*Beilschmiedia tarairi*	X					
Pohutukawa	*Metrosideros excelsa*	X	X	X	X	X	X
Puriri	*Vitex lucens*	X	X	X	X	X	X
Matai	*Prumnopitys taxifolia*	X	X			X	
Kahikatea	*Dacrycarpus dacrydioides*	X					X
Kauri	*Agathis australis*					X	

Fire Construction

Larger oven scoops may have required multiple smaller fires to be lit simultaneously to ensure cooking of the material. The plan of OM215 (Figure 43. Plan of OM215), for example, shows small circular charred areas at the base of the features exposed by the trenching. Some of these charred areas relate to single midden.

As discussed above, the use of a midden area after its initial use was common and fires built on top of later features may have resulted in changes to the surfaces observed on the sites. Two types of changes were identified at Omaha:

1. Thick black greasy charcoal layers with heavily burnt shell
2. Almost pure lime deposits showing high temperature destruction of shell from relatively ‘clean’ surfaces (Figure 77).

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Figure 76. OM 268 charcoal area with heavily burnt shell

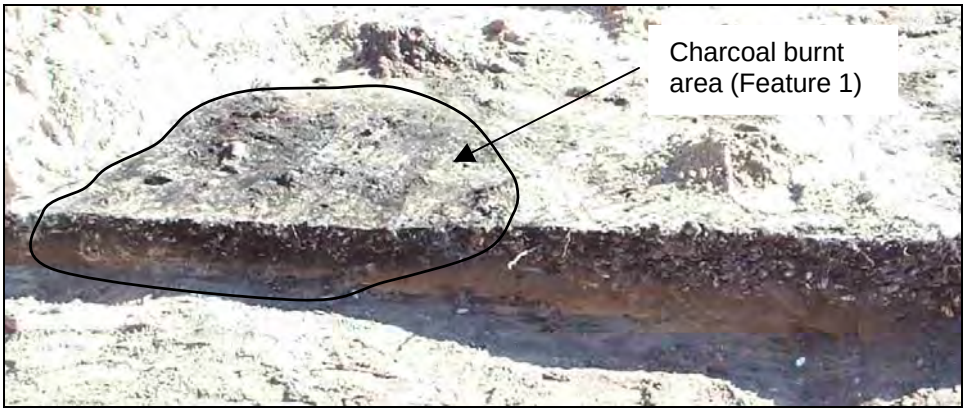

Figure 77. Burnt shell at surface of OM220

Midden Destruction

The Process

Once the midden is created a series of processes can then occur. The dune environment was very effective at preserving sites rapidly after their initial use and abandonment. However, as discussed earlier the dune environment is of varying stability and in many parts of Omaha the eroding banks of shell, particularly near the top of some of the larger dunes, indicate the ongoing natural processes involved in midden destruction. The excavations at R09/887 were particularly useful in illustrating the processes that midden undergo once erosion sets in (midden deflation).

Two points in particular relating to the process of midden deflation can be noted from the Omaha excavations, particularly from R09/887. The first is that deflation can either occur:

1. On an advancing vertical deflation front, as is the case in the south of midden 1 and at R09/890 (OM120) (Figure 78)
2. Or on a horizontal deflation surface, as is the case in midden 4 from R09/887 (Figure 79).

The difference seems to relate to 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.

The second point is that, contrary to expectations, the deflated deposit is destroyed in the process. Once the shell is removed from its matrix it seems to weather very rapidly, so that lighter organic material such as charcoal and bone is quickly dispersed and eventually only very sparse and fragmented shell can be seen below a deflation front (see Figure 80).

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Figure 78. Vertical deflation R09/890 (OM120)

Figure 79. Horizontal deflation at R09/887

Figure 80. Fully deflated midden

Prehistory of Omaha Beach

The Social and Physical Landscape

Introduction

Omaha beach is a complex and changing environment. Although the emphasis of the excavations was necessarily focussed on individual midden, the broader use of the landscape was also addressed in these investigations. The radiocarbon dates obtained from the first season were earlier than expected, as it had been thought that most sites would represent the historic and proto-historic periods. However, these earlier than expected dates were repeated in the second season results and confirm that the beach had been used from about 1450 to 1750 AD. Historical sources indicate that it continued to be used until c.1850 AD.

Life at Omaha

The archaeology of Omaha consists almost entirely of a series of shell midden of varying sizes. We can envisage members of a Maori hapu arriving at the brush-covered dunes, clearing a small area, setting up temporary shelters and collecting firewood and stones for hangi. In summer, high dune areas might have offered pleasant bases to set up camp, but there was probably little difficulty in finding a good spot anywhere on the spit. The swales offered protection from the wind but probably had to be avoided during heavy rain.

Over the next few days and nights, groups would head out to collect pipi in the nearby beach and estuary, while others would fish using nets or fishing lines in the harbour area. More dramatically, shark-hunting expeditions would set out to catch this challenging fare.

On returning to the campsites, the shellfish was probably piled on the fires and covered to steam along with fish and vegetables. A portion of the catch might have been set aside and smoked over nearby fires using temporary drying racks. After a few days, the hangi areas would have been raked over and the site abandoned, with the preserved food taken back to the various kainga.

Variations on a Scene

While the scenario above probably describes the typical source of the Omaha midden, the oral traditions also suggest a number of variations both on the make up of the people using the area and the focus of activities. Raiding and hunting parties probably often 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.

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Preservation of the Sites

It seems probable that a substantial portion of the midden on the spit were destroyed prior to any archaeological investigation, and in particular that the more disturbed central-southern areas were mined for shell. However, more than 200 midden were recorded during field work, ranging from simple oven scoops surrounded by the remains of a single meal, to midden up to 2m deep with an estimated volume of $100m^3$. It should also be noted that the area investigated did not included the northern half of the spit developed as a residential subdivision some years previously.

Use of the Sandspit

The midden consist almost entirely of quantities of shell debris. Fishbone was present but only in small quantities, which is surprising given the marine orientation of subsistence here. Very few artefacts were recovered – one small adze, one net sinker, a few flakes of obsidian and some fragments of worked sea mammal bone. There is no direct evidence of long-term continuous habitation. Although a few possible postholes were seen in the sites, these did not suggest anything more than temporary structures, perhaps drying racks.

There is no internal stratigraphy indicating re-occupation of any midden 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 midden. This suggests that most sites represent cooking areas used during a single episode of occupation that may have lasted days to a couple of weeks.

The Dune Environment

It was apparent from the charcoal analysis that prior to the conversion of the land into farm, and other 'mining' activities, much of the spit was covered in kanuka scrub with a variety of trees such as pohutakawa and puriri also present.

The dune system, prior to the earthworks, appears to have been relatively stable, with a tendency to accretion balanced by storm induced erosion. This stability cannot necessarily be projected back into the past, but it seems likely that, in general, the archaeology is relatively undisturbed by natural processes.

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The dune system falls into three distinct areas. To the south, flat ground rises gently about 2 m toward the west from a natural drainage path behind the beach dunes to a low ridge approximately 600 m long. The land then drops away to kahikatea swamp and the Waikokopu Creek. This low-lying area is generally damp, especially in winter. North of here the dunes are less stable, and probably younger than elsewhere. Very little archaeology was observed in this central area. In the northern part of the development a series of well-defined dunes runs parallel to the beach. These dunes are older and more stable and generally correspond to the pre-contact dune system. Some newer dunes probably originate with historic period land clearance.

Koiwi

It is unlikely that the burials were associated the midden, given the strong tapu beliefs evident in Maori culture. However, there was little evidence regarding the stratigraphic relationship between the burials and the main midden sites. One burial (OM261-1) was partly covered in a very deflated midden and another (OM271) was dug very close to a large midden, R09/894.

The radiocarbon date from OM261 reported earlier (Table 27) is earlier than the midden dates. However, because of the lack of comparative dating on bone, the accuracy of the date is uncertain. Because of this uncertainty it is possible that the date may be anomalously early, but equally it may indicate that the burials predate the main midden sites. It is unlikely that burials would have been located so close to major cooking zones if they were contemporary with the midden. However, the midden represent use of the spit over quite a long period of time (c.400 years) so that burial close to earlier, dune covered midden, would be quite likely.

If the early date is correct, then it is possible that the burials may date from a poorly understood period in New Zealand prehistory: the transition from Archaic to Classic periods. To explore this further it is worthwhile considering the Omaha landscape in a larger regional and comparative perspective.

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Changing Settlement Patterns

Generally, prehistory in New Zealand is divided by archaeologists into Archaic and Classic stages. While dates for the Archaic and original settlement of New Zealand are much debated, the archaeological evidence of the sites is better understood and characterised by midden rich with artefacts. The range of artefacts and activities found at large coastal sites show the exploitation of abundant wild resources in relatively pristine ecosystems. Houhora in the far north represents one of the better understood archaic sites in the upper north island and Furey (2002) interprets the site as a village, occupied year round, a base from which smaller groups moved to less permanent and often specialised resource extraction camps, hunting moa for example, on a seasonal round.

By around 600 years ago, this pattern seems to have been replaced, in the north and north east of the North Island at least, by a shift of settlements away from a purely marine focus towards use and protection of gardening land as shown by the distribution of pa and kainga around the landscape. Marine resources were still heavily relied upon and this is signalled by extensive, homogenous, artefact-poor midden dune landscapes like Omaha and Matarangi on the Coromandel (Sewell 2003).

Regional Landscape

The midden sites excavated represent one aspect of the larger landscape. Pa sites south of the spit at Te Kie Point and other pa sites around the harbour illustrate the importance of defending the rich marine resources. Exploitation of the marine resources is the obvious purpose of the Omaha sites excavated. Although there is some evidence of an older topsoil there was nothing definitive that suggested any major gardening in the areas excavated. However, the lack of evidence of gardening on the spit does not preclude gardening in many of the areas around the spit and it is highly likely that kumara and other vegetables were brought onto the spit as needed. Understanding the larger landscape will require further archaeological survey and excavations at a range of sites on the adjacent mainland.

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Fishing

The predominance of jack mackerel in the samples collected is similar to that found at Matarangi (Sewell 2003), Papamoa (McGovern-Wilson 1995**)** and Mangawhai (Hawkins 2001). Jack mackerel is a pelagic fish implying bait and hook techniques, but it is also possible that it was netted at various times when near the coast (see Sewell 2003: 31). Jack mackerel is not generally regarded that highly, especially compared to snapper. Its preponderance at Omaha suggests at least two possibilities:

1) It was the most abundant fish caught
2) It was most commonly eaten immediately while other species were smoked and preserved and taken offsite.

Snapper and trevally species were also commonly caught, and blue mackerel and kahawai less commonly.

Overall, the range of species recovered suggests a range of fishing techniques used, with netting evidenced by the net sinker, and various hook techniques used to catch the offshore species.

The relative paucity of fishbone recovered from sites makes it difficult to identify chronological trends at Omaha. Unlike smoking shellfish, where the shells are left behind, fish preservation would leave little evidence that is archaeologically recoverable and so cannot be discounted as a major activity at Omaha. Along with shark and ray fishing in the area, other species were very likely to have provided a major protein supply throughout the year but were not represented or identifiable in the midden. Shark teeth were also probably removed 'on-the-jaw' to be used back at the main settlements. Dogs may also have contributed significantly to the paucity of fishbone recovered.

Shellfish Exploitation

Pipi was heavily exploited at Omaha. Collections of other species including cockle, scallops and tuatua as well as a range of rocky shore species illustrate a wide range of collecting strategies. The small middens found in isolation containing cockle in particular, and other scoops found within larger pipi midden, also show deliberate targeting of these species as the interest or opportunity arose.

The composition of other extensive midden landscapes in the North Island is similar in that one or two species predominate, but differs as regards species composition. At Matarangi, cockle and tuatua predominate (Furey 1999), at Waihi Beach it is tuatua (Moore and Phillips, 2002), while tuatua and ostrich foot are the two most common species at Papamoa sites (McGovern-Wilson 1995). Fredericksen, Barber and Best (1995) suggest a shift from ostrich foot to tuatua through time at Papamoa.

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Focus on Pipi

The Omaha focus on pipi presumably reflects its abundance and accessibility in both the estuary and inshore areas around the spit. The presence of a large toheroa concentration within Feature 3 at OM219, though, shows how widely the food gathering may have extended. Toheroa is generally not found on the western beaches near Omaha and is generally obtained much further north on the western beaches (Ringi Brown pers. comm.).

Occupation

The midden landscape at Omaha is very similar to that of Matarangi (Furey 1999), with a range of midden, some very large in size, but poor in artefacts. Like Matarangi, Omaha can be seen as a specialised marine exploitation area occupied for relatively short periods of time as part of a general economic cycle. Furey (1999) stresses the importance of preservation of the protein sources by smoking as a major factor in interpreting Matarangi. At Omaha, although this is also very likely, the historical information reflects the fact that large scale exploitation would at times have been used to provide the large amounts of food required for hui and other gatherings where feasting was an essential social component (as described in the Introduction).

Conclusion

The Omaha Beach project has provided an important case study in the occupation of an early – late Classic period landscape used by Maori for the exploitation of the rich coastal marine resources including shark, ray, other fish and shellfish. From the mid-15th century, there was frequent use of the sandspit as a base for large-scale pipi extraction, with large quantities of protein collected both for immediate consumption and for longer-term storage. This pattern continued until well after European settlers arrived in the area.

APPENDICES

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References

Auckland Regional Council (ARC) Parks, 1992. Tawharanui Regional Park: Management Plan. Auckland Regional Council, Regional Parks Services.

Anderson, A. J., 1981. Barracouta fishing in prehistoric and early historic New Zealand. *Journal de la Société des Océanistes*, 34(72-73):145-158.

Anderson, A.J., 1991. The chronology of colonization in New Zealand. Antiquity, 65:767-795.

Best, E., 1977. *Fishing Devices and Methods of the Maori*. E. C. Keating, Government Printer, Wellington.

Campbell, Matthew, Rod Clough, Mica Plowman, Don Prince, Kim Tatton, Marianne Turner and Tania Mace, 2001. Omaha Beach: archaeological investigations – preliminary report (July – December 2000). Report prepared for Omaha Beach Ltd.

Campbell, Matthew and Rod Clough, 2001. Omaha Sandspit development: preliminary assessment of damage to archaeological sites. Report prepared for Omaha Beach Ltd.

Clough, Rod, 1998. Mangatawhiri Farm Development: Archaeological Assessment. Report prepared for Boffa Miskell Ltd.

Clough, Rod and Matthew Campbell, 2000. Omaha Beach Ltd: Summary of Archaeological Investigations. Report prepared for Omaha Beach Ltd.

Fredericksen, C., I. Barber and S. Best, 1995. Pre-European occupation on the Papamoa dune ridges: the archaeological excavation of site U14/2841, L.S. Johnson Trust Property, Papamoa, Bay of Plenty. Unpublished report to New Zealand Historic Places Trust.

Furey, L., 1999. Archaeological Excavation of T10/993 at Matarangi. *Archaeology in New Zealand*, 42(4): 314–336.

Furey, L., 2002. *Houhora: A Fourteenth Century Maori Village in Northland*. Bulletin of the Auckland Museum, 19. Auckland War Memorial Museum, Auckland.

Gumbley, W., n.d. Archaeology of pre-European garden soils at Papamoa, Bay of Plenty. Unpublished typescript.

Gumbley, W. and B. McFadgen, 1995. L.S. Johnson Trust residential subdivision, Papamoa: report on the preliminary archaeological investigation, 3 July to 7 July 1995. Unpublished report to New Zealand Historic Places Trust.

Gumbley, W. and K. Phillips, 2000. Papamoa lowlands archaeological survey and heritage assessment. Unpublished report to Tauranga District Council.

Harrison Grierson, 1999. Residential Subdivision, Omaha Beach Neighbourhood Units 4 & 5: Geotechnical Investigation Report. Report prepared for Manapouri Developments Ltd.

Hawkins, S., 2001. A fishbone sample from Mangawhai sandspit and inferred prehistoric fishing practices. *Archaeology in New Zealand*, 44(4): 304–311.

Leach, B. Foss, 1997. *A Guide to the Identification of Fish Remains from New Zealand Archaeological Sites*. New Zealand Journal of Archaeology Special Publication, Wellington.

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McFadgen, B. and A. Walton, 1996. Report of investigations for the NZ Historic Places Trust into garden soils at the Johnston Trust Estate, Papamoa. Unpublished report to New Zealand Historic Places Trust.

McGovern-Wilson, R., 1995. Archaeological Investigations and Monitoring for Stage 4 of the Development at Royal Palm Beach Estate, Papamoa. Unpublished report.

Moore, P. and K. Phillips, 2002. Waihi Beach sewerage scheme archaeological report, NZHPT Authority 2001/045. Unpublished report.

Parkinson, Brian, 1999. *Common Seashells of New Zealand*. Mobil New Zealand Nature Series. Reed Books, Auckland.

Paulin, Chris, Andrew Stewart, Clive Roberts and Peter McMillan, 1989. *New Zealand Fish: A Complete Guide*. National Museum of New Zealand Miscellaneous Series, 19. GP Books, Wellington.

Pritchard, Kim. 1983. 'Prehistoric Maori Settlement Patterns in East Rodney', Unpublished Thesis, University of Auckland, 1983, p.28 and Auckland Regional Council Parks Service, p.40.

Sewell, B., 2003. Archaeological monitoring of earthworks at Matarangi, Coromandel Peninsula. *Archaeology in New Zealand*, 46(1):24-32.

Simmonds, David, n.d. 'Mahurangi - Fact and Legend', H.J. Keys, ed., *Mahurangi River, Its Story*, n.p.

Tonkin & Taylor, 1998. Omaha Development: Revised Coastal Hazard Assessment. Report prepared for Boffa Miskell.

Tonkin & Taylor, 2000. Omaha South Development, Neighbourhood Units 4 and 5: Geotechnical Investigation Report. Report prepared for Omaha Beach Ltd.

Trimble, Carmen C. and Stephen A. Macko. 1997 Stable Isotope Analysis of Human Remains: A Tool for Cave Archaeology. *Journal of Cave and Karst Studies* 59(3): 137-142.

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