

Perspectives of Māori fishing history and techniques.

Ngā āhua me ngā pūrākau me ngā hangarau ika o te Māori

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ABSTRACT: To pre-European Māori, fishing was a significant component of subsistence, and the abundant coastal fish stocks provided a rich and readily available resource. However, interpreting early Māori fishing activities using indirect sources of information, including oral traditions, archaeological evidence and historical accounts, may reflect regional, localised and chronological variation, and also be subject to cultural interpretation. Pre-European Māori fishing provided the main source of sustenance, with methods of procuring fish based on the careful observations of generations of fishermen. Fish were taken with nets (some over a mile/1.6 km in length), traps, spears and hook-and-line. Fishhooks made of wood, stone, bone, ivory or shell, based on designs developed over many thousands of years, were used as lures (pā kahawai, pohau mangā) or suspended hooks (matau). Māori use of traditional materials to make hooks rapidly declined in favour of metals after European contact, although the demand for Māori artefacts by curio hunters in the late nineteenth and early twentieth centuries led to the manufacture of large numbers of replica traditional hooks for trade. Early explorers, historians and archaeologists have commented that they considered the Māori hooks to be ‘ill made’ or ‘impossible looking’, and were unable to decide how the hooks actually caught fish. Matau were made to a ‘circle’ design and function in a different manner to modern J-shaped steel fishhooks to catch fish. Recently, many commercial long-line fisheries have readopted the traditional hook shape in recognition of its advantages and improved catch rates.

KEYWORDS: Pre-European New Zealand Māori fishing, matau, fishhooks, rotating or circle hooks, pā kahawai, pohau mangā, fishing lures, curio trading.

Introduction

Fishing has always been of major significance to Māori communities (Fig. 1). Customary subsistence use of the sea, which ensured a sustainable and low-risk fish catch, is demonstrated in a rich tradition of ritual restrictions enforced by supernatural penalties and jurisdictions (Best 1929; Barber 2003). Numerous myths and legends focus on fishing: for example, the legend of Maui fishing up Te

ika o Maui (New Zealand); Kupe discovering New Zealand while in pursuit of a fish; and other legends that detail the origins of fish and surround fishing activities, including the inventions of the barbed hook, eel and crayfish pots, and fishing lines (Best 1982). These legends are complemented by the archaeological interpretation, which has emphasised extractive opportunism, particularly in southern waters (Anderson 1983; Anderson & Gumbley 1996; Nagaoka 2002), and by the historical record provided by

early Europeans (e.g. Dieffenbach 1843; Colenso 1869, 1891; Best 1929; Beaglehole 1955; and others), which describes the accessibility, high biomass and stability of the inshore Māori fishery (Barber 2003), particularly in northern waters.

Museum collections contain numerous examples of Māori fishhooks that have been used to provide chronological sequences and analyses of Māori fisheries as part of the historical and archaeological record. However, many other fishhooks in museum collections are items that appear to have been produced for artefact or 'curio' trading, and the demarcation between hooks produced for fishing, trade or personal decoration (hei matau) is difficult to determine, in part because of the unusual hook design, which is related to the 'rotating' manner in which the circle hook functioned.

The Māori fishery

Although early Māori in New Zealand found a plentiful food supply in the flocks of moa that were scattered throughout the country and the extensive seal colonies in some coastal regions, the legends, the names of people and places that denote an abundance of fish, and the oral history accounts acknowledge fish as a major food resource. Recently excavated archaeological sites at Purakanui and Long Beach, Otago, have revealed specialised fishing camps, occupied as early as AD 1300, and radiocarbon dates for some of the large Catlins sites now show that fishing began to replace moa hunting and sealing as early as AD 1350 (Leach 1989; Petchey & Higham 2000). The increasing Māori population quickly eliminated the slow-breeding moa, and because the country was devoid of native land mammals (with the exception of three species of small bats, which were neither large nor numerous enough to be of any food value) subsistence activity resulted in hunting pressure gradually switching to smaller taxa such as birds and fish (Nagaoka 2001, 2002), as well as dogs and rats introduced by Māori, and to cannibalism (Best 1903; Hiroa 1949; Davidson 1984).

Dogs as a food source were a luxury restricted to persons of high rank because of their limited numbers, and rats, although recorded as part of the daily food (Travers 1873; Firth 1929; Hiroa 1949), were similarly restricted to chiefs or visitors (Colenso 1891; Best 1903) and were of little importance owing to their small size (Hiroa 1926). Evidence for cannibalism, meanwhile, does not suggest

any significant contribution to diet (Best 1903; Davidson 1984) and may have been limited to ceremonial occasions (Hiroa 1949).

Access to fat or carbohydrate to supplement a protein diet is essential to avoid starvation, and in southern areas where kūmara (sweet potato *Ipomoea batatas*) could not be grown, successful permanent habitation depended upon a reliable source of fat that was available from sea mammals (Leach 2006). Localised extirpation of fur seals chronologically matched the extermination of moa in some regions (Lalas & Bradshaw 2001), and this paucity of large prey after AD 1500 caused a stabilisation (McGlone *et al.* 1994), or even a reduction (Anderson 1983), in the size of the Māori population in southern South Island where fish resources were more limited, and may have contributed to periods of starvation in all areas except the far north where kūmara could be grown (Leach 2006). Habitat destruction and the vulnerability of the New Zealand avifauna soon led to local depletion of many birds, with over 35 species becoming extinct between the time of the arrival of the Māori and the arrival of Europeans in the 1700s (Cassells 1984). Once these stocks were overexploited, Māori were dependent on fish and shellfish, and communities became concentrated in coastal regions, with extensions up river valleys and around larger lake shores (Hiroa 1926).

To Māori, the sea provided kai moana – literally 'food from the sea' – and it became the main source of protein and fat, with methods of procuring fish based on the careful observations of generations of fishermen (Hiroa 1926). As a result, fishing was a significant component of subsistence, and the unwritten Māori lunar calendar marked the seasons of appropriate food supplies (Best 1903; Hiroa 1926; Firth 1929). The frequency with which shell middens, generally rich in fish remains, occur about the New Zealand coast suggests heavy coastal exploitation given the low population densities (Anderson 1997). Isotope studies have shown that about 90% of all food energy consumed by Chatham Island Māori was of marine origin (including fish, shellfish and sea mammals) (Leach & Boocock 1993), and food of marine origin varied from 11% at an inland site at Rotoiti, North Island, to 61% at a coastal site at Wairau Bar, South Island (Leach *et al.* 2003; Leach 2006). The abundant fish stocks, supplemented by kūmara (in northern regions) and aruhe (root of bracken fern *Pteridium esculentum*) for carbohydrate, or sea mammals for fat, were sufficient to provide adequate food supplies for Māori, except in southern regions where



Fig. 1 Aorere, Golden Bay, 1843. Extensive view from a high point overlooking Wainui Inlet and Golden Bay, with Māori drying fish (including stingrays and barracouta) on racks. Watercolour by an unknown artist, 1843 (watercolour: Alexander Turnbull Library, C-030-019. Reproduced with permission).

kūmara could not be grown, and during seasonal periods of adverse weather that prevented harvesting activity, or when changing climate reduced the abundance of some marine species (Leach & Leach 1979; Leach 2006).

Throughout New Zealand, Māori used nets and lines made from harakeke (New Zealand flax *Phormium* spp.) or, occasionally, other fibrous plants such as tī (cabbage tree *Cordyline* spp.) and kiekie (perching astelia *Freycinetia banksii*). These were considered much superior in quality to those of the Europeans at the time, and Māori regularly supplied European explorers and settlers with fish, which were found in seemingly endless abundance (Cruise 1824; Polack 1838; Beaglehole 1955; Forster *in* Hoare 1982; de l'Horme *in* Ollivier & Hingley 1982; Johnson 2004).

The journals of James Cook, Joseph Banks and William Anderson from Cook's voyages of rediscovery between 1769 and 1779 on the ships *Endeavour* and *Resolution* provide numerous references to fish and fishing activities in New Zealand waters:

the natives brought of to the ship and sold us for small peeces [*sic*] of cloth as much fish as served all hands, they were of the mackarel [*sic*] kind and as good as ever was eat...

...as soon as it was daylight the natives began to bring off mackarel [*sic*] and more then we well know'd [*sic*] what to do with. (Beaglehole 1955: 195)

some few we caught our selves with hook and line and in the Saine [*sic*] but by far^r [*sic*] the greatest part we purchas'd [*sic*] of the Natives and these of Various sorts, such as Shirks [*sic*], sting-rays, Breams, Mullet, Mackarel [*sic*] and several other sorts; their way of catching of them is are the same as ours, / viz / with hooks and lines and with saines [*sic*], of these last they have some prodigious large made all of a Strong kind of grass. The Mackarel [*sic*] are in every respect the same as those we have in England only some of them are larger than any I ever saw in any other part of the world. (Beaglehole 1955: 219)

For this scarcity of animals on the land the sea however makes abundant recompense. Every creek and corner produces abundance of fish not only wholesome but at least as well tasted as our fish in Europe: the ship seldom anchored in or indeed passed over (in light winds) any place whose bottom was such as fish resort to in general but as many were caught with hook and line as the people could eat, especially southward, where when we lay at anchor the boats by fishing with hook and line very near the rocks could take any quantity of fish; besides that the seine seldom fail'd [*sic*] of success, insomuch that

both times that we anchored to the southward of Cooks streights [*sic*] every Mess in the ship that had prudence enough salted as much fish as lasted them many weeks after we went to sea... There are Macarel [*sic*] of several kinds, these come in immense shoals and are taken by the natives in large seines from whom we bought them at very easy rates. But above all the luxuries we met with the lobsters or sea crawfish must not be forgot... of them we bought great quantities of the natives every where to the northward, who catch them by diving near the shore, feeling first with their feet till they find out where they lie. (Beaglehole 1962: 75)

Early European explorers in the nineteenth century made observations on the abundance of fish and fishing activity and its importance to Māori (e.g. Dieffenbach 1843; Colenso 1869; Brunner 1959), while missionaries, including the Reverend James Buller and Samuel Marsden (Buller 1878; Elder 1932), and settlers (e.g. Savage 1807; Nicholas 1817; Yate 1835; Polack 1838; Heaphy 1842, 1880; Earp 1853; Tregear 1904) provide anecdotal comments on the local abundance and availability of some fish species. Hiroa (1926) and Best (1929) recorded detailed observations on the methods of making and using fishing nets (kupenga) in the early twentieth century, shortly before the techniques became obsolete as new European materials replaced the traditional harakeke flax. Prior to this, generally little attention was paid to the details of how Māori fishing gear was made and used. Comments and observations in the latter part of the nineteenth century also record large fishing expeditions, often involving groups of over a thousand people. For example, Matthews (1911) reported a night shark-fishing expedition at Rangaunu Harbour, Northland, in January 1855 that involved over 50 canoes, resulting in a catch of more than 7000 sharks, including one large canoe that took 6 tons (6100 kg) of kapetā (dogfish *Mustelus lenticulatus*) and tōiki (bronze whaler *Carcharhinus brachyurus*). Others noted the use of huge seine nets of several thousand metres in length, with catches frequently measured in tonnes (e.g. Yate 1835; Polack 1838; Taylor 1855; Mair 1873; Sherrin 1886; Downes 1918; Best 1929).

They were not (as many have rashly supposed) deficient in food... They were very great consumers of fish; those on the coast being true Ichthyophagi. The seas around their coasts swarmed with excellent fish and crayfish; the rocky and sandy shores abounded with good shellfish;...all choice eating. Sometimes they would go in large canoes to the deep sea-fishing, to some well known



Fig. 2 Māori communal fishing: ‘The Maoris are very fond of fish, and those tribes which live on the coastline make it their principal article of diet. The photograph shows a fine catch at Parengarenga, in the North Auckland Province. At the moment of taking the photograph the Maoris – all hands and the cook – were engaged in cleaning the fish’. *Canterbury Times*, 17 July 1907 (photo: Christchurch City Libraries Photo CD 8, IMG0053. Reproduced with permission).

rock or shoal, 5 to 10 miles from the shore, and return with a quantity of large cod, snapper, and other prime fish; sometimes they would use very large drag nets, and enclose great numbers of grey mullet, dog-fish, mackarel [*sic*], and other fish which swim in shoals; of which (especially of dog-fish and of mackarel [*sic*]), they dried immense quantities for winter use. They would also fish from rocks with hook and line, and scoop-nets; or, singly, in the summer, in small canoes manned by one man and kept constantly paddling, with a hook baited with mother-of-pearl shell, take plenty of kahawai; or with a chip of tawhai wood attached to a hook, as a bait, they took the barracouta in large quantities. Very fine crayfish were taken in great numbers by diving, and sometimes by sinking baited wicker traps. Heaps of this fish, with mussels, cockles, and other bivalves, were collected in the summer, and prepared and dried; and of eels also, and of several delicate fresh water fishes, large quantities were taken in the summer, and dried for future use. (Colenso 1869: 9)

The increasing availability of European crops and livestock, however, reduced the dependence of Māori on fishing. This, combined with new European laws in the latter half of the nineteenth century that restricted Māori access to fisheries, resulted in significant social and economic changes (Hiroa 1949; Ward 1974; Rata *et al.* 1988). It was not until the late nineteenth and early twentieth centuries, during a period of Social Darwinism (e.g. Simmons 1879; Colenso 1891; Grace 1901; Hill 1902; Baucke 1905), that historians made further observations on aspects of fishing or fishing equipment (e.g. Hamilton 1908; Matthews 1911; Hiroa 1921, 1926) and attempts were made to collate the available information (Best 1929; Hiroa 1949), by which time much had already been lost.

Tribal fishing and smaller scale group fishing for family needs (Fig. 2) declined from about 1885, and large communal efforts had virtually ceased by 1910 (Best 1929; Rata *et al.* 1988), although individual Māori fishermen still

sustained family livelihoods from personal efforts, and many coastal hapū still have a continuing fishing tradition that forms a significant part of their lifestyle and sustenance. The expansion of Māori agriculture using introduced cultigens, and trade with Europeans for other resources such as kauri gum and flax, distracted attention away from the sea, and as a result, fishing traditions, rituals and even associated language were no longer widely observed. Hiroa (1926: 597) noted that following the European fishing technique of carelessly leaving things to chance or indiscriminately dropping a baited line in the hope of hooking anything that came along ('the action of a kūware – a person devoid of practical sense'), instead of implementing the Māori knowledge, traditions and lunar calendars passed down orally through generations, marked 'the degradation of barbaric culture and the advent of a higher civilisation'. In the twentieth century, fishing knowledge amongst an increasingly urbanised Māori population became obsolete and almost disappeared owing to lack of interaction with fishing activity, and only snippets of traditional information survived to be recorded and documented. Despite this, many coastal-dwelling hapū (in contrast to urbanised Māori) have retained their fishing traditions, with many customary materials replaced or complemented by European metals and, more recently, synthetic materials (Marshall 1987; Rata *et al.* 1988).

While Māori fishing practices, knowledge and traditions passed down orally have been documented by many authors (e.g. Colenso 1869, 1891; Travers 1873; Wohlers 1875; Buller 1878; Grace 1901; Best 1903, 1919, 1929, 1982; Beattie 1920; Hiroa 1926, 1949; Grey 1928; Peart 1937; Tikao 1939), cultural traditions, passed down orally through word-perfect rendering of karakia (incantation or chant) by ritual specialists or tohunga, are subject to interpretation or distortion by European perspectives (Stack 1878; Baucke 1905; Hiroa 1949; Johansen 1958; Ritchie 1992; Durie 1998) during the process of being documented (e.g. Travers 1872; Simmons 1879; Tregear 1885, 1904; Lysnar 1915). However, some interpretation is necessary as sayings were not always statements of fact, and without clues to the figurative meaning, the true meaning can only be guessed (Firth 1926). Although William Colenso was well acquainted with Māori folklore and proverbs, he recorded only the text and not the attendant detail of how they were used in the realities of daily life (see Colenso 1869, 1891), hence much of their value for scientific study, and the full meanings

of the karakia used in everyday life, have been lost (Smith 1900; Firth 1926).

In recent decades there has been an increasing number of oral history projects recording the relationships between hapū and their fishing resources (e.g. Marshall 1987; Rata *et al.* 1988; Kawharu 1989; Macdonald *et al.* 1991; Leach 2003), although these are also far from complete. For example, the importance of kekeno (fur seal *Arctocephalus forsteri*) has not been documented in Māori oral histories of the pre-European period (Lalas & Bradshaw 2001) and fur seals were not mentioned in accounts of Māori fishing methods by Best (1929) or Hiroa (1949). However, Anderson & Beattie (1994) did describe hunting methods and utilisation of fur seals by South Island Māori, and the taking of South Island fur seal pups through summer was shown in a Māori calendar for the harvest of food resources by Dacker (1990), although older animals were not mentioned. This record is inconsistent with the archaeological evidence, which indicates that both pups and adults were taken at breeding colonies (Smith 1989). Traditional mātauranga and academic evidence are not necessarily in conflict: Barber (2003) argued that the regulatory and ritual emphasis of recorded Māori tradition is not incompatible with an ecological construction of the archaeological data, as a shift from periodically unpredictable resources to other high-yielding and more predictable resources may have had a religious explanation and context.

Māori oral tradition is not well understood by European culture. Comments on 'extravagant fishy tales' in oral histories were made by Leach & Boocock (1993), and Leach (2006: 2) stated,

A modern anthropologist could possibly be forgiven for the relatively minor attention given to fishing behaviour. It is a subject field with certain difficulties – we are all familiar with the notion of the extravagant fish story in European society...Fishing is one of the most important domains of the apocryphal story and it would be wrong to think that twentieth century European fishermen have a monopoly on fishy folk tales.

While oral tradition may be susceptible to manufacture, its worth lies in the essential message it imparts, and the power of the written word to entrench error makes criticism of oral tradition seem small (Durie 1998). There is a voluminous archival record of Māori fishing activities and archaeological investigation and analysis, which largely expresses the Pākehā (European) view and makes the truth difficult to ascertain (Durie 1998). Barber (2003) noted

that customary Māori uses of the sea recognised ritual restrictions enforced by supernatural penalties and jurisdictions, whereas archaeological interpretations of Māori fishing behaviour emphasised extractive opportunism and foraging theory. Evidence that cannot readily be understood should not be dismissed as a spiritual matter or as metaphysical; rather, a full interpretation and understanding of its meaning is required to reconcile the two approaches of Māori mātauranga and European scholarship.

Indirect information is available from the archaeological record. The dominant species of fishes reported from early Māori middens (Leach & Boocock 1993; Leach 2006) are common coastal species that are likely to have been taken frequently in coastal waters, and they reflect the coastal and proximal oceanic habitat that was available to, and exploited by, Māori. The broad geographical range of the main New Zealand islands between 34° S and 47° 30' S covers an equally broad range of ecological zones from warm to cool temperate, with a variety of fish assemblages (Paulin & Roberts 1992; Francis 1996). Analysis using a New Zealand-wide approach cannot therefore provide meaningful results simply by adding up diversity in catch from one region to another (Leach 2006). The archaeological interpretation of the fishing methods used, based on the faunal assemblages and presence of fishhooks at individual sites (e.g. Barber 2003), sometimes conflicts with oral accounts and direct observations by early European explorers. These report that nets were the primary means of fishing (Colenso 1869; Dieffenbach 1843; Best 1929; Cook *in* Beaglehole 1955; Banks *in* Beaglehole 1962), but nets are rarely preserved archaeologically (Best 1929; Hjarno 1967; Davidson 1984; Sutton 1989a; Furey 1996; Jacob 2000).

Recent analysis of fish remains in middens (Leach 2006) relies on a 'minimum number index' (MNI) from sites throughout New Zealand to assess the relative importance of different fish species represented. However, this method makes no allowance for the different sizes of species, and hence cannot be used to determine each species' true contribution to the pre-European Māori diet. For example, labrids such as paketi (spotty *Notolabrus celidotus*), tāngahanga (banded wrasse *Notolabrus fucicola*) and pūwaiwhakaruā (scarlet wrasse *Pseudolabrus miles*), which are a dominant species group in pre-European fish catches (MNI=10.6% for 126 archaeological sites with reliable information on fish abundance; Leach 2006), may reach

1.5 kg (Paulin 1998), while hāpuku (groper *Polyprion oxygeneios*) and moeone (bass *Polyprion americanus*), which are uncommon in archaeological sites (MNI=0.59%; Leach 2006), may reach 20 kg (Paulin 1998) or more. The relationship between size and relative contribution to food supply was calculated by Leach for six numerically dominant fish species in archaeological sites, and was used in assessing the relative contribution from fish, shellfish, mammals and birds to diet. A more detailed analysis for all species using both MNI and size frequency regression to back-calculate fish weights is required to determine each species' contribution, and hence ascertain the relative importance of different marine habitats exploited by Māori, including any chronological changes in that use. As observed by Reinman (1967), enumeration of remains, in the form of a list beginning with the most prevalent kinds to the least so, cannot be used to make statements about diet: the total fish weight represented in the archaeological record for labrids and groper as reported by Leach (2006) would be relatively similar for both species groups, assuming average weights of 1.5 kg and 20 kg, respectively. However, without size regression analysis this provides no information on whether groper were taken as schooling pelagic juveniles of up to 50 cm length, or as demersal reef-dwelling adults up to 140 cm in length (Francis *et al.* 1999) in shallow coastal waters along with labrids, where they were once common at depths of 20–40 fathoms (35–72 m) (Sherrin 1886).

Many fish species that were taken were rarely preserved in middens and are underrepresented in the archaeological record (Leach & Boocock 1993). Elasmobranch species, such as sharks and rays, reported in many of the anecdotal accounts of Māori tribal life (e.g. Taylor 1855; Colenso 1869, 1891; Hamilton 1908; Matthews 1911), were equally important as common inshore teleosts, if not more so, but, lacking any ossified skeleton, they have not been well preserved in middens (Leach & Boocock 1993; Leach 2006). This is a significant problem with the archaeological record, and also applies to the remains of other fish species that have not been identified or have not survived in middens. For example, freshwater fish such as upokororo (grayling *Prototroctes oxyrhynchus*) and korokoro (lamprey *Geotria australis*) were taken in large numbers by Māori (Beattie 1920; Hiroa 1926; Best 1929; Firth 1929; Leach 1969), but neither of these species has ever been recorded from an archaeological site. Heads of some species, such as hāpuku, moeone and 'cod' (possibly

rāwaru, or blue cod, *Parapercis colias*), were often disposed of before returning from fishing as offerings to the god Maru (Baucke 1905; Best 1929), thus identifiable head bones would be underrepresented in middens. The chances of being able to assess the importance of these (and many other species) archaeologically are therefore very remote.

Eels (both marine *Conger* spp. and freshwater *Anguilla* spp.) were a major food resource for Māori (Colenso 1891; Hamilton 1908; Downes 1918; Best 1903, 1929; Firth 1929; Marshall 1987; Furey 1996). However, eel bones are rare in archaeological sites (Davidson 1984; Marshall 1987; Leach 2006): they account for less than 2% of archaeological fish remains (Leach & Boocock 1993) and freshwater eels have an MNI of 0.33% for 126 sites with reliable information on fish abundance (Leach 2006). Davidson (1984) reported that eel bones were known from twelfth-, fourteenth- and sixteenth-century archaeological sites, but not from a Waikato site where eels were traditionally an important food. In addition, Davidson noted that there was no evidence of large-scale eeling in prehistoric times, and therefore large-scale eel fishing must be assumed to be a post-European development. Leach (2006) observed that eel bones were common in middens in other parts of the Pacific but were rare in middens in New Zealand, and suggested that the absence of freshwater eel bones in New Zealand archaeological sites reflected food avoidance behaviour.

Leach (2006) noted that eel remains in middens within the tropical Pacific reflected differing attitudes to eels as a source of food to exploit, but did not consider the differential survival of eel bones in middens on carbonate- or phosphate-rich coral atolls with neutral or alkaline soil pH (Morrison 1990), compared to the acidic soils of New Zealand (Webb & Wilson 1995), where eel (and other fish) bones may survive only in middens rich in mollusc shells that neutralise the soil pH. Rather, Leach suggested that the mass harvesting of eels as related in Māori oral accounts and reported by European observers was a very late phenomenon, and that earlier pre-European Māori had a strong belief that eels were sacred and should not be eaten, although there is no documented evidence for this in accounts by Colenso (1869, 1891), Travers (1873), Wohlers (1875), Buller (1878), Grace (1901), Best (1903, 1919, 1929, 1982), Beattie (1920), Hiroa (1926, 1949), Grey (1928), Peart (1937) or Tikao (1939). Saying so doesn't make it so (Sutton 1989b), and the absence of evidence is not evidence of absence, hence a silent argument

cannot be used to prove or disprove Māori use of eels as a food resource. Marshall (1987) stated that the negative evidence was not sound, and present-day customs pertaining to storage, preparation and consumption of eels strongly suggested that deposition of large eel-bone middens was unlikely, even if survivorship of eel bones was questionable.

An account by Brunner in 1848 (Brunner 1959), quoted by Hamilton (1908), of Māori custom at Hokitika and Okarito, West Coast of South Island, involving spiritual cleansing when dealing with eels, was used by Leach to support the theory of avoidance of eels as a food resource. Best (1929), however, commenting on the same ritual, considered that the cleansing took place prior to setting of traps and related to eels being able to detect human scent and thus avoid the traps. Downes (1918) reported that Wanganui Māori distinguished a black form of eel known as tuna-tuhoro that was considered an ill omen and was never eaten, and similar dark-coloured eels were also avoided in other areas of Northland and Southland (Beattie 1920; Best 1929), unlike other eels.

Non-migratory female longfinned eels (*Anguilla dieffenbachii*) may reach almost 2 m in length (McDowall 1990) and attain weights of up to 50 kg (Graham 1953), although eels this size are now rare as a result of commercial fishing. These very large eels were occasionally revered as atua, or gods (Best 1929), feared as tipua, or devils (Best 1982), or otherwise fed and tamed by some Māori. Taylor (1855) reported that 'they also paid a sort of worship to an enormous kind of eel, the ruahine; to such offerings were made, by which, in the process of time, they were rendered quite tame'. Polack (1838) reported that large eels in a lake at the summit of Mt Hikurangi were honoured as atua, and Best (1903, 1929) noted several huge eels: one said to have occupied a pool at Te Rua-o-Puhi near Tauranga was viewed as an atua by local Māori, while others at Ruatoko and Karitane, which apparently were not regarded as atua, were eventually caught (Fig. 3). Best (1929) stated that the custom of treating giant eels as atua was unusual and not generally followed in New Zealand. Three species of tuna (freshwater eel *Anguilla* spp.) are known from New Zealand, although over 150 additional names have been recorded for different life stages, sizes or varieties that were recognised by Māori (Best 1929; Strickland 1990). Hector (1874) commented on the minute detail with which Māori named fish species, including recognising different life stages. However, although a few important food species may have had up to a dozen Māori names, most have only



Fig. 3 Catching the legendary eel at Tangahoe. While eels of legendary size were uncommon, non-migratory female eels do occasionally attain lengths of up to 2 m and were revered as gods (*atua*), feared as devils (*tipua*), or even fed and tamed, as well as being caught and eaten. Watercolour by Thomas William Downes, 1868–1938 (watercolour: Alexander Turnbull Library, A-076-016. Reproduced with permission).

one or two (Paulin 1989), and the large number of names associated with freshwater eels indicates their socio-economic importance to Māori. While some Māori may have had particular customs, only two eel varieties, *ruahine* and *tuhoro*, are recorded as not being eaten.

Restrictions of *tapu* applied to eels in certain circumstances (Best 1929; Graham 1953), some of which still apply today (Marshall 1987), including cooking eels in separate ovens for ceremonial feasts at which women were not present, and ritual cleansing prior to setting traps (Brunner 1959; Hamilton 1908; Best 1929). Present-day eel fishing as part of Māori tradition remains sufficiently conservative to provide clear, demonstrable links with the past, and intensive eel-fishing methods, designed to take full advantage of the seasonal abundance of *tunaheke* (migratory eels), were developed in the prehistoric period and provided mass harvests at particular stages of the eel life cycle (Marshall 1987). Any limited aversion was not

widespread: throughout New Zealand, eels were highly sought after, and highly specialised fishing technologies targeting eels (perhaps unsurpassed anywhere else in the world) were developed, including the construction of huge weirs (*pā tuna*, *pā auroa*, *pā tauremu*) up to 400 yd (370 m) in length (Fig. 4), as well as canals, traps, holding pens and numerous *hīnaki*, or eel-pots (Hamilton 1908; Downes 1918; Best 1929; Hiroa 1949; Marshall 1987).

Eels are of particular importance among traditional Māori foods today, and pre-European Māori had a marked preference for eels (Beattie 1920; Best 1929; Marshall 1987). The taking of eels was an important industry throughout the year, with capture methods being intensified during migratory runs (Marshall 1987). Permanent weirs were highly valued and protected from unauthorised persons (Best 1929), as mass capture of eels during the autumn migrations provided a major contribution to the prehistoric Māori diet, constituting a valuable source



Fig. 4 Pā tuna eel weirs were designed to harvest tunaheke or migratory eels; the fence structures were up to 400 yd (370 m) in length and guided eels moving downstream into a funnel-shaped net (purangi). Eel-pots (hīnaki) attached to the net were emptied regularly from canoes. Whanganui River (photo: Te Papa, MA_B.000826, by James McDonald, 1921).

of fat (Marshall 1987). Leach (2006) noted that the calorific food value for eels was nearly twice that obtained from freshly harvested kūmara or fern root and considerably higher than any other fish species. In addition, Leach noted that eels exceeding 45 cm in length have over 17.5% by weight of fat, thus are the perfectly balanced food, supplying essential fatty acids and sufficient protein, provided that necessary vitamins and minerals are also available. That Māori, in a hunter-gatherer society with a subsistence economy that was often marginal in periods of adverse weather, would forego an ideal food source because of ritual restrictions or beliefs (Leach 2006) stretches credulity.

The extent of Māori fishing in offshore oceanic and deep water has been a subject of debate, particularly in recent years (e.g. Paulin 1989; Leach & Boocock 1993; Leach 2006). Fifteen species of tuna (Scrombridae), swordfish (Xiphiidae) and marlin (Istiophoridae) are seasonally

present in offshore oceanic waters, particularly around northern New Zealand, and these pelagic species were known to Māori, although only three species – paea (swordfish *Xiphias gladius*), takeketonga (black marlin *Makaira indica*) and taketonga (striped marlin *Tetrapturus audax*) – have recorded Māori names. No bones of any oceanic pelagic species of marlin, swordfish or tuna have been recorded from archaeological middens (Leach & Boocock 1993; Leach 2006), although Elder (1932: 145) recorded a chance encounter with an offshore fishing expedition: ‘They were fishing for none but swordfish with short lines and all fish they caught of this kind were tabooed and could not be disposed of as they were to be prepared for their winter food. We saw a number of their stages on shore which were erected to dry their fish upon.’

The maximum depth to which Māori fished has been estimated at between 50 m and 100 m on the basis of the

known ecological habitats of fish species represented in the archaeological record (Leach & Boocock 1993; Leach 2006) and a linguistic analysis of Māori fish names (Paulin 1989). Leach (2006) commented on the apparent absence of specialised deepwater fishing techniques by prehistoric Māori, with particular reference to oilfish (*Ruvettus pretiosus*), which were reportedly targeted in other parts of the Pacific (Hiroa 1949). It is unlikely that a specialised deepwater fishery for *Ruvettus*, a rare species in New Zealand waters (Nakamura & Parin 1993), would have developed here, because the presence of toxic wax esters and other oily compounds in the flesh of *Ruvettus* (Alexander *et al.* 2004) would not have been eliminated by the Māori practice of drying fish for later consumption, as reported by Elder (1932) and others. The profusion of fish stocks in shallow coastal waters around prehistoric New Zealand made it unnecessary for Māori to venture beyond the immediate coastline to meet their daily dietary requirements. Although technology to fish deeper water was available, the rarity of such fishing and the likelihood of disposal of diagnostic head bones at sea (as well as acidic soil conditions in middens) has resulted in a lack of direct observational evidence and the absence of any archaeological record.

The relationship between Māori and use of their fishery resources was dynamic and changeable, and is reflected in the difficulties of interpreting Māori fishing activities from various indirect sources of information, be they oral traditions, archaeological evidence or historical and archival accounts, which may reflect regional, localised and chronological variation. Following European contact, the superiority of metal for working implements quickly became apparent, and stone, wooden or bone tools as material symbols of Māori culture were discarded in a feverish desire that spread like a pandemic (Hiroa 1949). However, through the introduction of steel tools carving was rendered easier, although it also became overelaborate and ornate (e.g. Fig. 25B), which spoiled artefacts for actual use but improved them for trade purposes (Hiroa 1949). The extent to which Māori fishing activity changed as a result of European influence is subject to interpretation, by both Māori and European. Traditional Māori culture was not static and it cannot be concluded that 'Māori fishing' ceased when the traditional gear was discarded, that the language was not regularly spoken, and that new tools and technology were adopted. European influence, materials and technology added to, rather than replaced, generally compatible Māori techniques.

Kupenga: nets

Early Europeans frequently commented on the use of fishing nets and their importance to Māori, and fishing-net construction techniques and their methods of use are described in detail by Hiroa (1926, 1949) and Best (1929).

After having a little laught [*sic*] at our seine, which was a common kings seine, shewd [*sic*] us one of theirs which was 5 fathom deep and its length we could only guess, as it was not stretched out, but it could not from its bulk be less than 4 or 500 fathom. Fishing seems to be the cheif [*sic*] business of this part of the countrey [*sic*]; about all their towns are abundance of netts [*sic*] laid upon small heaps like haycocks and thatched over and almost every house you go into has netts [*sic*] in its making. (Cook *in* Beaglehole 1955: 444)

The making or repairing of fishing-nets or seines, some of which are several thousand feet in length, the material being unscraped flax, is the work of all the inhabitants of a village. (Polack 1838: 25)

Nets (kupenga) were made from strips of undressed harakeke, which was partially dried to prevent the knots from loosening after the net was made, although smaller nets were often made using two-ply strands of fully dressed flax fibre, or muka (Hiroa 1926). Nets varied according to local conditions and fish species targeted, and included simple hoop nets (matarau; Fig. 5), which were baited and sunk with stones before being drawn up vertically; scoop nets (kōrapa), which had a rigid wooden handle and were worked sideways; set nets or traps (hīnaki; Fig. 6), which were left in streams or channels; and seine nets (kaharao), which were often of immense size (Polack 1838; Taylor 1855; Hiroa 1926, 1949; Best 1929), with at least one example (recorded by Mair 1873) in excess of a mile (1.6 km) in length. Hiroa (1926) noted that large numbers of maomao (blue maomao *Scorpius violaceus*) were taken in matarau (a large circular net, held open by hoops, which was baited at the centre and lowered to the sea floor, then raised when full of fish), and that a haul of less than 700 was considered a poor catch.

The manufacture of nets, particularly large kaharao seines, was a task subject to extreme tapu (Best 1929) and restrictions were enforced rigorously, with offenders even slain and canoes passing an adjacent stream or tapu beach area destroyed. Polack (1838), expressing the European viewpoint, suggested that this was to induce the workers to stick to their occupation and so remove the 'irksome' restrictions as soon as possible. Best (1929), however,

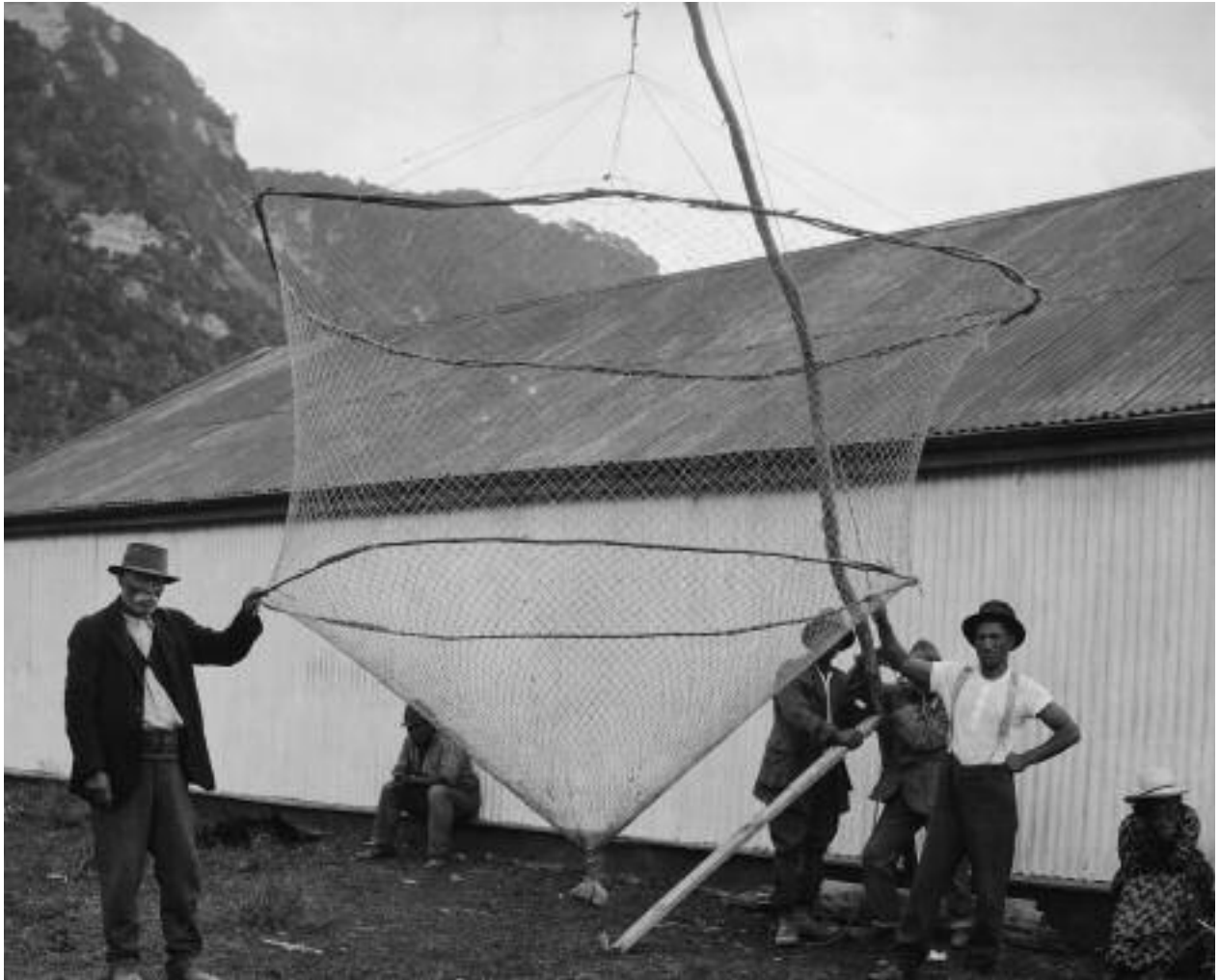


Fig. 5 Hoop nets (matarau), baited and sunk with stones, then raised vertically, were used to catch large numbers of demersal fish such as blue maomao (*Scorpius violaceus*) (photo: Te Papa, MA_B.004581, by James McDonald, 1923).

noted that such communal tasks were carried out willingly, and that the tapu restrictions arose from the cultural expectations of Māori, in which the spiritual presence of gods was necessary and without which the undertaking could not succeed. Nets were often made for specific purposes, such as taking fish for particular guests, and hence could not be used inappropriately (Best 1929). Once completed, the tapu on the net was lifted with befitting ceremony and karakia (following differing procedures in various districts): the first fish caught could be released, burnt or deposited in a sacred place, as an offering to the gods, and then preparation of the first catch or catches was carried out for ceremonial feasts involving those who had worked on the net. During these ceremonies fish were cooked in separate steam-ovens for priests, experts and

those of chieftain rank (tohunga), and in separate ovens for men and women (Best 1929), after which the net was used in the usual way.

Large nets were made collectively, each family within a village making particular sections that were then assembled and joined together. Several people would work on very large nets, each working left to right on a new row of mesh in a non-boustrophedon fashion (the boustrophedon method is when a single person works to his right on a section of net, and when each row is completed he then moves to the other side and continues working to his right, thus reversing the mesh at each margin). Mesh size of various sections of large seine nets differed, and was much smaller in the middle portion than at the ends in order to provide additional strength. Once the sections of the net had been



Fig. 6 A wide variety of both freshwater and marine species were taken using hīnaki traps. Here, hīnaki are being made for lamprey using kiekie (perching astelia) at Hiruharama, Whanganui River (photo: Te Papa, MA_B.000772, by James McDonald, 1912–26).

joined together, the long kaha ringa head-ropes and kaha raro foot-ropes (made of tī, which was more durable than flax) were stretched out and attached, and pōito floats (usually wood, or occasionally pumice or gourds) added to the upper rope and weights in the form of stones encased in a netted bag (kōpua) attached to the lower edge of the net (Best 1929; de l’Horme *in* Ollivier & Hingley 1982). Stones used for karihi net sinkers were smooth and water-worn, and were distinguished from mähē or maihea sinkers for fishing lines, which were grooved in order to take a cord lashing. The net was not folded, but was carried to the canoe (or double canoe when a large net was used) on which it was to be used, where it was stowed carefully. Some large seine nets reportedly required 500 people or more to drag the catch onto the beach after the net had been set, or if the catch was large, the net was pegged in place and the fish retrieved after the tide had receded

(Mair 1873; Hiroa 1926, 1949; Best 1929). In addition to large seine nets, other large funnel-shaped nets (ahuriri or riritai) up to 25 m in length were used in tidal rivers and were regularly filled with catches of around 1000 lb (450 kg) (Best 1929). In rocky areas, where drag or seine nets could not be used, matarau circular hoop nets and kōrapa scoop nets (Fig. 7) provided an alternative means of netting fish (Best 1929).

After use, nets were carefully dried and stored on raised platforms, and were protected from the weather. Despite this, green flax was not durable and nets were continually in need of repair or replacement. Hiroa (1949) noted that flax nets were still made in the East Coast region in the 1920s and suggested some ‘may survive for a time’, while the use of wire netting for hīnaki and eel-pots resulted in considerable time saving and he doubted whether younger generations would have the time, patience or need to learn



Fig. 7 Fishing for kehe (marblefish *Aplodactylus arctidens*) on Whareponga Beach. Scoop nets were preferred in rocky areas where large seines or drag nets could not be used. Men with wooden poles directed the fish along rocky channels to the scoop nets (photo: Te Papa, MA_B.004274, by James McDonald, 1923).

the expertise and techniques required for net-making. The ready availability of European fibres and materials that better withstood decay soon made the use of flax less common, and older flax nets were discarded. As a result, only a few archaeological net remnants are preserved in museum collections (Leahy 1976; McFadgen & Sheppard 1984; McAra 2001, 2004; Leach 2006), although numerous stone sinkers have been collected (e.g. Best 1929: Fig. 5). The use of traditional nets was diminished by regulation under the Sea Fisheries Act 1894, which set the style of nets and minimum mesh sizes according to non-Māori standards, requiring a larger mesh than was traditionally used and thus restricting Māori commercial fishing activity (Paulin & Paul 2006).

Traditional hooks

Early Europeans noted that fishing with nets was more important than hook-and-line fishing (e.g. Cook *in* Beaglehole 1955; Banks *in* Beaglehole 1962; Colenso

1869; Dieffenbach 1843; Hiroa 1926; de l'Horre *in* Ollivier & Hingley 1982). However, stone and bone portions of fishhooks survive well in archaeological sites, while wooden components, flax lashings and nets do not (Hiroa 1949; Hjarno 1967; Davidson 1984; Furey 1996; Jacob 2000). Best (1929) noted that the flax components of hīnaki lasted only 'about a month', while other materials such as kiekie would last only five to seven years.

Hiroa (1949) and Davidson (1984) observed that early fishhook types reflect initial attempts to copy Polynesian prototypes in local materials, and subsequent adaptations to suit local fishing conditions were reflected in a general trend to greater ornamentation, but there were also regional variations and other variations attributable to individual hook-maker preferences (Hiroa 1949; Leach 2006). Archaeological studies have shown that early Māori fishhooks (ascribed to the period of Māori culture referred to as 'archaic' or 'settlement' phase) were predominantly made from one piece of bone (Furey 1996), and lures were generally manufactured with stone shanks ('minnow



Fig. 8 Composite fishhooks with curved wooden shanks were fashioned from native hardwood saplings that were carefully restrained so that they would grow into the required shape. The upper end of the shank was often adorned with a small well-carved head, to which a length of cord (aho) was attached. The barbs were made from bone that was carefully worked into finely serrated points and bound to the shank with muka (processed harakeke, or New Zealand flax fibre) cord. Frequently, small strips of raupō (bulrush *Typha orientalis*) leaf were inserted between the bone barbs and the shank to help set the binding (Te Papa, OL000105, 127 mm length, 1800–1900, Ngāi Tahu).

lures'), similar to shell lures from Eastern Polynesia, with simple non-barbed bone points (Fairchild 1933; Fisher 1935; Lockerbie 1940; Skinner 1942; Hiroa 1949; Hjarno 1967). Wooden archaic hooks are rare, however, as wooden hooks or lures with flax lashings, like flax nets, are less likely to survive well in archaeological sites (Hjarno 1967; Furey 1996; Jacob 2000). In contrast, bone barracouta or minnow shank points and composite 'bait' hook points, which were associated with wooden shanks, are well represented (Duff 1942; Hjarno 1967; Anderson & Gumbley 1996; Jacob 2000). Hiroa (1949) noted that even old wooden-hafted tools such as adzes were rare, as

the wooden hafts and fibrous lashing material decayed, leaving only the stone heads.

Leach (2006) considered that insufficient stratigraphic evidence was available from archaeological sites in New Zealand to convincingly demonstrate changes in hook form through time. In contrast, Davidson (1984), Jacob (2000) and Furey (2002) considered that more recent 'classic' period (or 'traditional' phase) hooks were first developed in northern regions, and appear to have been introduced to southern regions around the mid-fifteenth century, possibly by Ngāi Tahu from the East Coast region of North Island (Hjarno 1967). These classic-period hooks

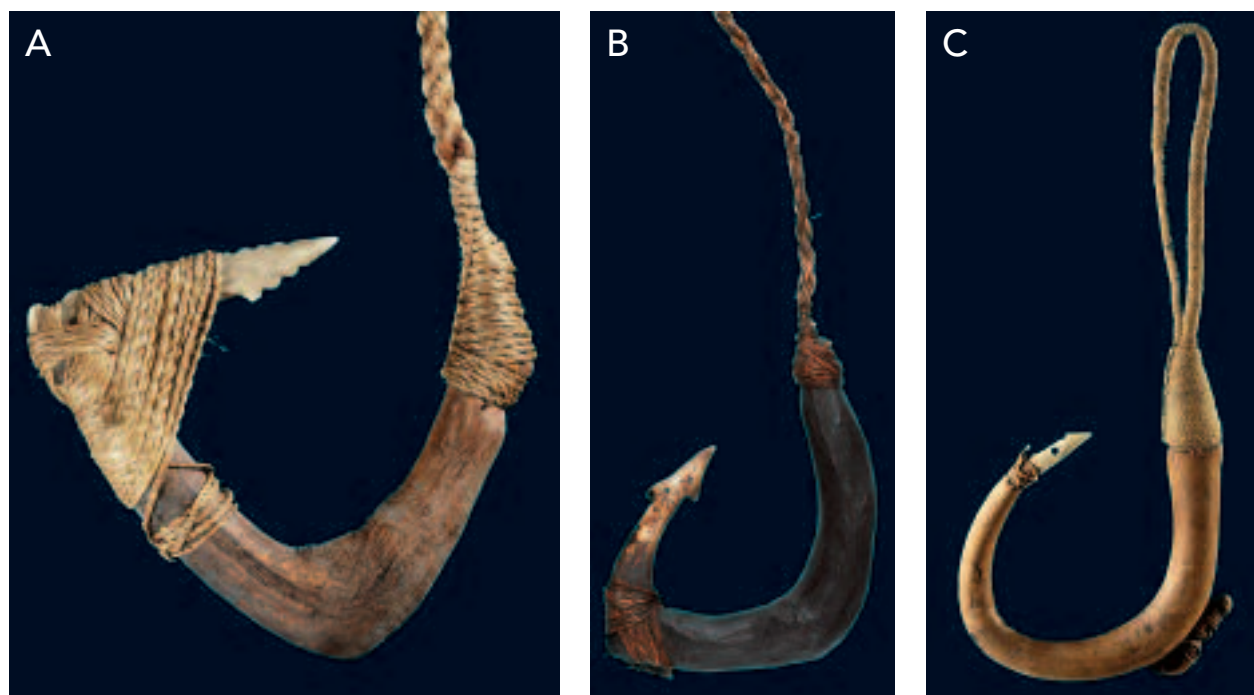


Fig. 9 Composite wooden hooks were manufactured with a strongly incurved barb and are known as ‘C-shaped’ or ‘circle hooks’. The circular design of the hook, with the characteristic narrow gap between the incurved point and shank, was deliberate and formed a trap that held the fish’s jaw without the need for the point of the hook to penetrate it (A, Te Papa, ME002496, 128 mm length, no data; B, Te Papa, ME000593, 150 mm length, no data; C, Te Papa, OL000101, 280 mm length, no data).

were frequently manufactured with wooden shanks and bone points, the component pieces being held together with lashings of muka (Fig. 8). Plain one-piece hooks (archaic) were replaced by hooks that were frequently adorned with bait nobs, or snood attachment knobs (*koreke*), often shaped as human heads. Other changes included the increased use of double internally barbed hooks and barbed lure points (Hjarno 1967). Shell, although used to manufacture complete hooks and shanks throughout Polynesia (usually pearl oyster *Pinctada* spp.), and during the earlier Māori archaic and classic periods in New Zealand, was a material predominantly utilised for barbs and to decorate lures such as *pā kahawai*. This was because pearl-oyster shell was not available and the local *pāua* (abalone *Haliotis* spp.) substitute was not as strong, hence could not be used to make large hooks (Hiroa 1949; Furey 2002).

Māori manufactured two principal types of hook: demersal or bottom-dwelling fish were caught with the traditional suspended hook ‘matau’; and pelagic fishes were caught with trolled lures such as ‘*pā kahawai*’ and ‘*pohau mangā*’. In addition, stone and shell ‘gorges’ were

used (Hamilton 1908; Beasley 1928; Hiroa 1949). Prior to the European introduction of metals to New Zealand, Māori utilised shell, bone, ivory, wood and stone for the manufacture of fishhooks (Beasley 1928). Sharp points required for piercing and holding the fish on the line, as used in present-day metal hooks, could not easily be manufactured from these materials, and they could not be relied upon because of their sometimes brittle nature. Because bone and shell lack strength, their use limited the size of one-piece hooks to less than 100 mm in length, as hooks would fracture at the base of the loop when subject to the stress of a fish pulling the point limb of the hook against the line attached to the shank limb. Hence, large hooks were composite, made with a bone or stone point lashed to strong, curved wooden shanks.

As a result, traditional Māori hooks differ in both shape and operation from modern metal J-shaped hooks. The latter are designed with the point of the hook oriented parallel to the shank, whereas traditional matau are made to a design known to as a ‘circle’ hook, where the point of the hook is directed inwards and perpendicular to the shank (Fig. 9). Large, strong bone hooks could be made in

two sections by lashing a point directly to a bone shank. However, although this method resulted in a stronger hook, the straight shank did not allow the point to be directed inwards as in the circle design, and the use of two-piece lashed hooks was generally restricted to the manufacture of lures.

Gorges were a device used by many neolithic cultures, and are frequently found in prehistoric sites worldwide. A gorge was made from a slender stone or portion of shell, usually 50–100 mm long, and was attached to a line, which was knotted through a hole in the centre. The fish swallowed the gorge (hidden inside a bait) end first, and tension on the line levered the gorge across the fish's throat, trapping it in place. There are drawbacks to fishing with a gorge, as it is hard to conceal, difficult to bait and hard to hook large fish on, and it is also liable to lose its hold while the fish is being played.

Matau: circle hooks

Traditional matau hooks were often large, distinctive and seemingly highly variable in shape. Early explorers Pottier de l'Horre, an officer on board de Surville's ship *St Jean Baptiste* in 1769, and William Anderson, ship's surgeon on board the *Resolution* during Cook's third voyage in 1777, commented on the odd shape of the Māori hooks:

...their hooks, are pieces of root...to one end they attach a very sharp fish bone, the point of which bends inwards following the shape of the wood; I doubt whether they catch great quantities of fish with this implement. (de l'Horre in Ollivier & Hingley 1982: 134)

They live chiefly by fishing, making use...of wooden fishhooks pointed with bone, but so oddly made that a stranger is at loss to know how they can answer such a purpose. (Anderson in Beaglehole 1955: 811)

Joseph Banks, naturalist aboard Cook's ship *Endeavour*, also commented on the pronounced curved shape of the Māori hooks, noting they lacked a barb and were in his view, 'ill-made' (Banks in Beaglehole 1962). Meanwhile, early settlers and historians suggested that many of the hooks were 'odd', 'of doubtful efficacy', 'very clumsy affairs' or 'impossible looking' (Polack 1838; Baucke 1905; Hamilton 1908; Beasley 1928). Recent archaeologists (Leach 1998) have also noted and commented on the traditional hook 'shaped in a manner which makes it very difficult to imagine could ever be effective in catching a fish'.

The design of Māori circle hooks, with the characteristic narrow gap between fishhook point and shank on one-



Fig. 10 Composite wooden hook from the Society Islands. Hooks made to the circle design are found in neolithic sites throughout early Polynesia, Asia, the Americas and Europe (Te Papa, FE 003001, 190 mm length, Society Islands, 1770).

piece and composite C-shaped hooks with incurved points, was deliberate (Reinman 1970; Sinoto 1991; Furey 2002) and is a common pattern found in neolithic sites throughout early Polynesia, Asia, the Americas and Europe, some dating back over 30 000 years (Fig. 10).

Māori trained growing plants and young trees into the desired curve for the wooden shanks of large hooks (Fig. 11), and then harvested them after they had grown and become rigid. Colenso (1869) described how branches of tauhinu (cottonwood shrub *Cassinia leptophylla*) and mangemange (climbing fern *Lygodium articulatum*) were grown into suitable form, then hardened by heating in hot earth beneath a fire to toughen the wood.



Fig. 11 Māori trained growing plants and young trees into the desired curve for the wooden shanks of large hooks, and then harvested them after they had grown and become rigid. As circle hooks do not require a sharp barb to pierce the fish, hooks could be made from a single piece of suitably shaped wood (Puke Ariki, A73-576, 520 mm length, no data).

Others noted that fresh growth on certain trees, including tānekaha (celery pine *Phyllocladus trichomanoides*), would be trained into a hook-shaped form for harvesting at a later date (Hamilton 1908; Best 1929; Hiroa 1949).

Matau hooks designed as a circle hook are constructed with a shank (papa-kau-awhi) leading to a broad circular loop (Hiroa 1949), allowing the barb (mata) to be placed pointing inwards with the tip close to the shank, leaving only a narrow gap. Bait cleats, in the form of a small knob or notch, were placed on the underside of the bend, which served as attachment points for the bait string (pākaikai). Best (1929) reported a wooden circular hook of 9 in (22.8 cm) diameter, with a gap of only 1¼ in (4.5 cm) opposite the barb, while Leach (2006) noted several examples of one-piece bone hooks measuring 35–50 mm in length with double internal barbs that had gaps of only 2 mm. Even after metals became available, Māori continued to make hooks following the circle design (Fig. 12)

well into the twentieth century until cheap European-made J-shaped steel hooks (Fig. 13A) were easy to come by.

Hiroa (1949) noted that professional fishermen in Hawai'i had metal hooks featuring incurved points without barbs that were based on the Polynesian design. Since the 1960s, many commercial long-line fisheries have abandoned the use of J-shaped hooks and switched to patterns based on the circle hook (Fig. 13B) because of increased catch rates associated with the design, and the hook has become increasingly popular in recent years in other commercial and recreational fisheries.

Cooke & Suski (2004) reviewed the use of circle hooks in 43 studies of modern fisheries since 1996. They found that more anglers were experimenting with circle hooks for various species, based on the perceived benefits of jaw-hooking, which makes removal easier; reduced gut-hooking, resulting in lower mortality; and easy setting of the hook, which is ideal for inexperienced anglers and in deepwater commercial long-line situations where passive line-hooking is essential. Other advantages were found to include fewer lost fish, fewer snags and safer handling.

Matau hook function

A circle or C-hook operates on a different principle to modern J-shaped fishhooks. Modern metal hooks rely on the point of the hook to act as a gaff to hold the fish, and when the line is under tension it pulls in the same direction as the point of the hook. In contrast, the stoutly pointed bone barb of the traditional matau hook acts as a guide to direct the fish's jawbone between the point of the hook and the shank, into the loop of the circular hook. The loop then acts as a trap or snare to hold the fish, and the attached line, when under tension, pulls against the direction of the point, thus preventing the fish from escaping.

Stewart (1977) argued that the configuration of the circle hook-type design promoted hooking because fish tried to expel bait they could not swallow. Leach (1973, 2006), on the other hand, proposed a 'rotating hook theory' based on earlier observations by Nordhoff (1930) and Powell (1964), who surmised that the fish hooked itself while swimming away because the shank acted as a lever as it became free of the mouth, causing the point to penetrate behind the jawbone when the hook rotated. Leach (2006) suggested the rotating hook design improved the chance of fish being hooked. However, this theory is incorrect, as it is not necessary for the point of a circle hook to penetrate the fish in order to hold it, and the line pulls on the hook

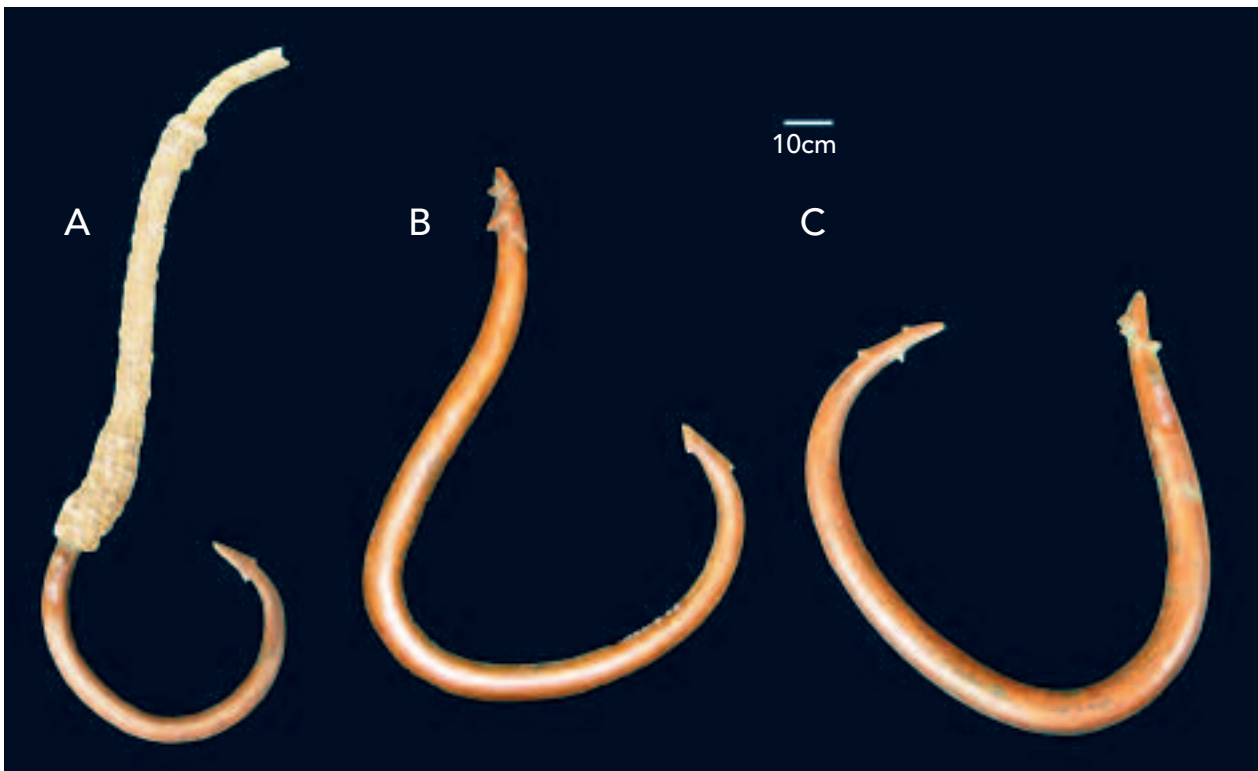


Fig. 12 Copper matau. After European metals became available, Māori continued to make hooks following the traditional circle design (A, Puke Ariki, A57-955, 70 mm length, no data; B, Puke Ariki, A80-536, 150 mm length, Pihama, Taranaki; C, Puke Ariki, A57-947, 130 mm length, no data).

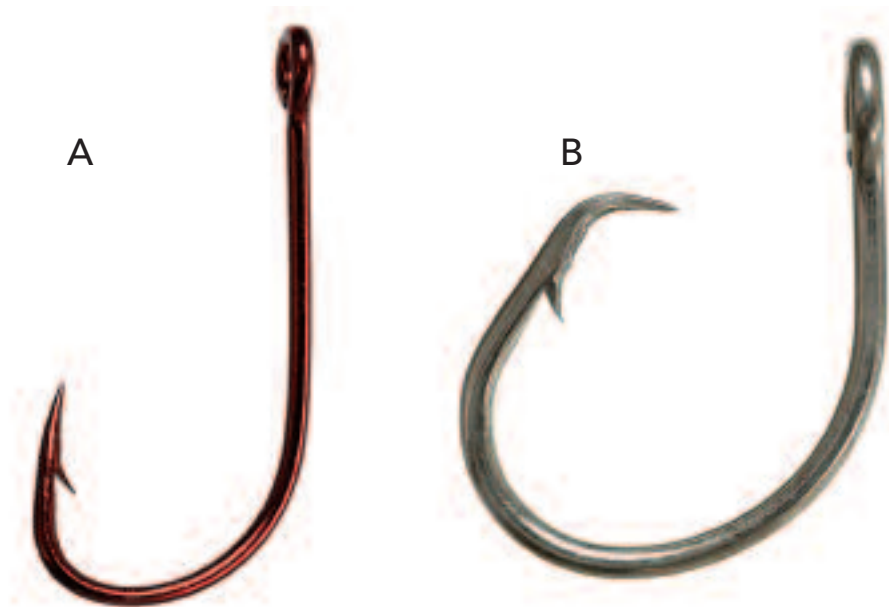


Fig. 13 Modern steel hooks. A, 'J-shaped' hook designed to act as a gaff to hold fish (37 mm length); B, 'C-shaped' tuna longline hook (57 mm length).

opposite to the direction of the point. Cooke & Suski (2004) found that the J-shaped design hooked fish more readily than circle hooks, but once fish are hooked, circle hooks are responsible for higher landing rates.

Critically, the success of the traditional circle hook relies on the width and depth of the fish jawbone in relation to the size of the hook gape (the distance between the point of the hook and the shank). A fish jawbone is relatively thin and slips easily into the narrow gape of the hook, while the vertical depth of the bone exceeds the width of the gape (Fig. 14). Johannes (1981) proposed a mechanical explanation for circle hook effectiveness based upon simple physics. As a fish attempts to consume a baited circle hook, it moves away, or gentle pressure from the angler pulls the hook to the side of its mouth. The point of the hook then catches on flesh at the jaw and pivots outwards as the amount of applied pressure increases steadily. Once tension exceeds a threshold, the maxillary bone (upper jaw) or dentary bone (lower jaw) slips through the narrow gape, then the hook twists and rotates in the opposite direction to the point of the hook (as the fish moves or the angler applies tension to the line) and slides to the corner of the mouth. The hook is held here because the width of the maxillary or dentary bone (now at right angles to the gape) exceeds the gape, and the point does not have to penetrate the fish at all. The design of the hook prevents the hook from backing out on its own and will hold a fish even under slack line conditions (Cooke & Suski 2004).

Māori rarely used rods (except with *pā kahawai* or *pohau mangā*, as noted below) and instead fished with baited hooks on hand-lines. Rod fishing, or *tihengi*, served only to enable several lines to be fished in close proximity (on rods of different lengths to prevent lines becoming tangled), and fish were retrieved by hand once hooked while the rod remained fixed in place (Hiroa 1926). However, Hiroa (1949) also documented the use of short rods with baited U-shaped hooks; these were used to flick fish out of the water while tension on the very short line was retained, in a manner similar to that used with *pā kahawai* and *pohau mangā*. The functional design of the circle hook, which allowed a fish to set the hook itself, did not require the use of a rod as it needed only a minimum of pressure on the line. Any sudden jerk on the line before the circle hook had trapped the jaw would simply pull it out of the fish's mouth (Hiroa 1949), hence rods were not needed with this design. Once the hook had been set, the design of the hook resulted in the fish's jaw being held

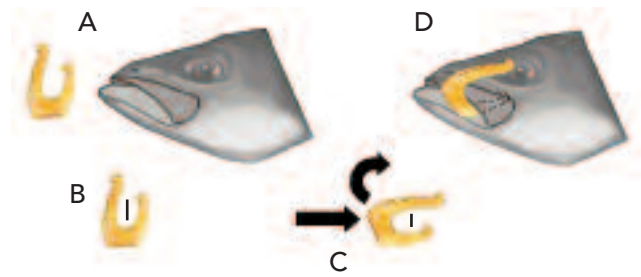


Fig. 14 Circle hook function: the fish approaches the baited hook (A), which is too big to swallow. As the fish attempts to remove the bait from the hook, the thin jawbone slips through the narrow gape of the hook (B). Gentle pressure on the line from above, or as the fish moves away, causes the hook to slide to the rear corner of the mouth and rotate (C), trapping the jawbone, which is too wide to slip back out of the gape (D).

firmly, and any relaxation of tension on the line did not lead to the fish escaping. Unlike modern circle hooks, which rely on the point of the hook catching on flesh to rotate the hook into position around the jaw, traditional *matau* relied on the point of the hook to guide the hook into position. As the hook did not need to penetrate the fish, its point was not embedded in the bait.

Wooden hooks were deliberately made large in relation to the size of the fish targeted, and were used to catch fish that could not swallow the entire hook. Rather, the pointed free end of the hook, acting as a guide, directed the fish's jaw down the shaft of the hook until it reached a point at which the distance between the outer free end and the shaft narrowed significantly, opposite the free end of the barb. The point of the hook was not baited, which enabled it to guide the fish's jaw into the trap formed by the loop of the hook and form an obstruction to prevent it sliding back out. When fishing, the large and medium-sized traditional circle hooks were prepared with bait tied to the bottom of the loop by flax twine. Many hooks were manufactured with a series of grooves, or a small protrusion or hole at the lower end of the loop, to attach the bait (Fig. 16), leaving the point and the shank free.

Large hooks manufactured from wood probably floated and would have been fished with a stone sinker: the wooden hook would float into a position where the heavier bone barb, and the shank (to which the line was attached), were directed downwards (rather than upwards, as with steel hooks). Beasley (1928: plate 25)



Fig. 15 Small matau hooks were made of bone or stone with two internal bluntly pointed barbs, which created a narrow gap and performed the same function as the main barb on the larger composite hook. The pointed free end served to guide the hook into position (A, Te Papa, ME007939, 78 mm length, bone, no data; B, Te Papa, OL000097, 30 mm length, greenstone, no data; C, Te Papa, ME009345, 35 mm length, whalebone, no data).

illustrated an example of a hook with an ‘inverted’ figure carved into the shank. This figure would, however, be upright when the hook floated, attached to a weighted line: this floating position would help to increase the rotation of the hook when tension was applied to the line from above. Furey (1996) noted that the presence of large hooks strongly suggested shark fishing, although other large species of fish (*c.* 1.5 m or more in length), such as hāpuku, moeone and hoka (ling *Genypterus blacodes*), were available to Māori in shallow coastal waters at depths of 20–40 fathoms (36–72 m) or less (Sherrin 1886; Graham 1953; Paulin 1989) prior to the development of commercial fishing in New Zealand waters. Such fishing has since resulted in a significant general decline in fish numbers and sizes, particularly in inshore waters of less than 100 m (Paul 2002; Leach 2006; Paulin & Paul 2006), and reducing biomass of desirable species such as tāmure (snapper *Pagrus auratus*) by up to 95% in some regions (Annala 1994).

Modern J-hooks (Fig. 13B) manufactured from steel are designed to have a similar shape at all sizes. In contrast, small traditional matau (Fig. 15) are very different in shape to larger matau. Large and medium-sized matau were usually composite hooks with bone barbs, or one-piece hooks made of wood or bone, and had a long shank with a broad circular loop, while small matau were made

with the shank and barb parallel and of equal length, and with double internal barbs.

Small matau hook designs had two internal bluntly pointed barbs, which created a narrow gap and performed the same function as the main barb on the larger hook design. The double internal barb was an integral part of this hook design and was not used as a cleat to hold bait as proposed by Hiroa (1949), nor was it simply a convenient way of narrowing the gap during manufacture of the hook as implied by Leach (2006). The point of the small hook was not directed inwards as with the larger one-piece bone or composite wooden hooks, but was directed forward, and served to guide the hook into position. As with the larger hook design, the hook rotated when pivoted by tension on the line pulling in a direction away from the lie of the point.

Small one-piece matau may also have been fished as a jig without bait, or perhaps with a small tuft of feathers. These small traditional hooks are usually illustrated with the barb pointed upwards, in a position similar to that for a modern steel hook. However, it is likely that these traditional hooks were also fished in a horizontal position, with the line leading away from the point on the inner side of the shank, as with larger hooks (e.g. Fig. 16C) and as recorded by Nordhoff (1930), who observed fishing with traditional

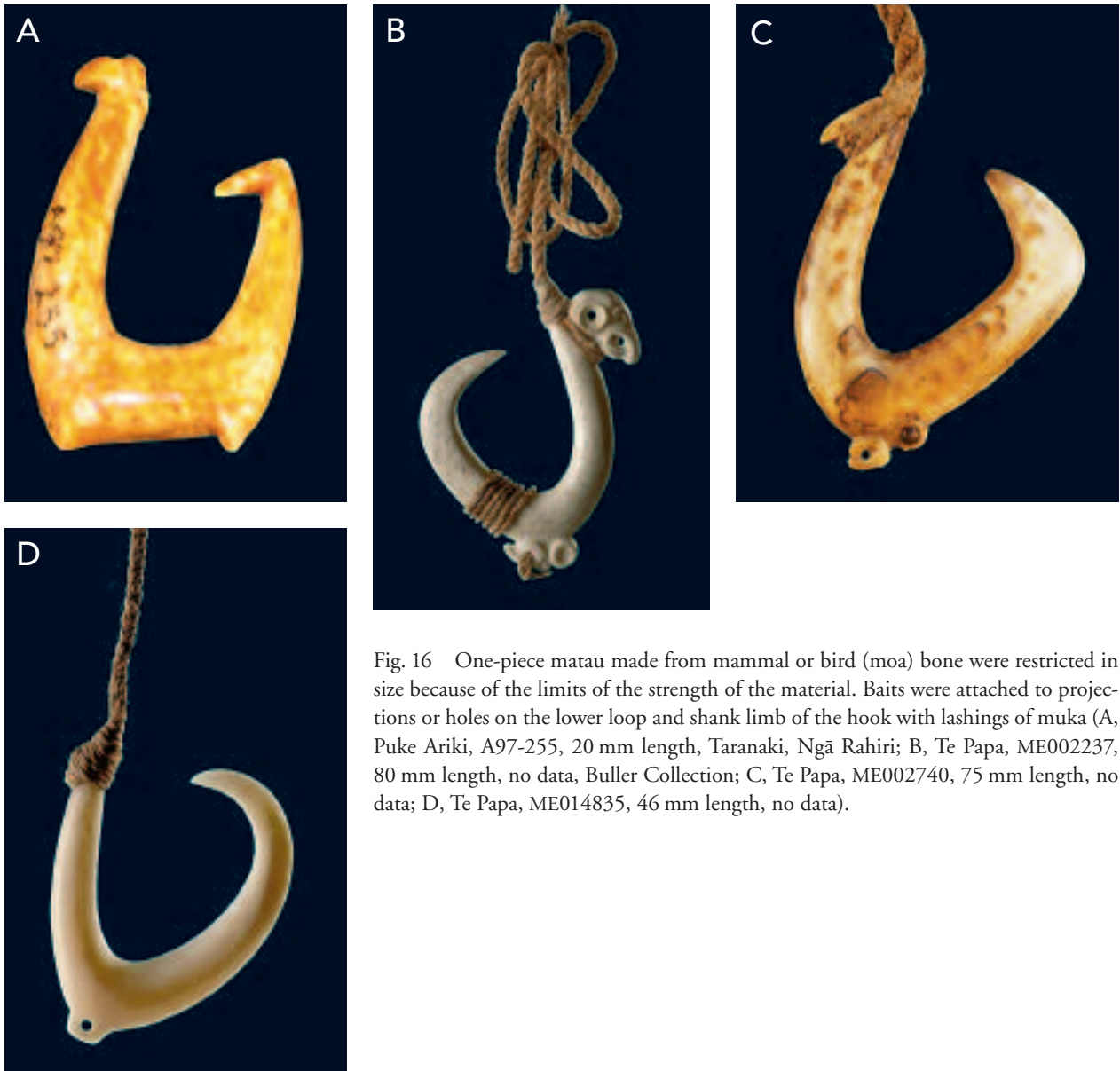


Fig. 16 One-piece matau made from mammal or bird (moa) bone were restricted in size because of the limits of the strength of the material. Baits were attached to projections or holes on the lower loop and shank limb of the hook with lashings of muka (A, Puke Ariki, A97-255, 20 mm length, Taranaki, Ngā Rahiri; B, Te Papa, ME002237, 80 mm length, no data, Buller Collection; C, Te Papa, ME002740, 75 mm length, no data; D, Te Papa, ME014835, 46 mm length, no data).

circle hooks in the Society Islands. Similar one-piece bone hooks with double internal barbs have been reported from archaeological sites in Norway dated at 7000–10 000 yrs BP (Herteig 1975).

Pā kahawai and pohau mangā: trolling lures

Trolling lures were used when fishing for pelagic species, including kahawai (*Arripis trutta*), which are more abundant north of Cook Strait, and mangā (barracouta *Thyrsites*

atun), which are more abundant south of Cook Strait. Lures were generally composite and were made using wood, bone, shell or stone shanks, with a short pointed ivory or bone barb set at the distal end (Beasley 1928; Teviotdale 1932; Lockerbie 1940; Duff 1942; Skinner 1942; Hiroa 1949). Because of their weight, lures made using stone or bone shanks (Fig. 17) would have fished deeper and been more effective than lures made using shell or wooden shanks. Triangular, rounded or grooved stone or shell shanks are associated with early Polynesian-style hooks from elsewhere in the Pacific (Hiroa 1949), and are known as ‘minnow lures’ and ascribed to the archaic

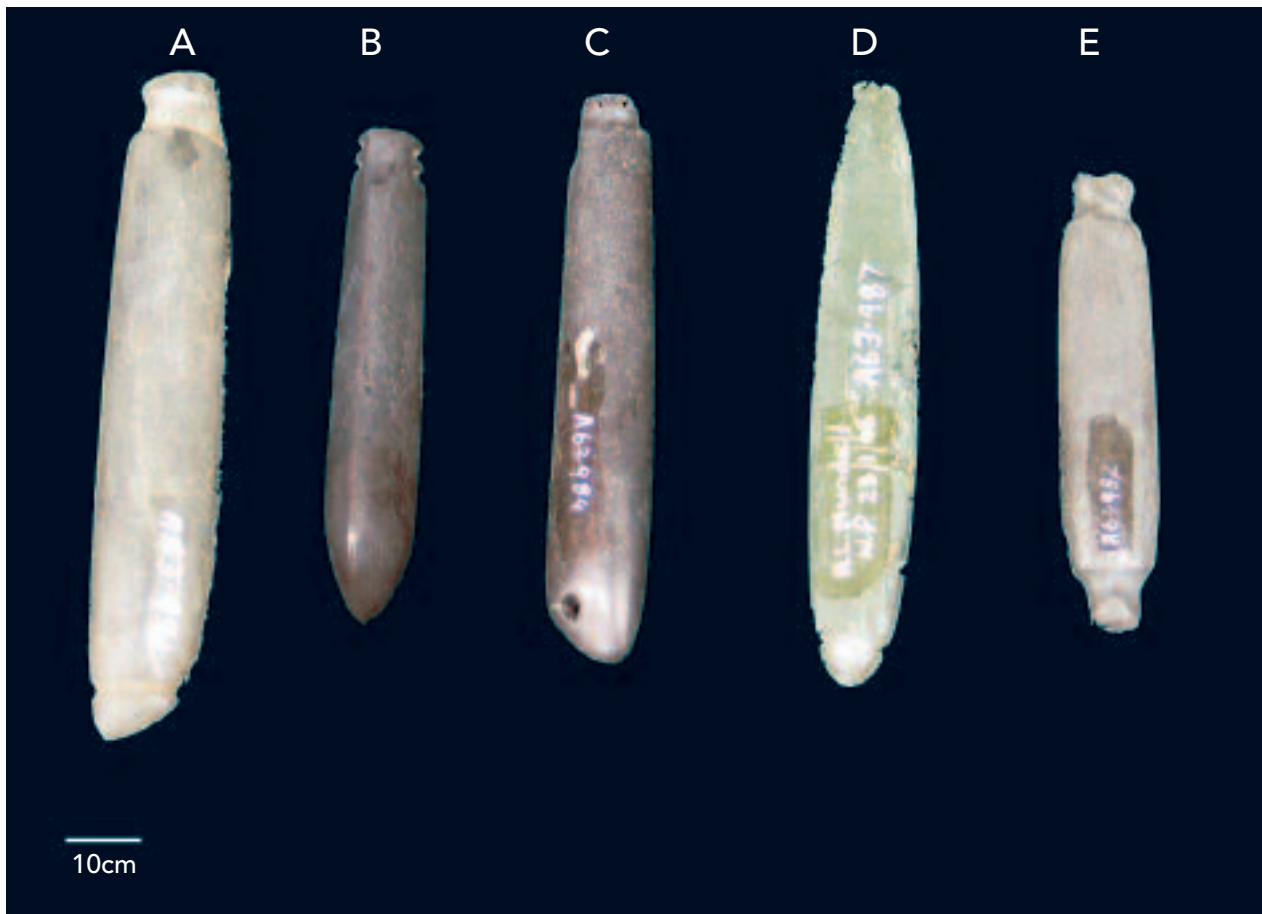


Fig. 17 Minnow shanks. Early trolling lures (pā kahawai) were made using stone shanks with bone barbs, but were soon replaced when European metals became available, so that no complete examples are known (A, Puke Ariki, A63-991, 80 mm length, Pukearehu, Taranaki; B, Puke Ariki, A63-996, 60 mm length, Oeo, Taranaki, Ngāi Ruahine; C, Puke Ariki, A63-984, 70 mm length, no data; D, Puke Ariki, A63-987, 80 mm length, no data; E, Puke Ariki, A63-982, 60 mm length, Taranaki).

period of Māori culture (Davidson 1984; Anderson & Gumbley 1996), while shanks made of bone and wood are more recent (Lockerbie 1959; Hjarno 1967; Davidson 1984; Anderson & Gumbley 1996). Regional differences in the shape of stone shanks have been documented (Beasley 1928; Hiroa 1949; Hjarno 1967; Davidson 1984; Jacob 2000): those that are triangular in cross-section were more common in South Island (particularly Marlborough), with examples also known from the Wellington and Taranaki regions, but were rare in the northern and eastern North Island; rounded shanks were common throughout New Zealand; and grooved shanks are found predominantly in northern areas.

Beasley (1928) noted that these stone fishhook shanks more closely resembled those of hooks used elsewhere in Polynesia than the shanks of lures used by more modern

Māori. Anderson & Gumbley (1996) suggested that the transition from minnow lures, traditionally used in Polynesia to catch tuna and other scombrids with small teeth, to longer wooden barracouta lures was a result of the need to protect flax lines from the sharp teeth of barracouta. Hamilton (1908) considered stone minnow lures to be 'charm stones', used without barbs to attract fish, and Leach (2006) also commented that these lures might have had some magico-religious observance, stating 'I find it hard to believe that anyone would spend 100 hours carving a lure from stone and then risk losing it by trying to catch a mackerel', although he contradicts this statement by observing that the sheer number [of stone lures] suggests they were actually used in fishing. Any lure, used with or without a barb, is at risk of being lost to sharp-toothed fish unless a steel trace is also used: an unbarbed 'charm



Fig. 18 Post-European pā kahawai made with pāua shell and copper lashed directly to wire, which formed the hook and shank (A, Te Papa, OL000106, 121 mm length, no data, Oldman Collection; B, Puke Ariki, unreg., 95 mm length, no data).

stone' is equally likely to be lost as a fully barbed lure, no matter how many hours were spent in its manufacture, as are many lead sinkers used on modern monofilament fishing lines.

No complete lures with stone shanks are known from the historical period in New Zealand (Hamilton 1908; Hiroa 1949; Leach 2006). Skinner (1942) suggested that 'gummy' material on the lashings of some bone and wooden lures in the British Museum had been put on by the collector to preserve the lashing, although Matthews (1911) noted the use of kōuaha, a poisonous gum from the bark of pukapuka (rangiora, or bushman's toilet paper,

Brachyglottis repanda), to preserve lashings on hooks (and later to prevent iron hooks from rusting). It is probable that the muka flax lashings used to bind the barb to stone minnow lures would have required regular replacement with use. Practicality would also suggest that these minnow lures were discarded and rapidly replaced as European metals became available, as has been documented for other hook types and stone tools (Hamilton 1908; Beasley 1928; Hiroa 1949): many post-European lures in museum collections are made with pāua shell lashed directly to wire, which formed the hook and the shank (Fig. 18). As with wooden-hafted toki adzes (Hiroa 1949) and flax



Fig. 19 Pre-European pā kahawai manufactured from bone (A) or shell (B) were decorated with feathers and trolled behind canoes to catch pelagic fishes such as kahawai (*Arripis trutta*) (A, Puke Ariki, A97-241, 90 mm length, A97-249, 35 mm length, Te Taniwha, Taranaki, Ngāi Rahiri; B, Te Papa, OL000106, 121 mm length, no data, Oldman Collection).

components of hīnaki traps (Best 1929), the harakeke lashings of the discarded minnow shanks would decay quickly.

Pā kahawai lures (Fig. 19) were not baited but were decorated with tufts of feathers from kiwi (*Apteryx* spp.), kōtare (kingfisher *Halcyon sancta*) or kororā (blue penguin *Eudyptula minor*), while more recent pā kahawai are typically wooden with inlaid pāua shell (Fig. 20). Lures inlaid with pāua shell were slightly curved, so that when trolled through the water the lure would spin, reflecting light from the shell. Pohau mangā were generally straight and simple (Fig. 21), without pāua-shell decoration but often with tufts of feathers attached (Hiroa 1949 noted these hooks were known as 'okooko'). The sharp teeth of

barracouta would easily cut the flax lines, so pohau mangā lures were comprised of long pieces of reddish wood, usually tawhai (southern beech *Nothofagus* spp.) or rimu ('red pine' *Dacrydium cupressinum*), with a simple bone barb embedded at the distal end. Bone barbs were rapidly replaced with iron nails after European contact.

Several pā kahawai or pohau mangā lures were trolled behind a canoe, which was then paddled rapidly through a school of fish. The lure, with a sharp barb set at an angle to the decorated shank, was trolled on the end of a short rod and line, without bait. This fishing technique was known as 'kaihau mangā' (Best 1929), and the aim was to snare the fish, then maintain pressure on the line so that the fish could not obtain any slack and disgorge the hook. As the

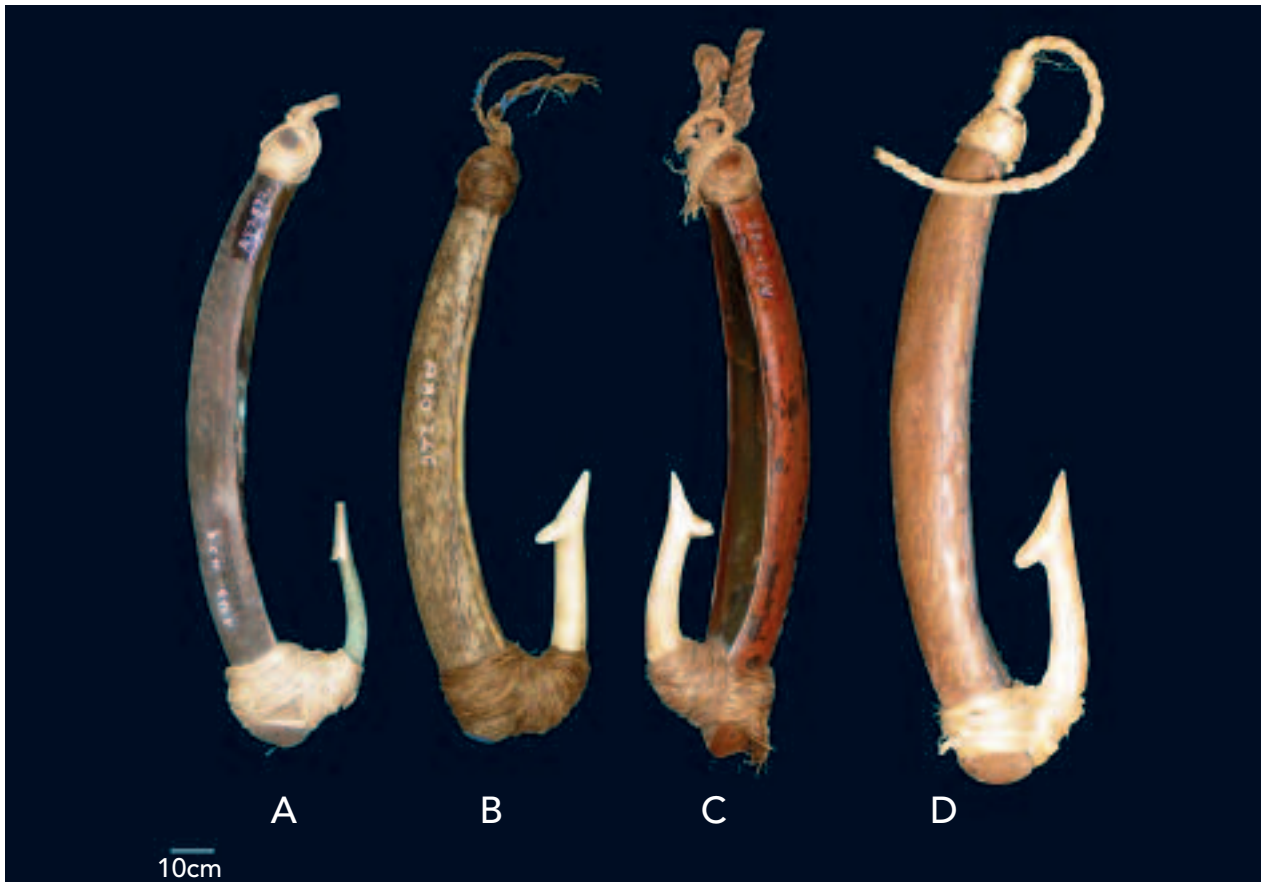


Fig. 20 Many pā kahawai in museum collections that were manufactured with wood or bone shanks inlaid with pāua shell have distinctive barbs made from copper, bone or wood, often crudely lashed to the shank with linen cotton rather than flax, and were made as 'curios' for the artefact trade in the late nineteenth and early twentieth centuries (A, Puke Ariki, A46-439, 90 mm length, no data; B, Puke Ariki, A80-246, 90 mm length, Ngamotu village, Taranaki; C, Puke Ariki, A57-788, 110 mm length, no data; D, Puke Ariki, A57-876, 120 mm length, no data).

fish struck the lure, the rod enabled tension to be kept on the line and the fish was quickly flicked into the canoe; any relaxation of the line tension would enable the fish to escape. Sherrin (1886) noted that two men using this technique, with one man rowing and one man fishing, could catch 30–40 dozen barracouta within two or three hours.

Duff (1956) considered the pā kahawai lure to be a relatively modern product because of its absence from the South Island, while other authors have suggested that these lures are rare in the south because of the rarity of kahawai in southern areas (Hjarno 1967). Kahawai, however, were previously common in southern waters, and shoals consisting of 'millions' were reported in waters off Otago Peninsula, with large numbers entering the harbours during summer months. The species declined in abundance during the 1930s (Graham 1953) and it is now

uncommon south of Banks Peninsula (Paulin 1998). Hjarno (1967) reported only three South Island examples of pā kahawai constructed with bone or shell shanks, although as wooden hooks or shanks rarely survive in early archaeological sites, frequently the only indication of the presence of pā kahawai or pohou mangā is the bone point, which is commonly found in sites throughout New Zealand (Hjarno 1967).

Artefact trading

Many pā kahawai lures in museum collections are decorative rather than functional. They typically have wooden shanks with bright, often highly curved, portions of inlaid pāua shell, and the bone (or occasionally greenstone or wooden) barbs are often fragile and delicate, carved more

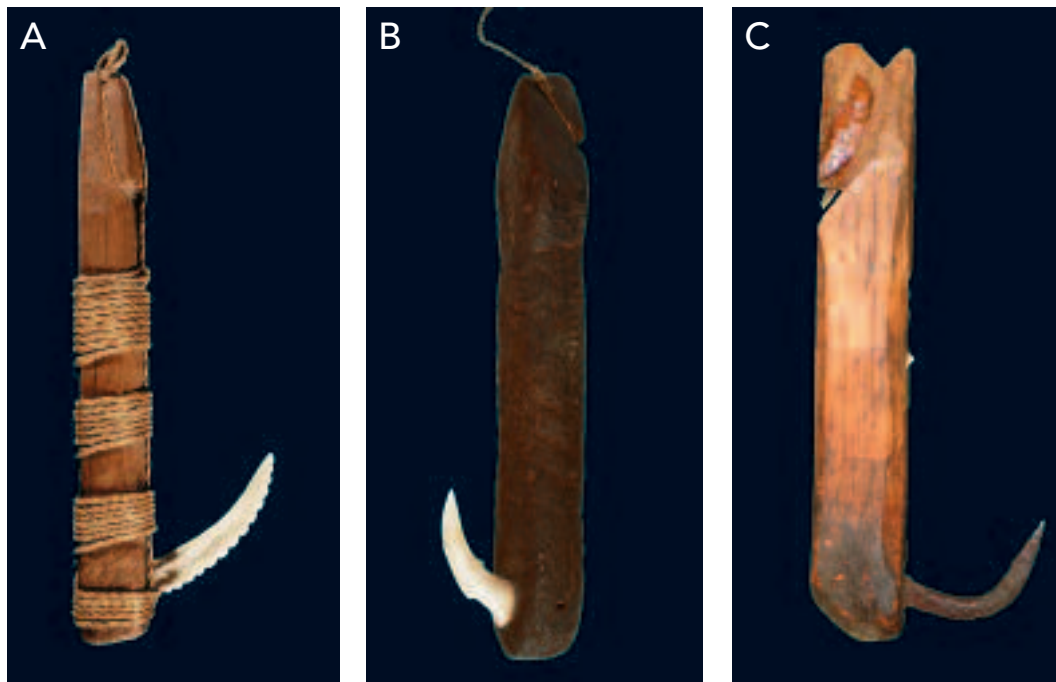


Fig. 21 Barracouta lures, pohau mangā, were made using wood to prevent flax lines being cut by the sharp teeth of the fish. Simple bone barbs were replaced by European nails as soon as they became available (A, Te Papa, ME002494, 135 mm length, no data; B, Te Papa, ME003974, 180 mm length, no data; C, Puke Ariki, A47-147, 140 mm length, no data).

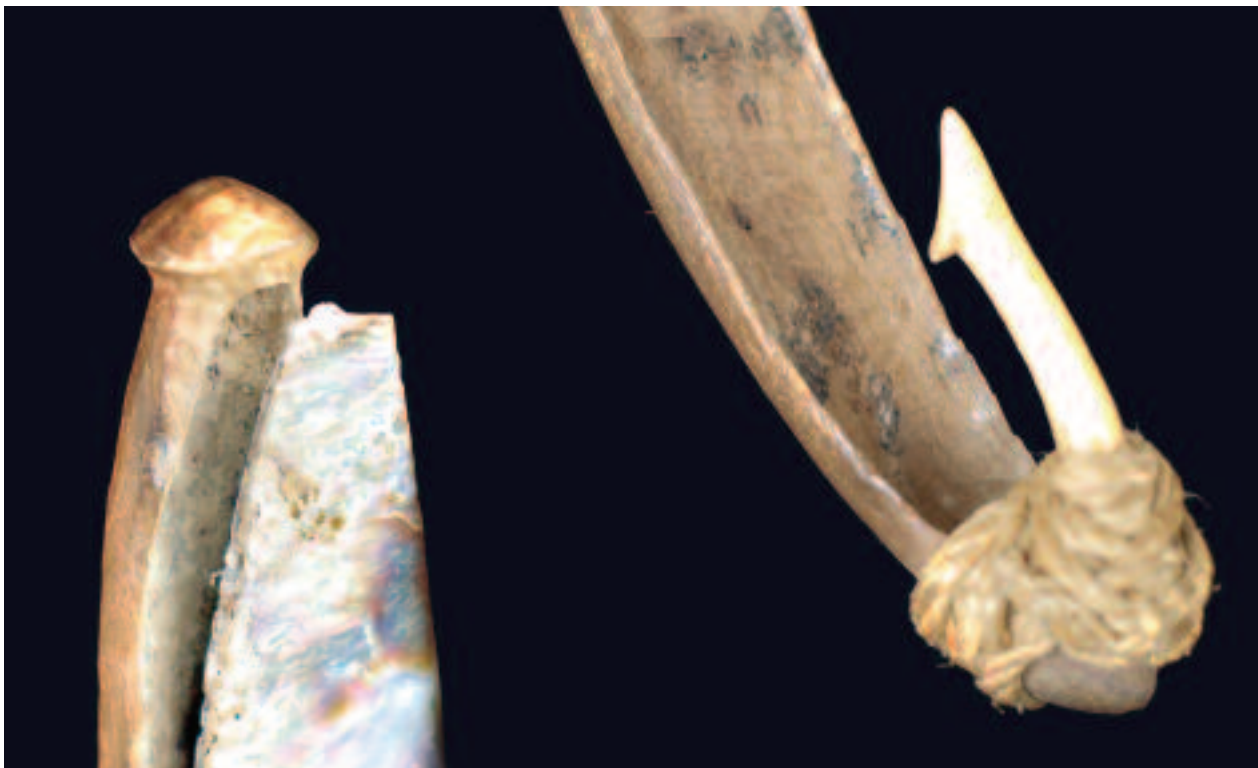


Fig. 22 Pā kahawai manufactured for the curio trade have wooden shanks delicately inlaid with pāua shell and distinctive barbs that have not reliably been reported from any archaeological site. Lashings binding the barb to the shank are often crudely tied (Puke Ariki, A57-783, 100 mm length, no data).

as replicas of steel fishhook barbs (Fig. 22) than the typical stoutly pointed bone barb of matau. Hiroa (1949) noted that the barbed points of these characteristic lures were an anomaly, and Leach (2006) reported that the bone points were quite distinctive but had never been found in a reliable archaeological context.

The inlaid pāua shell and delicate nature of pā kahawai lures made them highly sought after towards the end of the nineteenth century and into the early twentieth century by traders, including James Butterworth (Taranaki), Edward Spencer (Auckland), Sygvard Dannefaerd (Auckland and Rotorua), David Bowman (Christchurch) and Eric Craig (Auckland), as items for Victorian artefact collectors such as William Skinner (Taranaki), Captain John Bollons, Andreas Reischek, Willi Fels, Augustus Hamilton, Alexander Turnbull, Thomas Hocken and Walter Buller, amongst many others (Reischek 1930; Leach 1972; Edwards 1974; Watt 1990; Day 2005). One sales catalogue produced by James Butterworth in 1895 included 400 pā kahawai and 176 other matau hooks (Day 2005). As a result, many pā kahawai and other matau now in museum collections are replicas that were made specifically for trade rather than fishing, and large numbers were produced for the 'curio-hunting tourist' (Beasley 1928; Day 2005). These included possible forgeries made by James Frank Robieson, James Edward Little and others (Watt 1990; R.J. Watt, pers. comm. 2006), as a result of the demand for Māori objects outstripping supply (Beasley 1928). Hiroa (1949) observed that curio dealers imported 'pseudo' artefacts, including tiki, from Europe, where they were manufactured, to supply the demand by collectors in New Zealand. Furthermore, Day (2005) suggested there was evidence that items were being manufactured specifically for sale at the Māori village of Parihaka in Taranaki around 1888. Manufacture of lures for trading purposes may have been limited to certain areas where dealers were active. Davidson (1984) noted that the pā kahawai lure of museum collections is predominantly a nineteenth-century form, and was restricted to a few regions, mainly Taranaki, Northland and, perhaps, Auckland and Thames, areas where artefact traders were active (Day 2005). It is interesting to note here that Māori artefacts are still highly sought after by present-day collectors, with auction estimates for pā kahawai and matau in the range of \$500–1000 and \$1000–2500, respectively (Dunbar-Sloane: *Artefacts and New Zealand Historical Highlights Auction Catalogue*, May 2006).

Older pā kahawai were manufactured with pāua-shell shanks, or with pāua shell lashed to the inner side of a whalebone or wooden shank (Beasley 1928), while the more recent 'curio' examples were made with pāua inset into wooden (usually tōtara *Podocarpus totara*) shanks. Beasley noted that large numbers of these spinning lures were produced at the behest of the curio-hunting tourist, and that many were 'sad travesties of the older forms'. He did not, however, detail any reliable distinguishing features. The use of easily worked tōtara wood made it possible to manufacture numerous replica pā kahawai in a short period of time. 'Museum' pā kahawai examined in the present study show some degree of European influence in the frequent use of linen thread or sisal rather than harakeke (flax) for bindings that are often crude and untidy (Hiroa 1949 reported that traditional lashings were made with two-ply twisted cord). In addition, some have copper barbs, most have signs of steel chiselling to create the delicate pāua inlay, and many are highly curved and would spin uncontrollably in water. However, few of these pā kahawai in museum collections have associated provenance details. Traditional Māori fishhooks, as was the case with many other artefacts, were traded extensively and incorporated into many museum collections. As a result, they often fell out of context and lost their cultural significance (Māhina-Tuai 2006), thus lapsing into 'unmeaning collections of curiosities' (Hector 1870). The demarcation between functional pā kahawai produced for fishing, and stylistic or replica hooks for curio trading, is unclear and is unlikely to be resolved.

Hamilton (1908), Beasley (1928) and Smith (*in* Trewby *et al.* 2004) suggested that some hooks were manufactured as ornaments or as charms for ceremonial use (Fig. 23), including as magico-religious objects (Leach 1998), and were not intended for use in fishing. However, Best (1929, 1982) and others (e.g. Taylor 1855; Colenso 1891; Hiroa 1949) documented known Māori mythology and rituals associated with fishing, and made no mention of the manufacture or use of symbolic hooks other than rare examples of deliberately made and clearly identified hei matau (stylised fishhook neck pendants), from pounamu (nephrite jade) and tangiwaiti (bowenite greenstone) or bone, which were worn as decoration (Fig. 24). The unusual rotating or circle-hook design, adopted particularly when hooks were manufactured entirely from stone such as pounamu, has made interpretation difficult. Hiroa (1949) noted that authentic specimens of hei matau



Fig. 23 It has been suggested that some hooks were manufactured as ornaments or as charms for ceremonial use. However, there is no documented evidence or oral tradition that suggests the manufacture of hooks for purely ceremonial purposes. The use of a greenstone bird spear tip (with evidence of iron file scratch marks), lashed to a polished pig's tusk, suggests this example is recent in origin, and was possibly made for the curio trade (Te Papa, ME011848, 160 mm length, no data).

based on the spiral hook design were rare, but that they appealed strongly to 'European makers of greenstone curios'. Traditional (fishing) matau can be distinguished, however, as they were manufactured with a knob or groove at the snood end of the shank as an attachment point for the line to provide leverage when a fish was hooked, whereas hei matau were suspended from a simple



Fig. 24 Hei matau, made for use as pendants for personal use (A) can be distinguished from practical matau made for fishing purposes (B) by the simple drilled hole used for suspension, rather than a grooved lug for attaching the fishing line snood. Some matau may have had a dual function and may have been worn when not in use as a means of keeping the item safe (A, Te Papa, OL000096, 83 x 103 mm, no data; B, Te Papa, WE000400, 48 mm length, Mangonui, Bay of Islands, Ngā Puhī).

drilled hole. It is possible that valuable greenstone matau were worn as personal decoration when not being used as a means of safekeeping, hence some may have had a dual purpose, eventually giving rise to the development of purely decorative hei matau.

Māori fishing rituals recorded by Best (1929, 1982) were closely associated with the hooks and lines that were



Fig. 25 Albatross hooks are characterised by having wide gapes, and known examples seem to have come from the East Cape region (Hamilton 1908). Hiroa (1949) noted that the introduction of steel tools rendered woodcarving easier but it also became overelaborate and ornate, which spoiled artefacts for actual use but improved them for trade purposes (A, Te Papa, ME005033, 115 mm length, no data; B, Te Papa, ME010951, 90 mm length, no data).

actually used in fishing activity, including much ceremony linked with the first use of a new fishing tackle. Beasley (1928) noted that various ceremonies were undertaken prior to fishing activity, and that these ceremonies were based around the hooks that were to be used, as observed by Taylor (1855). Many matau have small detailed carvings on the outer loop where bait was attached, or at the snood end of the shank where the hook was lashed to the line, and these have been interpreted as symbolising the god of the sea Tangaroa (Hamilton 1908; Beasley 1928). Beasley (1928) described several unusual slender hooks (Fig. 25) that he considered to be for ceremonial purposes; however, Hamilton (1908), Best (1929) and Hiroa (1949) stated that these hooks were made to catch seabirds such as albatross and were perhaps restricted to the East Cape region (Hamilton 1908; Hiroa 1949). Talismanic objects (called 'mauri') and certain tapu stones, known as 'manea', were employed as a form of shrine or resting place for gods by

sea fishermen (Hamilton 1908; Best 1929; Hiroa 1949), and the use of ceremonial hooks with no practical function has not been documented.

Summary

In 1870, the Māori Land Court observed:

The use to which the Maoris appropriated this land [coastal foreshore] was to them to the highest value no one acquainted with their customs and manner of living can doubt. It is very apparent that a place which afforded at all times, and with little labour and preparation, a large and constant supply of almost the only animal food which they could obtain, was of the greatest possible value to them; indeed of very much greater value and importance to their existence than any equal portion of land on terra firma. (McHugh 1984: 240)

Following European settlement of New Zealand, the Treaty of Waitangi 1840 guaranteed Māori 'full exclusive

and undisturbed possession of their...Fisheries'. However, despite this, the Oyster Fisheries Act 1892 and the Sea Fisheries Act 1894 marked the beginning of a change in the fishing rights and management responsibilities of Māori. When sea fisheries were first made the subject of statutory regulation in the Fish Protection Act 1877, Māori rights under the Treaty of Waitangi were preserved. This provision was omitted in 1894 and reinstated in 1903 in a vaguer form. These acts were introduced under the false assumption that the dramatically increased strain on aquatic resources by European settlers could be managed separately and have little or no effect on the customary fisheries of Māori, and created an unnatural division not only between commercial and customary fisheries, but also between Pākehā (European) and Māori (Day 2004).

The abundance of fish stocks that were available to pre-European Māori in shallow coastal waters made catching adequate numbers for daily food requirements relatively easy using nets, traps, spears and hook-and-line, or even simply gathering fish such as kanae (grey mullet *Mugil cephalus*) that accidentally leapt into a canoe, as was a common occurrence in northern harbours such as Kaipara (Paulin & Paul 2006). The Māori belief system at the time was area-based and traditionally involved a complex arrangement of nested rights and responsibilities relating to extended families, villages and tribes. This specified who could fish and when, where and how they could do so, and was enforced by formal and informal cultural norms, beliefs, institutions and rituals (Day 2004), unlike English common law, which focused on a 'common property' belief that led to a largely unregulated 'open access' approach to fisheries management. From 1900 to 1962, Māori fishing rights were protected under law, which allowed fishing grounds to be reserved on application to the Marine Department in particular areas for meeting personal needs. However, although the statutory provision was in force for 62 years, no applications were ever approved (Rata *et al.* 1988).

The Fisheries Act 1983 was passed in order to consolidate and update regulations that had been in force since 1908. In addition, it was expected to help address issues associated with the general decline of inshore fish stocks in the 1960s and 1970s following deregulation of the industry in 1963, as well as the exploitation of deepwater stocks following the declaration of the 200-mile Exclusive Economic Zone in 1978 in response to high levels of foreign fishing throughout the preceding decades. Although

the 1983 Act acknowledged Māori fishing rights, it did little to uphold them, and it deliberately excluded many part-time fishermen from the industry, a lot of whom were Māori.

In 1986, the Fisheries Act 1983 was amended to introduce the Quota Management System (QMS), which provided a new way of managing commercial fish stocks. Under the QMS, rights to harvest set quantities of certain commercial fish species were allocated to fishermen who had commercial fishing permits, based on their historical catch record. As many Māori had been excluded from the industry in 1983 and no longer had commercial fishing permits, they did not receive quota allocations. Māori groups challenged the QMS through the courts and the Waitangi Tribunal (whose mandate had been widened in 1985 to examine claims prior to 1975, including the loss of fisheries), claiming the system was unfair because it ignored Māori fishing rights guaranteed under the Treaty of Waitangi. The New Zealand government acknowledged Māori customary and commercial fishing as an integral part of fisheries management and passed the Māori Fisheries Act 1989 as an interim solution, recognising customary rights, buying back 10% of quota already allocated and reserving 20% of all future allocation for Māori. Māori claims to commercial fisheries were settled with the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992. This Act resolved commercial fishing issues and ended the Waitangi Tribunal's involvement in Māori fishing claims. The Fisheries Act 1996 introduced regulations defining how customary fishing could take place and the rights and responsibilities of tangata whenua in managing their own customary Māori fisheries.

Present-day interpretation of early Māori fishing and fishing methods is complicated by the introduction of European metals and synthetics, which replaced traditional materials in the nineteenth century, and development of deregulated commercial fishing in New Zealand waters in the latter part of the twentieth century, which resulted in a highly significant decline in fish numbers, distribution ranges and sizes. The earlier abundance of fishes enabled Māori to take a wide range of species from all available habitats using traps, nets, spears and hook-and-line, prior to changes in lifestyle associated with the increasing availability of European agricultural cultivars and domestic animals in the nineteenth century, and urbanisation in the twentieth century. Rural Māori, however, continued their fishing traditions, and a wealth of information

documenting the decline of fish stocks, not only in the nineteenth century but also within living memory, is available in the oral histories presented to the Waitangi Tribunal (e.g. Rata *et al.* 1988; Leach 2003). Traditional Māori culture was not static and it cannot be concluded that 'Māori fishing' ceased when the traditional gear was discarded, the language was not regularly spoken, and new tools and technology were adopted. Customary materials were replaced or complemented by European metals and, more recently, synthetic materials: European influence and technology added to, rather than replaced, generally compatible Māori techniques.

Differences in Māori fishing gear often reflect localised and individual preferences as much as changes associated with regional and chronological variation. However, although the form of fishing gear may be adapted and may change with time, key components are retained and provide a means for tangible extrapolation into the past. Early archaic-period Māori fishhooks can be distinguished from later classic-period hooks and resemble hooks from other areas of Polynesia. Archaic-style hooks were replaced by hooks that were more ornamented and increasingly used barbed points, reflecting a cultural change that began in northern areas. That said, the demand for artefacts by European tourists and collectors in the latter part of the nineteenth century resulted in production of a large number of ornate replica hooks that cannot easily be distinguished. The use of hei matau for personal adornment, and the loss of wooden and flax hook components from the archaeological record, further complicate interpretation of the traditional Māori hook-and-line fishing technology, which became dominated in the late nineteenth century and into the twentieth century by cheap, mass-produced metal hooks.

The design of the traditional circle or rotating hook for fishing resulted from the need to manufacture tools from materials such as bone, stone, shell and wood, which cannot easily be made into strong but fine, sharp points. The circle design of the hook allows the fish to trap itself with no assistance required from the angler, and no rod is required. Because the barb of the circle hook is bent inwards, fish are usually hooked in the jaw and are rarely gut-hooked. Once caught, the fish is often unharmed as the non-metal point rarely penetrates to cause bleeding or tissue damage. Conversely, modern J-shaped metal hooks have a strong, pointed tip and are designed to operate as a gaff, penetrating the fish as the angler sets the hook with

a sudden upward movement of the line parallel to the direction of the hook point. When used in conjunction with a long rod, the lever action greatly increases the force that can be applied to the sharp hook.

In their review of case studies, Cooke and Suski (2004) found that metal J-shaped hooks catch fish more readily than circle hooks, but that once fish are hooked, circle hooks are responsible for higher landing rates. The advantage of the circle hook design for retaining live-hooked fish in passive fishing situations, such as long-lining, is the main reason for the readoption of the design by modern fisheries. Recreational fisheries favour the circle hook design because of perceived conservation advantages, whereby the hook facilitates catching the fish by the jaw, thus reducing mortality and making it easier to release a fish with minimal handling. Whilst this was found to be true for many species, the use of circle hooks in some freshwater fisheries increased injury, possibly associated with differing feeding strategies of different species, and so had minimal conservation benefit (Cooke & Suski 2004).

The traditionally shaped circle hook and the double internal barb hook designs have been used for millennia by many different cultures. However, the nature of the designs, their function and their unrecognised benefits were lost after the introduction and use of metals for manufacturing fishhooks, resulting in many traditional hooks being incorrectly interpreted as decorative, ceremonial or magico-religious objects by historians and archaeologists. It is perhaps ironic, therefore, that Cooke and Suski (2004) noted that metal circle hooks represented an advance in hook design, when it is rather a rediscovery of a much older technology.

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