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Marine resources in Māori oral tradition: He kai moana, he kai mā te hinengaro

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Abstract Aotearoa New Zealand (ANZ) was one of the last land masses settled by humans, with the arrival of Māori ca. 1280 AD. This relatively recent human history allows unprecedented opportunity to investigate traditional ecological knowledge (TEK) in changing environmental and societal contexts. Before European contact, Māori culture had a strongly developed tradition of oral literature, including ancestral sayings (whakataukī). Whakataukī represent one of the main ways of transmitting critical information about all aspects of life and society, including TEK. Our aim in this paper was to analyse information on marine resources contained in whakataukī. We analysed linguistic cues to place whakataukī that refer to marine resources in five time periods, before examining the frequencies of occurrence for these whakataukī, and thus infer the likely importance of these resources through time. References to specific fish reduced through time, in contrast to generic references; we argue that these patterns are associated with societal developments. Naming of fish species during the initial settlement period likely reflects prior Polynesian voyaging experience. Many early fish references are associated with food, but later references to fish do not strongly reflect this pattern. The occurrence of marine resources such as elasmobranchs and shellfish in the whakataukī differ from their occurrence in the archaeological record, reflecting limitations associated with both forms of record.

Introduction

The Māori people of New Zealand have a long association with the sea. The extensive voyaging history of the Polynesians through the Pacific Ocean over several thousand years (Barber, 2003; Best, 1929; Paulin, 2007) led to the settlement of Aotearoa New Zealand (ANZ) in around 1280 AD (Wilmshurst et al., 2011); as such ANZ was the last major land mass to be settled by humans. This landmass, however, contrasted with the islands previously inhabited by the Polynesians, consisting

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of a large island archipelago with varied topography, and temperate rather than tropical temperatures and weather patterns. It thus provided new challenges for Māori. For example, although a rich array of marine resources was present, the colder sub-Antarctic currents supported many marine resources that were probably unknown.

Fishing was a significant activity in early ANZ, as might be expected from people with a strong seafaring tradition. Many communities were also concentrated in coastal regions (Hiroa, 1926; Best, 1929; Anderson, 1997; Paulin, 2007). Not unexpectedly, then, fish and marine mammals recur in Māori myths and legends, beginning with stories of the demigod Māui who fished up the North Island of ANZ, through to events of tribal significance such as Paikea's journey on the back of a whale (Best, 1982; Barber, 2003). These long standing relationships with the marine environment have endured since initial settlement, continuing after European colonisation from ca. 1800 AD. Indeed, it has been argued that assessment and management of wild population stocks is part of indigenous cultural practice (Moller, 1996; Dick et al., 2013; McCarthy et al., 2013). Fish and aquatic invertebrates continue to be harvested by Māori (Moller and Lyver, 2010; McDowall, 2011) and fishing remains an important economic and cultural activity for Māori today (see, for example, Dick et al., 2013; McCarthy et al., 2013). Within Māori culture, manaakitanga or hospitality, including the provision of marine delicacies such as crayfish and shellfish such as pūpū (*Turbo smaragdus*) and pāua (*Haliotis iris*) at major tribal events, remains a vital cultural practice. Marine resources are therefore a highly significant part of this tradition for coastal tribes. For this reason, we have focused on marine resources in this paper, although we also present some additional data on freshwater resources.

To date, the archaeological record has dominated our understanding of environmental history and Māori marine resource use in ANZ. As Paulin (2007) has highlighted, however, this extensive archaeological record, as well as a voluminous archival record of Māori fishing activities, has served to maintain European notions about fishing. Many examples of material culture such as fish hooks and nets have been catalogued in museums, offering insight into the tools and technologies of culture, such as those of fishing (e.g. Paulin, 2010, 2012). Early European explorers, artists and ethnographers at a observed and recorded many details about Māori life in the 19th and early 20th centuries, including fishing (e.g. Polack, 1838; Dieffenbach, 1843; Colenso, 1869). Some, for example, focused on recording methods of tool and net construction (e.g. Best, 1929). Nonetheless, a rich oral tradition is one of the pillars of Māori culture. This oral tradition has been largely ignored, despite containing a depth of embedded ecological information in song, origin stories, whakapapa (records of genealogical relationships, including those of humans and nature) and whakataukī or ancestral sayings (Roberts et al., 1995). Yet examination of oral tradition highlights information that may be less evident in the archaeological or written archival records.

Māori fishing knowledge is certainly embedded in oral tradition, as can be seen in the lunar fishing calendars recorded by early ethnographers (e.g. Best, 1903, 1929; Hiroa, 1926) that continue to be used by Māori fishers. However, little attention has been paid to other forms of oral tradition as sources of information on marine resources, with anthropologists dismissing the 'extravagant fishy tales' inherent in oral histories (Leach, 2006 in Paulin, 2007). Recently, however, a number of researchers have concluded that knowledge of oral tradition and Māori cultural practices can enrich our understanding of environmental and human history (e.g. Barber, 2003; Paulin, 2007). Our aim in this paper is to examine one branch of oral tradition, known as whakataukī or ancestral sayings, to examine information on marine resources in particular. Using linguistic cues, such as sentence structure, grammar and vocabulary, we separated whakataukī into five main time periods since Māori settlement. We then analysed the information on marine resources to ascertain the likely importance of resources in these time periods. Firstly, we analysed both generic and specific references to fish, and the frequency of these references in the timeline, whilst also considering the context associated with these references. Secondly, we examined whether evidence of naming during initial settlement reflects prior Polynesian voyaging experience through the re-naming of new species with old Polynesian names (tracing roots). Third, we asked whether references to fish are associated with food, or have other contexts. Finally, we considered the occurrence frequencies of marine resources that are notably present or absent in the archaeological record, including shellfish, elasmobranchs such as sharks and stingrays (*Dasyatis thetidis*), and marine mammals.

Methods

Whakataukī collection and dating

Many 19th and early 20th century ethnographers in ANZ collected whakataukī, including Grey (1857), Best (1924) and Firth (1926). These archival recordings that began shortly after European arrival thus provide written compilations of Māori oral tradition. These source materials were comprehensively compiled by Mead and Grove (1981), with the later addition of translations and interpretations (Mead and Grove, 2001). We used this pariemological dataset of 2669 Māori whakataukī (Mead and Grove, 2001) as our primary dataset, supplementing this dataset with similar entries from Mead and Grove (1981). We then analysed semantic shifts and vocabulary changes across time periods. Using a range of methods including linguistic clues, structural analysis, historical context and word identification including ancestor names, events and genealogy and native speaker intuition, we aligned the whakataukī to five broad time periods: pre 1350 (pre Māori settlement), 1350–1500 (early settlement), 1500–1650 (occupation and interaction between tribes), 1650–1800 (settlement marked by inter-tribal fighting) and 1800ff (after the arrival of the first European settlers).

Polynesian languages have an extensive and comprehensive nomenclature for fishes. The Māori language is the southernmost member of the Polynesian languages, a subgroup of the very widespread Austronesian language family (Dunn et al., 2011). The Polynesian heartland is often described as 'Triangle Polynesia' because a number of Polynesian 'Outlier' languages are also spoken in Melanesia and Micronesia, with the northern apex in Hawai'i, and a southern base connecting ANZ to Easter Island (Blust, 2013). To make comparisons between Polynesian species names and whether they describe the same species or morphologically similar species, we examined names from the Pollex Database (see http://pollex.org.nz/about/) for

six sister languages of Māori from the Eastern Polynesian subgrouping of Austronesian language family (Rapanui EAS, Hawaiian HAW, Mangarevan MVA, Tahitian TAH, Tuamotuan TUA and Cook Island Māori CIM).

Statistical analyses

All statistical approaches were implemented in R (R Development Core Team, 2013). Word frequencies were determined using an online word counting tool (http://www.textfixer.com/tools/online-word-counter.php).

We analysed the dataset to first determine the total number of occurrences of the generic word for fish in Māori ('ika') and for specific species of fish. We similarly analysed the dataset for use of words meaning shark, or species of shark. By assigning each ancestral saying to a time period, based on linguistic clues, structural analysis, historical context and word identification, we then examined word occurrences to determine significance by simulation. Our null hypothesis was that proportions would not change through time, and the variance should therefore be close to zero.

It was not always possible to categorise resources hierarchically in the dataset. For example, eels were problematic. Eels are diadromous, and thus spend part of their life cycle at sea. Māori harvest eels both from rivers and coastally, such as from Te Waihora (Lake Ellesmere) in the South Island. Eels were however classified as 'freshwater' in a comparison of marine and freshwater resources, to reflect their main harvesting location. As such, we do not discuss eels further in this paper, despite their immense importance within Māori culture. As another example, the kākahi (*Hyridella menziesii*) which once formed extensive mussel beds in ANZ lakes, was categorised as freshwater, in contrast to all other shellfish which are marine. The kākahi nonetheless contributes to the overall category 'shellfish', but does not appear in the analysis of habitat types for marine shellfish.

Significant temporal changes in whakataukī references were determined via Monte Carlo simulation, due to the highly uneven number of whakataukī per time period, and order-of-magnitude differences in the number of whakataukī per reference (e.g. ika, $n = 38$; kōura, $n = 15$; hāpuku, $n = 2$). Our null hypothesis was that the proportion of whakataukī references did not vary across time periods: mean $p(\text{ref}) = p_t(\text{ref})$, for all time periods t. Under this framework, the variance in the proportion of any given whakataukī reference across the time periods should approach zero. Whakataukī were randomly permutated, controlling the total number of whakataukī per time period. The probability was returned as the proportion of permutations with the same or greater variance compared to the original data. Although the whakataukī dataset includes all existing faunal references, its small size ($n = 723$) markedly limited statistical power.

Results

Two hundred and thirty three whakataukī refer to both marine and freshwater based resources, including eels, elasmobranchs (sharks and stingrays), shellfish, marine mammals, and finfish (see Table 1 for some examples). Overall, these form around almost a third (32%) of the 719 whakataukī that refer to fauna. Whakataukī referring to marine and freshwater resources occur frequently throughout initial Polynesian colonisation and settlement in ANZ, appearing in 35% and 33% of faunal whakataukī in the early and middle time periods ($n = 52/149$ and $n = 176/533$ respectively), but occurring less frequently (13.5%) in the post-European period ($n = 5/37$). Marine references are consistently lower than those for terrestrial habitats (20–40% cf $> 55\%$) in the overall faunal dataset, and references to freshwater species are few ($< 10\%$). Whakataukī that refer to marine, rather than lake or river, resources dominate in the early period before declining in frequency over time, although this decline is not significant ($p = 0.059$). There is no change in the proportion of references to freshwater resources with time ($p = 0.30$).

The whakataukī reference a range of resources, with 125 references to fish in either a generalised (e.g. 'ika') or specific form (e.g. tāmure, *Chrysophrys auratus*; hāpuku; *Polyprion oxygeneios*). Fish are well represented in whakataukī from all time periods, never dropping below 49% (time period 4). There is therefore no evidence for a shift in the proportion of sayings related to fish across time periods ($p = 0.961$; Fig. 1).

All fish identified in the whakataukī are coastal species (Paulin, 2007), or deepwater species that occur coastally (Anderson, 1997). Twenty six specific fish and elasmobranch genera or species are identifiable in the whakataukī. The use of specific species names in the whakataukī declines significantly through time ($p = 0.022$), in contrast to the use of generic terms such as 'ika' that climb as a proportion of whakataukī references to fish ($p = 0.016$; Fig. 2). References to tāmure, for example, are relatively frequent in the initial settlement phase, but decline markedly through time as a proportion of sayings that refer to marine resources ($p = 0.011$). A number of whakataukī note the juxtaposition of plant phenology with specific fish abundance, such as the running of the tāmure during kiekie (*Freycinetia banksii*) flowering in coastal areas.

Shellfish are the next largest contributor to water based resources after fish, with 33 references; nonetheless, this is less than 5% of the faunal whakataukī as a whole. Shellfish references never exceed 25% of the marine resources group of whakataukī (time period 3; Fig. 1), and although shellfish appear rarely in the early time periods (and not at all in time period 1), the overall proportion of references to shellfish through time does not significantly change ($p = 0.29$). The range of specific shellfish mentioned is limited, but includes pipi (*Paphies australis*), toheroa (*Amphidesma ventricosum*), pāua (*H. iris*), cockles (*Austrovenus stuchburyi*), tusk shells (Scaphopoda) and Cook's turban (*Cookia sulcata*) as well as the freshwater mussel or kākahi. By habitat, estuarine species dominate this group of ancestral sayings ($n = 14$), with only small numbers of open and beach habitat shellfish species ($n = 3$), and rocky beach shellfish species ($n = 5$) appearing. Appendix 1 contains a list of species associated with habitats. It is unlikely that the proportion of whakataukī referencing shellfish from different coastal habitats changes significantly across time periods (estuarine $p = 0.10$, open/sandy $p = 0.65$, rocky $p = 0.78$), although our analysis is hampered by small sample sizes. Marine invertebrates as a group (shellfish, crabs, octopus, squid and crayfish) nonetheless appear to decline in importance through time ($p = 0.017$), in contrast to fish.

References to elasmobranchs ($n = 28$) occur more frequently than those to marine mammals ($n = 17$) in the

Table 1 Examples of ancestral sayings (whakataukī) that refer to marine resources. Both the whakataukī and the English translations are from Mead and Grove (2001).

Ancestral saying	Translation	Time period
He kaihua ki uta, he toka hāpuku ki te moana	A birding tree on land, a groper rock in the sea	1500–1650
He meroiti te ika i rāoa ai a Tamarereti	It was a small fish that choked Tamarereti	1800ff
Kei au te mātāika!	I have the honour of the first slain	1650–1800
He rei ngā niho, he parāoa ngā kauae	Follow the party of the whale	1500–1650
Te pātiki tahanui o Te Whanganui-o-Rotu	The big-sided flatfish of The Great-Bay-of-Rotu	1500–1650
Ka pō, ka pō, ka kai te rarī	When it is night the butterfish feed	1350–1500
Kei mate ā tarakihi koe, engari kia mate ā ururoa	Die like [the] shark, not like [the] tarakihi	1650–1800

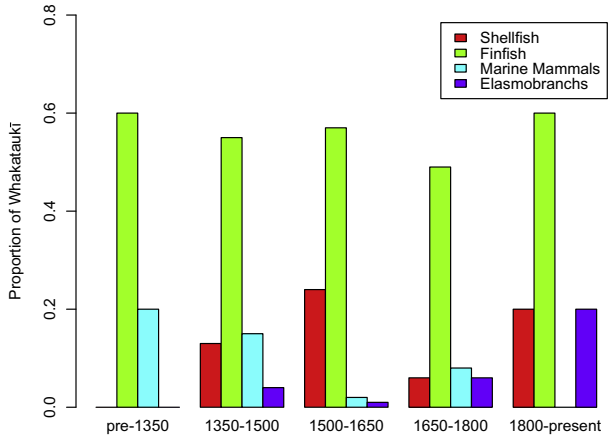


Fig. 1 Specific resource types that occur as a proportion of all water based resources. Time periods on the *x* axis refer to pre 1350 (pre Māori arrival in Aotearoa New Zealand (ANZ)), 1350–1500 (early Māori settlement in ANZ), 1500–1650 (settled occupation and interaction between Māori tribes), 1650–1800 (settlement marked by inter-tribal fighting) and 1800ff (after European arrival).

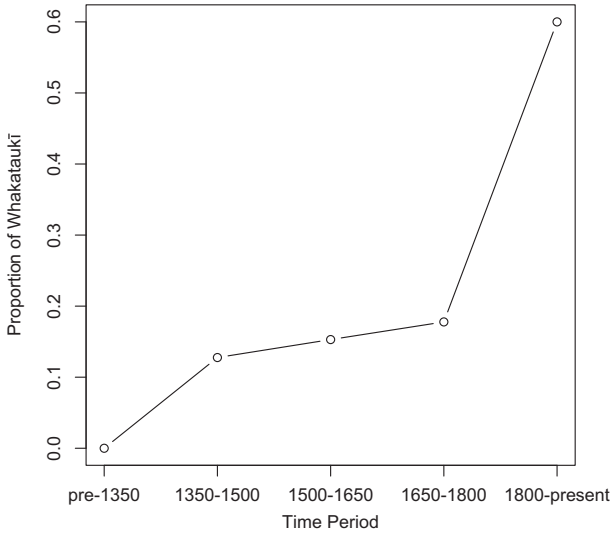


Fig. 2 Generic terms for fish such as 'ika' occur more frequently as a proportion of whakataukī through time.

whakataukī, reaching 25% of the sayings that refer to marine resources in time period 4 ($n = 23$). Most of the elasmobranch references are to sharks ($n = 19$), with a smaller contribution

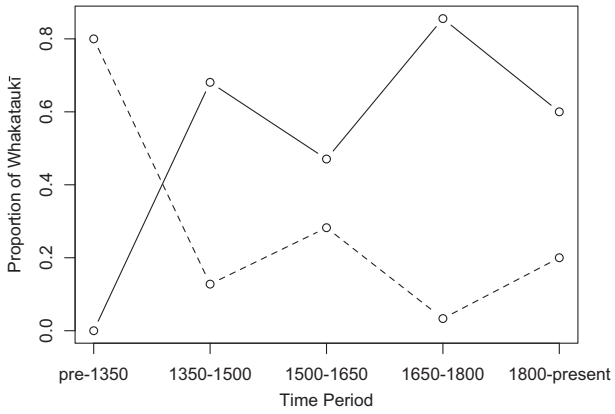


Fig. 3 Proportion of whakataukī classified as ecological observations (dashed line), and proportion that refer to cultural events and structures such as chieftainship (complete line) during the five time periods. Time periods on the *x* axis refer to pre 1350 (pre Māori arrival in Aotearoa New Zealand (ANZ)), 1350–1500 (early Māori settlement in ANZ), 1500–1650 (settled occupation and interaction between Māori tribes), 1650–1800 (settlement marked by inter-tribal fighting) and 1800ff (after European arrival).

from stingrays. These whakataukī focus on the fighting qualities of the shark when caught. The prevalence of whakataukī associated with fighting during period 4 (ca. 1600 AD) indicates that these fighting qualities may have been associated with societal patterns of change, including developing chieftainship and warfare (Fig. 3), and contrast with the pattern of whakataukī that can be categorised as ecological observations.

Whales are clearly important within the marine mammal group; only two whakataukī reference other marine mammals (probably the fur seal *Arctocephalus forsteri*, and sealion *Phocarctos hookeri* respectively). Although there is no clear pattern in their usage over time, sperm (*Physeter macrocephalus*) and minke whales (*Balaenoptera acutorostrata*) are both associated with qualities of strength, endurance and chieftainship in the whakataukī.

There are approximately forty Polynesian languages and Māori forms part of the Eastern Polynesian group consisting of Rapanui, Hawaiian, Mangarevan, Tahitian, Tuamotuan, and Cook Island Māori (Fig. 4). The names of 15 fish species identified in the whakataukī dataset are shown in Table 2. Tāmure provides a good example of name transfer, where morphologically similar, but different, species all called tamure (Fig. 5).

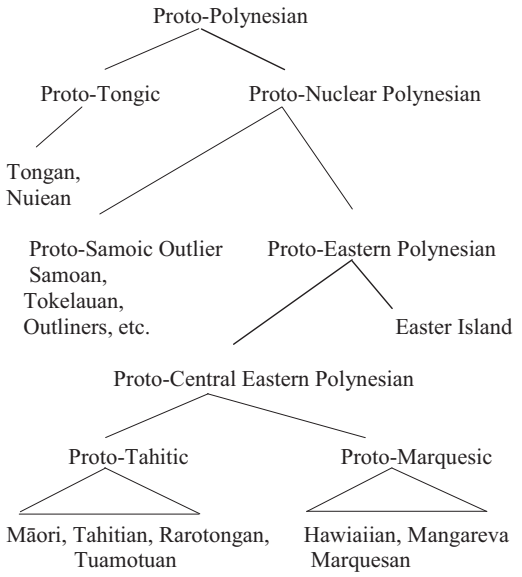


Fig. 4 Proto-Polynesian language subgrouping (from Harlow, 2007).

In most cases across Polynesian languages (PN), the reflex of the PPN **ika* refers to several other marine organisms including fish, cetaceans, cephalopods and turtles (Hooper, 1994). The cognate *ika* 'generic fish' occurs within these sister languages with *ika* occurring in MAO, EAS, MVA, TUA, and CIM and *i'a* in the northern and eastern apexes of TAH and HAW. Generic fish names are shared commonly among the 6 selected languages; e.g. PPN **fai* '*Himantura* sp. *stingray*, general term' – TAH, TUA *fai*, HAW *hai*, MVA *'ai*, MAO *whai*; PPN **mangō* '*shark*, general term' – MAO *mangō*, CIM *māngo*, EAS *māgo*, HAW *manō*, MVA *māgo*, TAH *ma'o,* TUA *mango*; PPN **tuna* '*Anguilla* sp. freshwater eel, general term' – MAO, MVA, TAH, TUA and CIM *tuna*, HAW *kuna*; PN **feke* 'octopus, general term' – MAO *wheke*, EAS *heke*, HAW *he'e*, MVA, CIM *'eke*, TAH *fe'e* and TUA *feke*. The Oceanic (OC) cognate **kanahe* 'mullet' occurs with all of these sister languages; MAO, MVA, TUA, CIM *kanae*, HAW *'anae*, and TAH *anae* (*Mugil cephalus*). *Aua* the yellow eyed mullet (*Agonostomus forsteri*) in MAO, *Valamugil engeli* when it is intermediate size in TAH, a small, silvery-grey fish or *Neomyxus chaptalii* when small in CIM, *uooa* a mullet in TUA, and *uoa* a fish (the false grey mullet) in CIM. The PN **faapuku* fish sp., (*Epinephelus* sp.) covers a range of species in Eastern Polynesia including *hāpuku* 'groper' (*P. oxygeneios*) in MAO, *kōpuku kava* (*Trachypoma macracanthu*) in EAS, *hāpu'u* (*Epinephelus guernus*) in HAW, *hāpu'u* (*Epinephelus fuscuguttatus*) in TAH, *'*āpuku (*Epinephelus polyphekadion*) in CIM, *'apuku* in MVA a 'fish species' and *hāpuku* in TUA a 'fish species'. The PN **talakishi* 'fish species' is similar to PN **faapuku* covering a range of species including *tarakihi* (*Dactylopargus macropterus*) in MAO, *taraki'i* (*Gnathodentex aureolineatus*) in MVA, *tarakii* (*G. aureolineatus*) in CIM and *tarakihi* a fish species with sharp dangerous spines. *Tamure* is snapper (*Chrysophrys auratus*) in MAO and *tamure* (*Lethrinus mahsena*) in TAH and *Lutjanus rivulatus* in TUA.

Tohorā 'whale' is used in MAO to refer to the Southern right whale (*Balaena australis*) but is used in a general sense with other Easter Polynesian languages with *ta'oraha* EAS, *koholā* HAW, *to'oora* MVA, *tohorā* TAH and TUA, and *to'orā* CIM. The marine invertebrate *kōura* 'crayfish' is also of Eastern Polynesian origin with MAO, TUA *kōura*, MVA, TAH *'ōura*, and CIM koura. However, in EAS *koo'ura* refers to 'flea or small insects in general' and the Austronesian term AN **qura* has a HAW reflex of *ula* for lobster. The PPN **paka* 'crab' has reflexes of *pāpaka* in MAO, MVA, TUA and CIM, *paapa'i* in HAW and *pa'apa'a* in TAH. The bivalve shellfish *pipi* has the same cognate throughout EP. The MAO *pāua Haliotis* spp. has a PPN **paasua* reflex. *Pāua* in TUA refers to a shellfish spp. and *pāpaua* in HAW refers to a bivalve shellfish (*Isognomen*) but *paua* in MVA and *paue* in CIM refer to a species of fish.

Patterns of meaning associated with fish clearly change in the whakataukī. Within the group of whakataukī that refer to fish, associations with food are a major feature of the initial settlement period, but later decline in frequency ($p = 0.01$). This pattern contrasts with whakataukī that draw parallels between fish and aspects of the human condition, including chieftainship, and that occur much more frequently in later time periods ($p = 0.0022$). Whakataukī with embedded ecological observations related to marine resources also decline through time ($p < 0.00$; Fig. 3).

Discussion

Our results demonstrate that marine resources are referenced frequently in whakataukī, although less often than terrestrial fauna. This result concurs with Anderson's (1997) view of sea-fishing as one of the most important subsistence activities in prehistoric ANZ (albeit based largely on the frequency of shell archaeological middens). Given the history of Polynesian marine voyaging, we might expect a high proportion of marine resources to appear in whakataukī that we have dated to first settlement. However, a trend in this direction was not significant; instead references to fish remain consistent among time periods.

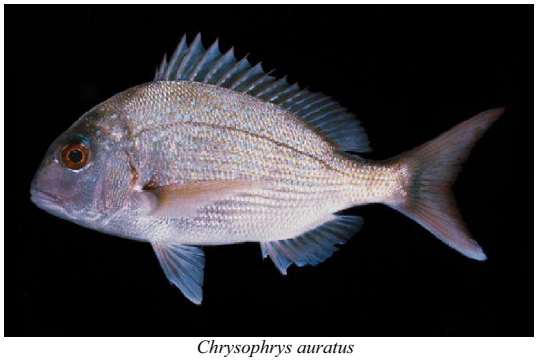
The high proportion of both fish and marine resources throughout all time periods could reflect the importance of coastal fishing in ANZ, as throughout Polynesia. An early emphasis on food might be expected during the initial settlement of a new land and seascape. Certainly, the particular species that are mentioned in the whakataukī are heavily coastal, although they include pelagic species that also occur coastally (e.g. barracouta *Thyrsites atun*, mullet and hāpuku; Paulin, 2007; Anderson, 1997). Nonetheless, the change in context associated with marine resources, from food gathering to commentary on the human condition and other aspects of society, underscores the importance of whakataukī in providing what has been described as 'a blueprint for living' (Mead and Grove, 2001).

The high proportion of specific names for marine resources in the early settlement period suggests that early Māori might have been using their knowledge of the central Polynesian seascape to quickly familiarise themselves with novel harvestable resources. Linguistic transfer of names for morphologically familiar resources could be considered part of the cultural transformation that occurred on arrival in ANZ.

The data provide supporting evidence that the early Polynesian settlers used names already known to them to name

Table 2 Pollex names and morphological similarity using 6 sister languages.

MAO	EAS	HAW	MVA	TAH	TUA	CIM
ika (generic – fish)	ika	i'a	ika	i'a	ika	ika
aua *Agonostomus forsteri*	–	–	–	aua *Valamugil engeli*	uooa (A variety of fish; the mullet)	ʻaua (Small, silvery-grey fish; (*Neomyxus chaptalii*) when small)
hāpuku *Polyprion oxygeneios*	kōpuku kava *Trachypoma macracanthu*	hāpu'u *Epinephelus guernus*	ʻapuku (Fish sp.)	hāpu'u *Epinephelus fuscuguttatus*	hāpuku (Fish sp.)	ʻāpuku *Epinephelus polyphekadion*
kanae (Mullet)	–	ʻanae (Full-sized mullet)	kanae	anae *Mugil cephalus*	kanae	kanae
kōura (Crayfish)	koo'ura (Flea; small insects in general)	–	ʻōura (Crayfish)	ʻōura (Crayfish)	kōura (Crayfish)	koura (Crayfish)
mangō (Shark)	māgo *Carcharhinus galapagensis*	manō (Shark)	māgo (Shark)	ma'o (Shark)	mango (Shark)	mangō (Shark)
pāpaka (Crab)	–	paapa'i	pāpaka	pa'apa'a	pāpaka	pāpaka
parāoa (Whale)	–	palaoa	–	–	parāoa	–
pāua *Haliotis spp*	–	pāpaua Bivalve shellfish (*Isognomen*)	paua (Fish sp.)	–	pāua (Shellfish sp.)	paue (A species of fish)
pipi *Paphies australis*	pipi (Any small sea-snail)	pipi (Shellfish sp)	pipi (Shellfish sp.)	pipi (Small shellfish, mussel-shaped)	pipi	pipi (Shellfish sp)
tāmure *Chrysophrys auratus*	–	–	–	tamure *Lethrinus mahsena*	tamure *Lutjanus rivulatus*	–
tarakihi *Dactylopargus macropterus*	–	–	taraki'i *Gnathodentex aureolineatus*	–	tarakihi (Fish species with sharp dangerous spines)	tarakī *Gnathodentex aureolineatus*
tohorā *Balaena australis*	ta'oraha (Whale)	koholaa (Whale)	tohora (Whale)	tohorā (Whale)	tohorā (Whale)	to'orā (Whale)
tuna (Fresh-water eel)	–	kuna (Eel – freshwater sp.)	tuna (Eel)	tuna (Eel (*Anguilla* sp.))	tuna (Eel)	tuna (Fresh-water eel)
whai *Himantura* sp.	–	hai	ʻai	fai	fai	–
wheke (Octopus)	heke	he'e	ʻeke	fe'e	feke	ʻeke



Chrysophrys auratus

Lethrinus mahsena

Lutjanus rivulatus

Fig. 5 Morphologically similar, but different species, all called tamure. *Chrysophrys auratus* (top) is distributed throughout the coastal waters of Philippines, Indonesia, China, Taiwan, Japan, ANZ and Australia, and is called tamure in Maori; *Lethrinus mahsena* (middle) is distributed throughout the Red Sea and East Africa to Sri Lanka and is called tamure in Tahitian. References to this species from the central Pacific probably refer to *Lethrinus atkinsoni* which is distributed from Indonesia and the Philippines, north to southern Japan, south to Australia, east to the Tuamoto Islands; and *Lutjanus rivulatus* (bottom) is distributed from East Africa to Tahiti, north to southern Japan, south to Australia, and is called tamure in Tuamotu.

species that were morphologically similar, in much the same way as has been described for plant species. Use of the same names for morphologically similar resources demonstrates the way taxonomies could be used by harvesters and fisher folk. Thus, for tāmure, the semantic shift in MAO for tamure to the species *Chrysophrys auratus* is motivated by the fact that *Lethrinus* spp. is not caught in ANZ waters but has a similar habitat and characteristics (Hooper, 1994). Folk taxonomies frequently use morphological features as a basis for classification, and similar examples can be found in the use of Polynesian words for plants such as kiekie (*Freycinetia banksii*).

Many whakataukī that refer to particular species also include ecological observations. In contrast, use of the generic 'ika' in whakataukī occurs most frequently in the later period of settlement, and peaks in 1650–1800. Many of the generic usages within the overall dataset are metaphoric, and allude to the protocols of warfare and awareness of death in battle, As such, they give insight into societal development amongst Māori and demonstrate the contribution of whakataukī to a sophisticated body of oral tradition that is concerned with far more than the harvesting of food resources.

The number of fish taxa (excluding sharks and rays) recorded in whakataukī is approximately two-thirds of those identified through analysis of midden material throughout ANZ (cf. 35 and 32 fish taxa from the Greater Hauraki and Otago–Catlins regions respectively; Smith, 2013). Many fish taxa identified from middens therefore do not appear in whakataukī. It seems likely that the number of species referenced in whakataukī has been winnowed down from the total number of species known to Māori using criteria such as ease of harvest, or distinctive behaviours. Again, this suggests that whakataukī have a role in society that surpasses observational commentary on resources and their availability.

Comparisons between the archaeological record and records from whakataukī are, moreover, limited by other cultural and physical discontinuities. For example, many of the whakataukī recorded in these collections probably have North Island origins, given the focus of early ethnographers (e.g. Grey, 1857; Smith, 1889; Kohere, 1951; Best, 1982). Comprehensive investigation in tribal regions that are under-represented in these collections would most likely reveal the existence of many more whakataukī. The archaeological record, on the other hand, tends to rely heavily on data from South Island midden locations. If we accept estimates that possibly half of the early Māori population inhabited the North Island ca. 1400 AD (Anderson, 1998), before climbing to 90% in ca. 1769 AD (Pool, 1991), then North Island archaeological data are clearly under-represented. Fish species distributions are, in addition, often stratified latitudinally, leading to further imbalances in representations of Māori activities and culture during the historic and prehistoric periods. Thus, for example, major southern fish taxa such as cod or barracouta (e.g. Brooks et al., 2010) rarely appear in the whakataukī dataset, whereas tāmure is an abundant fish in northern latitudes (Anderson, 1997) and certainly appears more frequently. Yet despite these differences, some similarities between the whakataukī and archaeological datasets exist. For example, deep water species such as hoki (*Macruronus novaezelandiae*), tuna (*Thunnus* spp.) and hake (*Merluccius australis*) do not occur at all either in the whakataukī dataset or in midden data (Anderson, 1997), although the Polynesians had developed the technology to capture large pelagic fishes in at least some parts of the Pacific (Leach et al., 1984; Rongo et al., 2009). Anderson (1997) also reported that tāmure was dominant in early northern North Island midden data, a finding that concurs with the frequency of tāmure in whakataukī.

Anderson and McGlone (1992) and Smith (2013) have both argued that that a reduction in relative abundance of species in archaeological assemblages over time reflects a decline in regional abundance. Within the whakataukī dataset, however, this explanation seems unlikely, given the linguistic attachment patterns that are evident during the period of first settlement.

The whakatauki dataset similarly contrasts with ethnographic sources: only four fish species (kehe *Aplodactylus arctidens*, kahawai, mangō, and hāpuku) are discussed in detail in Best's seminal work on fishing (1929). References to tāmure, sharks, and sperm whales dominate the marine resources dataset for whakatauki.

Whakatauki references to shellfish are stable through time and form an important part of the dataset. However, if we were to consider the occurrence of marine resources in whakatauki as indicative of their importance as dietary resources, there is a strong contrast with the occurrence of shellfish in whakatauki compared to the archaeological record (see, for example, Smith, 2013). Some midden sites are dominated by shellfish species similar to those that occur in whakatauki (e.g. Jacomb, 2008, Monck's Spur Cave, South Island), but numerous shellfish that have been identified from middens are invisible in the whakatauki. For example, Smith (2013) estimates 46 shellfish taxa were present in midden sites from the Greater Hauraki region. We therefore need to consider biases within the datasets from both oral tradition and archaeology, and what is reasonable to infer from both sources.

The frequent references to sharks create an interesting juxtaposition with archaeological data. Smith (2013) cautions that although the relative abundance of taxa in archaeozoological assemblages primarily records the frequency with which they were harvested, it is modified over time by taphonomic decay. The complexities of this problem have long been recognised, and many harvested fish thought to be underrepresented in the archaeological record (Leach and Boocock, 1993). The lack of bony skeleton in sharks and stingrays has certainly led to underestimates for elasmobranchs (Leach and Boocock, 1993; Leach, 2006). The importance of shark fishing has therefore been hotly debated in the ethnographic and archaeological literature. Written and pictorial evidence from the 19th century confirms shark and stingray fishing by Māori (see, for example, Taylor, 1855; Colenso, 1869; Matthews, 1911 and Paulin, 2007). From the whakatauki results, we suggest that shark fishing is likely to have been widely undertaken during earlier periods, although it is clearly impossible to establish the dimensions of the shark fishery from our data. References to lamprey also occur in the whakatauki dataset, consistent with the archival literature and other oral traditions (Beattie, 1920; Best, 1929), but in contrast to the archaeological record.

Fish references in the whakatauki remain steady from the time of first settlement onwards. How does this fit with the rapid decline of terrestrial resources such as bird populations that mark the settlement of East Polynesia, including ANZ? (Steadman, 1989; Grayson, 2008). Midden records reveal that as terrestrial resources became scarce, coastal people relied more heavily on fishes as their primary protein resource (Broughton, 1994). However, in the whakatauki, the emphasis on marine resources seems to shift from an initial emphasis on food gathering towards metaphorical commentary on aspects of society and behaviour. The contexts around marine resources in whakatauki therefore do not directly reflect the pattern of reliance on marine resources for food. The initial emphasis on contexts of food gathering and harvesting might reflect information dissemination about new species, including species that were abundant, easy to catch or safe to eat (such as tāmure). Yet later whakatauki resonate with historical significance, and culturally specific meaning. In particular, references to marine resources and the generic 'ika' from the later time periods are more likely to reflect social factors such as the turmoil of developing settlement patterns and intertribal warfare. These later settlement patterns, including the emergence of fortified pā around 1500 AD (Schmidt, 1996) and competition for chieftainship, are also evident in other forms of oral tradition.

The whakatauki that refer to marine mammals reflect a layer of Polynesian tradition that is rich with stories featuring whales, including the stories of Paikea, Tutunui, and others. As such, they illuminate the strong voyaging and marine history of the Polynesians through the millennia. Seals and sea lions both appear to have been harvested for food, especially in the South Island (Nagaoka, 2006; Jacomb, 2008) but the extent of the harvest is unclear in many locations. In the whakatauki, the number of references is minor, in common with other Māori oral histories from the pre-European period (Paulin, 2007).

Finally, we emphasise that oral tradition as a whole can provide rich sources of knowledge about fishing practices and trends. Recent research featuring interviews with elders who hold knowledge of traditional fishing systems in Samoa documents their observations of fishery decline (e.g. Levine and Sauafea-Le'au, 2013); these observations mirror elders' comments on fishery declines in British Columbia and ANZ (Turner et al., 2013). Whakatauki and other oral traditions can also complement broader archaeological concerns and illuminate connections between humans and their environment that transcend harvesting, and reach into patterns of human behaviour and societal development. Whakatauki offer an integrated reference source that encodes a Māori worldview and value systems, as well as providing environmental information that can shed light on resource use, for example. This contrasts with ethnographic records that have, for example, focused solely on fishing techniques, and the technology of netting and hooks (Best, 1929; Paulin, 2007), and midden data that provides evidence of diet and food resources. LeFebvre and Giovas (2009) have argued that observed patterning from past reconstructions should also consider humans as agents actively engaged in technological development rather than passive individuals reacting to a changing resource structure. We would emphasise that this reconstruction could also include the development of social customs and structure around resource use. Smith (2004) has argued that the integration of oral and documentary histories with the archaeological record is essential for any analysis of community identity. We strongly agree that examination of oral tradition, as demonstrated here, can provide invaluable information on patterns of human thought and behaviour and the formation of cultural practices.

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Appendix 1.

Shellfish species referenced in whakatauki, and their habitats. Habitats were identified from Te Ara Encyclopedia of New Zealand http://www.teara.govt.nz/ so that shellfish and their

habitats in whakatauki could be compared with shellfish (and their habitats) identified in archaeological midden material.

Shellfish name	Habitat
Cockle, tuangi	Estuarine
Cook's turban	Rocky
Limpet	Rocky
Mudsnail, periwinkle	Estuarine
Mussel	Rocky
Pāua	Rocky
Periwinkle	Rocky
Pipi	Estuarine
Ringed venus	Open sandy
Scallop	Open sandy
Toheroa	Open sandy
Tuatua	Open sandy
Tuskshell	Open sandy

References

Anderson, A.J., 1997. Prehistoric Polynesian impact on the New Zealand environment: Te Whenua Hou. In: Kirch, P.V., Hunt, T.L. (Eds.), Historical Ecology of the Pacific Islands: Prehistoric Environmental and Landscape Change. Yale University Press, New Haven, pp. 271–283.

Anderson, A.J., 1998. The Welcome of Strangers: An Ethnohistory of Southern Maori A.D. 1650–1850. University of Otago Press, Dunedin.

Anderson, A., McGlone, M., 1992. Living on the edge: prehistoric land and people in New Zealand. In: Dodson, J. (Ed.), The Naïve Lands: Prehistory and Environmental Change in Australia and the South-west Pacific. Longman Cheshire, Melbourne, pp. 199–241.

Barber, I., 2003. Sea, land and fish: spatial relationships and the archaeology of South Island Maori fishing. World Archaeol. 35, 434–448.

Beattie, J.H., 1920. Nature–lore of the southern Maori. Trans. N.Z. Inst. 32, 53–77.

Best, E., 1903. Food products of Tuhoeland: being notes on the food-supplies of a non-agricultural tribe of the natives of New Zealand; together with some account of various customs, superstitions, &c., pertaining to foods. Trans. & Proc. N.Z. Inst. 35, 44–111.

Best, E., 1924. The Maori As He Was: A Brief Account of Maori Life as it Was in Pre-European Days. Government Printer, Wellington.

Best, E., 1929. Fishing methods and devices of the Maori. Dominion Mus. Bull. 12, 1–231.

Best, E., 1982. Maori Religion and Mythology: Being an Account of the Cosmogony, Anthropogeny, Religious Beliefs and Rites, Magic and Folk Lore of the Maori Folk of New Zealand. Part 2. Government Printer, Wellington, N.Z..

Blust, R.A., 2013. The Austronesian Languages. Asia-Pacific Linguistics, Australian National University, Canberra, ACT.

Brooks, E., Jacomb, C., Walter, R., 2010. Interim Report on Archaeological Investigations at Kahukura (G47/128). Unpublished Report for the New Zealand Historic Places Trust and the SCHIP Partners, Southland.

Broughton, J.M., 1994. Declines in mammalian foraging efficiency during the Late Holocene, San Francisco Bay, California. J. Anthropol. Archaeol. 13, 371–401.

Colenso, W., 1869. On the Maori races of New Zealand. Trans. Proc. N.Z. Inst. 1, 1–75.

Dick, J., Stephenson, J., Kirikiri, R., Moller, H., Turner, R., 2013. Listening to tangata kaitiaki: the consequences of loss of abundance and biodiversity in Aotearoa, New Zealand. Mai J. 1, 117–130.

Dieffenbach, E., 1843. Travels in New Zealand. John Murray, London.

Dunn, M., Greenhill, S.J., Levinson, S.C., Gray, R.D., 2011. Evolved structure of language shows lineage-specific trends in word-order universals. Nature 473, 79–82.

Firth, R., 1926. Proverbs in native life, with special reference to those of the Maori, II. (continued). Folklore 37, 245–270.

Grayson, D.K., 2008. Holocene underkill. Proc. Natl. Acad. Sci. USA 105, 4077–4078.

Grey, G., 1857. Ko nga whakapepeha me nga whakaahuareka a nga tipuna o Aotea-roa. Proverbial and popular sayings of the ancestors of the New Zealand race. Saul Solomon, Cape Town.

Harlow, R. (2007). Māori: A linguistic introduction. Cambridge University Press, Cambridge, UK, New York

Hiroa, T.R. (Buck, P.H.), 1926. The Maori craft of netting. Trans. Proc. N. Z. Inst. 56, 597–646

Hooper, R., 1994. Reconstructing Proto Polynesian fish names. In: Pawley, A., Ross, M. (Eds.), Austronesian Terminologies: Continuity and Change. Dept. of Linguistics, Research School of Pacific and Asian Studies, Australian National University, Canberra, ACT, pp. 185–230.

Jacomb, C., 2008. The chronology of Moncks cave, Canterbury, New Zealand. Rec. Canterbury Mus. 22, 45–56.

Kohere, R.T., 1951. He Konae Aronui: Maori Proverbs and Sayings. A.H. & A.W. Reed, Wellington, N.Z..

Leach, B. F., 2006. Fishing in pre-European new [sic] Zealand. New Zealand J. Archaeol. Spec. Publ. Archaeofauna 15, i–iv + 1–359.

Leach, B.F., Boocock, A.S., 1993. Prehistoric fish catches in New Zealand. BAR-IS 584, 1–38.

Leach, B.F., Intoh, M., Smith, I.W.G., 1984. Fishing, turtle hunting and mammal exploitation at Fa'ahia, Huahine, French Polynesia. J. de la Societe des Oceanistes 79, 183–197.

LeFebvre, M.J., Giovas, C.M., 2009. The zooarchaeology of islands: towards synergy and synthesis. J. Island & Coastal Archaeol. 4, 141–150.

Levine, A., Sauafea-Le'au, F., 2013. Resources in American Samoa: documenting changes over time through interviews with elder fishers. Pacific Sci. 67, 395–407.

Matthews, R.H., 1911. Reminiscences of Maori life fifty years ago. Trans. Proc. N.Z. Inst. 43, 598–605.

McCarthy, A., Hepburn, C., Scott, N., Schweikert, K., Turner, R., Moller, H., 2013. Local people see and care most? Severe depletion of inshore fisheries and its consequences for Māori communities in New Zealand. Aquat. Conserv. Mar. Freshwater Ecosyst.. http://dx.doi.org/10.1002/aqc.2378, in press.

McDowall, R.M., 2011. Ikawai: Freshwater Fishes in Māori Culture and Economy. Canterbury University Press, Christchurch.

Mead, S.M., Grove, N., 1981. Ngā Pēpeha a ngā tīpuna: He Whakairiwhare Na. 2. Department of Māori, Victoria University, Wellington N.Z..

Mead, S.M., Grove, N., 2001. Ngā Pēpeha a ngā tīpuna: The Sayings of the Ancestors. Victoria University Press, Wellington N.Z..

Moller, H., 1996. Customary use of indigenous wildlife – towards a bicultural approach to conserving New Zealand's biodiversity. In: McFagen, B., Simpson, P. (Eds.), Biodiversity. Department of Conservation, Wellington, pp. 89–125.

Moller, H., Lyver, P. O'B., 2010. Traditional ecological knowledge for improved sustainability: customary wildlife harvests by Māori in New Zealand. In: Walker-Painemilla, K., Rylands, A.B., Woofter, A., Huges, C. (Eds.), Indigenous Peoples and Conservation: From Rights to Resource Management. Conservation, International, Arlington, VA, pp. 219–234.

Nagaoka, L., 2006. Prehistoric seal carcass exploitation at the Shag Mouth site, New Zealand. J. Archaeol. Sci. 33, 1474–1481.

Paulin, C.D., 2007. Perspectives of Māori fishing history and techniques. Nga ahua me nga purakau me nga hangarau ika o te Maori. Tuhinga 18, 11–47.

Paulin, C.D., 2010. Māori fishhooks in European museums. Tuhinga 21, 13–41.
Paulin, C.D., 2012. The traditional Māori 'internal-barb' fishhook. Tuhinga 23, 1–8.
Polack, J.S., 1838. New Zealand: Being a Narrative of Travels and Adventures During a Residence in That Country Between the Years 1831 and 1837. Richard Bentley, London.
Pool, D.I., 1991. Te Iwi Maori: A New Zealand Population, Past, Present & Projected. Auckland University Press, Auckland, N.Z..
R Development Core Team, 2013. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, url http://www. R-project.ofc.
Roberts, M., Norman, W., Minhinnick, N., Wihongi, D., Kirkwood, C., 1995. Kaitiakitanga: Māori perspectives on conservation. Pacific. Conserv. Biol. 2, 7–20.
Rongo, T., Bush, M., van Woesik, R., 2009. Did ciguatera prompt the late Holocene Polynesian voyages of discovery? J. Biogeogr. 36, 1423–1432.
Schmidt, M.D., 1996. The commencement of pa construction in New Zealand prehistory. J. Polynesian Soc. 105, 441–460.
Smith, T.H., 1889. On Maori proverbs. Trans. Proc. R. Soc. N.Z. 22, 111–118.
Smith, I.W.G., 2004. Archaeologies of identity: historical archaeology for the 21st century. In: Furey, L., Holdaway, S., (Eds.), Change Through Time: 50 Years of New Zealand Archaeology. New Zealand Archaeological Association Monograph 26, pp. 251–262.
Smith, I., 2013. Pre-European Maori exploitation of marine resources in two New Zealand case study areas: species range and temporal change. J. R. Soc. N.Z. 43, 1–37.
Steadman, D.W., 1989. Extinction of birds in Eastern Polynesia: a review of the record and comparison with other Pacific island groups. J. Archaeol. Sci. 16, 177–205.
Taylor, R., 1855. Te Ika a Maui. Wertheim and MacIntosh, London.
Turner, N.J., Berkes, F., Stephenson, J., Dick, J., 2013. Blundering intruders: extraneous impacts on two indigenous food systems. Human Ecol. 41, 563–574.
Wilmshurst, J.M., Hunt, T., Lipo, C., Anderson, A., 2011. High precision radiocarbon dating shows recent and rapid initial human colonization of East Polynesia. Proc. Natl. Acad. Sci. USA 108, 1815–1820.