NEW ZEALAND
ARCHAEOLOGICAL
ASSOCIATION

ARCHAEOLOGY IN NEW ZEALAND

STONE NET WEIGHTS AT PEGASUS TOWN, NORTH CANTERBURY

ALISON WITTER
WITTER ARCHAEOLOGY, TAUMUTU

Introduction

A new town, Pegasus Town, is to be developed in a 3 x 4 km area between Woodend and the coast, about 25 km north of Christchurch. Archaeological investigations are proceeding in conjunction with earthworks (Witter and Witter 2007: 33).

This paper focuses on a single site at Pegasus Town, consisting of one hundred selected greywacke river pebbles. These occur as a discrete group, with no other associated cultural material, and are unmodified. Based on the site location, the tight range in size and shape of the pebbles, and the strong spatial patterning, they have been interpreted to be net weights or net sinkers. That is, they are the weights from the weighted line of a net, all other traces of which have disappeared.

Landscape and site location

From west to east the Pegasus Town block consists of an alluvial plain, an extensive inland dunefield including the Western Ridge with the Hohoupounamu site, and an interdunal low-lying wetland area. To the east the wetland area is bounded by the coastal dunes of Pegasus Bay (Figure 1).

This landscape has altered hugely in the last 500 years (Witter and Witter 2007: 33–34). The present coastal dunes are only about 500 years old. They are the result of a period of major sand deposition following earthquakes in the Southern Alps, and the consequent massive amount of sediment carried out to sea by the big Canterbury rivers (Goff and McFadgen 2002). The Western Ridge and the inland dunefield formed the earlier coastal dunes.

In June 2006 a sewer-line was dug through the low-lying wetland area between the present coastal dunes and the older dunefield. The sewer-line contained an abundance of large estuarine shellfish (mostly cockle) indicating

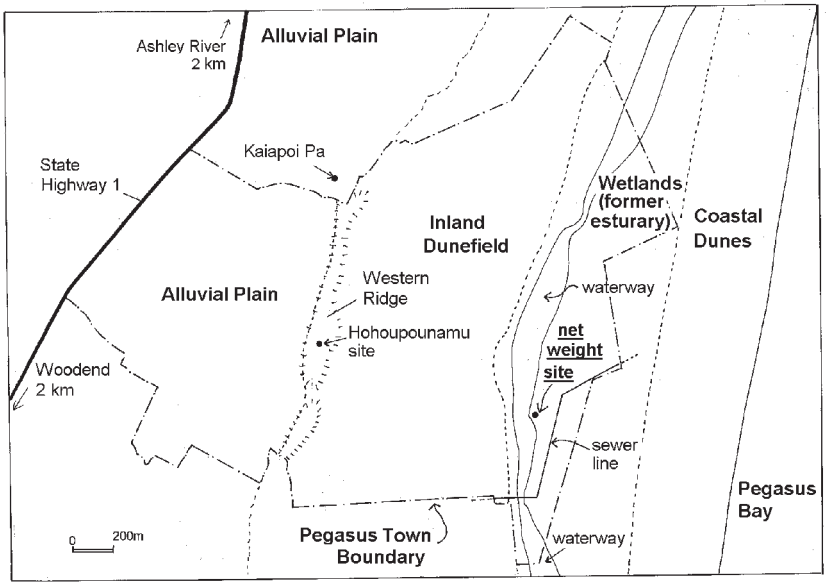

Figure 1. Location of WPT 582 Net Weight Site in the Pegasus Town landscape.

that a lagoon/estuary had developed soon after the formation of the current coastline. This estuary gradually filled in to become the wetland it is today.

A waterway runs through the interdunal low-lying area with areas of hummocky wind-blown sand on both sides. These areas are heavily grassed and have no exposure except in small patches, such as farm tracks, animal tracks, and areas of rabbit disturbance.

These pockets of exposure were examined while the sewer-line was monitored. One such area of rabbit disturbance occurred on a prominent sandy knoll adjacent to a channel in the waterway. The knoll bordered the channel with a bank half a metre high; elsewhere the channel bank was indistinct and marshy. Here Joseph Hullen, (Tuahiwi Cultural Observer for Pegasus Town Ltd) found seven elongated and cylindrical pebbles in a 50 x 50 cm area (Figure 2). These pebbles were natural river-worn greywacke pebbles, with no visible human modification, but they occurred in a wind blown sand deposit. Given the location and unusual shape of the pebbles an artificial explanation was required to account for their presence. The site was given the field number WPT 582 (WPT refers to the GPS waypoint).

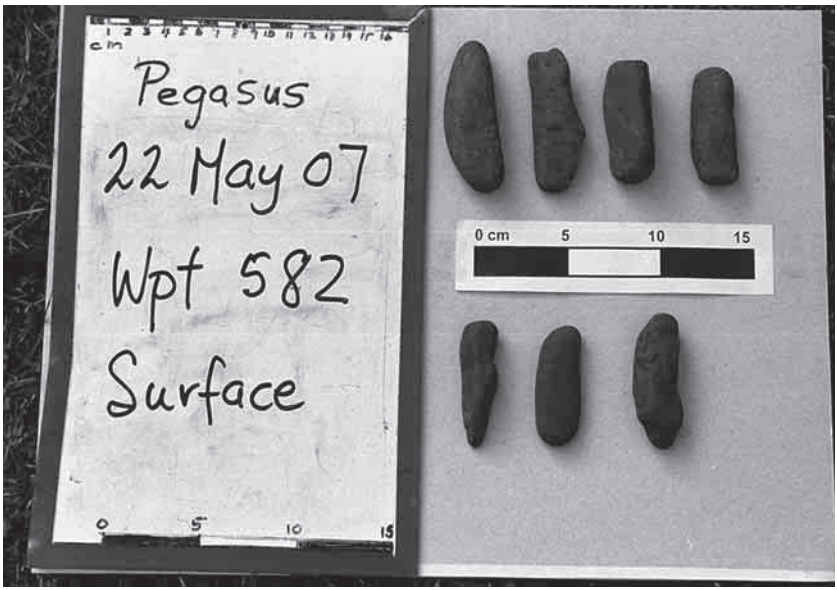

Figure 2. Net weights from Pegasus WPT 582 Net Weight Site, surface find.

Excavation

A 1 x 1 m test square was opened and within 5 cm of the surface, immediately below the turf, a tight cluster of similar elongated pebbles was exposed in the mid-brown sandy soil. Subsequent 1 m squares were opened to expose the full extent of the pebble feature which was contained within a 2.5 x 2 m area (Figure 3). Most of the pebbles occurred as a single layer, a few were superimposed, though nowhere more than two pebbles deep. The pebbles were not scattered randomly. There were several zigzag patterns of 5 or 6 stones, plus patterns in which several stones occurred in straight or slightly curved lines. Pebbles lying parallel were also observed. Most of the pebbles lay horizontally or nearly so. Each pebble was numbered, mapped and measured (length and width, to the nearest 0.5 cm), and note taken of horizontality and orientation. Descriptive details were added where appropriate. All the pebbles were river-worn greywacke. No other material was found in the site, except one isolated fragment of light-green bottle glass.

After the pebbles were removed the mid-brown sandy soil was excavated down to the contact with clean light-brown sand. This sterile sand layer occurred at a depth of 5 to 10 cm below the pebble feature, and was less com-

Figure 3. Photograph of Pegasus WPT 582 Net Weight Site excavation, showing the patterning of the elongated pebbles.

pact than the mid-brown sandy soil containing the pebbles. While excavating down to the clean sand we were looking especially for possible post or stake holes but found none.

The pebbles were remarkably homogeneous in form. They were remeasured and weighed by Iain Gover. The dimensions and weights are shown in Table 1, in which L = maximum length), W = width mid pebble, T = thickness mid pebble at right angles to width and Wt = weight. Numbers 1–93 = artefact number for excavated pebbles, S1–7 = surface collected pebbles and Av = average of all pebbles. The pebbles averaged 68 mm in length with a range of 44–120 mm. The average width through the middle was 24 mm with a range of 13–35 mm. The average weight was 68 gm with a range from 15–124 gm.

Discussion

The patterning of these stones was familiar to me from childhood, reminding me of the patterns formed by the lead-lines of my father's nets while hanging in a net-shed. My father, George Smith, was a commercial fisherman on Lake Ellesmere/Waihora in the 1950s when cotton nets were still in use (modern nets are synthetic). Cotton nets needed to be well looked after and

Table 1. WPT 582 Net Weight Site stones, showing length, width, thickness (mm) and weight (gm).

No	L	W	T	Wt	No	L	W	T	Wt	No	L	W	T	Wt
1	79	30	24	83	35	69	27	15	34	69	77	27	25	70
2	75	32	17	56	36	70	18	16	40	70	77	18	14	43
3	57	20	12	21	37	57	16	13	26	71	57	21	12	20
4	72	32	19	64	38	73	33	17	54	72	59	20	13	23
5	93	26	15	71	39	66	25	22	59	73	97	27	18	76
6	70	31	24	70	40	66	25	16	39	74	44	22	14	25
7	87	25	15	61	41	63	25	15	39	75	65	22	20	38
8	120	29	17	126	42	66	28	17	57	76	59	20	13	23
9	67	20	19	40	43	79	32	24	107	77	52	22	12	21
10	63	20	17	50	44	56	17	12	22	78	60	17	16	36
11	62	22	16	35	45	68	26	12	33	79	67	27	21	58
12	61	25	21	45	46	73	30	22	69	80	81	21	17	61
13	77	29	25	85	47	66	25	16	46	81	44	28	20	43
14	55	19	18	30	48	69	27	17	57	82	55	22	9	18
15	52	19	19	27	49	58	23	12	29	83	73	21	19	55
16	62	22	15	43	50	91	18	16	70	84	72	16	13	35
17	60	23	21	47	51	73	28	16	48	85	67	29	14	46
18	60	26	11	24	52	62	30	22	69	86	85	26	13	50
19	56	28	11	32	53	66	29	15	45	87	56	22	19	40
20	54	21	12	21	54	83	33	26	112	88	61	17	14	23
21	55	20	18	31	55	58	18	17	27	89	57	19	16	31
22	57	23	14	24	56	75	27	19	58	90	59	23	19	43
23	65	25	17	43	57	87	23	19	66	91	69	20	15	46
24	57	20	16	33	58	57	23	9	25	92	49	17	13	17
25	66	31	15	57	59	66	25	19	52	93	74	23	22	57
26	99	20	19	85	60	85	25	17	50	S1	63	24	15	40
27	95	35	23	124	61	68	28	18	57	S2	75	26	15	40
28	75	20	18	50	62	60	21	12	23	S3	64	17	17	27
29	61	16	15	27	63	69	26	24	75	S4	83	29	20	76
30	86	33	18	68	64	65	23	18	41	S5	62	24	15	36
31	60	24	18	39	65	67	22	19	48	S6	66	27	20	65
32	76	18	15	31	66	97	15	10	34	S7	69	22	17	47
33	70	22	19	51	67	51	13	12	15					
34	55	25	14	27	68	55	26	16	40	Av	68	24	17	47

even so had a short life span. They were tanned before use, and were fished only two or three times before being tanned again. Most importantly they were stored very carefully. After tanning and after each use they were slung on a row of posts to dry, and when completely dry, transferred to a hook and hung in a net shed. From memory the nets in my father's net shed hung from four rows of six eyebolts in the ceiling. Each net hung on a separate eyebolt and hook, suspended from the cork line. Because the cork line was gathered in this manner, and because the lead line was made of much thicker line than the rest of the net, and was considerably longer than the cork line, the nets flared out at the bottom, in a manner enchanting to a child (Figure 4).

This is the patterning I see in the archaeological site. The patterning suggests not only that the weights were fastened on a line when the net was abandoned, but also that they were attached to a net which was hanging up and had later fallen, as opposed to a net originally left on the ground. I would suggest that such a net would be carefully dried before it was gathered up and hung in this manner.

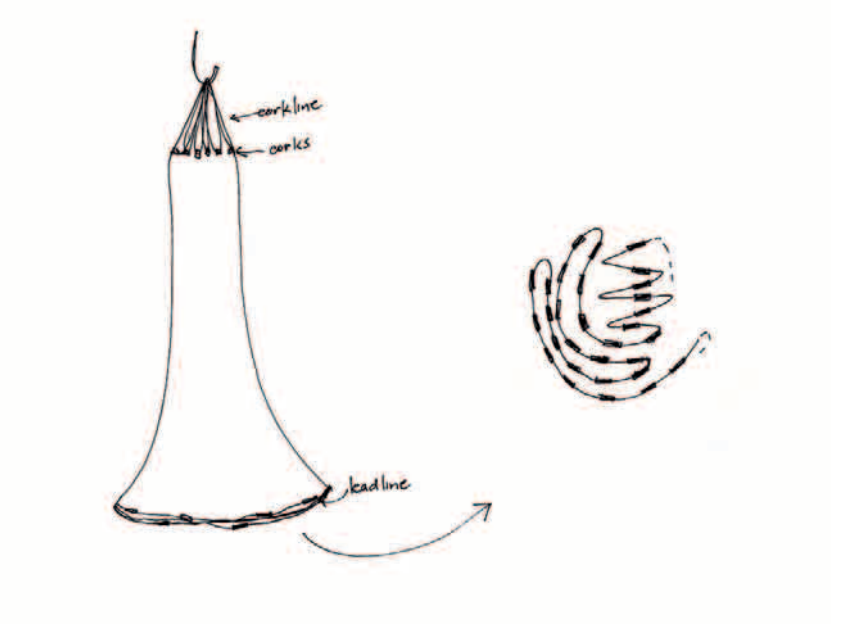

Figure 4. Sketch of a cotton set net hanging in G. Smith's net shed (left), and the patterning of the weights in the lead line, viewed from below (right).

According to my analogy with my father's nets, the way to estimate the length of the net would be to measure the lengths of the weights and the spaces between those weights which form a straight (or slightly curved) line. The patterns of three pebbles in a line suggest that the weights were quite closely spaced, almost end-to-end, with a maximum of 10 or 20 mm between the stones. The tight positioning of the zigzag patterns reinforces this impression. If the stones were placed end to end they would produce a line less than 7 m long (6.791 m). Allowing 2 cm between each stone the line would still be less than 9 m.

The nearest source of river-worn pebbles to this site is the Ashley River. To give an indication of the availability of stones of this size and shape, six people spent half an hour gathering stones on the Ashley River bed. In that time 245 elongated cylindrical stones were collected. 191 were within the length and width dimensions, 18 were too small and 36 were too large. Thus, although the parameters for the net weights were relatively narrow, finding such pebbles was not difficult.

Ethnographic descriptions indicate nets were most commonly made of green flax strips, but that some of the smaller nets were made dressed flax cordage (Buck 1956: 213). Weights are described as being contained in woven rolls (Best 1952: 268) or pockets (Leach 2006: 112). I consider it unlikely that the site WPT 582 weights were attached to a green flax net, as this would have been relatively stiff, and the patterning of the stones suggests great flexibility in the gathered net. The bottom line, as well as the body of the net, would have had to be very flexible to produce this tight patterning. I think it likely that the stones were tied on individually to the line, and certainly their elongated shape is suitable for this.

The presence of fishbone at other Pegasus sites may indicate the catch species. Fishbone has been recovered from several Pegasus sites, and in a few it has been recovered in large quantities. These sites include middens which have been interpreted as cleanup dumps for nearby habitations and a possible fish rack drying area. Little fishing gear has been found at other Pegasus sites: a tip of a two-piece fishhook and a grooved sinker.

Field identification of fishbone by Dan Witter indicates that red cod (*Pseudophycis bachus*), which has a distinctive premaxilla, comprised over 90% of the fish present. These were generally small-sized individuals, probably juvenile. Ling, identifiable in the field by the tooth sockets on their premaxilla and dentary, were also present in small numbers, and there were a few other, as yet unidentified, species.

Tantalising hints in descriptions of red cod ecology may suggest that they could be somewhat estuarine in their juvenile stages. Red cod are con-

sistently described as a bottom feeding, shoaling, migratory fish, found in shallow coastal waters during some seasons, usually said to be the warmer seasons (Parrot 1957: 48; Paul 1986: 57; Jones and Marsden 2005: 126; Leach 2006: 90). A Northland Regional Council environmental information web page includes red cod among the 30 or so commercial species that "use the estuaries at some stage during their life."

In this context the occasional presence of juvenile cod in considerable numbers in Lake Ellesmere/Waihora is significant. This shallow coastal brackish lake immediately south of Banks Peninsula, and 40 km south of Pegasus Town, is in many respects similar to an estuary. Separated from the sea by a coastal barrier bar (Kaitorete Spit) with no permanent outlet to the sea, the lake is kept at an artificially low level by periodically bulldozing a channel through the barrier bar at the narrowest point, near Taumutu. Usually the lake remains open for a few days only, just long enough for the lake levels to drop. Occasionally, depending on weather conditions, it remains open for weeks or even months. While the lake is open, fish stock replenish, notably the commercially fished species: eel, flounder and herring. Eel enter as glass eels and flounder as tiny juveniles and continue their life cycle here. Other fish enter the lake on a less regular basis, among them young red cod.

My brother, Clem Smith, a commercial fisherman on the lake, reports that a few young red cod will often be caught during or immediately after a lake opening. He recalls that several years ago a particularly large quantity of juvenile red cod appeared in the lake. They were all of a similar size, about 100–150 mm. These cod did not seem to thrive in the lake; they remained the same size over a period of months, until they gradually disappeared (Clem Smith pers. comm. 2006).

The specimens caught in Lake Ellesmere were nearly all trapped in the fyke nets used for catching eels (fyke nets are tunnel trap nets which are staked in place, with long staked wings directing the fish towards the mouth of the trap). The fyke nets that caught the cod were all set near the lake opening. Flounder nets, with a mesh of 5–6¼ inches (125–160 mm), set in the same area did not catch any red cod. Yellow eyed mullet nets, with a mesh of 2½–3 inches (65–75 mm), set further up the lake caught the occasional red cod. The low number of red cod in the yellow eyed mullet nets is probably due more to the location of the nets than mesh size, as the relatively big head of a juvenile red cod means they are readily entangled in the smaller meshed (½ inch /65 mm) yellow eyed mullet nets (Clem Smith pers. comm. 2006).

When speculating on how the Pegasus net might have been used, several possible methods of fishing for juvenile red cod with a small weighted net in an estuary occur.

1. It was staked out at full tide and the fish intercepted as they moved down stream, and stranded as the tide recedes.
2. It was a gill net, either staked out, or with extra weights (such as the grooved weight mentioned above) attached to each end.
3. It was a wing net, directing the fish into a trap.
4. It was a dragnet, with either poles or ropes at either end, small enough for two people to handle with ease.
5. It was a throw net.

All these methods seem feasible for the size of net the weights indicate and the proposed target species.

The first four are rectangular nets, and the fifth a circular net. Estimating possible net depth of a rectangular net is difficult, though the depth of the net would be related to the depth of the water it is fished in. The sewer-line trench 75 m to the east of WPT 582 contained cockles and pipi at 1–2 m deep, suggesting a net of approximately this depth. A circular net with a weight line of 8 m would have a 1.3 m radius.

Whatever the type of net these pebbles represent there would have to be a definite advantage in dressed cord over green flax, considering the amount of extra labour involved in making cordage. With a rectangular net, in the first three methods a dressed cord net would seem to have no advantage over a finely made green flax one. However, for a small dragnet, targeting a shoal of small fish, flexibility could be a distinct advantage. A circular net would require extreme flexibility.

There would also have to be a definite advantage for the specific weight of the weight line, considering the narrow size and weight range in which the pebbles have been selected. The total weight of all the pebbles is less than 5 kg (4763 gm), which would also be suitable for a small dragnet or a throw net.

A search of readily available ethnographic literature indicates that early descriptions of Maori nets concentrate on the big seine nets, which were indeed impressive. Many specialised fresh water net types have also been described, notably by Hiroa who recorded various net types on the East Coast on the North Island which he referred to as local types (Hiroa 1926: 214–215). None of his nets, which he groups as scoop nets, bag nets, set nets and trap nets, resemble the Pegasus example, as none involve weighted lines, except possibly "leading nets" (purangi) which were attached to eel traps. The Pegasus net may resemble a net cited by Crosby: "Matthews records that for the mullet fishing that "*papua*" is the term used when a net is stretched across a creek or inlet just before high water so the fish are caught as they return with the ebb" (Crosby 1966:76). The dimensions of the Pegasus net may be similar to a net cited by McAra, a 'small river seine net', 6 m x 88 cm, from

the Paeroa river and now in the Auckland Museum (McAra 2001: 87). McAra also records a description by Beattie of the kaka as a "closely woven net (or mat) of four or five feet in depth [1–1.5 m] and up to fifteen or twenty feet in length [4.5–6 m]. It had a pou (stick) at each end and the two men wade out into water shallow enough for the purpose and scoop them onto the shore." This example is of particular interest as Beattie's informants were elders from Banks Peninsula (McAra 2001: 86). I have not found any ethnographic references to throw nets in New Zealand, though they were present in Polynesia (Ellis 1831: 140).

Descriptions of net weights are rare in the New Zealand archaeological literature. The best known description is by Knapp, who published diagrams and descriptions of lines of stone found in the sand dunes of Rabbit Island, Waimea Estuary, Nelson (Knapp 1940: 375–381). He recorded "whole lengths of nets" 30–35 feet long (9–10.5 m) and one of 55 feet (16 m). He believes that these were seine nets, with the weights likely to have been held in place by a basket sheath as described in various ethnographic accounts. The stones were fairly even in size. Half a dozen sinkers on one set of nets weighed over 1½ pounds (0.68 kg) and on other nets 2½ pounds (1.13 kg). Leach cites Knapp as his single example of net weights (Leach 2006: 112). According to Janet Davidson this was the only reference they could find for the book (pers. comm. 2006). Davidson's comment was in response to a note in the September 2006 AINZ (Fieldwork and Other Activities) about the Pegasus net weights. There were several other responses to this note; all were personal communications, not citations. When Logan Coote was a boy he met Jim Eyres who was then an old man. Eyres described to Coote a line of stones he said were net weights in the sand at Nelson. Jack Walls had a similar account from his own observation. It is possible that all these references refer to the same archaeological site; they are all from the sand dunes in Nelson. All the accounts describe uniformly shaped stones laid out in a single line of regularly spaced stones, found in a marine environment.

Summary

Site WPT 582 is unique within the over 400 sites so far recorded at Pegasus Town, and is possibly unique within New Zealand.

These distinctive small stones have been interpreted to be the net weights of a small net, with the weighted line about 8 metres long. The net was extremely flexible and probably made of dressed cordage rather than the more common split flax, with each weight tied on individually. The net was probably used in the estuary then adjacent to the site, this estuary formed about five hundred years ago and subsequently filled in to form the present

wetland. Juvenile red cod is suggested as the likely catch species, for which a mesh size of about 2½ inches (65 mm) would be appropriate.

He taonga tenei.

Acknowledgements

I have appreciated assistance from the following. Dan Witter is always helpful. Clem Smith provided useful information and discussion. Andre Codyre, Joseph Hullen, Cherie and Hoana Williams, Tuahiwi Cultural Observers for Pegasus Town, were sharp eyed on the Ashley River bed. Logan Coote and Erin Williams sourced references.

References

Best, E. 2005 [1929]. *Fishing Methods and Devices of the Maori*. Te Papa Press, Wellington.

Crosby, E.B.V. 1966. Maori Fishing Gear. Unpublished M.A. thesis, University of Auckland.

Ellis, W. 1831. *Polynesian Researches, During a Residence of Nearly Eight Years in the Society and Sandwich Islands.* Fisher, Son & Jackson, London.

Goff, J. and B. McFadgen 2002. Seismic driving of nationwide changes in geomorphology and prehistoric settlement – a 15th century New Zealand example. Q*uaternary Science Reviews*, 21: 2229–2236.

Jones, M.B. and I.D. Marsden 2005. *Life in the Estuary.* University of Canterbury Press, Christchurch.

Hiroa, Te R. 1958 [1949]. *The Coming of the Maori*. Whitcombe and Tombs, Wellingon.

Hiroa, Te R. [S Buck] 1926 The Maori craft of netting. *Transactions and Proceedings of the New Zealand Institute*, 56: 597–646.

Knapp, F.V. 1940. Trawling customs of the Tasman Bay Maoris. *Journal of the Polynesian Society*, 49(3): 375–381.

Leach, F. 2006. *Fishing in Pre-European New Zealand*. New Zealand Journal of Archaeology Special Publication.

McAra, S. 2001. Maori fishing nets in the Canterbury Museum. *Records of the Canterbury Museum,* 15: 83–99.

Northland Regional Council 2007. Estuaries. Environmental Education School Information Pack. Whangarei.

Parrott, A.W 1957. *Sea Angler's Fishes of New Zealand*. Hodder and Stoughton, London.

Paul, L.J. 1986. *New Zealand Fishes: An Identification Guide*. Reed Methuen, Auckland.

Witter, D. and A. Witter 2007. The Middens of Pegasus Town, Canterbury, Stages 1–5. *Archaeology in New Zealand*, 50(1): 32–42.