

6. Conclusion

The following table summarises the cultural and environmental history of the Kapiti-Horowhenua subregion for the last 900 years. Changes can be expected as the dating of environmental events is refined and as the archaeology of the region becomes better known.

| CAL YEARS BP | SAND DUNE EVENTS | MAORI HISTORY | FOREST VEGETATION |
|--------------|-------------------------------------|--|--|
| 900 | | | |
| 800 | <i>Motuiti sand advance</i> | | Forest advances on to Motuiti dunes. Nearly all of the dunes are forested. |
| 700 | | | |
| 600 | | Maori settlement People living in small, centralised village-like settlements in forested surroundings in the dunes. Satellite sites for coastal food gathering | Burning begins and forest retreats. |
| 500 | | Plentiful food remains from a wide range of species. Economic activities include moa hunting, fishing, fowling, eeling, kumara gardening (?). Widespread trade for imported stone. | |
| 400 | <i>Old Waitarere sand advance</i> | Moas become extinct | Forest advances on to Old Waitarere dunes |
| 300 | | People living mostly in small, dispersed settlements and pa along rivers and the inner edge of the dunes. Sparse food remains from narrow range of species. Economic activities include fishing, fowling, eeling, kumara gardening. Food resources less abundant than previously. Little imported stone. | Burning continues and forest retreats. |
| 200 | | | Forest largely cleared from Motuiti and Waitarere dunes and is replaced by bracken fern and scrub. |
| 100 | <i>Young Waitarere sand advance</i> | European settlement | |
| 0 | | | |

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9. Appendices

APPENDIX 1: GLOSSARY

Maori shellfish names mentioned in text

| | | |
|-----------|----------------|-------------------------------|
| kaikaroro | triangle shell | <i>Spisula aequilateralis</i> |
| paua | | <i>Haliotis iris</i> |
| pipi | | <i>Paphies australis</i> |
| tipatipa | round cockle | <i>Dosinia anus</i> |
| tohemanga | | <i>Longimactra elongata</i> |

APPENDIX 2: RADIOCARBON DATES FOR SITES OF THE WELLINGTON CONSERVANCY

There are 96 radiocarbon dates for archaeological sites in the Wellington Conservancy (Table 1). About two thirds are on charcoal, one third on marine shells. Three dates, of which two are unreliable because of contamination, are on moa bone. Except for a single date from high in the Tararua ranges (Park 1970), the dated sites are all coastal (Figure 1).

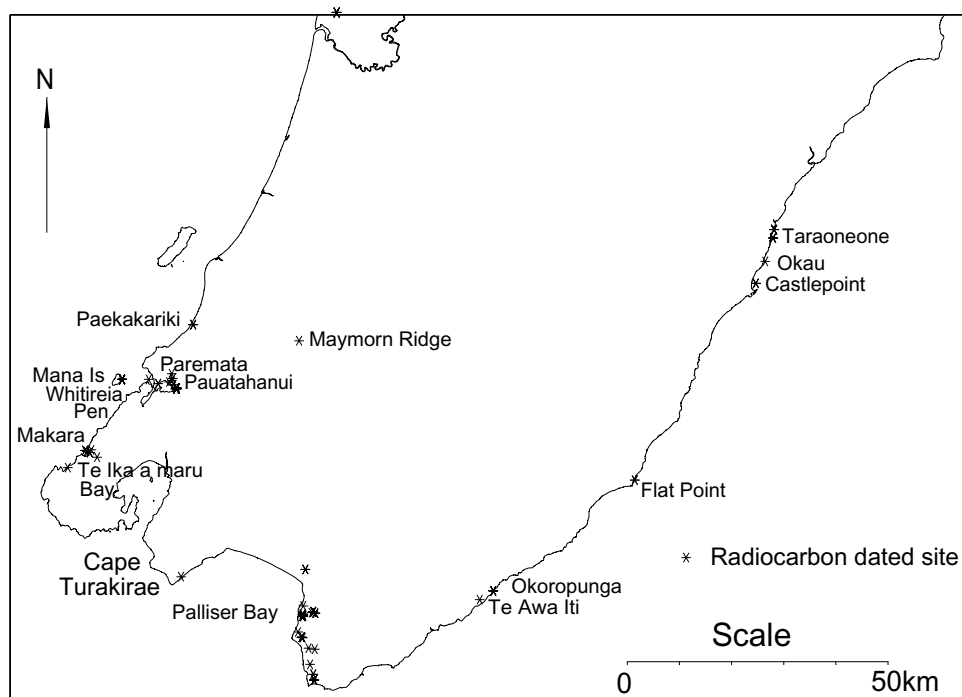


FIGURE 1. DISTRIBUTION OF RADIOCARBON DATED ARCHAEOLOGICAL SITES IN THE WELLINGTON CONSERVANCY.

Each radiocarbon date is reported as a Conventional Radiocarbon Age (CRA) (Stuiver and Polach 1977), which is a measure of the difference in the radiocarbon activity between the sample and modern wood. CRAs are expressed as radiocarbon years before present (BP), where 'present' is the year 1950AD. The oldest reported date on shells is 1147 ± 84 radiocarbon years BP, and on charcoal 2055 ± 105 radiocarbon years BP. These dates do not, however, indicate that the Conservancy was first settled 2000 years ago, or even 1100 years ago. Five factors need to be taken into account when interpreting the dates as calendar years: changes in the radiocarbon content of the atmosphere and oceans over time; standard errors quoted with the dates; depletion of radiocarbon in sea water compared with the atmosphere; *inbuilt age* (McFadgen 1982); and interaction between the standard errors and the variation of radiocarbon in the oceans and atmosphere over time (*Calibration Stochastic Distortion (CSD) effect*) (McFadgen, Knox and Cole 1994).

Changes in the radiocarbon content of the atmosphere and oceans mean that radiocarbon years are not calendar years. Calendar years are found by applying a standard correction procedure based on radiocarbon dates of carefully counted tree rings. A graph of the radiocarbon age of the tree rings plotted

against tree ring or calendar age allows radiocarbon dates on charcoal and wood to be easily converted to calendar dates. The graph for marine shells is different from the graph for charcoal and wood, being derived in a rather more complex fashion which takes into account rates of carbon dioxide exchange between the atmosphere and the oceans. Both graphs show variations over time, with those for charcoal and wood being more extreme than those for marine shells. The difference between a radiocarbon date and its corresponding calendar date may be several hundred years, and in the case of dates of charcoal and wood, one radiocarbon date may correspond to three or more calendar dates more than one hundred years apart.

The standard error is the statistical uncertainty of a radiocarbon date due to measurement errors. To be reasonably (95%) sure of encompassing the true date, a range of 4 times the standard error centred on the measured date is usual. The average 4 standard error range for shell dates in the Conservancy is about 160 years, and for charcoal dates about 260 years. These ranges make it very difficult to give accurate dates for sites in the Conservancy.

The radiocarbon activity of sea water is less than the activity of growing wood at any given time, making radiocarbon dates of marine shells appear much older than wood of the same age. Shell dates need correction for the difference (Stuiver and Braziunas 1993). The difference varies over time and the correction (about 400 years) depends on the age of the shells. It is possible that the difference may also depend on the parts of the Conservancy coast the shells are from.

Inbuilt age results from Maori burning old wood in their fires, and is a particularly important source of error of charcoal dates making them too old. Many of the charcoal dates from Conservancy sites are of unidentified charcoal which has an unknown, and possibly large, inbuilt age. In at least one instance, samples from the moa hunter site at Makara (Figure 1) (Davis 1962), the collectors were asked to collect the biggest charcoal pieces (John Daniels pers.comm.). Charcoal gives a date for when the original wood died and if the burnt wood was from the centre of a large tree, or was driftwood, then the date could be some hundreds of years before the Maori fire. To avoid such large errors of inbuilt age, charcoals are now routinely identified and only short-lived species are dated. Although twigs may be short-lived, it is difficult to distinguish between twigs and the centres of large branches that have had their outer rings burnt off. Unfortunately, more than two thirds of the charcoal dates from sites in the Wellington Conservancy have an unknown and possibly large inbuilt age.

Shells from middens in the Conservancy, on the other hand, probably have a negligible inbuilt age because the shellfish are likely to have died at the time of their collection for food. Their date of collection, and hence death, is therefore likely to be close to their date of deposition in the midden.

The Calibration Stochastic Distortion (CSD) effect causes calibrated radiocarbon dates to cluster in well-defined calendar periods regardless of their true calendar age. It affects all radiocarbon dates whether for archaeological sites, earthquake uplifts, prehistoric forest fires, river terrace formation, slips and erosion, sea level changes, or climate changes. Research, currently under way in the Science and Research Division, has recognised the problem and is developing techniques to cope with it.

After taking into account changes in atmospheric and marine radiocarbon activity, standard errors, the marine reservoir correction, inbuilt age, and the CSD effect, the earliest dated sites in the Conservancy are between about 500 and 650 calendar years BP, i.e., between about 1300AD and 1450AD. I anticipate that further work on the CSD effect will narrow this range and bring it somewhat closer to the present.

The large standard errors of Conservancy radiocarbon dates, the CSD effect, and the relatively short prehistoric period (less than ca 450 years), limit the effectiveness of radiocarbon dates for determining the relative ages of cultural events in the Conservancy. Many more dates are needed than are currently available. Fortunately, the dynamic nature of the Conservancy's coastal landscape has resulted in a stratigraphic record of widespread natural events that can, and have been, used for correlation and relative dating.

Table 1

Radiocarbon dates from archaeological sites for the Wellington Conservancy.

All dates for archaeological sites in the Wellington Conservancy listed according to the material dated: marine shells, charcoal and moa bone. Dates listed are the conventional radiocarbon ages (CRAs). Before being used, shell dates should be corrected for the depletion of the marine environment, and all dates converted to calendar years by the use of the appropriate radiocarbon calibration curve. For site locations see Figure 1.

Note: the following dates are for sites in the Manawatu. They have been included in this table because they are relevant to the prehistory of the western dune belt: NZ0683, 1250, 1251, 1347, 1349, 1479, 1480, 5279, 5280, 0682, 0684, 0685, 5266.

| LAB NO. | DELTA C13 | CRA | SE | METRIC MAP SHEET | SITE | EAST | NORTH | FEATURE NAME | SAMPLE DESCRIPTION, SITE LOCATION | SIGNIFICANCE |
|-------------|-----------|------|----|------------------|------|---------|---------|--|--|--|
| SHELL DATES | | | | | | | | | | |
| NZ0148 | -0.63 | 449 | 39 | R27 | 1 | 2652700 | 5997400 | Paua shells from midden on Pa terrace. | Shells: (<i>Haliotis iris</i>). Makara. | Close date for occupation of pa site |
| NZ0683 | -0.54 | 1095 | 60 | S24 | 3 | 2700900 | 6081300 | Shell lens 2, Occupation Layer II | Shells: (<i>Cbione stutchburyi</i>). Foxton. | Close date for occupation of Foxton moahunter site |
| NZ1250 | 0.15 | 671 | 68 | S24 | 3 | 2700900 | 6081300 | Shell lens 3, Occupation Layer II | Shells: (<i>Paphies mesodesma subtriangulata</i>). Foxton. | Close date for occupation of Foxton moahunter site |
| NZ1251 | -0.73 | 1147 | 84 | S24 | 3 | 2700900 | 6081300 | Shell lens 4, Occupation Layer II | Shells: (<i>Cbione stutchburyi</i>). Foxton. | Close date for occupation of Foxton moahunter site |
| NZ1347 | -0.24 | 1139 | 47 | S24 | 3 | 2700900 | 6081300 | Shell lens 4, Occupation Layer II | Shells: (<i>Cbione stutchburyi</i>). Foxton. | Close date for occupation of Foxton moahunter site |
| NZ1349 | -0.44 | 1075 | 45 | S24 | 3 | 2700900 | 6081300 | Shell lens 1, Occupation Layer I | Shells: (<i>Cbione stutchburyi</i>). Foxton. | Close date for occupation of Foxton moahunter site |
| NZ1479 | -0.44 | 965 | 58 | S24 | 3 | 2700900 | 6081300 | Shell lens 3, Occupation Layer II | Shells: (<i>Cbione stutchburyi</i>). Foxton. | Close date for occupation of Foxton moahunter site |
| NZ1480 | 1.02 | 936 | 58 | S24 | 3 | 2700900 | 6081300 | Shell lens 1, Occupation Layer I | Shells: (<i>Paphies mesodesma subtriangulata</i>). Foxton. | Close date for occupation of Foxton moahunter site |

| | | | | | | | | | | |
|--------|------|-----|----|-----|-----|---------|---------|---|--|---|
| NZ1874 | 0.2 | 687 | 57 | S28 | | 2728300 | 5968800 | Shells marking beginning of deposition of stream sediment that separate two occupation layers and soils. | Shells: (<i>Haliotis iris</i> , <i>Turbo smaragda</i> , <i>Malagrapbia aethiops</i> , <i>Cellana</i> sp.). Te Awa Iti. | Close date for occupation, maximum date for Ohuan deposits. |
| NZ1877 | 1.32 | 840 | 58 | R27 | 42 | 2653000 | 5997200 | Garden soil of angular talus and shell midden. | Shells: (<i>Haliotis iris</i> , <i>Cellana radians</i> , <i>Cellana denticulata</i> , <i>Haustrum baustorium</i>). Makara. | Maximum date for garden soil, close date for occupation. |
| NZ1878 | 0.3 | 804 | 57 | R26 | 159 | 2669300 | 6010800 | Midden stratified above Maori Plaggen Soil. | Shells: (<i>Chione stutchburyi</i>). Pauatahanui. | Minimum date for gardening. |
| NZ1882 | 1.9 | 851 | 40 | U26 | 24 | 2784700 | 6039700 | Shells from layer 1 | Shells: mixed spp. Taraneone Bay. | Close date for final occupation of beach midden. |
| NZ1883 | 1.8 | 719 | 40 | U26 | 24 | 2784700 | 6039700 | Shells from layer 2 | Shells: mixed spp. Taraneone Bay. | Close date for second occupation of beach midden. |
| NZ4229 | 2.3 | 760 | 33 | R28 | 26 | 2671100 | 5973200 | Shell (below turf layer) in midden on Beach Ridge C. | Shells: (<i>Haliotis iris</i>). Cape Turakirae | Date for occupation on Beach Ridge C. |
| NZ4699 | 1.9 | 883 | 67 | R27 | 45 | 2670200 | 6009200 | Shell midden located within topsoil | Shells: (<i>Haliotis iris</i>) Pauatahanui. | Close date for occupation. |
| NZ4720 | 0.06 | 632 | 32 | U26 | 14 | 2784500 | 6038100 | Terrace site with single occupation layer (Layer 2) of midden and cooking stones. Sample from middle of layer (Layer 2a). | Shells: (<i>Melagrapbia lugulovis</i>), Okau. | Close date for occupation. |
| NZ4721 | 1.6 | 602 | 32 | U26 | 14 | 2784500 | 6038100 | Terrace site with single occupation layer (Layer 2) of midden and cooking stones. Sample from middle of layer (Layer 2a). | Shells: (<i>Turbo smaragda</i>), Okau. | Close date for occupation. |

| | | | | | | | | | | |
|--------|------|-----|----|-----|----|---------|---------|---|---|---|
| NZ4723 | 1.00 | 635 | 29 | U26 | 17 | 2781200 | 6029400 | Shells from topmost occupation layer of stratified midden. | Shells: (<i>Papbies subtriangulata</i> , <i>Protothaca crassicosta</i>). Castlepoint. | Close date for topmost occupation layer. |
| NZ4724 | 1.20 | 758 | 27 | U26 | 17 | 2781200 | 6029400 | Shells from lowest occupation layer of stratified midden. | Shells: (<i>Papbies subtriangulata</i>). Castlepoint. | Close date for lowest occupation layer. |
| NZ4854 | 0.3 | 747 | 33 | R27 | 35 | 2670100 | 6009300 | Midden in topsoil. | Shells: (<i>Chione stutchburyi</i>). Pauatahanui | Close date for occupation. |
| NZ4855 | 0.3 | 736 | 28 | R27 | 35 | 2670100 | 6009300 | Midden in topsoil. | Shells: (<i>Chione stutchburyi</i>). Pautahanui. | Close date for occupation. |
| NZ4856 | 0.6 | 745 | 28 | R27 | 36 | 2670200 | 6009300 | Midden in topsoil. | Shells: (<i>Chione stutchburyi</i>). Pauatahanui. | Close date for occupation. |
| NZ4857 | 0.5 | 705 | 33 | R27 | 37 | 2670300 | 6009400 | Midden in black topsoil. | Shells: (<i>Chione stutchburyi</i>). Pautahanui. | Close date for occupation. |
| NZ4858 | 0.2 | 745 | 33 | R27 | 45 | 2670200 | 6009200 | Midden in topsoil. | Shells: (<i>Chione stutchburyi</i>). Pautahanui. | Close date for occupation. |
| NZ4859 | -0.1 | 722 | 28 | R27 | 45 | 2670200 | 6009200 | Midden in black topsoil. | Shells: (<i>Chione stutchburyi</i>). Pauatahanui. | Close date for occupation. |
| NZ4860 | 1.4 | 751 | 33 | R27 | 45 | 2670200 | 6009200 | Midden in topsoil. | Shells: (<i>Chione stutchburyi</i>). Pauatahanui. | Close date for occupation. |
| NZ4861 | -0.2 | 797 | 33 | R27 | 45 | 2670200 | 6009200 | Midden in black topsoil. | Shells: (<i>Chione stutchburyi</i>). Pauatahanui. | Close date for occupation. |
| NZ5279 | 1.2 | 814 | 33 | S24 | 26 | 2699200 | 6088800 | Shells from coastal midden on Waitarere sand, 300 m from sea. | Shells: (<i>Papbies subtriangulata</i>). Himatangi. | Close date for occupation. Minimum date for Ohuan unstable phase. |
| NZ5280 | 1.4 | 841 | 32 | S24 | 26 | 2699200 | 6088800 | Shells from coastal midden on Waitarere sand, 300 m from sea. | Shells: (<i>Papbies subtriangulata</i>). Himatangi. | Close date for occupation. Minimum date for Ohuan unstable phase. |
| NZ7754 | 0.4 | 680 | 50 | Q27 | 30 | 2649400 | 5994100 | Shell midden - Layer 5 in square B4 | Shells: (<i>Protothaca crassicosta</i>). Te Ika-a-Maru Bay. | Close date for occupation. |
| NZ7848 | 1.00 | 600 | 30 | T27 | 12 | 2758000 | 5991700 | Shells from on top of lower buried soil. | Shells: (<i>Haliotis</i> sp). Flat Point. | Close date for deposition of midden. |

| | | | | | | | | | | |
|--------|-----|-----|----|-----|-----|---------|---------|---|---|--|
| WK1756 | 1.2 | 680 | 35 | R26 | 255 | 2673400 | 6021500 | Shells from midden on upper buried soil in 'Taupo' sand dune. | Shells: (<i>Paphies mesodesma subtriangulata</i>). Paekakariki. | Minimum date for 'Taupo' dune, close date for second occupation. |
| WK1757 | 1.4 | 660 | 35 | R26 | 255 | 2673400 | 6021500 | Shells from midden on lower buried soil in 'Taupo' sand dune. | Shells: (<i>Paphies mesodesma subtriangulata</i>). Paekakariki. | Maximum date for 'Taupo' dune, close date for 1st occupation. |

| CHARCOAL AND MOA BONE DATES | | | | | | | | | | |
|-----------------------------|--------|------|-----|-----|-----|---------|---------|---|---|--|
| NZ0149 | -25.00 | 364 | 42 | R27 | 1 | 2652700 | 5997400 | Wood from butt of palisade post. | Wood. Makara. | Maximum date for palisade construction on pa. |
| NZ0480 | -0.44 | -100 | 144 | R27 | 54 | 2653600 | 5997000 | Moa bone in beach midden area, behind boulder storm ridge. | Moa bone: <i>Dinornis cf hercules</i> . Makara. | Contaminated. Sample from makara moahunter site. |
| NZ0510 | -25.00 | 582 | 48 | R26 | 122 | 2666700 | 6010200 | Occupational layer 3, sand impregnated with charcoal, midden. | Charcoal (unidentified). Paremata. | Maximum date for occupation of layer 3 of Paremata moahunter site. |
| NZ0653 | -26.20 | 442 | 87 | R27 | 54 | 2653600 | 5997000 | Charcoal from oven containing moa bone, within beach midden. | Charcoal. Makara. | Maximum date for occupation of makara moahunter site. |
| NZ0654 | -24.70 | 987 | 74 | R27 | 54 | 2653600 | 5997000 | Charcoal from oven containing moa bone, within beach midden. | Charcoal. Makara. | Maximum date for occupation of Makara moahunter site. |
| NZ0682 | -25 | 736 | 48 | S24 | 3 | 2700900 | 6081300 | Moahunter layer, west side of site | Charcoal: unidentified. Foxton moa hunter site, Manawatu. | Maximum date for occupation |
| NZ0684 | -25 | 523 | 63 | S24 | 3 | 2700900 | 6081300 | Oven, Occupation Layer II | Charcoal: unidentified. Foxton. | Maximum date for occupation of Foxton moa hunter site. |

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|--------|--------|-----|-----|-----|----|---------|---------|--|---|--|
| NZ0685 | -25 | 177 | 113 | S24 | 3 | 2700900 | 6081300 | Layer above oven, Occupation Layer II | Charcoal: unidentified. Foxton. | Maximum date for occupation of Foxton moahunter site. |
| NZ1057 | -25.00 | 747 | 59 | S26 | 3 | 2693700 | 6018400 | Charcoal from fire-place on broad flat crest of Maymorn ridge. | Charcoal (?small branches) Maymorn Ridge, Southern Tararua Ranges. | Maximum date for occupation (possibly not more than 100 years too old) |
| NZ1309 | -25.50 | 546 | 86 | S28 | 43 | 2694500 | 5967600 | Charcoal from stone row, between beach ridges, in black sandy loam. | Charcoal (unidentified). Whatarangi, eastern Palliser Bay. | Maximum date (close?) for soil disturbance next to stone row. |
| NZ1310 | -26.00 | 784 | 70 | S28 | 66 | 2693500 | 5962600 | Charcoal from within stone row, in black sand with fractured stones. | Charcoal (unidentified). Te Humenga, eastern Palliser Bay. | Maximum date for cultural layer associated with stone row. |
| NZ1311 | -25.20 | 676 | 86 | S28 | 68 | 2694200 | 5961600 | Charcoal from matrix of stone row (black sand with shell and fish bone) built on raised beach. | Charcoal (unidentified). North Pararaki midden row, eastern Palliser Bay. | Maximum (close?) date for construction of stone row. |
| NZ1312 | -27.00 | 737 | 86 | S28 | 68 | 2694200 | 5961600 | Charcoal from matrix of stone-filled trench containing midden, underlying stone row. | Charcoal (unidentified). North Pararaki eastern Palliser Bay. | Maximum (close?) date for construction of stone row; and maximum (close?) date for infilling of trench with stones and midden. |
| NZ1313 | -25.70 | 712 | 86 | S28 | 68 | 2694200 | 5961600 | Charcoal in matrix of stone row (black sandy loam with stones and shells) on third raised beach ridge. | Charcoal (unidentified). Pararaki North, eastern Palliser Bay. | Maximum (close?) date for construction of stone row. |

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|--------|--------|-----|----|-----|-----|---------|---------|--|--|---|
| NZ1314 | -26.30 | 817 | 86 | S28 | 73 | 2694400 | 5961500 | Charcoal from base of charcoal rich layer between double row of stones. | Charcoal (unidentified). Pararaki South, eastern Palliser Bay. | Maximum (close?) date for pathway within stone row system. |
| NZ1315 | -26.50 | 692 | 86 | S28 | 79 | 2695500 | 5959500 | Charcoal from base of deep stone-filled trench. | Charcoal (unidentified). Kawakawa North, eastern Palliser Bay. | Maximum (close?) date for infilling of trench. |
| NZ1316 | -26.10 | 484 | 72 | S28 | 96 | 2695800 | 5956400 | Charcoal, from base of stone wall on uppermost raised beach ridge. | Charcoal (unidentified). Waiwhero North, eastern Palliser Bay. | Maximum (close?) date for construction of stone row. |
| NZ1317 | -25.40 | 566 | 86 | S28 | 103 | 2696400 | 5954500 | Charcoal from matrix of stone row. | Charcoal (unidentified). Black Rocks, eastern Palliser Bay. | Maximum (close?) date for soil disturbance next to stone row. |
| NZ1505 | -25.80 | 767 | 45 | S28 | 49 | 2694400 | 5965600 | Charcoal from midden pit cut into crust of layer 5. | Charcoal (unidentified) Washpool, eastern Palliser Bay. | Maximum date for Level I occupation at Washpool Midden. |
| NZ1506 | -25.90 | 488 | 44 | S28 | 49 | 2694400 | 5965600 | Charcoal from scoop hearth cut into Layer 5 and overlain by lens IIB. | Charcoal (unidentified) Washpool, eastern Palliser Bay. | Maximum date for Level II at Washpool Midden. |
| NZ1507 | -26.10 | 665 | 44 | S28 | 49 | 2694400 | 5965600 | Charcoal from midden pit, cut into crust of layer 5, overlain by Layer 4 (sandy). | Charcoal (unidentified) Washpool, eastern Palliser Bay. | Maximum date for Level II at Washpool Midden. |
| NZ1508 | -25.80 | 683 | 88 | S28 | 49 | 2694400 | 5965600 | Charcoal from small depression in crust of layer 5, overlain by Lens VB and Layer 4 Black. | Charcoal (unidentified) Washpool, eastern Palliser Bay. | Maximum date for Level II at Washpool Midden. |

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|--------|--------|-----|----|-----|----|---------|---------|--|--|---|
| NZ1509 | -25.70 | 554 | 46 | S28 | 48 | 2694300 | 5965600 | Charcoal from layer 2. | Charcoal (unidentified) Washpool, eastern Palliser Bay. | Maximum date for Washpool Campsite. |
| NZ1510 | -25.70 | 670 | 44 | S28 | 49 | 2694400 | 5965600 | Charcoal from scoop hearth cut into crust of Layer 5, and overlain by Lens VB and Layer 4 Black. | Charcoal (unidentified) Washpool, eastern Palliser Bay. | Maximum date for Level II (later part), Washpool Midden. |
| NZ1511 | -25.20 | 797 | 45 | S28 | 49 | 2694400 | 5965600 | Charcoal from Layer 4 Black. | Charcoal (unidentified) Washpool, eastern Palliser Bay. | Maximum date for Level I, Washpool Midden. |
| NZ1512 | -26.80 | 390 | 87 | S28 | 47 | 2694400 | 5966000 | Charcoal from layer 3 (light brown sand), beneath stone row. | Charcoal (unidentified) Washpool, eastern Palliser Bay. | Maximum date for stone row construction. |
| NZ1513 | -26.60 | 344 | 86 | S28 | 47 | 2694400 | 5966000 | Charcoal from layer 2A, topsoil in stone row. | Charcoal (unidentified) Washpool, eastern Palliser Bay. | Maximum date for soil disturbance and stone row construction. |
| NZ1514 | -25.80 | 514 | 87 | S28 | 47 | 2694400 | 5966000 | Charcoal from layer 2B (brown cultural soil), next to stone row. | Charcoal (unidentified) Washpool, eastern Palliser Bay. | Maximum date for soil disturbance. |
| NZ1636 | -24.30 | 146 | 83 | S28 | 51 | 2694500 | 5965700 | Fill of circular raised rim pit, layer 13. | Charcoal (unidentified). Makotukutuku River mouth, eastern Palliser Bay. | Maximum date for pit fill. |
| NZ1637 | -26.40 | 583 | 86 | S28 | 51 | 2694500 | 5965700 | Charcoal fragments at interface of layers 2 and 3 within garden soil. | Charcoal (unidentified). Terrace garden. Makotukutuku River mouth, eastern Palliser Bay. | Maximum date for layer 2, garden soil. |
| NZ1638 | -24.90 | 479 | 85 | S28 | 54 | 2696100 | 5966300 | Charcoal from charred stick with burial remains. | Charcoal (unidentified). Cleft burial. Makotukutuku Valley, eastern Palliser Bay. | Maximum date (possibly close) for burial. |

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|--------|--------|-----|----|-----|-----|---------|---------|--|---|---|
| NZ1639 | -25.00 | 107 | 83 | S28 | 58 | 2696800 | 5966200 | Charcoal from Titoki Pit, hearth M5 (next to buttress), layer 11, beneath clay soil. | Charcoal (unidentified). Titoki Pit, Makotukutuku River, eastern Palliser Bay. | Maximum date for pit use. |
| NZ1640 | -24.00 | 376 | 85 | S28 | 58 | 2696800 | 5966200 | Charcoal from hearth A in west wall of pit, beneath clay soil. | Charcoal (unidentified). Titoki Pit, Makotukutuku, eastern Palliser Bay. | Maximum date for pit use. |
| NZ1641 | -25.90 | 701 | 86 | S28 | 56 | 2696400 | 5966500 | Charcoal from stone mound structure, Layer 6. | Charcoal (unidentified). Cross-site mound, Makotukutuku, eastern Palliser Bay. | Maximum date for construction of stone mound. |
| NZ1642 | -23.60 | 340 | 84 | S28 | 56 | 2696400 | 5966500 | King post of house (structure 40). | Charcoal (unidentified). Cross site terrace, eastern Palliser Bay. | Maximum date for house construction. |
| NZ1643 | -24.30 | 492 | 85 | S28 | 56 | 2696400 | 5966500 | Charcoal of centre post of house (structure 33). | Charcoal (unidentified). Cross site terrace, eastern Palliser Bay. | Maximum date for house construction. |
| NZ1644 | -24.80 | 775 | 59 | S28 | 9 | 2694900 | 5974600 | Part of base slab of house north wall. Layer 2, next to butts H and AE. | Charcoal: small untrimmed branches, <i>Podocarpus</i> sp.? Moikau, Whangaimoana eastern Palliser Bay. | Maximum date for house construction. |
| NZ1645 | -26.10 | 777 | 59 | S28 | 9 | 2694900 | 5974600 | Part of base slab of house east wall. Layer 2 next to butt AC. | Charcoal: small untrimmed branches, <i>Podocarpus</i> sp.? Moikau, Whangaimoana eastern Palliser Bay. | Maximum date for house construction. |
| NZ1646 | -25.10 | 809 | 59 | S28 | 104 | 2696600 | 5953400 | Midden near stone rows, basal layer (layer 2) of site. | Charcoal: burnt brushwood. Black Rocks, eastern Palliser Bay. | Close date for occupation ? Midden BR3. |
| NZ1647 | -25.2 | 687 | 58 | S28 | 104 | 2696600 | 5953400 | Top layer (Layer 1) of a midden on 3rd up-lifted beach ridge. | Charcoal (unidentified) (Brushwood?) Black Rocks, eastern Palliser Bay. | Close date for occupation ? Midden BR4. |

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|--------|--------|------|----|-----|-----|---------|---------|---|---|---|
| NZ1648 | -25.6 | 681 | 58 | S28 | 104 | 2696600 | 5953400 | Bottom layer (Layer 4) of a midden on 3rd uplifted beach ridge. | Charcoal: unspecified (Brushwood?) Black Rocks, eastern Palliser Bay. | Close date for occupation ? Midden BR4 |
| NZ1849 | -25.8 | 39 | 56 | S28 | 104 | 2696600 | 5953400 | Single layer (Layer 1) of very dense shell midden immediately behind 2nd uplifted beach ridge. | Charcoal (unidentified) (Brushwood?) Black Rocks, eastern Palliser Bay. | Close date for occupation ? Midden BR2. |
| NZ1884 | -24.2 | 599 | 58 | U26 | 24 | 2784700 | 6039700 | Charcoal from layer 3. | Charcoal: unspecified. Taraneone Bay. | Maximum date for first occupation of beach midden. |
| NZ1885 | -24.2 | 674 | 59 | U26 | 24 | 2784700 | 6039700 | Charcoal from layer 3. | Charcoal: <i>Podocarpus totara</i> (bark and twigs) Taraneone Bay. | Close date for first occupation of beach midden. |
| NZ2696 | -24.2 | 75 | 32 | R26 | 115 | 2664900 | 6011000 | Fill forming terrace tread with charcoal fragments of burnt bracken fern roots. | Bracken fern root (<i>Pteridium esculentum</i>). Whitiorea Peninsula. | Maximum date for terrace construction. |
| NZ3114 | -25.6 | 337 | 79 | T28 | 47 | 2730900 | 5970500 | Charcoal within paleosol beneath stone row. | Charcoal (<i>Coprosma</i> sp., <i>Hebe</i> sp. and <i>Podocarpus spicatus</i>). Okoropunga. | Maximum date for stone row construction. |
| NZ3115 | -25.6 | 531 | 58 | T28 | 47 | 2730900 | 5970500 | Charcoal within stone row alignment, dating bush clearance. | Charcoal (<i>Coprosma</i> sp. (dominant), <i>Podocarpus totara</i> (minor)). Okoropunga. | Maximum date for stone row construction. |
| NZ3116 | -21.8 | 746 | 41 | T28 | 47 | 2730900 | 5970500 | Charred totara root found within paleosol on uplifted beach ridge and buried by Maori Plaggen Soil. | Charcoal: <i>Podocarpus totara</i> . Okoropunga. | Maximum date for Maori Plaggen Soil and for vegetation clearance. |
| NZ3581 | -12.60 | -100 | 36 | R26 | 122 | 2666700 | 6010200 | Occupation layer, sand impregnated with charcoal, midden. | Moa bone. Paremata. | Contaminated. Sample from Paremata moa-hunter site. |

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|--------|--------|------|-----|-----|-----|---------|---------|---|---|----------------------------------|
| NZ4722 | -26.3 | 221 | 55 | U26 | 14 | 2784500 | 6038100 | Terrace site with single occupation layer (Layer 2) of midden and cooking stones. Sample from base of layer (Layer 2c). | Charcoal: (twigs, bark), Okau, Castlepoint. | Close date for occupation. |
| NZ5266 | -24.7 | 2055 | 105 | S24 | 20 | 2699500 | 6090800 | Charcoal from wind deflated midden. | Charcoal: (<i>Podocarpus totara/ballii</i> group (dominant), <i>Sophora</i> sp. (probably <i>S. microphylla</i>) (minor). Himatangi. | Maximum date for occupation. |
| NZ6267 | -25.6 | 456 | 55 | S24 | 26 | 2699200 | 6088800 | Charcoal from deflated dune midden. | Charcoal: (<i>Shefflera digitata</i> (dominant), <i>Podocarpus totara/ballii</i> group, <i>Notbofagus</i> sp., <i>Vitex lucens</i> (minor). Himatangi. | Maximum date for occupation. |
| NZ6965 | -24.7 | 714 | 37 | S28 | 87 | 2696700 | 5959300 | Charcoal and burnt wood between burial sites, beneath wind blown sand. | Charcoal (unidentified). Pararaki Burial site, eastern Palliser Bay. | Maximum date for burial ? |
| NZ6968 | -25.8 | 592 | 52 | U26 | 20 | 2783000 | 6033600 | Charcoal layer (Layer 5), beneath burnt oven-stones, midden, windblown sand and soil. | Charcoal (unidentified). Okau. | Maximum date for 1st occupation. |
| NZ7850 | -15.50 | 750 | 60 | T27 | 12 | 2758000 | 5991700 | Moa bones from oven in lower buried soil. (Claw in position of articulation). | Moa collagen. Flat Point. | Close date for occupation. |
| NZ7887 | -26.50 | 556 | 71 | R26 | 141 | 2659800 | 6011000 | 2nd cultural deposit at northern end of site R26/141 - a charcoal-rich deposit with some midden. | Twig charcoal (<i>Kunzea ericooides</i> , <i>Meliclytus ramiflorus</i> , <i>Coprosma</i> sp.). Mana Island. | Close date for occupation. |

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|---------|--------|-----|-----|-----|-----|---------|---------|--|---|----------------------------|
| NZ7888 | -25.30 | 588 | 72 | R26 | 141 | 2659800 | 6011000 | Black layer: 2nd cultural deposit at northern end of site R26/141 - a charcoal-rich deposit with some midden. | Twig charcoal (<i>Schefflera digitata</i> , <i>Carpodetus serratus</i> , <i>Pseudopanax arboreus</i> , <i>Macropiper excelsa</i> , <i>Melicytus ramiflorus</i> , <i>Hoheria</i> sp., <i>Coprosma</i> sp., <i>Hebe</i> sp., <i>Olearia</i> sp. Mana Island. | Close date for occupation. |
| NZ7889 | -26.00 | 891 | 106 | R26 | 141 | 2659800 | 6011000 | Layer 3: earliest cultural deposit at northern end of site R26/141. A midden containing bird, fish, mammal bone, shells, bone and shell artefacts. | Twig charcoal of short-lived species (<i>Coprosma</i> sp., <i>Olearia</i> sp., <i>Macropiper excelsus</i> , <i>Aristotelia serrata</i> , <i>Myrsine</i> sp., <i>Kunzea ericoides</i>). Mana Island. | Close date for occupation. |
| NZ7890 | -25.40 | 556 | 89 | R26 | 141 | 2659800 | 6011000 | Single shallow cultural deposit (20 cms) at south end of site R26/141. Midden with bird, fish, mammal bone, shells, bone and stone artefacts. | Twig charcoal of short-lived species (<i>Macropiper excelsus</i> , <i>Coprosma</i> sp., <i>Pseudopanax arboreus</i> , <i>Olearia</i> sp., <i>Melicytus ramiflorus</i> , <i>Hebe</i> sp., <i>Pittosporum eugenoides</i>). Mana Island. | Close date for occupation. |
| NZ7891 | -24.90 | 434 | 65 | R26 | 141 | 2659800 | 6011000 | Single shallow cultural deposit (20cms) at south end of site R26/141. Midden with bird, fish, mammal bone, shells, bone and stone artefacts. | Twig charcoal (<i>Coprosma</i> sp., <i>Olearia</i> sp., and other spp.). Mana Island. | Close date for occupation |
| NZA2182 | -25.7 | 413 | 90 | R26 | 141 | 2659800 | 6011000 | Cultural deposit (Layer 3). Earliest cultural deposit at north end of site. Midden with bird, fish and mammal bone, and bone and stone artefacts. | Charcoal (<i>Coprosma</i> sp., <i>Olearia</i> sp., <i>Kunzea ericoides</i> , <i>Dysoxylum spectabile</i> . Mana Island. | Close date for occupation. |

APPENDIX 3: FRESHWATER AND TERRESTRIAL
MOLLUSCS FROM LOWER SHELL MIDDEN, SITE
R26/255, ON FOXTON SOIL BENEATH OLD
WAITARERE DUNES AT PAEKAKARIKI

Identifications by Dr. F.M. Climo, National Museum of New Zealand, Wellington
(24 September 1990). ()= numbers of snails present in sample.

Hydrobiidae

Potomypyrgus antipodarum (8)

Planorbidae

Planorbis corinna (2)

Physastra variabilis (1)

Rhytididae

Delos coresia (3)

Tornatellinidae

Lamellidea novoseelandica (1)

Punctidae

Phrixgnathus phrynia (15)

"Paralaoma" serratocostata (1)

Iotula gracilis n.sp (1)

Paralaoma caputspinulae (1)

Charopidae

Phenacharopa novoseelandica (2)

Huonodon pseudoleioda (1)

"Geminoropa" subantialba (1)

Sinployea parva (1)

Charopa coma (46)

Mocella eta (4)

Therasia zelandiae (4)

Fectola trilamellata (8)

"Mocella" prestoni (101)

"Mocella" maculata (181)

Cavellia buccinella (13)

Cavellia serpentinula (3)

Cavellia brouni (2)