NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

NEW ZEALAND JOURNAL OF ARCHAEOLOGY

This document is made available by The New Zealand Archaeological Association under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License. To view a copy of this license, visit http://creativecommons.org/licenses/by-nc-sa/4.0/.

Maori Mass Capture of Freshwater Eels: An Ethnoarchaeological Reconstruction of Prehistoric Subsistence and Social Behaviour

Yvonne Marshall

Department of Anthropology, University of Auckland

ABSTRACT

A curious paucity of eel bone midden in the New Zealand archaeological record has placed prehistorians in a quandary as to how eel fishing might best be included in reconstructions of prehistoric Maori lifeways. This paper takes an ethnographic approach to the problem, demonstrating how contemporary Maori mass capture eel-fishing techniques derive directly from a tradition with its origins in the pre-European Period. Documentation of the ways eel fishing has changed through the Historic Period reveals both conservative and adaptive features in the technology of eel weir fishing and in the cultural context in which it survives. Recognition of the processes of change taking place in the Historic Period makes extrapolation from the contemporary to the prehistoric context possible; thus contemporary eel fishing provides the prehistorian with a basis upon which to formulate a much needed model of eel fishing in New Zealand prehistory.

Keywords: NEW ZEALAND, MAORI, EEL-FISHING, EEL-WEIR, TECHNOLOGICAL CHANGE, ETHNOGRAPHY, ETHNOARCHAEOLOGY, CULTURAL CONTINUITY.

INTRODUCTION

Early ethnographic and ethnohistoric literature draws attention to the freshwater eel as being of particular importance among traditional Maori foods.

> The rich sweet flavour of eel flesh appealed with irresistible charm to the Maori palate and the collector, himself a lover of the epicurean delights of the tasty eel, found many evidences of the esteem in which this food, so despised by the prejudiced white man, was held by the modern as well as the ancient Maori (Beattie n.d.: 15).

It also provides an unusually detailed description of the technology and methods employed for eel capture (Best 1929; Downes 1918). These accounts span most regions of New Zealand, indicating a broad geographical distribution for eel fishing, and almost without exception they document large-scale, mass-capture techniques. Despite the wealth of ethnographic information available, archaeologists have largely failed to integrate eel fishing into their reconstructions of prehistoric Maori lifeways. This can be attributed to the absence of large eel bone middens in the archaeological record. To date, eel bone has been recovered from only six sites: Washpool Midden (Leach 1979); Riverton (Leach and Leach 1980); Rotokura (Butts 1977); Aotea (Davidson 1984); N148/1 Manawatu (Boyle 1974); Sunde Site, Motutapu Island; Hohoura (Nichol in prep.); Crater Hill (Nichol n.d.), and then only in very small quantities. As a result, archaeologists have been unsure of the extent to which historic period accounts of eel fishing may be legitimately extrapolated to the prehistoric context. Anderson (1980, 1982) has for example made a cautiously general attempt to incorporate eel fishing into his reconstructions of economic patterns in southern New Zealand. On the other hand, Davidson (1984: 141–2, 146–7) has opted for the extreme conservative position, maintaining that in the absence of evidence to the contrary in the form of large eel middens, large scale eel fishing must be assumed to be a post-European development.

The common dogma invoked to explain the paucity of eel middens has been that eel bone is soft and highly susceptible to decay and therefore does not survive well (Boyle 1974). Although this may in fact prove to be the case, it cannot be used as a basis for interpretation until it has been clearly demonstrated by rigorous testing. Contemporary Maori custom and some ethnographic accounts (Best 1929) pertaining to the preparation, cooking and consumption of eels suggest a strong preference for leaving the fish whole. Today, small eels under 50 cm long are barbecued and eaten whole, bones often included. Larger eels may also be cooked whole in a *hāngī* or, if smoked, are boned out, but the bones are also smoked, then eaten like spare ribs.

Consequently, considerable doubt surrounds the question of (1) whether eel bone was ever deposited in large middens even if large numbers of eels were caught and consumed in the prehistoric period, and (2) if eel middens were generated, how long they could survive. Very real problems therefore attend the interpretation of either the presence or absence of eel middens, and while I do not wish to undervalue the contribution of midden analysis to our understanding of prehistory, I suggest that in the case of eel fishing, other complementary approaches may prove more productive.

Most prehistorians would agree that eel fishing did take place in prehistory—the question is one of scale. This paper explores a number of avenues of enquiry in an attempt to build a comprehensive reassessment of the role and nature of large-scale eel fishing in prehistory.

Firstly, the ethnographic literature is reviewed in conjunction with new evidence collected by the author in a study of contemporary eel fishing on the Kawakawa River. Rather than being simply descriptive, this section aims to elucidate the processes of change occurring within the technological assemblage used for eel fishing. Ethnographic evidence is commonly invoked in situations where an interpretation for an unexplained facet of prehistoric culture is sought through a simple comparison of a contemporary artefact with a prehistoric counterpart. There has, however, been little or no examination of the role which ethnographic and ethnohistoric sources might play in the elucidation of the processes of change by which a prehistoric tool or culture is transformed into a new contemporary form.

Consider for a moment the "comparative method" developed by historical linguists for reconstructing proto-languages (Clark 1979; Pawley and Green 1985). It examines process, or mechanisms of change—the objective being to reconstruct the pathways by which a cultural artefact, in this case language, changes from one form to another. The method assumes that not only is the sequence of change definable but that the mechanisms promoting or inhibiting change are also definable.

Such an approach may prove equally rewarding if applied to technological artefacts. If the mechanisms provoking change in the technology of eel fishing through the historic period can be isolated, extrapolation back into the prehistoric becomes an informed rather than an *ad hoc* process.

The first section of this paper concludes with a summary of the changes seen to have taken place and outlines their implications for the prehistory of eel fishing. On the basis of these conclusions, the efficiency of contemporary eel capture is used to assess the potential of eel fishing as an economic practice in prehistory. Finally, ethnoarchaeological studies are especially valuable for the opportunity they provide for studying material culture within a living context, thus enabling archaeologists to build interpretative links between material culture and behaviour (Charlton 1981). This avenue is explored in the third section.

Before proceeding to a discussion of technological change, a brief introduction to the general principles of large-scale eel capture methods is necessary. Mass capture of eels focuses on the taking of *tunaheke* or migrating eel. "Each summer and autumn the downstream and seaward migration to spawning grounds of adult freshwater eels takes place" (Todd 1981: 225). It occurs intermittently in "runs" triggered by heavy rains which flood the stream and discolour the water. Consequently during certain highly specific periods each year, eels concentrate in huge numbers as they move out of the swamps and lakes along waterways to the sea. This has allowed eel fishermen to intensify methods of eel capture by concentrating their efforts on these periods of seasonal abundance. Although a considerable number of eels have always been taken outside the *tunaheke* runs using baited hooks, traps and spears (Beattie n.d.; Best 1929; Kahotea n.d.), this paper deals only with *tunaheke* capture and its associated technology—the eel-weir.

Central to all eel-weir designs, whether prehistoric, historic or contemporary, is the understanding that weir-fishing is a passive form of capture and involves guiding or channelling the eels into traps. Various methods can be employed to do this, giving rise to a variety of eel-weir designs and styles. However, the essential element, common to all of them, is embodied in the term *awa*, meaning "channel, leading place for a canoe, river, gorge, groove, garden furrow, course or valley" (Williams 1957: 23). Ethnographic literature also records its use in reference to eel-weirs, rivers and particularly to denote artificially cut canals for use in eel fishing (Beattie 1954: 60; Best 1929: 129; Phillips 1956; Sheppard and Walton 1983). In the following discussion of eel-weir technology, themes relating to the term *awa* constantly emerge. I have used it only to refer either to contemporary eel-weirs specifically, or to artificial eel-channels.

The technological assemblage for *tunaheke* capture is based on three sets of equipment:

(i) The actual eel-weir structure itself, usually a framework built in or across a stream, river or lake.

(ii) A set of nets.

(iii) Storage facilities for eels after capture.

Each of these components is discussed separately. First, contemporary examples from the Kawakawa River are outlined, then compared with prehistoric or historically recorded eel-weirs in an attempt to follow the sequence of technological change.

Most of the contemporary ethnographic information given in this paper is based on personal observation of eel-weir fishing on the Waiharakeke Stream, a small tributary of the Kawakawa River, in the north of the North Island (Fig. 1). Along the Kawakawa River tributaries, some 20 families today engage in eel-weir fishing. Working in this area was made possible by the generosity of Nathan and Anna Baker, who own and operate the best eel fishing operation on the river. With their assistance I was able to make a detailed record of their eel-weir or *awa* and its operation. In the following account I have dealt almost exclusively with the Baker family's eel-weir, referring to other eel-weirs in the locality only to illustrate variation or conformity with the Baker family's operation.

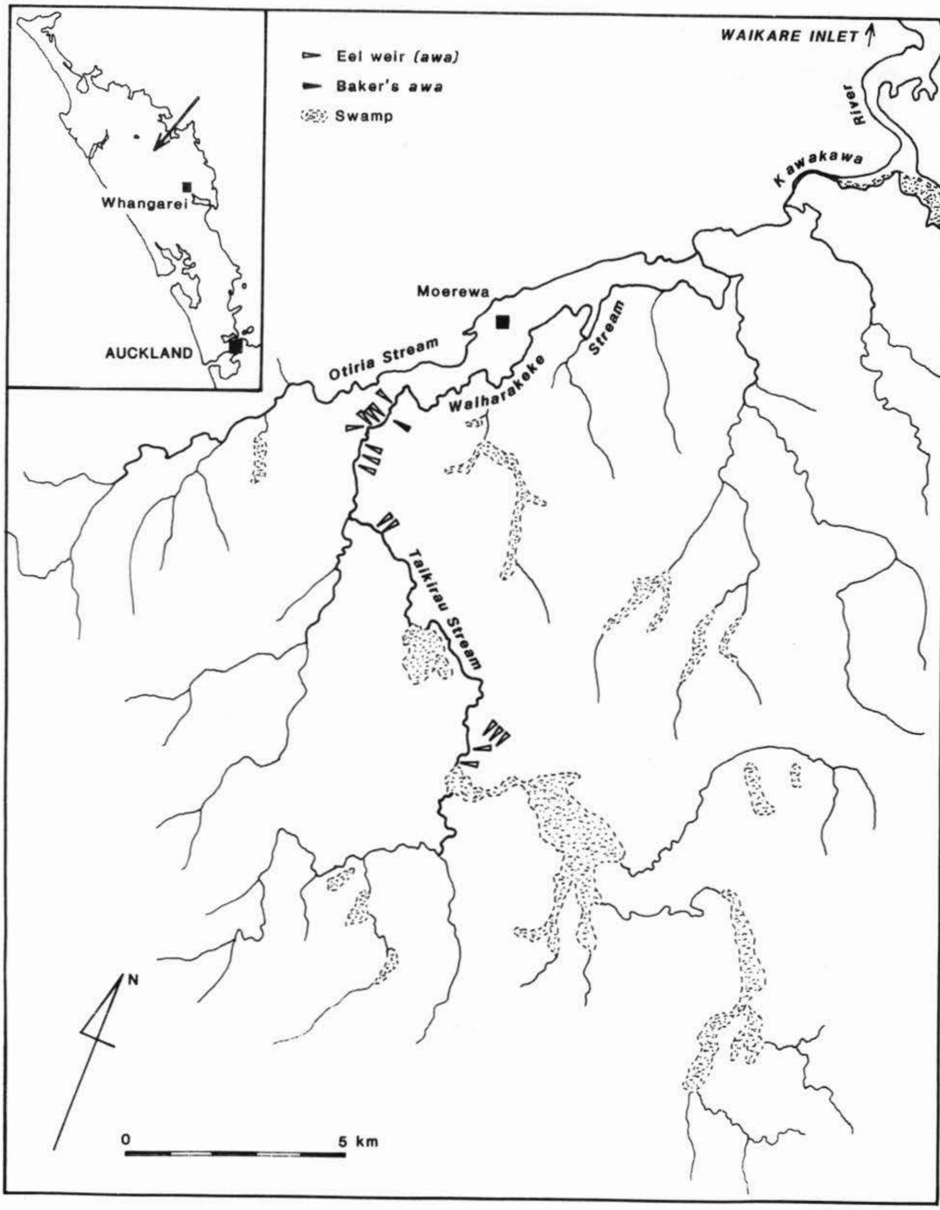

Figure 1: Location of contemporary eel-weirs along the Kawakawa River.

THE EEL-WEIR ASSEMBLAGE

THE *AWA* STRUCTURE

The basic framework of a contemporary *awa* consists of a walkway across the river supported by two rows of poles (Fig. 2) and may optionally include a working platform and/or temporary living shelter. All three parts are shown in Figure 3. The total length of the walkway, from the far bank to the working platform, is approximately 20 metres. The five eel-weirs in the small cluster near the Baker *awa* are very similar in design but vary in detail according to the amount of time and care put into the construction. Another five *awa* recorded further upstream are also built along the same lines, with the same basic principles applied in their design, but are far simpler in construction, and are built across much smaller tributaries.

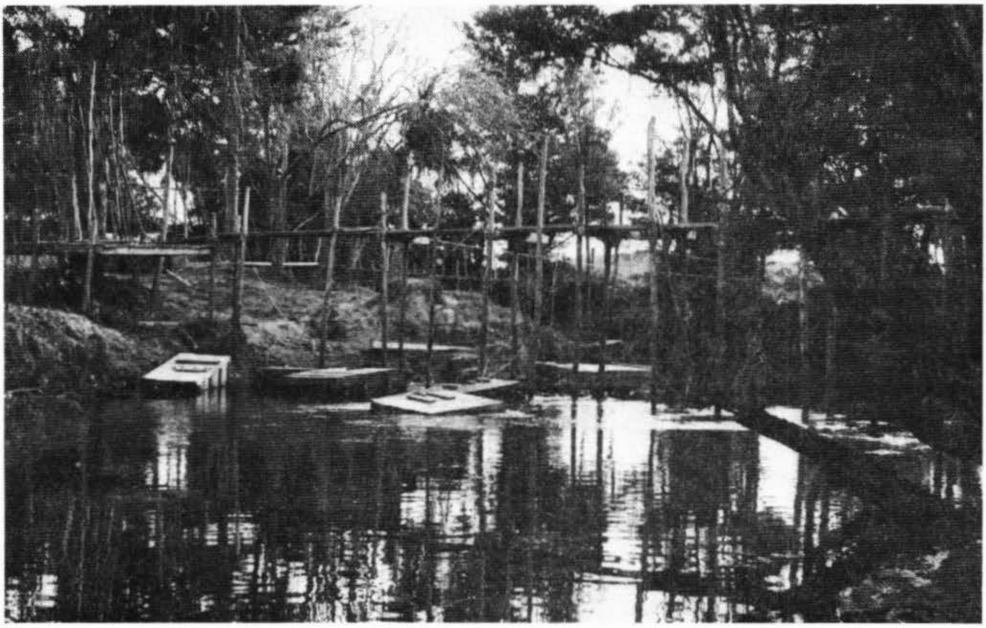

Figure 2: The Baker *awa*, looking upstream. On the far left is the working platform and in the background is the next *awa*. Storage boxes can be seen, tied to the *awa* support poles.

Constructing the Baker *awa* was a job in which all the immediate family took part. (The family at this time would have included two adults, two adolescent girls, and five young children). Everyone was expected to contribute according to age and skill, and construction took about three weeks, working weekends and spare time. Two adults working every day could probably build one in a week.

First, 33 manuka (*Leptospermum scoparium*) stakes, 10 cm in diameter and at least 6 metres long, were cut to form the support poles for the walkway and working platform. Green wood was essential for strength, suppleness and durability. Today, the use of a chainsaw greatly facilitates this work. The poles were sharpened at one end before being driven a metre or so into the river bed using a mechanical pile driver—previously, though, a large wooden maul would have been used (Best 1929: 134).

By comparison, in the early 1900s, the construction of an eel-weir for a small stream 30–40 ft wide (comparable to the Waiharakeke Stream) took a company of eight men three days to collect, prepare and drive the support poles, even with the aid of metal tools (Downes 1918: 307). Of course the time would be much greater still using stone tools only.

For the Baker *awa*, nine poles were placed along the upstream side. It was not especially important to space them evenly as their purpose is primarily to support the walkway and brace the structure against the current. Three poles positioned in the swiftest part of the

Figure 3: The *awa* looking along the walkway to the working platform and living shelter beyond.

current were further strengthened by securing them to trees on the opposite bank using a high tensile multi-stranded wire rope (Fig. 2). On the downsteam side, 14 poles were placed at 1 metre intervals. More care was taken to space the poles evenly because they formed the framework against which the nets would be set, as well as providing support for the walkway.

The walkway itself is approximately half a metre wide and set 3–4 metres above the riverbed. The height of the walkway is determined by a compromise between ensuring that it remains out of the water even during floods (as this is the time when the *awa* is worked) and ease of handling the nets. Nevertheless, floodwaters have sometimes covered the whole structure, rendering it inoperable. This is a long standing difficulty, as Downes (1918: 309) notes that "In a high flood the *pa-tuna* (eel-weir) cannot be operated upon, and in this way the natives often miss the season's catch".

The working platform is approximately 2 metres square and, like the walkway, is built of timber planks. Apart from providing easy access on to the *awa* itself, the working platform greatly facilitates the handling of the nets, as fishing takes place during periods of high rainfall when the ground rapidly turns to mud. It is a special Baker refinement, as it is not part of any of the other local *awa* and neither is there mention of such a construction being found in conjunction with eel-weirs in any of the early ethnographic literature. Best (1929: 122) does, however, note their use in reference to line fishing: "eel-fishers at lagoons or on the muddy banks of streams, sometimes erected a small elevated platform from which to conduct fishing operations".

Similarly, the Bakers have given particular attention to the construction of their living shelter. Many *awa* have no shelter at all, while the others have only a very rudimentary structure. In contrast, the Baker set-up is quite comfortable with its solid wood-plank walls and big fireplace. Such shelters were historically a common feature of the eel-weirs, and are recorded for Murihiku (Beattie n.d.: Murihiku, p. 22), Lake Forsyth (Beattie n.d.: Canterbury, p. 12), and more recently at Lake Horowhenua (Curtis 1964: 168).

Since its construction seven years ago, upkeep of the Baker *awa* has been minimal. Last year the first structural repairs were undertaken and these simply entailed replacing four support poles. The low level of upkeep is a product of the *awa* design. Except for the short periods when the nets are set during fishing, very little pressure is placed on the *awa* structure. Wear and tear has been minimised by reducing the permanent structure, which is subjected to constant water pressure, to a mere skeleton. This is achieved by constructing most of the fishing equipment in detachable parts. This point will be illustrated further by comparison with earlier eel-weir designs, and in the later section on nets.

In the following discussions of "traditional" eel-weir design, I have tried to focus on common components, and avoid variation likely to be the result of regional or stylistic differences. Two broad categories are immediately apparent. First, there are the *pā-tuna* or *pā-auroa* types in which the eels are channelled into *hīnaki* (eel-pots) by stake and brushwood barriers built across streams, rivers and in lakes. Second, there are *awa* or *kōuma* consisting of excavated channels into which the eels are diverted then trapped. These are usually found in swamps, lagoons or sand-bars dividing a lake from the sea (Best 1929).

The basic structure of a *pā-tuna* consisted of two "wing fences" (Best 1929: 141) or "wing dams" (Beattie n.d.: Murihiku, p. 26) which converged at the point where the nets were set. In large rivers or lakes, a series of these barriers may be built forming a multiple "V" design (Best 1929; Downes 1918). The timber used in their construction was usually manuka for the upright stakes (Downes 1918: 307; Beattie n.d.: Canterbury, p. 13; Best 1929: 133), with lashings of *aka*—plant vines of various kinds (Downes 1918: 307–12; Best 1929: 135), and wattling of manuka brush and bracken fern (Downes 1918: 308; Best 1929: 133). Construction and maintenance of these barriers required considerable time and skills. "After getting all the poles, timber and lashing together [in itself several days work; see above], it takes from four to six men at least seven days hard work to construct the simplest form of this *pa-tuna*" (Downes 1918: 311). Furthermore, "the fences would need to be renovated, or possibly reconstructed each season" (Best 1929: 136; Beattie n.d.: Murihiku, p. 26), as they were built right across a small stream or placed in the swiftest currents of larger rivers or lakes (Beattie n.d.: Murihiku, p. 24, 26, 29; Best 1929: 133; Downes 1918: 310). They were therefore subject to year-round battering by water and driftwood. Interestingly though, Beattie (n.d.: Canterbury, p. 13) refers to one instance where only the main posts were permanent and "as soon as the season was over the sticks [forming the fence] were pulled up, rolled in bundles, and put away. By so doing they lasted for years".

Awa or *kōuma* employed canals instead of barriers to channel the eels into the traps. Ethnographic accounts of this type of eel-weir most commonly refer to lagoon situations where a sand-bar divided the lake from the sea—such is the case at Lake Waihora, Lake Ellesmere and the Wairarapa lakes (Beattie n.d.: Murihiku, p. 22–3, Canterbury, p. 12, 16; Best 1929: 128–9; Phillips 1956; Mair 1979). Extensive use was also made of *awa* in swampland areas. No ethnographic record describing swamp *awa* in use is known but numerous man-made channels have been found in swamps and their use for eel fishing is now well established (Barber 1984: 24–30; Harding 1928; Pullar 1975; Sheppard and Walton 1983; W. H. Skinner 1912; H. D. Skinner 1921, 1922; Swarbrick 1958; Wilson 1921, 1922). The operation of this type of eel-weir involved either trapping the eels in a short channel, then waiting for the water to drain out, leaving them stranded, or alternatively, placing nets across the channel entrance after the eels have entered, then catching them in the nets as they try to escape (Beattie n.d.; Best 1929: 129; Phillips 1956).

Despite enormous variation in size and form of eel-weirs, one structural feature appears to be common to all—the central posts or *pou* which articulate the actual structure and the detachable net section.

The many connotations of meaning attributed to this term by Williams (1957: 297) are all concerned with strength, support or reverence. It may be used to refer to the posts supporting the ridge pole in a meeting house, a teacher or expert, as a reverential term of address, or simply to denote support or sustenance in general. All these connotations are embodied in the role of the *pou* in the eel-weir.

Their importance both functionally and as objects of ritual importance is stressed by several authors (Beattie n.d. Murihiku, p. 26, Canterbury, p. 13; Downes 1918: 308–311). In some cases the *pou* may even be carved:

> The post inserted away from the end of the fence in order to hold the *poha* [leading net], in many cases had its upper part carved into the form of a human head. The last such seen in the district was in a weir on the Matahiwi Rapid of the Whanganui River in 1878 (Downes 1918: 308).
>
> The two *pou reinga* or stout posts at the *ngutu* or narrow outlet of a weir seem to have been viewed as the most important parts of a fish weir. These were the posts that were sometimes embellished with a carved design, and were viewed as being of a permanent nature (Best 1929: 136).

This feature is today preserved in the row of support poles forming the downstream side of contemporary *awa* structures. Modification to accommodate a multiple net setting has, however, somewhat obscured the pole's original central focus. One further contemporary account of eel-weirs near Levin also emphasises the maintenance of this traditional feature (Curtis 1964: 167).

Overall, the Baker *awa* is an interesting combination of features from a range of earlier designs. No single ethnographic account would adequately describe the contemporary form, although the closest single description comes from Murihiku. In this instance, elements of both *pā-tuna* and *awa* type weirs occur together:

> Some *awa* were made . . . wide enough to space 3 or 4 *hinaki* [eel-pots] side by side. In the latter case, *ka poupou* (posts) were placed between the *hinakis* to fasten the *purakis* [leading nets] of each *hinaki* to the front of the posts (Beattie n.d.: Murihiku, p. 23).

No element of the contemporary Baker *awa* is, however, without an ethnographically recorded antecedent.

Even the incorporation of a walkway into the basic structure is, although unusual, not unprecedented. Best (1929: 138), informs us that, "In the Waiapu district in some cases the larger weirs had a footway along the top of the fences for the convenience of persons engaged in attending to the eel pots or nets". More commonly, though, weirs were attended by canoe (Best 1929: 130–9, 148; Downes 1918: 309), even in the case of very small streams. Canals cut in swamps were also built to accommodate canoes (Barber 1984; Sheppard and Walton 1983; Skinner 1912; Wilson 1921, 1922). Considering the impermanent nature of many of the traditional *awa* structures, canoes rather than walkways would have been a far more practical alternative.

Choices determining which forms of eel-weir would be employed in any given situation were dependent on what suited the conditions best (Beattie n.d.: Murihiku, p. 23). The central feature, both in terms of ritual importance and structural strength, was the stout posts. They were the permanent feature around which structural change took place. The simplicity of this central component has meant that considerable flexibility of design was possible while still remaining within the confines of a recognised traditional form. Contemporary *awa* design is in accordance with this principle, synthesising elements of many different styles into a new form in which maximum efficiency of capture is combined with minimal upkeep, while retaining the *pou* as the central points.

THE NETS

Contemporary eel nets are made up of three detachable parts: a wooden frame; a *kupenga*—leading or guiding net; and a trap net. When in use, the three parts are lashed together with flax or nylon rope to form a single composite net (Fig. 4). They are always dismantled for storage during the off-season, in late winter to early summer. The net frame is made from

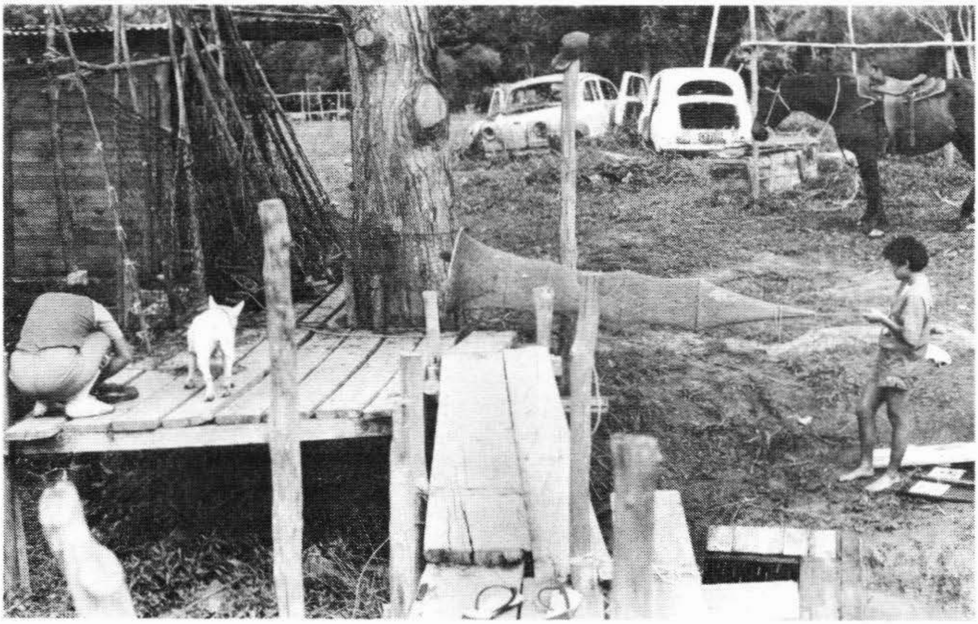

Figure 4: Net frame, *kupenga* and trap net assembled ready for use.

three manuka stakes; two four-metre long uprights and a short cross-bar lashed across one end of the two uprights hold them about one metre apart (Fig. 4). The frame serves two purposes. First, it holds the *kupenga* open and in place and secondly it is complementary to the support poles in providing the means by which the nets and structure are articulated. When in use the frame uprights are lashed parallel to, and hard against the downstream support poles with the cross-bar at the bottom (Fig. 5). In this way, any part of the stream can be fished by varying the number and placement of a series of nets. Such flexibility is important, as the eels travel in the swiftest part of the current, close to the surface of the water, and only during periods of high water. Positioning of the nets must therefore be regulated in response to constant changes in water level and currents. Five or six nets are commonly in use at one time. The *kupenga* is 2–3 metres long and trumpet-shaped. The narrow end is enclosed into a circle while the broad end is left open so it can be attached to the cross-bar and lower part of the frame, leaving the top open. The small circular end is lashed using blanket stitch to the largest hoop of the trap net (Fig. 4).

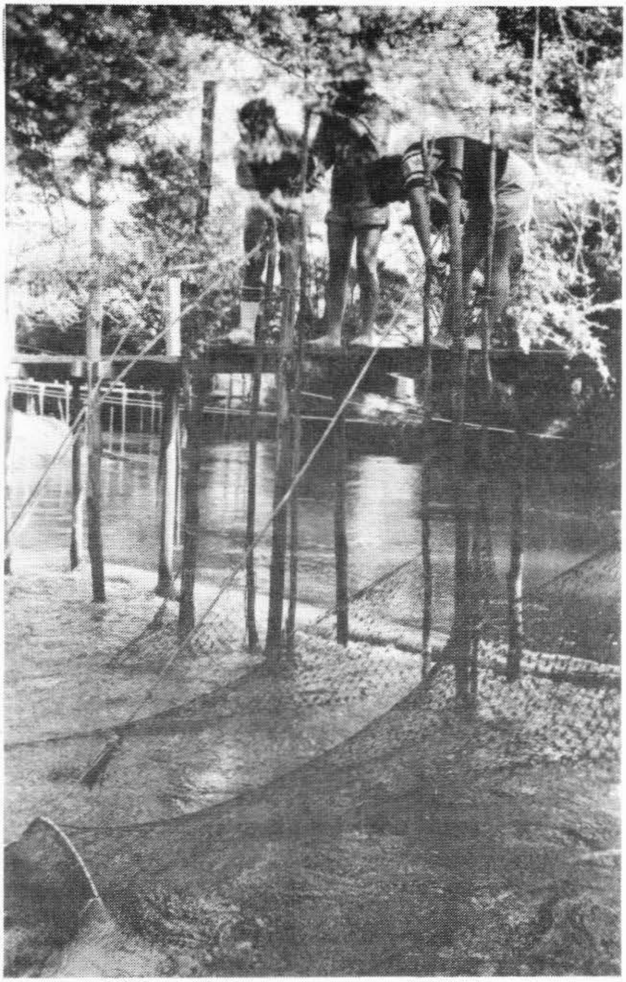

Figure 5: Setting the nets. Net frame, *kupenga* and the first metal hoop of the trap net are visible. A rope attached to the hoop and *awa* support pole holds the net near the surface of the water.

Originally, flax was used for making *kupenga* nets (Beattie n.d.: Murihiku, p. 21, Nelson, p. 37; Curtis 1964: 167; Downes 1918: 310). Today however, flax has been replaced with tough new fishing twines which considerably extend the life expectancy of the net. Downes (1918: 310), for example, found that the flax "*poha* [*kupenga*] lasts only about two nights as it is quickly torn to pieces", whereas the modern twine nets will with a few repairs last several seasons.

Apart from the materials used, the *kupenga* is made according to the method described by Best (1929: 158) and Downes (1918: 310). It is worked in one piece commencing at the small end. Once big enough, it is suspended from a roof beam and worked downwards. The 6 cm mesh is regulated by measuring against the fingers of the left hand, and a completed net represents at least 14 hours work.

Most of the Kawakawa River eel fishermen either make their own *kupenga* or know someone who will make them for them. It is said that the weaving of *kupenga* was, only two generations ago, the preserve of women, but today it has largely passed to men. The knowledge, however, remains closely guarded and is still only taught to a few selected pupils, usually a chosen son, or other favourite. In this case, a net maker will refuse to make nets for a chosen pupil, saying "I will teach you but not make them for you".

If an eel fisherman has no access to hand made nets a simpler somewhat less effective commercial product is available. These are "wing nets" consisting of two side nets leading into a trap net much like a miniature net version of the *pā-tuna* fences. It is possible to fish without *kupenga*, attaching the trap net directly to the *awa* structure, but this is less effective.

The contemporary trap-net, used on all the Kawakawa River eel-weirs, is a ready-made Japanese eel-net (Fig. 4), and can be purchased for about $100. These are of standard design. They consist of a fine-mesh (about 2 cm), funnel shaped net about 2 metres long attached to a series of five ascending sized metal rings. Two internal trap nets, one at the broadest end and one attached to the central ring, ensure that eels once netted do not escape. Trap nets will last a number of years, but usually require minor repairs every season.

Old style traps, called eel-pots or *hīnaki*, were quite different from the modern nets. They were made in a wide range of sizes, styles and materials. Explanations for this variety, and an attribution of function for each type is attempted by both Best (1929) and Downes (1918); but these accounts are often contradictory both within and between one another. Although part of the variation can be safely attributed to regional differences, no consistent correlations have been demonstrated between form and material, and variations in eeling conditions such as river size or swiftness.

One type of *hīnaki* has been positively identified for the Kawakawa River area. Several years ago, a *hīnaki* of *mangemange* (*Lygodium articulatum*) (Cheeseman 1925: 1023) almost identical to that illustrated by Best (1929: 171) was recovered from a stream by a local resident. It is still in excellent condition and retains much of its original flexibility.

Mangemange was a highly prized material for *hīnaki* because of its superior flexibility (Best 1929: 167–170). Since its natural distribution was confined to the northern part of the North Island (Cheeseman 1925: 1023), Best (1929: 164) suggests it was used as a trade item. These *hīnaki*, he continues, "if well cared for will last a life-time" (p. 164). By comparison, flax it hīnaki may "only last about a month" (Best 1929: 179), and Downes (1918: 314) estimates that a *hīnaki* of *kiekie* (the aerial root of *Freycinetia banksii*), probably the most common material used and certainly the most generally available would, even with care, last only five to seven years.

It "usually takes an expert about a week to weave an ordinary *hinaki* about 5 ft long of the *heaurara* pattern which is certainly the simplest", (Downes 1918: 316), and to make a basket of *mangemange* would have taken considerably longer (Downes 1918: 316).

The pre-European origin of the *hīnaki* is fairly secure. A *mangemange hīnaki* was included in an assemblage of wooden artefacts recovered during the investigation of the Lake Mangakaware swamp *pā* (Bellwood 1978: 45). Radiocarbon dates from this site indicate late prehistoric occupation (Bellwood 1978).

Introduction of European materials which could be utilised in making *hīnaki* effected the swiftest and most complete changes in eel-weir technology. By the 1920s when Beattie (n.d.), Best (1929) and Downes (1918) were collecting ethnographic information on eel fishing, the knowledge of eel-weir construction and the making of *kupenga* was still common, but only a few old people still knew the art of weaving *hīnaki*. Poata (1919: 17–18) was the only one able to record a first-hand account of the making of a traditional *hīnaki*. Wire netting was an early, popular substitute for vines (Best 1929: 170; Downes 1918: 297), and has remained in use until very recently (Curtis 1964: 166). Although almost any convenient material was used to replace the traditional vines and flax of the *hīnaki*, it is interesting that the flax *kupenga* was retained.

James Beattie earlier noted this discrepancy in the resistance of the two types of net to change.

> The modern Maoris use eelpots made of wire netting but with the old time flax mouthpiece. The collector saw one with a sugar bag tied to it and he heard of one where a stocking with the foot cut out comprised the *rohe*! [i.e., the trap of the *hīnaki*] (Beattie n.d.: Murihiku, p. 21).

Contemporary accounts from Kawakawa and Lake Horowhenua (Curtis 1964) confirm this trend. The *kupenga* has survived in its original form but made in modern materials. The *hīnaki*, however, has disappeared. I am informed that no one in the Kawakawa area still knows how to make *hīnaki*.

STORAGE

In contemporary Kawakawa, the eels are stored alive in large wooden boxes set in running water (Figs 2, 6). These boxes may be of any shape but are most commonly long and narrow, ranging from 0.5–1.5 metres wide by 1–2 metres long and half a metre deep. Metal grills form the front and back ends so that water can run through unimpeded. The boxes are tied with wire to the *awa* support poles, in such a way that one grill will face directly into the current and part of the box will be lifted just out of the water. This is said to provide necessary air. The *awa* fishermen also maintain that as long as there is constant running water, there is no noticeable change in the condition of the eels for at least a year, even though they are never fed.

Todd's intensive study of eel breeding ecology revealed that "prior to migration, eels undergo several distinct morphological changes; . . . the gonads develop, the guts are reduced in size and feeding ceases" (Todd 1980: 283). Although this is an adequate explanation of why the eels do not eat, how exactly they are able to retain condition is a mystery.

Any non-migratory eels, locally called *oke*, which are swept into the nets by the rising flood waters, are thrown out. They are easily recognised as vigorous and aggressive in contrast to the *tunaheke* which are extremely placid, easily handled, and never known to bite. If *oke* are kept in the boxes they will attack and eat the other eels. This behaviour is consistent with the eating behaviour of adult eels observed by Ryan (1978) and Todd (1980).

Both live storage of eels and several methods of preservation are well recorded in the ethnographic literature. Preservation techniques usually involved some form of cooking and drying (Beattie 1920: 60; Best 1929: 114–5; Brunner 1850: 368; Downes 1918: 303; Phillips 1956: 172; Poata 1919: 19), and would last anything up to three years (Phillips 1956: 172; Poata 1919: 19; Mair 1979). An alternative method recorded by Heaphy and Brunner for the West Coast of the South Island was to "preserve them in fat, potted in the bladder of the sea weed termed kelp" (Heaphy 1846: 4), in which case they would keep two years (Brunner 1850: 358). Preserved eel meat could be used for winter consumption (Beattie 1920: 60; Best 1929: 114), gifting (Best 1929: 115), or food while travelling

(Beattie 1920: 60), its major advantages being long term storage, ease of transportation, and the convenience of a compact, instant food source.

Live storage of eels in corfs, or baskets is also well recorded (Best 1929: 150, 164–6); Downes 1918: 312–315; Mair 1879: 316), but the accounts all imply that live storage was temporary, for only up to a few months, and that the eels were fed. Mair (1979) is particularly confusing as he specifically states that in the Whanganui *tunaheke* the migrating eel were stored in large wickerwork baskets and fed on boiled potatoes. The confusion may simply result from a misunderstanding of eel ecology.

Large scale, live storage in the prehistoric period cannot, however, be ruled out. Swarbrick (1958), describes an "eel-pound" built in the original stream bed of a swamp which was exposed in 1958 when floods washed out the swamp down to the clay bed. It consisted of two pen enclosures, approximately 6 ft × 3 ft with walls of vertical stakes wattled with fern stalks. No European materials were included, although Swarbrick suggests that the stakes had been prepared with steel tools. Swarbrick has interpreted this as evidence for large scale, live storage of eels in the protohistoric. In support of this interpretation he adds that "the Maoris of Te Awamutu district say that it was a common practice of their ancestors to confine live eels in this way" (Swarbrick 1958: 176). In the light of Swarbrick's interpretation, several other references raise interesting possibilities.

A series of eel weirs, one of which formed a "box" with sides of Kahikatea sticks wattled with brush and twigs, was exposed beneath a swamp in the bed of the ancestral channel of the Waingaehe Stream, Lake Rotorua (Pullar 1975). Coutts (1970), in the course of surveying the Lake Manapouri area, found the remains of what he calls an "eel-house". "This structure comprised a series of manuka sticks ... pushed into the soft clay bottom of the lagoon ... and was about 1 metre wide by 2 and a half long" (Coutts 1970: 182). The "so-called eel-weir at Mokau", depicted by Angas (Best 1929: 156), could also be reconsidered as a possible storage facility rather than for eel capture.

A reappraisal of the many references to channels (or *awa*) for capturing eels (Barber 1984: 24–30, 92–93; Beattie 1920: 60; Best 1929: 129–154; Phillips 1956: 175; Sheppard and Walton 1983; W. H. Skinner 1912; H. D. Skinner 1921, 1922; Wilson 1921, 1922) may also reveal evidence that at least some channels could have been for storage as well as capture.

Finally, there is Curtis' (1964) account of eel fishing at Lake Horowhenua. Here:

> ... the captured eels are kept alive in large wooden packing cases equipped with a hinged lid which takes up half the top of the box. The boxes have numerous small holes drilled in the sides to allow the water to pass through. The boxes are attached to a piece of fencing wire and secured to a convenient tree. The boxes float in the stream and the eels stay alive in them for months if necessary. The eels are not fed while in the boxes (Curtis 1964: 168).

The above description closely parallels the situation on the Kawakawa River. I have no evidence to suggest that the close similarities are a result of recent dissemination of information between the two areas. Rather, I would suggest that the techniques of live storage developed independently, out of a tradition of live storage which has been in place since the prehistoric period and has recently acquired a new relevance. Live storage is clearly preferable to preservation in terms of workload. In the prehistoric period when seasonal movement around a series of living sites was common, live storage of eels at the place of capture would not always be possible. Preservation would, therefore, often become the better alternative. Today, however, with settled residence and the ease of motor transport, it is practicable and preferable to store eels alive at the eel-weir for consumption as required (Fig. 6).

Figure 6: Transferring eels from the storage boxes to a holding net.

SUMMARY OF CHANGE

Before the introduction of European materials, a highly specific technology designed to take maximum advantage of the seasonal abundance of *tunaheke* was already in place. The subsequent introduction of new materials initiated a series of changes, which ultimately resulted in the transformation of a pre-European technology into its modern contemporary form. Documenting the sequence of change has been possible, but the sources available were not sufficiently detailed to allow adequate control of regional variation. Overall trends have, however, emerged. Change did not occur uniformly across the various components which make up an eel-weir assemblage. Instead, certain features changed very little while others changed quite radically.

Least change has occurred in the two components most central to the operation and articulation of the various parts of the eel-weir, namely the *pou* or stout posts and the *kupenga*. For the *pou*, resistance to change can be partially attributed to their functionally central position, but I would argue that their ritual importance and the fact that they symbolised strength were also factors which contributed to the retention of a conservative form.

The *kupenga* is still hand-made, retaining its original form and design despite present use of new, stronger, European materials. In contrast, greatest and most rapid change is evidenced for the more peripheral components: the trap net and framework. The old *hīnaki* is now completely superseded by shop-bought Japanese nets and the old *pā-tuna* fences are gone, leaving a simplified skeletal structure of *pou* alone.

These changes are all interrelated, and taken together can be seen to comprise a single technological transformation. Changes in the materials used vastly extended the life expectancy of both *kupenga* and trap nets. They therefore moved from being the weakest to the strongest component in the assemblage. This made it possible to move the channelling device from the weir structure to the nets. Gone, then, were the brushwood barriers, leaving only the *pou*. Other than the vastly simplified eel-weir structure, all the assemblage was then concentrated in the detachable net sections. As a result, wear and tear on the system was dramatically reduced as the weir is only assembled when in use and is no longer subject to year-round battering by water. This in turn significantly increased the eel-weir's efficiency by vastly reducing the work involved in maintaining it.

I would suggest, therefore, that changes in eel-weir technology from pre-European to contemporary forms focused on improving efficiency through lowering the upkeep rather than on increasing catch sizes. A similar trend is seen in changes in storage methods. Prehistoric living conditions usually required seasonal movement of residence, in which case, transportation of dried eel meat, despite the work involved in preparing it, would be more convenient than the keeping of live eels. Today, permanent settlement has become the rule rather than the exception, and vehicle transport is readily available. A corresponding reversal has occurred in storage techniques and live storage has become the optimum alternative, although eels are still dried in some cases where people have access only to open fishing areas (Curtis 1964: 169).

A point I would like to re-emphasise here is that the technological change occurred within a context of cultural continuity. True, new materials have been incorporated into the assemblage, but no component of the present eel-weir is without a traditional precursor. Changes have taken the form of new emphases placed on the various components of the eel-weir equipment. They have occurred within the tradition and have pivoted around two central elements: the *pou*—structural and symbolic centre piece; and the versatile *kupenga*, adaptable to any modification of the structure or nets which it articulates into a composite whole.

The argument supporting a prehistoric origin for eel-weir fishing can then be summarised as follows:

(i) Customs pertaining to storage, preparation and consumption of eels strongly suggest that deposition of large eel-bone middens is unlikely, and survivorship of eel-bone questionable. The negative evidence is not therefore sound.

(ii) The eel-weir assemblage complete with a variety of styles and executed entirely in locally available materials is well documented for the Historic Period, and it occurs in areas throughout New Zealand. If eel-weir fishing was introduced by Europeans, one might reasonably expect to see evidence of its origin in either the use of European materials or construction methods, even in the earliest examples. This is not the case.

(iii) When European materials do begin to occur there is not at first any concomitant change in the eel-weir form. Materials change but form is conservative. This kind of change is a characteristic response to the introduction of new materials into a well established tradition. It is apparent in other proto-historic artefact forms such as the very early use of metals for fishhooks, bird spears and adzes, and may also be observed, for example, in the translation of Archaic East Polynesian shell fishhooks into bone and stone (Davidson 1984: 63). Materials change; form is conservative.

(iv) With time, form also changed. But the key components central to both traditional design and ritual are retained through to the present and remain closest to their original form. Cultural continuity is strongly expressed. This point is developed further in the third section, *Whanaungatanga*.

EFFICIENCY OF EEL-CAPTURE

The preceding analysis of technological change indicates that change was associated with improved efficiency only in as much as it dramatically reduced maintenance. It did not result in any demonstrable change in the capture capacity of contemporary eel-weirs over their pre-European counterparts. Bearing in mind that it would entail a heavier workload, it may then be assumed that contemporary catch sizes were also within the capacity of pre-European eel-weirs. Contemporary catch sizes therefore offer an accurate indication of the degree to which prehistoric eel fishermen were able to harvest this potentially valuable resource.

The composition and size of the 1984 catch from the Baker *awa* is shown in Table 1. As described earlier, the *tunaheke* migrate in "runs". Usually the Baker family will fish three runs annually, easily taking sufficient eels to meet their own needs and provide for community functions. Most eels are taken in the first catch of the season when the storage boxes are empty and everyone is hungry for *tuna*. Subsequent runs are only fished according to demand, not availability. At least as many eels could, if wished, be taken in the later runs but demand does not usually warrant it.

TABLE 1
COMPOSITION AND SIZE OF CATCH

First Run: (March)

Size Range	Av. Weight (kg)	No. caught	Total Weight (kg)
40–50 cm (males)	0.2	1000	200
70–100 cm (females)	1.0	300	300
140 cm (females)	7.0	1	
			TOTAL = 500

Second Run:

Estimate 250 kg

Third Run:

Estimate 250 kg

TOTAL ANNUAL TAKE = 1000 kg

NOTE: The figures have been rounded off in accordance with the accuracy of estimates.

All eels except the very large female appeared to be of the smaller species, *Anguilla australis schmidtii*. The large eel was *A. dieffenbachii*.

Measurements for the first run were recorded in April, some weeks after the eels had been caught, and a considerable number had already been given away. The figure of 500 kg is therefore conservative. The figures for the two subsequent runs are based on estimates by Nathan and Anna Baker and again I have deliberately erred on the conservative side. Annual harvests are, however, highly variable, so double or half this total would be possible. Most of the variation is, I would stress, due to the adjustment of catches to community and family requirements rather than to good or bad fishing seasons.

The figure of 1000 kg/year represents the annual catch for one *awa* and one family. Along the river there are 19 operational *awa*, of which the Baker *awa* is second from the downstream end. Not all are as sophisticated in design as the Baker *awa* but all are potentially as productive. If all were operated with the dedication of the Baker family, approximately 19,000 kg of eels would be harvested annually. However, enthusiasm for fishing is variable amongst the *awa* operators and the actual annual harvest is probably more like 15,000 kg. Assuming the eels are available, however, greater motivation would be all that was needed to double this figure as the technology at present in use is more than adequate.

The *awa* have now been operating in their present form for about seven years and to date they do not appear to have had any negative impact on yields. No changes in eels size have been observed, and a disproportionate representation of males to females has been shown by Todd (1974) to be a product of different habitat preferences rather than due to the effects of heavy fishing pressure.

Interestingly, neither the position of an *awa* in the queue, nor the fact that they are often built within a few metres of each other (Fig. 1) seems to affect the catch size. This also suggests that overall annual harvests are well within the limitations of the catchment yield.

At this point it is useful to consider the degree to which eels could have contributed to the prehistoric diet if they were captured at the rate outlined above. No allowance has been made for waste, as *tunaheke* require no gutting, owing to the cessation of feeding prior to migration. Furthermore, eels are not skinned and even the bones are sometimes consumed.

Table 2 outlines the calorific content of the eels collected from (1) the Baker *awa*, and (2) all *awa* combined. To summarise: meat taken by a single *awa* would provide sufficient calories for a family of two adults, one adolescent, and two children, for a six month period, if nothing else were consumed. If all the *awa* catches are totalled, they would provide food for seven to eight families annually.

Even on a strict calorie count this is by no means a meagre contribution, especially considering it required only three to four weeks work, including making and repairing the *awa* structure and equipment. An alternative angle is to consider the contribution eel meat could make to human protein requirements. This is outlined in Table 3. Here again, eels are clearly a very valuable resource. Just one *awa* could provide sufficient protein for two to three families annually and the *awa* catchment as a whole could provide the annual protein requirements for 34 families.

Dried eel meat consists of half protein, half oil (Shortland and Russell 1948). Apart from being a rich protein source it is also therefore a valuable source of fat. With the moa virtually extinct and availability of sea mammals irregular (Smith 1985) reliable fat sources must have been rare in prehistoric New Zealand, enhancing the importance of freshwater eels.

In terms solely of its richness as a food resource, eel meat clearly had considerable potential as a major contributor to prehistoric diet. Furthermore, this paper has demonstrated that a technology capable of tapping that resource, possibly to its limit, was in place before the introduction of European materials into the assemblage. Given the potential of eel fishing, and the presence of a prehistoric technology to realise it, how then might it have contributed to or promoted aspects of prehistoric lifeways?

WHANAUNGATANGA

An initial approach might then be to consider the cultural context in which contemporary eel fishing takes place.

Along the Kawakawa River, eel fishing is not carried out as an isolated activity divorced from the cultural context in which it survives. Rather, it remains an integral part of the

TABLE 2
CALORIFIC CONTRIBUTION TO DIET

1. The Baker *awa*:

Calorific value of *tunaheke* = 27,000 j/g (Ryan 1978: 91)
= 6,500 kcal/kg, dry weight

Note: eel meat consists of approximately 17% protein, 17% oil, 66% water (Shortland and Russell 1948), so dry weight is $\frac{1}{3}$ wet weight.
The Baker *awa* captures 1000 kg/yr wet weight = 333 kg/yr dry weight
Calorific value = 333×6500 kcal/yr = 2,164,500 kcal/yr
For a family of 2 adults, 1 adolescent, and 2 children,
Daily calorific requirements = 8,000 kcal (Rappaport 1968: 75)
Adjusted for people of larger stature = 12,000 kcal.
The *awa* then provides calorie requirements for 1 family for 180 days.

2. The *Awa* catchment:

15,000 kg wet weight = 5,000 dry weight of meat
Which provides $5,000 \times 6500$ kcal/yr = 35,500,000 kcal/yr
= 2958 days requirement for 1 family
or sufficient for 7–8 families for 1 year.

TABLE 3
PROTEIN CONTRIBUTION TO DIET

1. The Baker *awa*:

Eel meat is 17% protein, or $\frac{1}{2}$ the dry weight
1000 kg (wet weight) of eels contains 166 kg of protein
Daily protein requirements for one family (as above) = 139 gms (Rappaport 1968: 75)
adjusted for stature = 208 gms
= 0.208 kg

so 166 kg of protein will provide sufficient protein for 1 family for 798 days
or 2.22 families for 1 year

2. The *Awa* catchment:

Provides 166×15 kg protein = 2409 kg
Sufficient for 2.22×15 families annually = 33.3

dynamic Maori culture in which it exists, and operates as a mechanism for the maintenance and self-definition of that culture. At first glance, one might not expect traditional values and lifestyles to be an important focus in the local community. Many of the people now living in the area have been drawn there from all regions in Northland, and have come to take advantage of the jobs available in the freezing works. The population is not therefore tribally united and much of the social activity centres on or derives from the workplace.

But despite social change and displacement of people from their family lands, traditional ways are still pertinent in many aspects of community and family life. One of the mechanisms by which traditional lifestyles are made operational is a strongly expressed preference for traditional foods. Such foods are not necessarily traditional in the sense of pre-European. They tend rather to be seen in terms of collected *versus* bought food, so that foods such as shellfish and eels which are affordable only if collected, or other delicacies like *pirau* corn which can be processed but not bought, are highly regarded items. This is particularly true at social gatherings which mark life crises, e.g., weddings and funerals, where the serving of traditional foods has an important role in creating the sense of occasion, and of Maori identity.

Amongst these collected foods, some are more generally available than others. Shellfish beds, for example, are accessible to anyone with a car. But this is not true for the *tunaheke*. To eat *tunaheke* one must have knowledge of and access to an eel fishing stream, combined with an ongoing commitment to setting up and maintaining the technology; or alternatively, know someone who does.

Any person in the community could, if he or she wishes, gain access to the eeling streams of the Kawakawa River. Much of the land bordering the streams is owned by the freezing works (a public company) and permission for access is, I am informed, easily obtainable. Nevertheless, almost all the eel-weirs in operation belong to families who still retain rights in family land along the stream and often have traditional ties with specific eel fishing spots. It appears that part of the impetus to continue eeling may come through a desire to maintain "hands on" ties with family land—not an unimportant consideration in a situation where Maori ownership of land is continually eroding.

The Baker family is no exception. The land on which their *awa* is built is family land, through the paternal grandparents, and most of the 20-odd *awa* operators along the stream have kin links through these grandparents. Each *awa* is operated independently as a family enterprise, but the community of *awa* operators is tied into a recognised kin network and comprises a local subgroup within the broader community. The *awa* families are a very small proportion of those with land rights in the area, so many families, including a large number who live close to the streams, choose not to exercise their fishing rights. Most, however, do participate in a passive sense, through what is perhaps the most important aspect of eel fishing: the gifting system.

Gifting of eels by families who operate *awa* to other members of the community is so well established as to be obligatory, whereas a prohibition on direct trading or selling of eels is enforced by strong local censure. A well-enjoyed local story illustrates this point. One *awa* operator decided to go commercial. It is said that in the first year he caught and sold some $20,000 worth of fish and on the strength of this gave up his job at the freezing works. But the following year his eel-weir caught only logs and was largely destroyed.

Gifting obligations can be many and varied. They range from the small gifts given to close family whenever eels are cooked or those given to relatives and friends when up visiting from Auckland, to the massive obligation of supplying eels for weddings, funerals, and other *hui* which take place frequently on the local *marae*. First priority invariably goes to the elders. The old people are never left to want for *tuna*, and for one very senior elder a box is filled each year and taken to a stream near his house, so he can eat whenever "he is hungry for *tuna*".

The concepts of generosity and abundance are inextricably linked. If a man's family engages in eeling he is socially obliged to give away eels. It is said that the more eels one gives away, the more eels will come into the nets. Nathan Baker's strict observance of gifting obligations has earned him a reputation for extreme generosity and he is said never to have refused a request for eels. It is as well then that his *awa* is one of the most productive on the river.

Nathan's reputation for generosity and the wealth of eels caught in his nets are considered to be interrelated. Local folklore has invested the spot now occupied by Nathan's eel-weir with a long history as a good eel station. It contends that for a long time it was an open spot where no one family could fish for more than a few days. In this way everyone could fill their nets and receive their share of the annual eel harvest. The supreme abundance of eels at this point is attributed to an underground waterway which eels may enter several kilometres upstream and exit from just in front of the Bakers' nets. By occupying this particular spot, Nathan concomitantly accepts exceptionally heavy responsibilities for redistributing eels through the community by gifting, for since Nathan chooses to fish an open spot so too must his generosity be correspondingly open.

Rewards for participation in this gifting system are multifaceted. Very seldom, if ever, are eels directly exchanged for other food items or goods. Unsolicited items are, however, constantly gifted into the Baker household from families who may for some reason have more than they immediately require. Gifting, therefore, redistributes abundance but could not be described as an ordered exchange network.

Much has often been made of the importance of oratory and a knowledge of oral tradition to a man wishing to establish status or a high social postion in a Maori community (Salmond 1975). But this is not to say that alternative pathways to social recognition do not exist. Participation in the described gifting system offers one such alternative. Nathan Baker never speaks on the *marae* but he does operate the most successful eel-weir, on what is generally recognised as the best fishing spot on the river, and is therefore able to give generously and without measure. Although such generosity is expected if not demanded, Nathan's acceptance of and ability to meet those demands means he is accorded in return both respect and status within the community.

While generosity in any circumstances is deemed highly desirable, it is particularly so when operating through a traditional medium such as eels, or more generally through food rather than money.

Eel fishing is thus seen to be part of the traditional dimension of people's lives and is self-consciously recognised and maintained as such. This occurs at several levels. Eels are preferred prepared and cooked in traditional ways similar to those described by Best (1929: 115–6) and Downes (1918: 300). Often they are reserved for formal social gatherings, and though seldom prepared simply for the family table, are also a common feature on the menu at larger informal family gatherings.

The technology of eel fishing remains sufficiently conservative to provide clear, demonstrable links with the past. This is reinforced by a continued observance of rituals associated with eel fishing. These include prohibitions on the cooking or consumption of eels near the eel-weir and in some cases a *tapu* on women walking on or working an eel-weir.

Like its technology, the social context of eel fishing demonstrates both durability and flexibility as it accommodates changes while actively preserving links with the past. Again, the consideration of process as well as the form of change is used to bridge the contemporary and the prehistoric. In the concluding section of this paper, the social context of contemporary eel fishing, as described above, is used as the basis for tentative reconstruction of this aspect of prehistoric eeling.

TOWARDS A MODEL FOR EEL FISHING IN PREHISTORY

In the absence of direct archaeological evidence for prehistoric mass capture eel fishing, in the form of substantial eel bone middens or durable artefacts, this paper has sought to explore other avenues of enquiry. Contemporary and historic ethnographic accounts are seen to provide a lens through which to view prehistory. Distortions due to changes taking place through the Historic Period have been identified and fully documented, thus enabling the archaeologist to control for at least some post European influences. The emergent picture, implicit in the opening quotation from James Beattie, reveals how food and the technology and customs pertaining to the collection, cooking and consumption of food, are today and have in the past been used as mechanisms for the definition and maintenance of social structures and cultural identity. Following through the chain of technological changes which have taken place in the eel weir assemblage illustrates how these mechanisms have operated to maintain a tradition while still accommodating change. In this case, rapid and dramatic change occurred in the peripheral components of the assemblage, counter-balanced by conservatism in form and materials in the more central components upon which ritual significance was focused. In a comparable example, Prickett (1982: 142) has argued in respect of the traditional Maori dwelling that "the strength and continuity of symbolic and behavioural parameters" underlies an evident conservatism of house form. Thus, in each case change is embraced while cultural continuity is maintained.

Following from the argument for formal continuity in eel weir technology it is proposed:

> that intensive eel fishing methods, designed to take full advantage of the seasonal abundance of *tunaheke* were developed in the Prehistoric Period. With the resultant technology, harvests of up to or even greater than maximum catchment yields were potentially possible, and could be taken in comparatively short periods.

This form of economic strategy is not without precedent in New Zealand prehistory. Hamel (1969: 154) points to a general tendency towards focusing intensive exploitation of "particular species often at particular stages in their life cycles". The most widely acknowledged example is the *titi* or muttonbird (Sutton and Marshall 1980). There is, however, an important difference between muttonbirding and eel weir fishing. While the former required only the recognition of a potential for intensification to be possible, eel fishing further required the development of an appropriate technology and its maintenance. The occurrence of eel weir fishing in prehistory of necessity presupposes the existence of an on-going, actively pursued desire for intensification and a socio-political order which would make it possible. Its emergence could not therefore have been merely opportunistic. This is a point to which I will return later.

Given the nature of the data presented in this paper it should now be possible to move beyond a purely economic model and consider also the social and political dimensions of prehistoric eel fishing. In its contemporary setting, eel fishing contributes in several ways to personal and group identity. First, it gives active expression to the bond which exists between families and their traditional land. Secondly, it strengthens ties between members of a kin group through participation in shared activities. This occurs at three levels. It binds together the nuclear family through the shared work of maintaining and fishing the *awa*. Those families who operate *awa* are bound loosely as a kin group which traces common descent, and finally a broader web of relationships is woven through the gifting system. The salient characteristic of the latter two groups is that although they are in the first instance based on kinship, they are in fact defined and operationalised by participation. Kin relations alone do not define social affiliations. Rather, choices are made from a field of alternatives and although close kin tend to be preferred, maintenance of social bonds requires constant reaffirmation through shared activities.

The social dynamics evident in the operation of contemporary eel fishing thus points to a number of possibilities for its prehistory. Broadly speaking it suggests that

(i) Social relations were not rigidly defined and permitted options in personal associations and group affiliations.

(ii) Choices were operationalised by participation in shared activities.

(iii) Gifting and redistribution was largely defined by obligation to kin but also provided a way of keeping open alternative social avenues and maintaining more distant relationships.

Control of the eel harvest centred on access to choice fishing spots—particularly bottlenecks in streams. Fishing rights to key positions were therefore crucial. The contemporary situation suggests that in theory these would be open to all with appropriate kin affiliations, probably at a *hapū* level, but that effective control can only be exercised and maintained by actively fishing any particular fishing spot. The case in point is that Nathan Baker is able to personalise an "open" fishing spot by transforming "open access" into "open gifting". By so doing he effectively transfers the structuring of "openness" from the broader group to being channelled through a person or family.

Nevertheless, control over or access to a fishing spot would not necessarily guarantee control over the resultant eel harvest, especially if it is converted to preserved eel meat. Of interest here is Anderson's (1980) suggestion that the muttonbird, *tītī* may have been central to the operation of the socio-political system extant in proto-historic Murihiku. He argues that:

> Their [tītī] value as a food resource lay in their fat-rich flesh, their abundance, and the reliability of their seasonal appearance. Just as important, and more so from the point of view of exchange was the fact that very effective preservation and storage techniques were traditionally available.
> [As a result], a quite phenomenal amount of food or potential wealth and prestige could be injected into the Ngai Tahu community each winter (Anderson 1980: 14).

All Anderson's conditions have in this paper been demonstrated to apply to eel fishing. Like the *tītī*, the *tunaheke* is an extremely rich food with a high oil content; it is localised in space and seasonally highly abundant. An important difference, however, is that the *tunaheke* is not restricted to off-shore islands and can be collected at a much greater number of places. Furthermore, as discussed above, a clear desire for intensive exploitation is implicit in the development of a technology designed for their mass-capture and storage. Stored eels must have represented an enormous annual reservoir of wealth, and control over its collection and redistribution must, as a matter of course, have had a major influence on the structure and operation of the socio-political system. The Maori of northern New Zealand, unlike the Murihiku people, were horticulturalists and *kūmara* would also have been a source of potential wealth and power in the form of stored food. The *tunaheke* and *tītī* are in many ways very similar resources, but the influence of the *tunaheke* on the socio-political structures of the northern Maori is mediated by the presence of *kūmara*, and is more diffuse, because of a less restricted resource distribution.

Given that access to the collection of *tunaheke* would be wider than for *tītī*, on the basis of its broader distribution, it might reasonably be expected that control of the harvest was less centralised and occurred at a broader social level, possibly the *whānau* or *hapū*. At this level, the judicious use of kin-based and non kin-based gifting of eels would have been an important potential source of socio-political influence, and a major contributor to the underpinning of the distinctive form of complex socio-political organisation which emerged in northern New Zealand.

Evaluation of the model presented in this paper will rest on our ability to find new, innovative methods for testing it against the archaeological record. But however the model stands the test of time, its value today lies, in part, with the demonstration of the fact that prehistorians, especially those of the Pacific, need not be hamstrung by the absence of specific forms of empirical data. Prehistory is encompassed in the present in many forms. So too does the prehistorian require a broad range of analytical tools and considerable ingenuity in their application.

ACKNOWLEDGEMENTS

The conceptualisation and design of this project grew out of my frequent discussions with Dr Doug Sutton. He provided encouragement and support by editing many successive drafts, and maintaining a steadfast commitment to seeing the material published. I am grateful to Dr Harry Allen for his comments on the ecology section, to Kati Kereszturi who typed the manuscript and to Caroline Phillips who drew the map.

Nathan and Anna Baker entrusted me with their knowledge as well as welcoming me into their home. I hope they will accept this paper as my *tohu aroha*.

I would also like to thank Pumata and Bebe Paraone of Moerewa for allowing me to examine and photograph their *hīnaki*.

REFERENCES

Anderson, A. J. 1980. Towards an explanation of protohistoric social organisation and settlement patterns amongst the southern Ngai Tahu. *New Zealand Journal of Archaeology* 2: 3–24.

Anderson, A. J. 1982. A review of economic patterns during the Archaic Phase in southern New Zealand. *New Zealand Journal of Archaeology* 4: 45–76.

Barber, I. 1984. Prehistoric wetland cultivation in far northern Aotearoa: an archaeological investigation. Unpublished M.A. thesis, Anthropology Department, University of Auckland, Auckland.

Beattie, J. H. 1920. Nature-lore of the southern Maori. *Transactions of the Royal Society of New Zealand* 52: 53–77.

Beattie, J. H. 1954. Our southernmost Maoris. Their habitat, nature notes, problems and perplexities, controversial and conversational, further place names, antiquity of man in New Zealand. *Otago Daily Times and Witness*, Dunedin.

Beattie, J. H. n.d. The South Island Maori. Records of interviews with old Maoris of Canterbury, Nelson, Westland, Otago and Southland. Manuscript, Hocken Library, Dunedin.

Bellwood, P. 1978. Archaeological research at Lake Mangakaware, Waikato, 1968–1970. *New Zealand Archaeological Association Monograph* 9.

Best, E. 1929. Fishing methods and devices of the Maori. *Dominion Museum Bulletin* 12. Government Printer, Wellington. Reprinted without textual alteration, 1977.

Boyle, G. D. 1974. Eels in New Zealand Prehistory. Unpublished M.A. research essay, Anthropology Department, University of Auckland, Auckland.

Brunner, T. 1850. Journal of an expedition to explore the interior of the Middle Island of New Zealand. *Journal of the Royal Geographical Society* 20: 344–378.

Butts, D. J. 1977. Seasonality at Rotokura, Tasman Bay: a case study in the use of faunal identifications to establish the season of occupation for an archaeological site. Unpublished B.A. Honours dissertation, Anthropology Department, University of Otago, Dunedin.

Charlton, T. H. 1981. Archaeology, ethnohistory and ethnology: interpretive interfaces. *In* M. B. Schiffer (Ed.), *Advances in Archaeological Method and Theory* 4, pp. 129–176. Academic Press, New York.

Cheeseman, T. F. 1925. *Manual of New Zealand Flora* (2nd edition). Government Printer, Wellington.

Clark, R. 1979. Language. *In* J. D. Jennings (Ed.), *The Prehistory of Polynesia*, pp. 249–270. Harvard University Press.

Coutts, P. J. F. 1970. Archaeological reconnaissance around Lake Manapouri. *New Zealand Archaeological Association Newsletter* 13: 178–190.

Curtis, C. S. 1964. Notes on eel-weirs and Maori fishing methods. *Journal of the Polynesian Society* 73: 166–170.

Davidson, J. 1984. *The Prehistory of New Zealand*. Longman Paul, Auckland.

Downes, T. W. 1918. Notes on eels and eel-weirs (tuna and pa-tuna). *Transactions and Proceedings of the New Zealand Institute* 50: 296–316.

Hamel, G. 1969. Ecology method and theory: Tiwai Peninsula. *New Zealand Archaeological Association Newsletter* 12: 147–163.

Harding, E. 1928. Prehistoric drains on the Kaipara West Coast. *Journal of the Polynesian Society* 37: 367–369.

Heaphy, C. 1846. Notes of an expedition to Kawatiri and Auroura on the western coast of the Middle Island. Manuscript, Hocken Library, Dunedin.

Kahotea, D. n.d. Eeling in the Kaimai Range. Unpublished stage 3 research essay, Anthropology Department, University of Auckland, Auckland.

Leach, B. F. 1979. Fish and crayfish from the Washpool midden site, New Zealand: their use in determining season of occupation and prehistoric fishing methods. *Journal of Archaeological Science* 6: 109–26.

Leach, H. M. and Leach, B. F. 1980. The Riverton site: an archaic adze manufactory in western Southland, New Zealand. *New Zealand Journal of Archaeology* 2: 99–140.

Mair, Captain. 1879. Notes on fishes in the Whanganui River. *Transactions of the New Zealand Institute* 12: 315–16.

Mair, G. 1979. Maori occupation in the Wairarapa during the Protohistoric Period. *In* B. F. and H. M. Leach (Eds), Prehistoric Man in Palliser Bay, pp.11–28. *Bulletin of the National Museum of New Zealand* 21.

Nichol, R. K. n.d. Analysis of fish bones from Crater Hill. Unpublished report to the New Zealand Historic Places Trust.

Nichol, R. K. in prep. If you took the Bones out it wouldn't be Crunchy, would it? Ph.D. thesis, Anthropology Department, University of Auckland, Auckland.

Pawley, A., and Green, R. C. 1985. The Proto-Oceanic language community. *In* R. Kirk and E. Szathmary (Eds), *Out of Asia: peopling the Americas and the Pacific*, pp.161–184. Journal of Pacific History, Canberra.

Phillipps, W. J. 1956. A Maori method of trapping eels in Lake Forsyth. *Journal of the Polynesian Society* 65: 172–173.

Prickett, N. 1982. An archaeologists' guide to the Maori dwelling. *New Zealand Journal of Archaeology* 4: 111–147.

Poata, T. R. 1919. *The Maori as a fisherman and his methods*. W. B. Scott, Opotiki.

Pullar, W. A. 1975. Fish weir discovery—Rotorua. *Historical Review, Journal of the Whakatane and District Historical Society* 23: 98.

Rappaport, R. A. 1968. *Pigs for the Ancestors. Ritual in the ecology of a New Guinea people*. Yale University Press, London.

Ryan, P. A. 1978. The ecology of the short-fin eel, *Anguilla australia schmidtii*, in Lake Ellesmere, Canterbury. Unpublished Ph.D. thesis, Zoology Department, University of Canterbury, Christchurch.

Salmond, M. A. 1975. *Hui—A Study of Maori Ceremonial Gatherings*. Reed, Wellington.

Sheppard, B. and Walton, T. 1983. Eel trapping channels at Tangimate Lagoon, Horowhenua. *New Zealand Archaeological Association Newsletter* 26: 137–144.

Shortland, F. B. and Russell, J. 1948. Observations on the oil content of New Zealand freshwater eels. *New Zealand Journal of Science and Technology* 29: 163–191.

Skinner, W. H. 1912. Ancient Maori canals. *Journal of the Polynesian Society* 21: 105–108.

Skinner, H. D. 1921. The Kaitaia carving. *Journal of the Polynesian Society* 30: 92–95.

Skinner, H. D. 1922. The Kaitaia carving. *Journal of the Polynesian Society* 31: 57–58.

Smith, I. W. G. 1985. Sea Mammal Hunting and Prehistoric Subsistence in New Zealand. Unpublished Ph.D. thesis, Anthropology Department, University of Otago, Dunedin.

Sutton, D. G. and Marshall, Y. M. 1980. Coastal hunting in the subantarctic zone. *New Zealand Journal of Archaeology* 2: 25–50.

Swarbrick, H. A. 1958. An old Maori eel pound. *Journal of the Polynesian Society* 67: 175–176.

Todd, P. R. 1974. Studies on the Reproductive Biology of New Zealand Freshwater Eels. Unpublished Ph.D. thesis, Victoria University, Wellington.

Todd P. R. 1980. Size and age of migrating New Zealand freshwater eels (*Anguilla* spp.). *New Zealand Journal of Marine and Freshwater Research* 14: 183–293.

Todd, P. R. 1981. Timing and periodicity of migrating New Zealand freshwater eels (*Anguilla* spp.). *New Zealand Journal of Marine and Freshwater Research* 15: 225–235.

Williams, H. W. 1957. *A Dictionary of the Maori Language* (6th edition). Government Printer, Wellington.

Wilson, D. M. 1921. Ancient drains, Kaitaia swamp. *Journal of the Polynesian Society* 30: 185–188.

Wilson, D. M. 1922. Maori drains, North Auckland. *Journal of the Polynesian Society* 31: 130–133.

Received 15 April 1986