Māori environmental knowledge in natural hazards management and mitigation

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Executive Summary

Based on a long and close association with the land and its resources, Māori have developed a detailed knowledge of local natural hazards. This includes oral histories and traditions that record past catastrophic hazard events, place names that designate areas that are high hazard risk, and environmental indicators that inform about the safety and viability of activities linked to changes in the environment. We propose this Māori environmental knowledge (MEK) provides a valuable source of expertise that can contribute to contemporary natural hazards management and mitigation in New Zealand.

Some of the contributions that MEK can make to natural hazards management and mitigation include raising community awareness and informing hazard planners about past catastrophic events; raising research questions and providing supporting evidence for broad scale models/predictions; assisting with the detection of subtle, but significant changes taking place in the environment; and providing insight on past vulnerability, including ideas about how past natural hazards were prevented and mitigated. This study suggests the detail contained in Māori traditions and nomenclature is a valuable and neglected area of information about the past which can help with hazard identification, managment and prevention in New Zealand.

Note, the authors of this report wish to acknowledge that incorporating MEK into the process of hazard management does not end with documenting that knowledge. Rather, the process should actively involve Māori people, their knowledge and expertise. If opportunities can be created to accommodate these contributions and ensure greater Māori participation in hazard planning and management, then there is potential for all the knowledge and skills that Māori possess - not just traditional knowledge - to contribute to contemporary natural hazard management and mitigation in New Zealand.

Heoti anö te körero mö tënei wä. Ëngari kia kaha, kia mäia, kia ü tätou ki ngä tikanga me ngä kawa a kui mä, a koro mä. E ai ki ngä körero nunui o Tä Apirana Ngata ki tana mokopuna, "Ko tö ngäkau ki ngä taonga a ö tupuna hei tikitiki mö tö mahunga". Nö reira tënä hoki tätou katoa.

1. Introduction and background

The rugged land and seascape of New Zealand exposes its people to a variety of natural hazards – ranging from storms and associated flooding, landslides and coastal erosion, to less frequent (yet sometimes devastating) earthquakes, volcanic eruptions and tsunamis. When the ancestors of Māori first settled New Zealand they would have discovered a land that differed greatly from their former northern homes. Māori would have had to adjust to colder temperatures and different seasonal rhythms, to discover the resources of the country and the conditions it imposed upon them, and to invent new ways of acquiring clothing, tools and shelter. The need to understand the new local natural environment and its ecological processes was therefore imperative for their survival. Based on long-term association with the land and its resources (extended by successive generations) Māori developed a detailed knowledge of local environmental features and processes. This environmental knowledge included observing and recording changes in the physical environment, naming and classifying areas of risk, and predicting environmental disturbances.

In more recent times, acknowledgement has been made of the contribution that this local expertise can make to western science and environmental management. In particular, environmental planners have sought to have this local insight incorporated into resource management, biodiversity conservation, landuse assessment, and sustainable development. This shift in thinking is based on the premise that those who live on the land and harvest its resources have an intimate knowledge of the functioning of local ecosystems, landscapes and the relationship between these environments and their culture. The acknowledgement also stems from the politicisation of Māori and the recognition of their rights by central and regional governments. That is, increasingly government agencies require local authority planners and hazard managers to consider the 'knowledge' of Māori in environmental management and assessment. On another level, there is also growing recognition of the limits of conventional science in solving all the issues related to natural hazards and this has resulted in calls for the incorporation of 'indigenous knowledge' and practices into natural hazards management. However, despite these developments there are very few examples or models of 'indigenous knowledge' being used in natural hazards mitigation and management[1].

[1] This is also likely due to Maori environmental knowledge not being adequately understood or appreciated by mainstream scientists and resource managers. There appears to be a general misunderstanding of what 'indigenous knowledge' is, how it is constructed and what role it has in western knowledge paradigms (Stevenson, 1996).

This study explores how Māori environmental knowledge (MEK) can contribute to natural hazards management and mitigation. We address this through an extensive review of written records (based on oral transmissions), looking specifically at stories, songs, place names and narrative that relate experience with natural hazards. This knowledge and information is documented and arranged according to the three strands of MEK advanced by King et al. (2006). These include: oral recordings, place names, and environmental indicators[2]. Finally, the contribution these different sources of MEK can make to future natural hazards management and mitigation is discussed. In this report the term Māori environmental knowledge (MEK) is defined as a cumulative body of knowledge, practice and belief that has evolved through adaptive processes. This knowledge is not just "traditional" but also contemporary[3], representing the totality of experiences of generations of Māori in New Zealand.

[2] These knowledge strands represent important bridges for creating more effective and creative interactions between indigenous and scientific knowledge systems (King et al, 2006).

[3] Stevenson (1996) argues that "all knowledge is contemporary, for it is given meaning and value from a frame of reference that is continually being updated and revised. Moreover, viewing the knowledge that indigenous people possess as essentially traditional invites denial of the relevance and efficacy of applying their knowledge to present-day issues and problems".

2. Previous studies of indigenous knowledge in hazard assessment and mitigation

A handful of studies have explored the contributions of indigenous knowledge to understanding natural hazards. One of the earliest studies of indigenous knowledge in natural hazards research is Blong's (1982) work which examined 'the time of darkness' traditions of various indigenous communities across Papua New Guinea. He examined a cataclysmic eruption that occurred some 300 years ago, using the oral histories of widespread groups to help better understand the eruption, its magnitude and effects. His study scrutinised the limitations and challenges associated with using oral histories and concluded that local 'legends' are historical accounts (despite stylisation and embellishment) of an actual event – demonstrating that unwritten history can preserve, with fair accuracy, historical events that occurred some three centuries earlier.

The value of considering indigenous knowledge in hazard identification, management and prevention has also been suggested by some authors (Cronin and Cashman, in prep; Vansina, 1985), among others. However, there are few studies that have examined the contributions of MEK to hazard management and mitigation. Cronin and Cashman (2005) make some reference to Māori tradition, however, their focus on the use of volcanic oral traditions in hazard assessment and mitigation is largely based around work conducted in the Pacific Islands. Their study concluded that despite the challenges of unmasking information within cultural histories, oral traditions remain valuable sources of information that can be used to both record catastrophic events and help to warn indigenous peoples of hazardous events in the future.

Related studies of the value of incorporating MEK into environmental assessment include the work by McCraw (1990), Lowe et al. (2002) and King et al. (2006). McCraw (1990) argued for the use of MEK as a teaching aid in earth science while Lowe et al. (2002) explored a variety of information sources, including the Māori oral history of volcanic eruptions, to gain understanding of the response and recovery of Māori to volcanic hazards. More recently, King et al. (2006) documented the contributions that MEK can make to understanding local weather and climate changes. This included the important role of local knowledge in minimising the risk of activities linked to weather and climate such as fishing and farming. Based on the findings from this work, we propose that MEK can contribute to understanding local natural hazards and assist future hazards management and mitigation.

3. Oral histories and traditions

There are many oral histories and traditions that record details of past natural hazards, helping facilitate the transfer of important knowledge from one generation to another. These oral recordings can provide a valuable source of information about local environments, helping to teach, retain memory and explain the cause of hazardous events (Best, 1972). The following section provides examples of a number of Māori oral histories and traditions that illustrate a diversity of experience with local natural hazards. Some are known far and wide throughout Polynesia, some are known to almost all tribes of New Zealand, others are local stories known only within a limited area. Further Māori oral histories and traditions are provided in Appendix 1.

The following oral histories and traditions involve storms, flooding, volcanic eruptions, earthquake and tsunamis. A series of maps are provided to help with the interpretation of regional boundaries (Figure 1), tribal territories[4] (Figure 2) and the location of orally recorded hazards events (Figure 3). Before reviewing and annotating these stories, however, it is important to acknowledge some of the limitations in using written records to investigate oral histories and traditions, as well as the limitations in using oral histories and traditions in general to inform us about the past.

Firstly, the writers of history are not objective, and personal bias can influence the documentation and retelling of history and tradition. Phillips (2000) coins the term 'synthetic oral traditions' to describe popular reinterpretations of Māori oral traditions by historical ethnographers that are considered to be inaccurate. This affliction is not limited to the written word, however, but rather is a phenomenon that is shared among all people of all backgrounds. Cross checks and ground truthing can help to examine the veracity of these 'oral histories and traditions', including geographical landmarks and knowledge of the character of the supplier of information (Blong, 1982).

Orally derived records typically describe events that are difficult to date and interpret (Philips, 2000). That is, the numbers of generations since an event roughly indicates its age, but the possibility of missed generations coupled with an uncertain average generation length – and an absence of independent dating - makes dating somewhat vague. In addition, while many events appear to have been catastrophic in some way, the precise nature of the catastrophe is nearly always open to interpretation (Vansina, 1985). A large devastating landslide might be from an earthquake, or rather heavy rain during a "Cyclose Bola" type event. Attention must therefore be paid to the context in which the tradition is collected, whether external influences are important such as emotional bias, stylisation and embellishment and/or whether the tradition is part of a

[4] Only the tribal territories of those iwi referred to in this report are provided in Figure 2.

vital tradition (Williams, 2000). Again, cross checks and ground truthing can help to examine the veracity of oral histories and traditions. Multiple accounts of the same event may even indicate that it was more widespread, and potentially more devastating, than any since European settlement.

Lastly, many very old stories were sometimes transferred to describe similar events that happened in other places (Best, 1924) and may not relate to New Zealand. For example, there is debate about where the tradition of 'Te Tai a Ruatapu' originates. This tradition is found in Canterbury (Beattie, 1994a), the East Coast (Colenso, 1881), Taranaki (Smith, 1910) and the Cook Islands (Tregear, 1904). Further, the interpretation of some of these events may be incorrect. Hence, the interpretation of individual stories, their context and the characters discussed, depends upon an intimate understanding of Māori language and tradition. Despite the many challenges facing the user of written records that are based on oral transmission, these sources can still be informative presenting us with valuable starting points to generate questions and therein better understand the nature and history of our local environments.

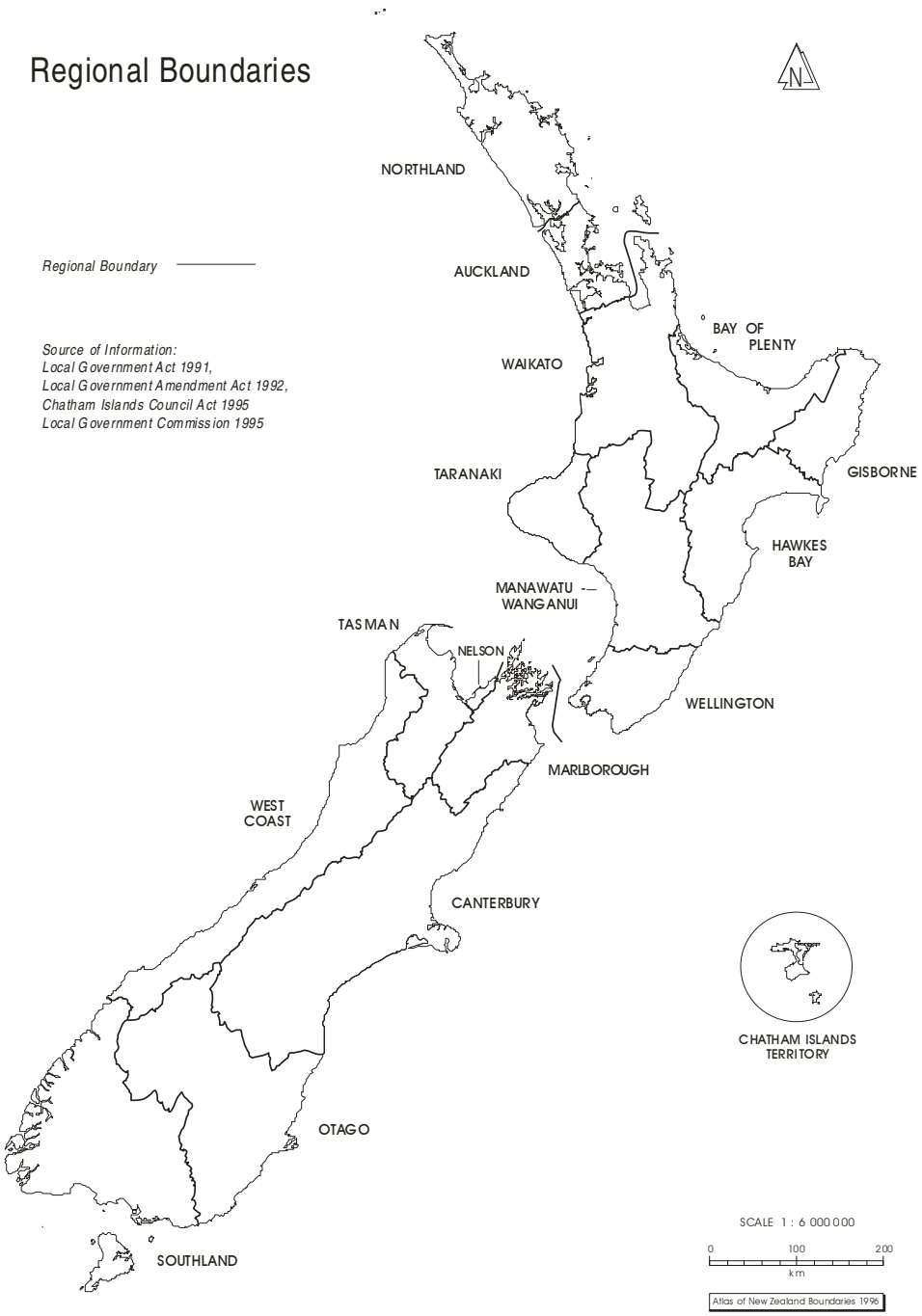

Figure 1: Regional boundries

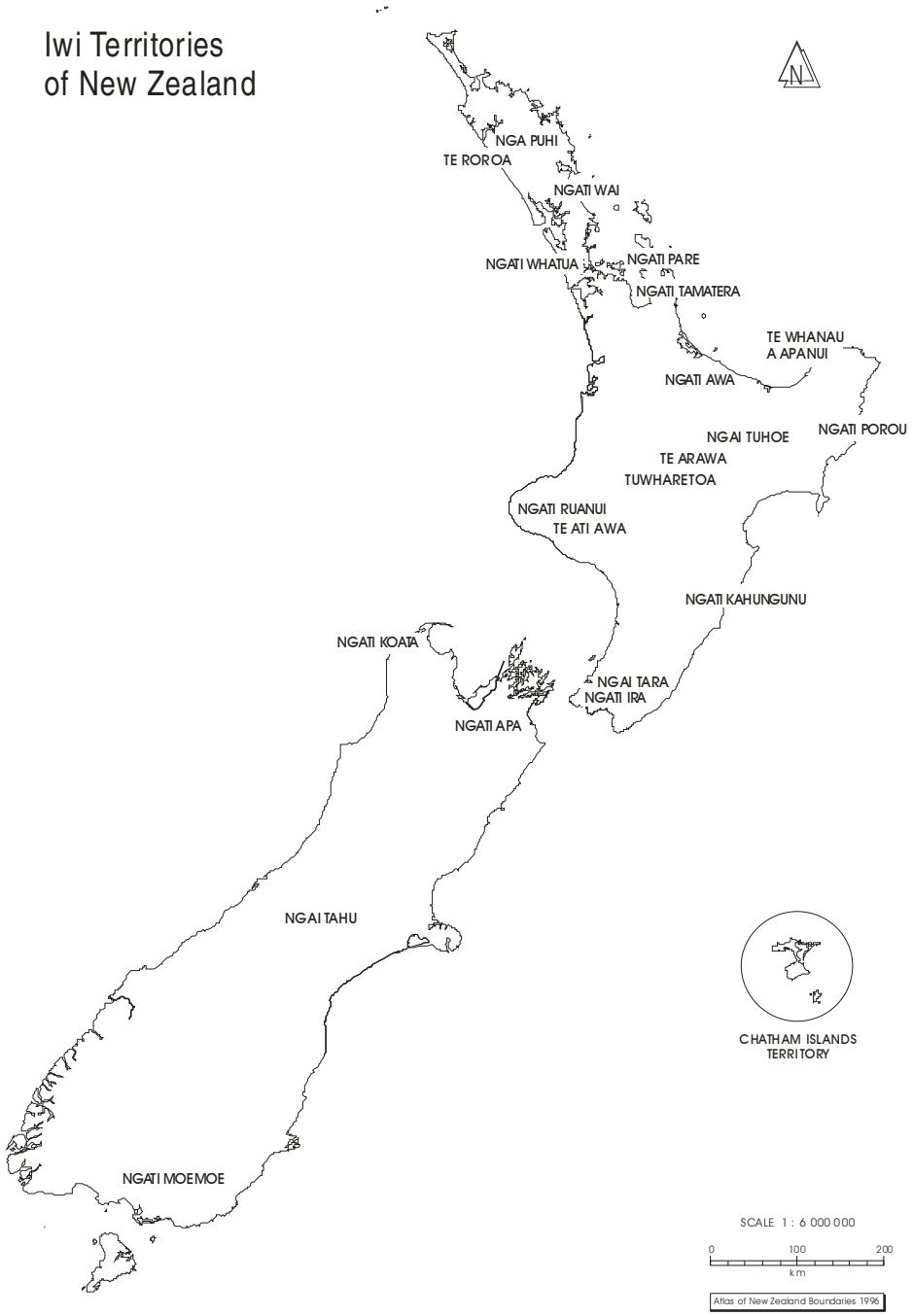

Figure 2 Tribal Territories

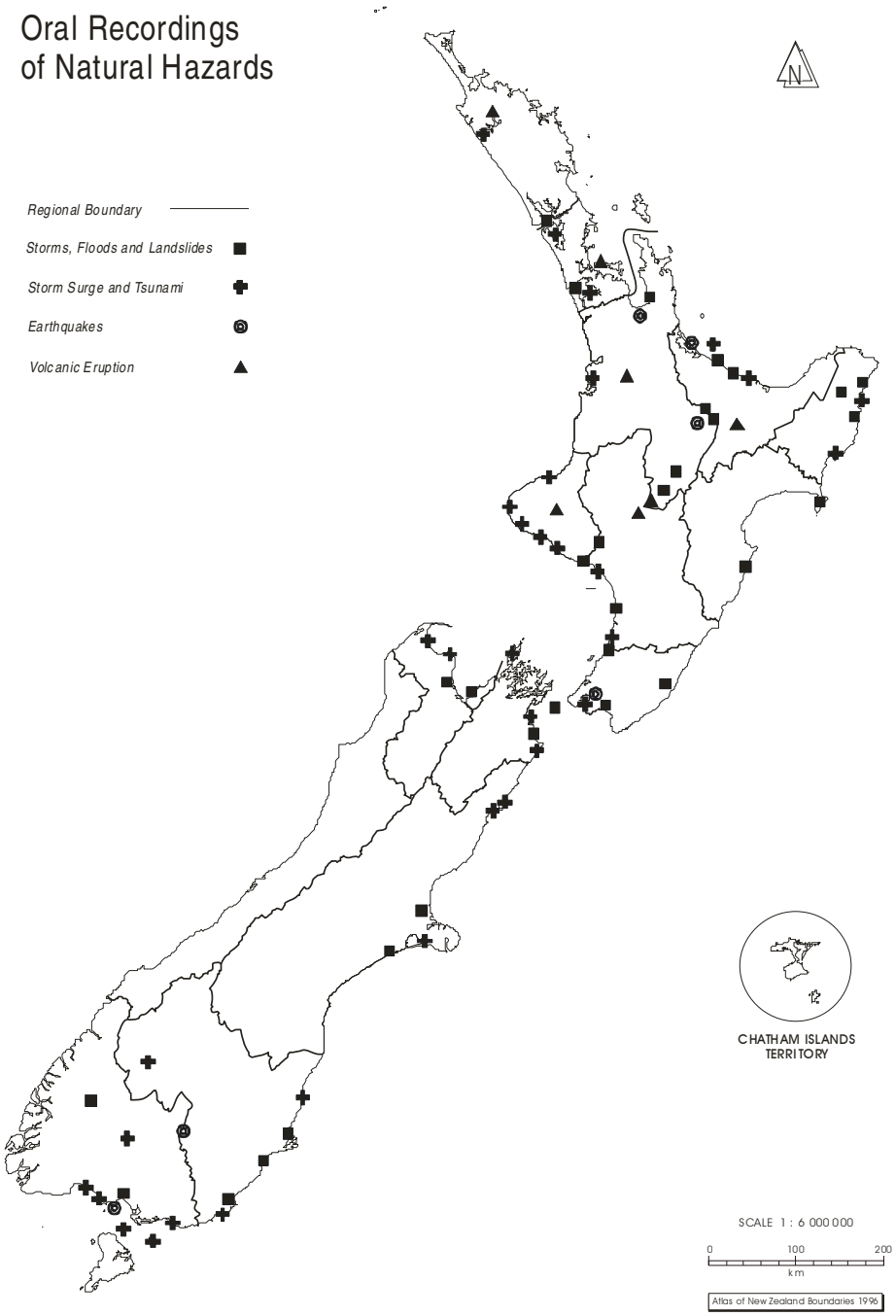

Figure 3: Location of orally recorded hazards events

3.1 Storms, floods and landslides

Information and knowledge about storms, floods and landslides are widely recorded in the oral records of Māori across New Zealand. Sometimes the details of these events were recorded to give explanation to the causes of natural hazards and to warn others of the nature of local places. Perhaps the large number of stories that tell of the impacts from severe storms, great floods and deadly landslides is not surprising given the character of New Zealand's climate and landscape.

Arguably the most widely known story of landslide in Māori tradition is the 'moteatea' (lament) for Te Heuheu (II) Tukino (Ngati Tuwharetoa) and his people who perished at Te Rapa in a landslide, on the shores of Lake Taupo, during the night of the 4th of May, 1846. It is recounted in song that the landslide was caused by a mud volcano on the slopes of Mount Kakaramea. Te Rapa was the name of the village which lay between Tokaanu and Waihi below Mount Kakaramea. Some 40 to 60 people perished in the disaster. As an aside to this disaster, in 1910 one of Te Heuheu's grandsons brought back the remains of Te Heuheu from high on Tongariro to Whakatara, just above Waihi village. Shortly afterwards another portion of the mountain above Te Rapa broke away in a landslide, and Hori was overwhelmed and never seen again (Ngata, 2004). This oral history is an important tool for informing people about possible future scenarios. That is, some events are not unique but rather occur repeatedly on different time scales. Incidentally, within the last year a landslide warning sign has been placed in the area to warn those of the dangers inherent to this location.

In other cases, stories pay tribute to loved ones and provide powerful tools for maintaining local knowledge of community loss and natural hazards. For instance, Binney and Chaplin (1986) interviewed and recorded aspects of the lives of eight Māori women from the Bay of Plenty Region. Memories of the tragic drowning of 16 children (from Omaio School) and 2 adults who tried to cross the wide, ever-shifting, Motu River in a canoe on 5 August 1900 were recorded. To remember the event people changed there names (with associated meanings) to reflect their loss. Contemporary western accounts indicate that there was a flash flood in the river (Binney & Chaplin, 1986).

A further example from Binney and Chaplin (1986) describes severe flooding, accompanied by massive landslips and the destruction of the Matahi Bridge, isolating the upper Tauranga valley on 11 March 1964. Miria Rua, a local Māori woman, comments:

> *"We were milking cows, living at Wairatu, across from Whakarae. We had a farm over there on the Waiiti. That's when we had the big flood, when Sam Biddle's house was smashed in the landslide, and our home was washed away. After the flood, we had to sell the cows. There was no way to feed them. Everywhere was sand, black sand. And even over here – the logs were down here at Matahi. Even those little creeks, they started flooding. That was the worst flood ever. After that we came over and stayed at Whakarae". [Binney and Chaplin, 1986: 144-45]*

Beattie (1957) refers to a chief named Te Kaumira who was frozen to death in a severe snow storm near Waimate (near the McKenzie Pass). In addition, Ngati Porou Māori record in a lament a flood which swept away Pahoe, the chief of the Whanau-a-Hinetapora tribe and washed him ashore at the mouth of the Waiapu River (Ngata, 2004). These stories represent a valuable source of historical information, which can be used to identify phenomena and reconstruct long-term trends in regional climatologies (Bell and Ogilvie, 1978).

Māori oral tradition may also be able to tell us about large scale impacts. For example, Beattie (1919a) tells of Māori traditions recounting great floods in the Aparima, Mataura and Clutha Rivers. He recounts: "Māori refer to a vast flood in the Clutha known as the 'Wai-mau-pakura' - meaning 'water which carried the swamp hen' - so called because it swept many nesting birds out to sea" (1919a: 63). Although debris has been found by early settlers at a height which has never been approached since, the dating of this event is uncertain[5]. Stories such as this can help raise questions about our past, and can contribute to the process of formulating research hypotheses for future scientific enquiry. In some cases, they may even offer alternative explanations which question orthodox views and provide new insight into environmental change.

3.2 Storm surge & tsunami

Information and knowledge about waves, storm surge and tsunamis are widespread throughout the oral records and traditions of Māori across New Zealand. Written records reveal an assortment of stories that tell of the impacts from great waves caused by storms, inundation caused by incantations, and water beings or giant lizards known

[5] Interestingly, Spink (1969) suggests that Eskimo knowledge of deluge events may not necessarily derive from direct experience but rather result from inductive processes that seek to explain environmental change. For example, an elder questions: "Did you ever see little stones, like clams and such things as live in the sea, away up on the mountains" (Spink, 1969: 40). These methods of enquiry may explain some of the content inherent in Māori oral traditions.

as ‘taniwha’ causing destructive surges to imperil the lives of people near the water. It is likely that these events were recorded to give explanation to the causes of natural hazards, and to help to record the loss of life and serve as warnings about the nature of certain places.

In many cases it can be difficult to differentiate between traditions concerning storms, storm surges, and tsunamis, and perhaps this is an artificial division. Such a case is the tradition of the Mahuhu canoe that finally landed at the mouth of the Kaipara where people settled at a place called Taporapora (Smith, 1896). This is believed to have taken place around AD 1300 (Parnell, 2004). The people lived here for many years but then the place was ‘shaved off by sea’, the land disappeared and ‘all were carried away by the sea’ (Smith, 1898). The nature of the event is difficult to determine from this account, but other elements of this tradition are given in Parnell (2004). Mahuhu is the canoe of Ngati Whatua, and Rongomai was the chief. Rongomai and his people settled at Taporapora, but while out fishing one day Rongomai’s waka capsized and he drowned. His death was deemed to be caused by his failure to undertake the appropriate karakia before leaving to go fishing. Following his death, some of his people left the area in the Mahuhu canoe and created a great storm that destroyed the island of Taporapora and all the remaining people living there. Parnell (2004) also relates several slightly different versions of these events, with one stating that a taniwha named Kaiwhare “raised a terrible tempest which shook the whole coast” and it was this that swept away the land. A case seems to be made for this being at least either storm, storm surge, or both. Another version of the tradition however points to the destruction of Taporapora by ‘a meteorite that came from the south-east’ (Parnell, 2004). A tsunami can not be entirely ruled out.

While it can still be difficult to determine the specific hazard, there are several traditions with fewer variants. For example, the coming of the sands is perhaps one of the most compelling traditions from the Taranaki region (Smith, 1910).

The tradition refers to a place called Potiki-taua between Waitaha and Tipoko, just to the south of Cape Egmont. It was here that Potiki and his party settled in the area. Mango-huruhuru the old priest, built a large house on low land near the sea; Potiki-roa and his wife lived in a house on higher ground a bit further inland. The large house was fronted by a rocky beach which was a poor landing place for canoes. Mango-huruhuru decided to use his powers to improve matters and to bring some sand from Hawaiki. After sunset he climbed on his roof and sang his karakia. As soon as he had finished a large storm hit bringing the sands with it. Many people, including the old priest and his daughter, were buried in the sand. Houses, cultivations, and all the surrounding land were covered in a deep layer of sand, but Potiki-roa and his wife escaped because they

had built their home further inland and uphill. According to Smith's (1910) calculations this occurred in the 16th century.

Smith (1910) also recounts the tradition of a group of Ngati Tara who went fishing off the coast of Wai-iti (about 40km NE of New Plymouth). They were caught in a great storm the drove them south until they eventually landed on Rangitoto (D'Urville Island). They found the place very much to their liking and so returned to their homes to collect their families and went to live at Moawhitu (Greville Harbour) on D'Urville Island in NE Tasman Bay. They lived here until the community was destroyed by a tidal wave around the 16th century (Mitchell and Michell, 2004). Mitchell and Mitchell (2004) note that tidal wave was called Tapu-arero-utuutu. It swept into the harbour drowning almost everyone and "tumbling their bodies into the sand dunes". While no tsunami-related research has been carried out at this site, Goff and McFadgen (2001) report the findings of early work in the area that could be indicative of such an event.

A tradition reported by Grace (2003) offers another compelling description.

> *"…the sea grew dark and troubled and angry, and presently a great wave, which gathered strength as it came, swept towards the shore. It advanced over the beach, sweeping Titipa and all his fish before it till with the noise of thunder it struck the cliff on which the people stood…The great wave receded, sucking with it innumerable boulders and the helpless, struggling Titipa. Then another wave, greater than the previous one, came with tremendous force and, sweeping the shore, struck the cliff with a thunderous roar. This was followed by a third which, when it receded, left the beach scoured and bare. Titipa and all his fish had disappeared."*

It is unfortunate that no location is given, and there is insufficient information here to help identify it, although this might relate to a similar event cited by Grace (2003) from Motiti Island, in the Bay of Plenty.

The coming of the sand is associated with lightning and high winds and is a vivid description of a large storm. However, the water penetrates a long way inland, far enough to cover the whole area including all the cultivations in a thick layer of sand. This is far more likely to be the result of a tsunami (Goff et al., 2004). In either instance, this was a sufficiently catastrophic event to be recorded as an oral tradition. A similar case could be made for the D'Urville Island 'tidal wave'. Here the bodies were tumbled into the sand dunes "which were piled up by the force of the waves" (Mitchell and Mitchell, 2004). The latter statement is possibly indicative of the magnitude of the

event in that it moved sand dunes inside Greville harbour within Tasman Bay, a feat unlikely to be achieved by a storm. Grace's (2003) description though is probably the most plausible tradition relating to tsunami inundation. There are three catastrophic waves of variable size involving components of both runup and backwash.

Other events involving large waves, storm surge and tsunamis were commonly explained as the work of 'taniwha'. Taniwha can be divided into land and marine creatures – and are a common element in Māori oral traditions. For example, Smith (1910) reports a tradition from around the 16th century concerning a taniwha that lived in a cave at the base of cliffs around Kawhia Harbour. The taniwha was called Rapa-roa and every year used to create large waves that washed up to inundate Haumia's clifftop gardens. Haumia finally killed the taniwha earning the name Rapa-roa-whakatere-taniwha.

Another example relates to a taniwha that used to wait for people to start crossing the Wairau Bar. It then came at them out of the sea, rising up in the form of a tidal wave. Once it was subdued however, then then people could return to the land again in safety (Carrington, 1934; Tau, n.d.).

According to Best (1976: 480) the "fear of taniwha was a useful force in Māori land, and this fear of the unknown…was exploited by the elders of a community, and so young folk were told that if they did certain things, then they would be carried off by taniwha to fearsome places, often underground, or under the waters of a river or lake. The offences for which persons were so punished were usually some infringement of 'tapu', and the stories of those punished were invented and taught to young folk; all of which served to uphold social discipline". This explanation likely holds some truth – particularly the use of 'tapu' as a mechanism to inform people about danger and keep them away from hazardous areas - but the implication of all 'taniwha' stories being the work of fanciful minds is misleading and a simplistic evaluation.

3.3 Volcanic eruptions

Information and knowledge about volcanic disturbances and eruptions are scarce in the oral records of Māori across New Zealand. While some traditions describe eruptions as angry mountains fighting each other with much rumbling, sometimes throwing out boulders and fire glowing, there are few traditions about the hazards or disasters associated with volcanic activity (McCraw, 1993).

There are two known written accounts of volcanic eruptions on Taranaki where lava flows around the Taranaki volcano may have impacted upon Māori communities who were living within stream valleys. Oliver (1931) refers to the obscure story of a village called Karaka-Tonga on the Waiwhakaiho River on the northern slopes of the mountain that was destroyed and buried by an early (unknown) volcanic eruption. Perhaps the inhabitants of these areas at the time did not feel threatened by the risks. Whatever the case may be, most narratives of Māori relationships with the mountain highlight the restrictive sacred and spiritual reverence with which it was regarded and suggest that day to day activities on its slopes were limited (Alloway et al., 1990). Further, Lowe et al. (2002: 138) suggest "it is possible that the designation of the upper slopes [of Mt Taranaki] as a scared area (wahi tapu), perhaps after initially being declared out of bounds (rahui), was a deliberate societal response to reduce the impacts of future eruptions". Such responses to natural disasters elsewhere are known for early Māori (e.g. Waihi Village, Lake Taupo). The second story is derived from Best (1976) who briefly describes an eruption of Mount Taranaki that killed many people at Kaimirumiru. However, in the absence of other oral traditions or evidence, the dating or occurrence of this event is uncertain.

Arguably the most widely known volcanic tradition among Māori concerns the eruption of Mount Tarawera in the Bay of Plenty in 1886. Interestingly, Cowan (1939) describes the appearance of a phantom canoe as an omen of the eruption to come from Tarawera. In the story titled: 'When Tamaohoi Awoke' a series of pre-eruption warnings occurred including the unaccountable rising and subsiding of the waters of Tarawera and Rotokakahi and the phantom canoe which would later be interpreted as a presage for the impending disaster. The canoe is described as a 'waka-wairua' with a double row of occupants, one row paddling, the other standing wrapped in flax robes with their hair plumed for death. The omens were not heeded however, and

> *"suddenly in the black midnight the earthquakes shook the land, lightning flashed, a great wind passed in a hurricane that burst over the mountains, and with an awful roar Wahanga and Ruawahia, the northern and middle peaks of Tarawera, burst forth in huge black clouds and fireballs and showers of red-hot rock and ash. The mountains rent in twain; lightning set the forest on fire, and then the enormous rift made by the bursting of Tarawera split down into Rotomahana Lake. The whole lake-water, mud, islets, wonderful terraces and all – was blown into the air with the roar `of all the worlds' artillery. Thousands of feet into the lightning split sky shot the mountain top and the lake bottom and the islets all mingled in one black cloud, and down it came; falling for hour after hour-hot mud, rock, ash, huge stones, raining upon Te Wairo and*

the Tarawera lakeside villages Te Ariki and Moura, until everything was buried. Over a hundred Māori were killed and also seven Europeans (Cowan, 1939: 149-50).

Apart from the direct deaths caused by the eruption from Mt Tarawera some landsliding and debris avalanching triggered by aftershocks or rainstorms may have occurred as well. It is likely that the eruption and subsequent events would have had an enormous impact on Māori living in the eastern North Island. Tarawera proper is the abrupt shattered peak overlooking Lake Rotomahana and may be interpreted literally as 'burnt peak'. The middle peak is Rua-wahia (Chasm burst open) and the eastern one, Wahanga (Split or divided). All three names bear reference to the volcanic origin of the mountain. Lowe et al. (2002) intimate that Māori were also witness to another 'ancient' eruption of Tarawera (i.e. before AD 1886) however, little is known about this. They also state that Māori have probably witnessed only a handful of large eruptions and numerous smaller eruptions from the frequently active volcanoes of Tongariro, White Island and Mount Taranaki.

Finally, while the *c.* AD 1400 eruption of Rangitoto was undoubtedly witnessed by early Māori, there are no known traditions that refer clearly to this event (Lowe et al. 2002). It is commonly speculated the lack of traditions is because the people who witnessed the event were eliminated by later invaders, erasing the memories of the eruption. Alternatively, Nichol (1992) has suggested that Motutapu (the island adjacent to Rangitoto Island) may have been the original name for Rangitoto but that it was transferred with the emergence of a new volcano. He dispels ideas about multiple eruptions from Rangitoto citing among other arguments a paucity of information from Māori oral traditions.

3.4 Earthquakes

Māori oral accounts of earthquakes are uncommon in written records, with only a handful of stories recounting the physical and social impacts from earth movements[6].

Perhaps the most well known oral tradition is that concerning the Hao-whenua earthquake. This is recorded by the Ngati Ira iwi from the Wellington Harbour region.

[6] According to Ngai Tuhoe tradition Ruiamoko is one of the offspring of Rangi and Papa, who remains with Papa and is responsible for causing earthquakes (Best, 1972). When he moves or turns over, earthquakes are the result. Wainui – the daughter of Ranginui also has something to do with earthquakes, through the shaking of her breasts. This shaking occurs each season and if the shaking does not occur, then a poor, fruitless season follows. Conversely, if earthquakes are many, a fruitful season is expected.

The Hao-whenua earthquake caused the land around the Rongotai Isthmus to be uplifted, drying up the narrow stream channel called Te-Awa-a-Taia and joining Miramar Peninsula to the mainland coast. According to Best (1918) this took place about 18 generations before he was writing, in about the mid-15th century AD. Chronological and geological evidence indicate the channel was most probably open during the time of early Māori occupation, and appears to have been suddenly closed off sometime during this period (Pillans and Huber, 1995; Goff, 1997). The channel is also named in the oral traditions of the Ngati Tara iwi, who lived in the Wellington Harbour region prior to Ngati Ira (Best , 1923) and was clearly a marked feature of the area prior to uplift.

The name Hao-whenua was interpreted as meaning the destroying or swallowing up of the land which is at odds with the general nature of the event, an uplift, and caused Best (1918) to treat the tradition with some scepticism. It is possible though that the name does not necessarily refer to the earthquake *per se*, but rather to a tsunami generated by it. The associated inundation could be perceived as destroying or swallowing up the land, although a more applicable translation of Hao-whenua states that it could mean "to sweep the land clean" (Goff et al., 2003).

4. Place names

Māori often committed knowledge about the physical environment to memory, using place names as a way to record and transfer information. The mountains, valleys, rivers, lakes, streams, bays and headlands were named, revealing local history, geography, biology, hydrology and climate. These place names were able to transmit aspects of social, cultural and environmental history from one generation to another. Many of these place names are still used, while others are retained by local literature.

According to Orbell (1985:72-73) "a tribe's territory was intimately known to its members, with every small feature in the landscape being given its own name. Everywhere the land held complex associations which came partly from the daily experience of winning a livelihood from it, and partly from knowledge of events that had occurred in the past". There are several New Zealand books which have documented Māori place names, however, nothing has yet been published focussing on natural hazards. In this respect, indigenous nomenclature is a somewhat neglected subject in informing mainstream society about natural hazards.

In the table overleaf is a selection of place names that reveal some of the insights available on local natural hazards. The translations of the place names are derived from the reference author. Further lists of place names can be found in Appendix 2. The place names are grouped by region and follow the regional divisions established by the 1991 Local Government Act (Figure 1). Uncertainty surrounded the origin of some names, and often authorities could not be provided. In these cases, the place names have been omitted. Further work is required to determine the exact location of some of the place names provided.

There are challenges in using place names to inform us about our local landscapes, however. For example, sometimes Māori place names have been relocated - thus explaining the ubiquitous naming of certain places (e.g. Ruatapu – on the South Island south of Hokitika – apparently came from East Cape). Further, there can often be more than one explanation for a place name. Consequently, additional work is required to establish the veracity of the translations offered. A further limitation on using place names to understand local environments are the personal interpretations applied by early Pakeha and Māori scholars. Reed (2002: 4) suggests that some place names "have suffered alteration and distortion [sometimes giving] false and ludicrous conclusions". Consequently, without knowledge of the reason for the naming of a place, translations can be misleading.

Table 1: Selection of place names revealing information about local hazard history and risk.

Place name	Meaning	Location	Reference
Whangateau	Channel with a strong current	Auckland	Davis et al., 1990
Ōpaheke	Place where landslip occurred	South Auckland	Reed, 1975
Mangakino	Dangerous stream	Mangakino	Davis et al., 1990
Waikino	'Harmful waters'. The narrow passage is known to cause a raging torrent of destruction. Waikino was also the name of a taniwha that inhabited the river	A settlement 5km west of Waihi	Turoa, 2000
Parihoro	Crumbling cliff - name of the point just past the cemetery gate	Gisborne	Vangioni et al., 1970
Wahaparata	Parata's mouth – refers to a disagreeable and dangerous place on the East Bank of the Ngaruroro River where there was a brawling, noisy water course	Napier into the interior of Te Aute and Waipawa	Colenso, 1889
Rangipo	Place of darkness - name given to the barren tephra plain downwind of Ruapehu and Tongariro/Ngaruahoe volcanoes	Taupo Volcanic Zone	Cronin and Cashman, 2005
Ōngārue	Place of shaking (as in earthquake)	Taranaki	Reed, 1975
Mākerikeri	Mā (stream) kerikeri (rushing violently). Turbulent stream	Canterbury	Reed, 1975
Wawa-waiau or Hau mate	West north-west wind or "death wind" because it upsets canoes	Stewart Island	Beattie, 1994a

5. Environmental indicators

Traditionally, Māori used environmental indicators or 'tohu'[7] to measure, monitor and indicate changes taking place in the environment. These indicators permitted judgements about the health of wildlife, the correct time for planting and harvesting and, the danger of crossing local rivers and seas. This section provides details of environmental indicators used by iwi across New Zealand. These indicators have been sourced from local literature, historical ethnographies, indigenous narrative and personal communication.

Many of the indicators used by Māori were closely aligned with changes in the weather and climate - helping Māori to adapt their activities and prepare for the arrival of storms, floods and sometimes weather/climate extremes. This application is echoed widely among Māori, and underscores the interconnected nature of weather and climate in all aspects of Māori occupation and settlement – from rainfall and flooding, to drought and changes in temperature. Syd Cormack from Kai Tahu states:

> *"Knowing about the weather was important…We used to fish south of Kaikoura at what they called Bushett Shoals. It's about four or five miles off the land. Well, when you saw the clouds of dust two to three hundred feet high coming out of the mouth of the Waiau River, you knew it was time to get out of it. That was the nor-west coming down the rivers from away inland." (Cormack and Orwin, 1997: 91)*

A similar application is expressed by Bill Tawhai (Te Whanau a Apanui) in describing the use of the plume of 'Whakaari' (White Island) to determine a range of expectant weather conditions including weather extremes. He states:

> *"The thickness of the plume, its constancy, shape, angle and the side on which the plume lies all indicate the type of rain, wind direction and storm intensity that can be expected. When the plume flattens and the end breaks off – watch out. Under these conditions no one would go out on the water" (King et al, 2006).*

These examples illustrate the importance of using environmental indicators to make decisions about the safety or danger of certain activities. They may even be regarded as local hazard prevention tools. It is important to recognise the importance of context for understanding and communicating these indicators however. That is, the actual content

[7] The word 'tohu' means simply 'mark, sign, and/or proof'.

of this strand of MEK can be difficult, if not impossible to communicate with others, other than through personal interaction or shared experiences. A selection of other indicators that inform about immenent rain, floods and gales is presented in Table 2. Further indicators are presented in Appendix 3.

Table 2: Selection of environmental indicators to forewarn of weather and climatic hazards.

Name	Indicator	Expected Outcome	Iwi / Region
Pukeko (Swamp hen)	Pukeko head for higher ground	Imminent storm and flooding	Ngäti Wai: NE North Island
Kaka (Native parrot)	Kakas begin acting up, twisting and squawking above the forest	A storm is on its way	Ngäti Pare NE North Island
Nga ngaru (Waves)	The booming sound of waves across the land	A storm is coming	Te Whanau a Apanui E North Island
Whakaari (White Island)	The plume flattens and the end breaks off	Watch out extreme weather is expected	Te Whanau a Apanui E North Island
Matuku (Bittern)	The continuing cry of the bittern as it moves around at night	Floods are likely	Ngäti Ruanui: SW North Island
Rawaru (Blue Cod)	Stones in the belly of the rawaru	Bad weather is coming	Ngäti Koata: N South Island
Kötuku (Heron)	The heron are plentiful in summer	Gales and a heavy winter will follow	Ngäti Apa: N South Island
Rä (Sun)	A vivid halo encircles the sun	A storm is approaching	Kai Tahu: E South Island

Importantly, many of the traditional indicators were used together to predict changes in the weather and climate. That is, if the majority of indicators were pointing in one direction then a forecast would be made in this direction. This approach to weather and climate forecasting is similar to scientific forecasting methods that rely on the consensus among different computer models to forecast climate (King et al., 2006). Perhaps, this common ground offers an opportunity to improve and increase the accuracy of current weather and climate forecasting, for both Māori and non-Māori, by combining MEK and western meteorological and climate models in corresponding localities and regions?

Finally, while documentary evidence of Māori predicting earthquakes, tsunamis and/or volcanic eruptions in association with environmental signals has not been found, anecdotal evidence suggests that Māori have used other indicators such as dreams, the unusual appearance of supernatural phenomena, and the behaviour of birds and dogs to forewarn of all of these events.

6. The contribution of MEK to hazard management and mitigation

Can MEK improve our understanding of natural hazards and be used to mitigate and prevent future natural hazards? If so, how might MEK and it various components be best incorporated into natural hazard management? It is evident from the lists of MEK presented in this report that (1) Māori have long observed, recorded, monitored and forecasted changes in the physical environment, and (2) these different forms of local knowledge (based on astute and careful observation) have many strengths that might contribute to hazard management and prevention/mitigation. These contributions are listed in Table 3.

Firstly, oral histories/traditions provide valuable sources of information about past catastrophic events. This information can contribute to informing and raising community awareness about the hazard histories of local areas and the range of events that are possible. Clearly some events are not unique but rather occur repeatedly on different time scales (e.g. landslides at Waihi Village, Taupo). Cronin and Cashman (2005) suggest that information of this kind is especially useful for beginning dialogue in communities where there is distrust among locals and outsiders. This in turn can be used to provide the basis for beginning discussions about natural hazards preparedness, response and recovery. Next, oral histories and traditions can provide important baseline information against which to compare change. This is particularly important for reconstructing historical time series and determining the return periods of specific natural hazards. Māori elders with extensive local knowledge may even be aware of subtle, but significant changes taking place in the environment.

Oral records and nomenclature can also contribute to the raising of research questions about local hazards and environmental processes. This might even extend to providing new insight on areas that may again be impacted by extreme events. Hazard planners might benefit from having their attention directed to the phenomena that indigenous people have observed, as much as indigenous people can gain insight about the environment from the latest scientific information. However, hazard planning, management and mitigation based on information from oral histories and place names should be considered with caution, particularly given the risk of misinterpretation. The desired use may be different to that which gave value and significance to such knowledge in the first place.

Aside from the use of oral histories and place names to inform (and perhaps warn) people about the nature of local environments, Māori - among many Polynesian peoples – commonly employed the concept of ‘tapu’ (meaning sacred or forbidden) to

discourage actions that might bring harm to people and the environment. Many of the Māori traditions presented carry a moral that describe the dangers of interfering with the rigid rules of tapu, such as retribution from supernatural sources against those who cross certain stretches of sea and/or climb on the summits of mountains and active volcanoes. This practice represents some of the earliest forms of hazard mitigation used in New Zealand. It might again usefully contribute to educating people today about such hazards.

In addition, the development and use of environmental indicators is another local hazard prevention tool helping to make decisions about when a given activity is safe or perilous. It is important to recognise the significance of context for understanding and communicating these indicators however. That is, the actual content of this strand of MEK can be difficult to communicate with others, other than through personal interaction or shared experiences.

Table 3: Summary of the potential contributions of MEK to natural hazards management and mitigation.

Raising community awareness (i.e. education)	MEK can inform and raise community awareness that hazard events are possible, helping facilitate the transfer of important knowledge from one generation to another
Natural hazards histories	MEK can provide insight into past hazards including the provision of important baselines to assist with the construction of chronologies
Research hypotheses	MEK can present us with valuable starting points to generate questions and therein better understand the nature and history of our local environments – including insight about the areas that may again be impacted by natural hazards
Past community response and recovery	Past response and recovery experiences can assist with future community hazard management
Community monitoring	Community assessments of change are based on the cumulative knowledge of local trends, patterns and processes. This can be important for detecting changes taking place in the environment

Past hazard response and recovery knowledge might also be gained from the oral histories of elders. Given the diversity of natural hazards events faced by various Māori communities, insight might be gained from these experiences – including knowledge

about areas of relative danger and safety. Information on physical relocation, which is understood to be a relatively common form of recovery chosen by a number of Māori communities over the ages, might be a way to educate others about the acceptability of relocation as a hazard mitigation option. The knowledge and insights of Māori who have already experienced hazards impacts might even be useful in predicting, assessing and managing future impacts.

Finally, the authors of this paper acknowledge that incorporating MEK into the process of hazard management does not end with documenting that knowledge (Stevenson, 1996). Rather, the process should actually involve Māori people, their knowledge and expertise. By letting Māori assume responsibility for hazard preparedness, response and recovery, all the knowledge that Māori possess - not just traditional knowledge - can be brought to bear on local hazards management and mitigation[8].

[8] Maori themselves feel their participation in environmental management is warranted given that they have close relationships with their local environment and have collected a considerable amount of experience concerning those things that affect their existence (King et al., 2006).

7. Conclusions and summary

From a long and close association with the natural environment Māori have developed a detailed knowledge of their local landscapes - from the changing course of rivers, to the erosion of coastal features and the inundation of land and settlement. Based upon local experience, observation, recording and classification their stories, songs and narratives express their vulnerabilities and resilience. This study has shown the detail contained in Māori oral histories and traditions, place names and environmental indicators are valuable and neglected areas of knowledge and information in New Zealand. Further, despite the limitations and challenges involved in using 'orally transmitted records', this local environmental expertise has a range of contributions to make to contemporary natural hazards management and mitigation. These include enhancing our understanding of localnatural hazards, informing hazard planners and raising local community awareness about the range of events that are possible, generating research questions, ground-truthing scientific predictions and providing supporting evidence for broad scale models. Environmental indicators can be especially useful for detecting subtle, but significant changes taking place in the environment. If opportunities can be created to accommodate these contributions and ensure greater Māori participation in hazard planning and management, then there is potential for all the knowledge and skills that Māori possess - not just traditional knowledge - to contribute to contemporary natural hazard management and mitigation in New Zealand.

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Appendix 1: Oral histories and traditions

Storms, Floods & Landslides

Location	Event	Reference
Kaipara Harbour, Taporapora	Mahuhu is the canoe of Ngati Whatua And landed at Kaipara Harbour, Taporapora around 1300 AD. Rongomai, the chief died when his waka overturned. After his death, some of his people left the area in the Mahuhu canoe, coming to rest at Rangaunu on the east coast of Northland. After the departure the people of Rongomai created a great storm which devastated the island of Taporapora and the remaining inhabitants and their taonga and whare were washed away. One version states: "the storm which caused the loss of Taporapora made a breach in the river systems that formerly flowed through the low land and marshes. Thus was formed the Kaipara Harbour much as it is known today". (An interesting account of Taporapora is found in the Auckland Star newspaper dated 19 August 1936). Centuries ago, a vast fertile area of land lay inside the present North Head. This land was named Te Taporapora-o-Toko-o-Te-Rangi which means "The Outspread Mat of Toko-o-Te-Rangi". Toko was a son of Kauea, the grandson of Toi-kai-Rakau, who led the migration which arrived about 1150 AD. The fertile "mat" lay approximately opposite the mouth of the Oruawharo River, and is now only sand flats, having been overwhelmed by the sea. The method of its engulfment is poetically accounted for in folklore by the magic powers of the guardian ocean Taniwha of the descendants of Rongomai, whose canoe, the Mahuhu, it had safely escorted to Aotearoa. This Taniwha, named Kaiwhare, when invoked 'to avenge an insult to the Rongomai tribes from the people who lived on the "mat" of Toko-o-Te-Rangi" is said to have raised a terrible tempest which shook the whole coast, sweeping away the "mat" and its Maori inhabitants, (refer also to Storm Surge and Tsunami section).	Parnell, 2004
Manukau Harbour, Auckland	Paorae: In early times a huge sandy plain stretched from the south head of the Manukau Harbour right down to the Waikato River mouth. This land was called Paorae, and stretched some 6 km out to sea and to walk around the perimeter was at least a 3 day	Diamond and Hayward, 1979

	journey. No permanent settlements were established on Paorae, although it was apparently flourishing about 1400 AD. Paorae was slowly eroded away by the storms waves and winds of the West Coast. By about 1880 only a large island south of Manakau Harbour remained. In early European times, food gathering parties of local Maori visited the island, but the name Paorae had been dropped in favour of Nga-toku-rau-o-puakirangi Old residents of Te Huia told of the picnics held there in the 1880's. The last remnant of Paorae vanished during a terrific storm in 1936 (refer also to Storm Surge and Tsunami section).	
Thames, Waikato	Taumaharua (on the River Ohinemuri, near confluence with the Waihou – also called Thames): The wind from the lofty mountain called Keteriki to the east always brings rain and flood each year.	Shortland, 1865
Maketu, Bay of Plenty	The Manaia curse: This took place on Motiti Island off Maketu. The old priest Ngatoro calls forth wind, rain, lightning and thunder and "into the harbour poured all the mountainous waves of the sea…nor did the storm itself last very long". All were killed on the beach. The storm that slew them was called Te Aputahi-a-Pawa. The telling of the story of the curse of Manaia: This reaches its climax in a raging storm with mountainous waves that sweep the seas. The thunder and lightning apparently lasted until dawn killing Manaia and his warriors who were waiting upon the ocean.	Grey, 1855 Grace, 1959
Kapenga, Bay of Plenty	The taniwha, Hotu-puku, used to eat people here.	Taylor, 1870
Rotorua/ Taupo area	The lost isle of Rotoma as told by the Awa folk: Some five or six generations ago the isle of Motutara in the lake known as Rotoma became lost to the world following the call of a taniwha to destroy the land. There occurred such a storm as man had never seen at Rotoma, amid the roar of terrific thunder *and the terrible motion of the reeling earth* the isle of Motutara sank below the waters of the lake. So, perished the inhabitants of Motutara. A somewhat similar tale refers to the lost village at Ohinemutu, Rotorua, where a few massive posts are still seen projecting above the lake waters, these are all that remain of the drowned village. Two different taniwha seem to claim the honour of having	Best, 1976

	destroyed the lakeside pa, their names being Te Ihi and *Hurukareao*. Here there is probably some confusion of names, for Ko*hurukareao* is given as the name of a village at Taupo destroyed by Te Ihi. That is, two (maybe four) fortified villages named Kohuru-kareao and Whakao-hoka were destroyed by Te Ihi and subsequently they sank into the depths of Lake Taupo. According to Te Hueheu Tukino the taniwha Hurukareao destroyed the pa at Ohinemutu. Evidently this submergence of the village was *caused by one of the minor land movements* of which there must have been many in the district. The story concerning the part taken by Hurukareao is an origin myth evolved in order to account for the occurrence (refer also to Earthquakes section).	
Rotorua	A taniwha who migrated to the shores of Tikitapu is described as devouring groups and parties making their way between the lakeside route between Te Wairoa and Rotorua.	Cowan, 1939
Taupo District	Te Ihu-o-te-rangi: this taniwha was able to travel underground and was seen as far apart as Taupo and Tarawera. It was believed by a number of people that the landslide that overwhelmed the village of Te Rapa in 1846, when Te Heuheu Tukino and many of his people were killed, was caused by Te Ihu (see Tokaanu, Taupo District below). On another occasion, a man was sleeping on the shore of an island in Lake Tarawera when Te Ihu emerged from the lake and carried him away. Tamamutu – was asleep on the shore of Lake Tarawera when he was taken by a *taniwha.* He was returned several days later – bald. This was the Taupo taniwha who would also appear in Lake Rotorua and the sign of his coming was boiling of the water followed by great waves. When this taniwha's mother died four pas around Lake Taupo were swallowed up in the water (Kohuru kareo and Waka ohoka were two of these pas). The mother was killed in revenge for sinking the chief's canoe. The pas were covered in deep water.	Reed, 1963 Taylor, 1870
Tokaanu, Taupo District	Wherever quicksand appeared causing a landslip there was believed to always be a *taniwha* nearby. Te Heuheu Tukino II and 60 of his tribe were killed in the great landslide at Tokaanu in 1846.	Taylor, 1870
Mt Hikurangi,	Tai-o-Ruatapu: This historical deluge occurred some	Best, 1976

East Coast	five or six centuries ago. Ruatapu had warned Kuhutia to assemble his people on top of Mt Hikurangi when the eighth month arrives. The forewarned people retired to Hikurangi in order to escape the flood promised by Ruatapu in his ambiguous warning. Those who remained in the low lands perished. "In the eighth month the sea swept over the lowlands and devastated them, and that inundation is known to the natives of Rarotonga as the Tai o Uenuku, but to the Maori of NZ as the Tai o Ruatapu. In Whites 'Ancient History of the Maori' from the lines of descent from Ruatapu and his contemporaries we may place the date of the inundation at about the year 1380 AD. Note: there is a Mt Hikurangi at Tahiti, another at Rarotonga and several in New Zealand (refer also to Storm Surge and Tsunami section).	
Otuauri, East Cape	A lament for Te Rakahurumai - Riria Turiwhewhe (Ngati Porou) tells how Te Rakahurumai died at sea in 1852 whilst on a fishing expedition to Warehou Reef at Otuauri. A high wind arose, usually referred to as a 'ritual wind' – so called because after canoes are wrecked or capsized by it, the wind subsides.	Ngata, 2004
Waiapa River, Gisborne District	Songs contain history and the names of ancestors, such the famous lament for the Tuhoe chief Puhoe who was swept away by a grand flood and washed ashore at the mouth of the Waiapa River.	Schwimmer, 1966
Mahia, Hawke's Bay	A song of sorrow (Ngati Kahungunu): This lament comes from the Mahia District. "There is no need to harvest the taro of Kea, out yonder at Taiporutu; with the flood tide of Whiringatau, entirely submerging all, alas".	Ngata, 2004
Whirinaki, Hawke's Bay	One tale involves a Te Tahi-o-te-rangi (Ngati Awa) who was marooned by his tribe on Whakaari. Te Tahi had been blamed for numerous and heavy floods that destroyed the tribal cultivations on the low delta lands. Another story tell of a taniwha that lived in the Canyon of Toi "At certain times loud reports and booming sounds are heard from the canyon where 'Hine-ruarangi' dwells. Omens are derived from these sounds as the waters and masses of rock boulders of Whirinaki are in flood.	Best, 1972
Patea, Taranaki District	Two boys argued and one called the father of the other a tutua – a slave – because he had no canoe. When the father heard of this he chanted a karakia that night and the other family, at rest near Raumano	Reed, 1977

	(Patea) at the mouth of the river were inundated by a severe storm. It caused part of the island to slide into the sea and float away.	
Wanganui, Manawatu-Wanganui	A dreadful monster, Tutai-poro-poro, lived below a cliff at Taumahauti. It swallowed the canoe and crew of Aukehu. The taniwha had come from Lake Rotoaira and down the Wanganui River.	Taylor, 1870
Whanganui River, Manawatu-Wanganui	The perpendicular cliffs and swift deep waters of the Whanganui River provided a natural home for taniwha. Many are the tales that tell of taniwha that lurk below the rapids and under the cliffs of the Whanganui River. Tu-tangata-kino was arguably the most dreaded of all Whanagnui River taniwha who dwelled in the river near Te Ohu. The Tukopiri Stream which flows into the Whanganui at Koriniti was also the home of a man-eating taniwha: Te Maru. It used to lurk amongst stranded logs below the rapids. About a hundred years ago there was a big flood and Te Maru was seen travelling upstream carrying ponga upright on his back.	Reed, 1963
Manawatu River, Manawatu-Wanganui	Whãngaimokopuna was a taniwha who lived in the Manawatu River. He was a beloved pet of the Motuiti people. One day when the elders were away, the children who had been left in charge of the village, including the pet saw no reason for coddling a taniwha, so they fed him on the heads of eels, keeping the best portions for themselves. Whangaimokopuna was naturally upset by this and he seized one of the boys and swallowed him. When the elders returned to the village they discovered the boy was missing and went out to find him Whangaimokopuna vomited up the boy's remains and on seeing this, the elders became enraged. The Taniwha immediately fled from their anger, heading inland until he came to an area where the sound of the sea was inaudible - hence the name Taikorea. He continued inland up the Manawatu River and passed through the Manawatu Gorge. He carried on until he neared the point where the Tamaki River entered the Manawatu (between Tahoraiti and Dannevirke). This is where the river then took a sharp bend and passed round some high hills. Whangaimokopuna saw no point in travelling all that distance so by using his mighty talons he simply cut his way straight ahead through the slopes of the hills, leaving a high cliff which was called Raikapua. This straightening of the riverbed left a depression on the southeast side of the river which is now partly occupied by the Mahangaiti	http://www bwaipuka bigpondhosting com/Maoristor es/ Whangai.htm

	Lagoon at Kaitoki. Whangaimokopuna continued upstream till he reached the Mangapoaka Stream.	
Otaki Wellington	"When Manaia and Nuku landed at Paekakariki after their memorable sea fight off Pukerua, it was arranged that their quarrel should be settled the following day by means of single combat. That night, however, Te Aowhaingaroa seems to have taken advantage of his powers as a wizard to detroy his enemies by magic arts; he was the tohunga of Tokomaru, the vessel of Manaia. By means of his dread powers he raised such a terrific storm that most of Nukus companions perished. *So severe was the gale that sand and gravel were carried far inland from the sea beach, such having been the origin of the sand hills now seen along the coastline towards Otaki (tsunamis?)*. Hence the stretch of coastline received the name of Te One-ahuahu-a-Manaia" (refer also to Storm Surge and Tsunami section).	Best, 1976
Wairarapa region	Ngarara Huarau, being a water taniwha, could not travel very far from the water. His permanent home was at Uwhiroa in the centre of the Longbush area, Wairarapa. The usual route the taniwha took on his foraging was down the Makahaka stream, through Gladstone to the Taueru and Ruamahanga rivers. On one of its raids the taniwha came upon a large fishing camp with people who had joined together to harvest fish. The camp was pitched near where the Taueru River flows into the Ruamahanga River. The taniwha came upon the campers so suddenly, that very few were able to escape from the monster. Among those who escaped was Konini, the beautiful maiden who was betrothed to Tupurupuru.	Saunders, 1972
Lake Onoke, Wairarapa	Pupu-karekawa is said to have been a taniwha that occasionally caused the Onoke Lake at Palliser Bay to break bounds and roll seaward.	Best, 1976
Cook Strait	"A form of charm was employed when it was desired to put an end to bad weather. But if storms could be calmed by the Maori tohunga, they could also be raised by him, and we encounter many incidents of this nature in old narratives. Thus in the tale of Hinepopo we are told that a violent storm was raised by magic arts in Cook Strait in the long ago, and this was done for the purpose of punishing a faithless husband. In this case justice seems to have overshot the mark, in as much as about a hundred innocent persons were drowned in order to make sure of the guilty one".	Buck (Te Rangi Hiroa), 1977 Taylor, 1870

	A Monster cuttle fish in Cook Strait used to pull canoes under water.	
Oterongo Bay, Cook Strait	A taniwha or ngarara lived here. Whenever a traveller lit a fire here the monster came up from the sea and put it out. Immediately after this a great tonga or south-east gale blew in (Ngati iri) (refer also to Storm surge and Tsunami section).	Adkin, 1959
Collingwood, Tasman District	A particularly powerful taniwha was Te Kai-Whakaruaki who lived in the Parapara Stream at Collingwood. He was known to kill large numbers of travellers at a time.	Reed, 1963
Cloudy Bay, Marlborough	At Karauripe (Cloudy Bay) there was once a taniwha named Ngarara Huarau who was responsible for the deaths of many inhabitants of nearby villages and settlements. According to Whakapapa this took place some 15-16 generations ago. The taniwha's main weapons were his thrashing tail and corrosive urine. He was eventually killed It is not known how the taniwha came from the cove at Wainui Bay over at Nelson.	Mitchell and Mitchell, 2004
Raikaia Gorge, Canterbury	A taniwha lived at the gorge (Fighting Hill). When he went away to get warm a devil disguised as a NW wind flattened its home So the taniwha build a pile of boulders in the way to stop it and now the two get hot fighting (wind) over the area.	Taylor, 1952
Oaro, Canterbury	Oaro Creek: A taniwha used to live here. At full water the creek used to shoot up and down in a dangerous way indicating that the taniwha was there.	Beattie, 1994b
Te Anau, West Coast	Te Anau was once a spring that one day welled up following the clandestine approach of a tohungas wife and secret lover. The spring overwhelmed a village and its people and filled the adjoining valleys until a huge lake was formed.	McCraw, 1993b
Taieri River, Otago	A winding part of the river called Te Rua-taniwha (Maori Leap?) was said to be haunted by a Karara (taniwha), children were told "don't go there – that is where the taepo (taniwha) dwells" They went and shouted for it to come out – a fearsome thing like a shark came out of a hole in the bank and began throwing water in the air with its tail. They fled. The story consists of exploits of Mere-Mere, a taniwha who was a guardian and pet of Te Rakitauneke, chief of Ngatimoemoe. The taniwha lost	Beattie, 1919 http://wwwtextiles orgnz /betty/wool/ taniwha

	its master in the hills around Dunedin and in searching frantically found itself at Whare Flat. It turned round and round creating the flat and eventually found its way through the hills down what is now known as Silverstream to Mosgiel. Somewhere on the trip it made a hollow, called by the Maoris "Waipotaka" or "turning around and round at midnight". At Mosgiel the taniwha was tired and made an even bigger hollow "Te-kokika-o-te Mata-Mata" or "Mata-Mata's crawl". This is where Mosgiel now lies. From there it wriggled down the Taieri Plain and followed the course of the river for a few miles below Allanton, forming the tortuous reach known by the Maoris as "Te Rua-Taniwha" - "The Monster's Lair". Finally poor Mere-Mere, completely worn out and heartbroken at the loss of his master, writhed and stretched at full length across what was then the Taieri coastal plain and became the coastal range, Saddle Hill being his head.	/legend.html
Clutha River, Otago	A karara or taniwha lived of the Mataau River (Clutha) and was called Kopowai. It captured a girl called Kaiamio who escaped and it tried to drink the Kawarau River dry to catch her.	Beattie, 1919
Port Molyneux, Otago	Merehau was a tohuka who lived in Port Molyneux and if offended could upset canoes which were out at sea.	Beattie, 1919
Invercargill, Southland	Te Rapuwai or Nga ai tanga a te Puhirere succeeded the Kahui Tipua and rapidly spread themselves over the greater part of the [South] island. They left traces of their occupation in the shell heaps found both along the coast and far inland. It was in their time that the country around Invercargill is said to have to have been submerged, the forests of Canterbury and Otago destroyed by fire, and the moa exterminated.	Stack, 1877
Southland	We have a doubtful account of a widespread deluge and a well established story of what seems to have been a local catastrophe; the latter is just such a tale as might have been evolved after the occurrence of a devastating tidal wave… In Parewhenuamea, we have the origin and personified form of water…and her name is connected with floods, mythical and otherwise. In recorded data we note references to a catastrophe that occurred in time primeval and is known as the Hurihanga-a-Mataaho (overturning of/by Mataaho). One version has it that the saying Hurihanga-a-Mataaho denotes the separation of the primal parents Rangi and Papa, but it is the	Best, 1976

	overturning of the earth mother that is meant, and that gave rise to the saying. Another version of this colossal turning act describes Mataaho connected with Whakaraumoko in his volcanic activities overturning and arranging the head and limbs of Papa that she might lie in a proper and seemly manner. Best also describes the text by Mr White who gives an account of a deluge described by South Island Maori This deluge is said to have been brought about by Parawhenuamea and one Tupu-nui-a-uta. White also describes another catastrophe as a Hurihanga of the land, possibly meaning overwhelming or overturning. No location is provided. At some time in the mythical period, a great flood occurred which received the name 'Parewhenuamea'. White has recorded a curiously detailed account of this event derived from a Ngai Tahu source. It states that as men multiplied into many tribes, they forgot to worship Tane, and evil prevailed everywhere Parewhenua and his father were righteous men who tried to keep up the worship of Tane but the people jeered at and cursed them. They saw it was hopeless so they felled a totara and a kahikitea and made a raft (moki). On it they put fern root, sweet potato and dogs. They prayed for rain to convince the people of the power of Tane It rained for four or five days and the waters rose so that the raft was floated away on the river Tohinga. All the men, women and children who had denied the doctrines of Tane were drowned. The raft floated for about eight months before the waters subsided (n.b. Parawhenua is also a Maori word for "tidal wave" – Goff et al, 2003).	Buck (Te Rangi Hiroa), 1977

Storm surge & Tsunami

Location	Event	Reference
Hokianga, North Auckland	Nuku-tawhiti successfully called a mountainous wave ashore to rescue a whale	Smith, 1896
Kaipara Harbour, Auckland	The story of the Mahuhu canoe – eventually landed at the mouth of the Kaipara at a place named Taporapora People dwelt there for many years but eventually the place was shaved off by the sea and the land disappeared with the Whare-kura, atuas, and tikis – "all were carried away by the sea" (refer also to Storm, Floods and Landslides section). One account from holders of traditional knowledge record the inundation event that caused the destruction of Taporapora was 'a meteorite that came from the south-east'.	Smith, 1896 Parnell, 2004
Manukau Harbour, Auckland	Kaiwhare: is a taniwha that caused trouble (even death) for Maori who canoeing on the Manukau Harbour. Te rua o Kaiwhare (the blowhole at Piha) was one of his lairs Kaiwhare is known to set up swell which can have the effect of a small tidal wave as it reaches the shore. Several such surges have been experienced at Huia Bay where unexpecting people have been doused in water. This is not unusual on the calm waters of the Manukau. According to a local newspaper in 1844 a much larger surge occurred. It states that the waters of the Manukau Harbour flooded the grounds and washed into the Mission House at Orua Bay – on the opposite side of the harbour to Huia. In less than 30 minutes all household goods and furniture were saturated with sea water and the well water rendered unusable for human consumption for many months.	Diamond and Hayward, 1979
Motiti Island, Bay of Plenty	Three successive waves struck the beach and ran up to the cliffs, drowning a fisherman and scouring the beach.	Grace, 2003
Maketu/ Motiti, Bay of Plenty	Manaia attacked Nga toro rangi (and his sisters) but with his canoes offshore in the evening, Nga toro rangi said why not attack in the morning, I cannot be killed at night anyway. During the night Nga toro rangi and his sisters uttered spells and created a tempest/hurricane/tsunami that destroyed the whole of Manaia's fleet – all died.	Taylor, 1870

Parawhenua-mea, Bay of Plenty	Story of a tidal wave: Tikao talks of the story of Paikea and a large coastal flood that took place at Parawhenuamea (or possibly Southland).	Beattie, 1990
East Coast	Rua-tapu sent ashore a big wave that drowned many people. Paikea and his family and friends, fore-warned, climb Hikurangi and escape.	Tregear, 1904; Smith, 1910; Beattie, 1994b
East Coast (+ Canterbury, Taranaki)	Ruatapu, was angered by his father Uenuku referring to him as "unchiefly". In revenge he took a canoe full of all the sons of highborn chiefs out of sight of land and drowned them. He saved one, his half-brother Paikea, who swam back to shore after Ruatapu had told him that on a particular day he would send a large wave to drown everybody who had not sought refuge in the hills. When these events unfolder Paikea, his family and friends survived by seeking refuge in the hills and all the rest were drowned. The wave was called Te Tai a Ruatapu. Similar accounts of this story have been recorded in several other parts of New Zealand such as Canterbury and Taranaki.	Colenso, 1881
Ruatapu – Hikurangi, East Cape	Ruatapu was a mighty chief from Hawaii who sought revenge for humiliation suffered at the words of his father about a comb owned by his elder brother. He drilled a hole in a canoe and revealed his deed to others when out at sea. All perished save himself and Paikea. This deed left Ruatapu still dissatisfied. He warned Paikea of his intention to make others on land suffer. Later by incantations he caused the waters of the ocean to rise "With an immense sweeping rush – a tidal wave – on came the billow, carrying everything before them like sticks and straw, overwhelming the land, covering high hills and drowning every living creature – some few who succeeded in making their escape to the lofty peaks of Hikurangi being alone left to tell the tale".	Izet, 1904
Kawhia, west Waikato coast	Taniwha named Rakei-mata-taniwha-rau drove the ocean up the cliffs. The taniwha Rapa-roa lived in a cave at the base of some cliffs around Kawhia Harbour about 15 generations before 1900 AD. The taniwha used to create large waves that inundated Haumia's clifftop garden year after year. Haumia finally killed the taniwha earning the name, Rapa-roa-whakatere-taniwha.	Tregear, 1904 Smith, 1910

	A story tells of the taniwha slayer Haumia of the Kawhia region some three centuries ago where he was annoyed by the pranks of a taniwha named Raparoa, who caused the ocean to surge and overwhelm and destroy the crops of Haumia.	Best, 1976
Okato, Taranaki Okato and Stoney Creek, Taranaki	This name relates to a tsunami that inundated the coast causing much loss of life and communities. Reports on the story of a huge wave of water which caused such destruction "many years ago", the story of which the Maori hand down by word of mouth. This is in the Okato and Stoney Creek area where the wave went over a stone pah destroying everything including over 100 Maoris.	Skinner, 1965 Andrews, 1997
Between Waitara and Cape Egmont, Taranaki coast	The Coming of the Sand – S of Cape Egmont between Tipoko and Waitaha: Potiki-roa returned to Taranaki and brought with him Mango-huruhuru and his daughters. M-H built his house on low land near the sea, Potiki-roa built his about 1/8 mile further inland. M-H thought the landing place/beach was inconvenient and rocky so to improve his beach he went up on the top of his house and chanted a karakia (in full in Smith, 1910). On conclusion the dark cloud with its burden of sand reached the shore. The women called out "A! The sea rises; the waves and the sand will overwhelm us". In a moment the storm was upon them…… The people fell where they stood and were buried in the sand, the house and cultivations and all surrounding country were buried deep in sand, and with them, the old priest and his youngest daughter (turned into a rock which stands there today). Potiki-roa and his wife escaped the disaster because their home was further inland and on higher ground. Over 100 people were killed and their bones are still there today. Genealogically this occurred about 1500AD.	Smith, 1910
S Taranaki	Puketapu (midway between Manaia and Opunake): When preparing for a fishing trip near Cape Egmont one paddler moved Moke-uhi's (a tohunga) fishing gear. He was upset and refused to go out fishing and instead he angrily called up a massive southerly storm/tidal wave – all the canoes were lost except for one with one person left alive in that went to Urenui, and one with one person alive in it that went to Motupipi, Tasman Bay.	Smith, 1910
Taranaki coast	Matakawa calamity, probably a wave, destroys Maori fishing fleet, and causes damage and destruction to	Skinner, 1965

	gardens and villages.	
Warea, Taranaki coast	An earthquake damaged the Mission station and huge waves smashed up Maori ships (1800's).	Greenwood, 1967
Taranaki Coast	a) Two strange canoes arrived on the coast, blown there by a storm, one with 2 daughters of a god in it (the other had their servants), they were treated very well and when they returned home the god was happy and asked his daughters what he could give the people – they told him "sand for the coast". So he sent a large canoe full of sand for their beaches and to make dunes with (variation of Coming of the Sand above). b) An old priest found the stones of the Taranaki coast hurt his feet and so in anger he uttered a spell and sand was immediately blown up onto the coast (variation of Coming of the Sand above).	Taylor, 1870
Whanganui River, Manawatu	Tutae-poroporo, a taniwha, is said to have lived in the river at the Taumaha-aute (Shakespeare Cliff) where he intercepted and swallowed canoes passing up and down the river sending a great wave rolling before him.	Best, 1976
Otaki, Wellington	"When Manaia and Nuku landed at Paekakariki after their memorable sea fight off Pukerua, it was arranged that their quarrel should be settled the following day by means of single combat. That night, however, Te Aowhaingaroa seems to have taken advantage of his powers as a wizard to detroy his enemies by magic arts; he was the tohunga of Tokomaru, the vessel of Manaia. By means of his dread powers he raised such a terrific storm that most of Nukus companions perished. *So severe was the gale that sand and gravel were carried far inland from the sea beach, such having been the origin of the sand hills now seen along the coastline towards Otaki* (possible tsunami geomorphology). Hence the stretch of coastline received the name of Te One-ahuahu-a-Manaia" (refer also to Storm Surge and Tsunami section). The fierce south wind – Tahu-parawera-nui arose. "Then from the Anaputu hard by Pukerua to the Uruti and Otaki the very foundations of the roaring sea were torn up, sand and gravel were hurled ashore, in prodigious quantities, hence the long extent of sand hills now seen along that coastline".	Best, 1976
Wellington	A large earthquake called the Haowhenua raised	Best, 1918

	Miramar Island and joined it to mainland, and probably causes a large tsunami. This was dated to about 18 generations prior to 1900, about AD 1460. Local geological evidence supports an uplift in the area (refer also to Earthquakes section). Best was suspicious of the name of Hao-whenua earthquake, because he thought it meant the "Land-swallower" but it can also mean "to sweep the land clean" and likely relates to the tsunami generated by the earthquake (refer also to Earthquakes section).	Goff and McFadgen, 2003
Oterongo Bay, Cook Strait	A taniwha or ngarara lived here. Whenever a traveller lit a fire here the monster came up from the sea and put it out. Immediately after this a great tonga or south-east gale blew in (Ngati iri) (refer also to Wind section).	Adkin, 1959
D'Urville Island, Tasman Bay	A tsunami called Tapu-arero-utuutu drowned nearly all people living around Greville Harbour, piling the bodies into the sand dunes. There are many other stories pertaining to taniwha named Te Ngarara-huarau. One such story was told by Te Whetu of Te Atiawa – who describes the folk of Ngai-Tarapounamu who settled the isle of D'Urville Island (known as Rangitoto to Maori). An apparent breach of tapu by a local woman led to the gods stirring up the deep ocean and causing great waves to sweep away an encampment of people where the erring woman was living – all perished in the upheaval, although other hamlets escaped.	Mitchell and Mitchell, 2004 Best, 1976
Taihoa Pt, Croiselles, Tasman District	A taniwha called Rapahoe used to live in Lake Kaiaua (on the coast) – but after a while there were so few people that it died, but the area is still a dangerous place to go to.	Beattie, 1994b
Colling-wood, Golden Bay	Te Kai-whaka-ruaki was a taniwha that occupied the Parapara Stream at the coast near Coillingwood. It ate many men until Poturu a famous seal hunter (and 340 men) killed it.	Tregear, 1904
Lake Grassmere/ Wairau Marl-borough	There was a taniwha that lived in a cave at Cape Stephens (a similar story places a taniwha a Wairau). It attacked people travelling along the coast between Cape Stephens and the Wairau River. It would attack and eat groups of all sizes, up to several hundred people at a time. It would wait until the group was on	Tau, nd

	the spit at which time it would rush out of its cave and attack them in the form of a large tidal wave which would wash them into the lagoon behind where they drowned. It could then eat them when it wished. The taniwha was eventually killed by a great warrior who made the coast safe for subsequent travellers. A Taniwha waited for people to start crossing the Wairau Bar and then came out of the sea and rushed at them in the form of a tidal wave. Once it was subdued then people could return to the land again in safety. Kupe (of the Matahourua canoe) created Lake Grassmere and the Wairau Lagoons when he made the sea to rise up and wash over Haumia's lands and gardens. When Kupe sailed around near Cape Campbell, he took revenge on people in the area and turned the sea in on their crops, thus creating Lake Grassmere. At the same time he caused an island, called Titipua, off Cape Campbell to sink (earthquake?).	Carrington, 1934 Mitchell and Mitchell, 2004; Stack, 1877 Elvy, 1950
Lyell Creek, Kaikoura	Taniwha waits for people to cross spit between sea and lagoon at stream mouth, and then eats them.	Elvy, 1950
Oaro, Kaikoura	Two girls were collecting berries near the sea, one was eaten by a taniwha in the guise of a large wave, then spat back later on the shore dead. Two girls walked from Omihi (Stream) to Oaro (River) to pick berries. They were so engrossed in this work that they did not notice that the taniwha has risen up and completed surrounded them by water – at the last minute one girl jumped to safety but the other was "eaten". Later on the dead girl was thrown back on to the shore (also refer to *Kaikoura Historical Society, 1998*).	Sherrard, 1966 Carrington, 1934
Moeraki, Otago	The sea god Takaloa masquerading as a whale spouted water over the hillside polluting the freshwater springs with salt. Rakitauneke was a famous tohuka of old, and had a guardian whale Tu-te-raki-hua-noa, and also sometimes one called Matamata. One day the former whale appeared off Moeraki and the children cursed it, and its owner in anger sent a tidal wave which drowned them. The creek they were standing by had been fresh water till then but it has been brackish ever	K. Hulme, pers comm, 2006 Beattie, 1919

	since. Its name is Ka-wa. A tohuka brought up lots of fish for the people because they wanted food but they said there were too many so he called up Ruatapu (a tidal wave) who sent a big sea and washed the fish off.	Beattie, 1994b
Kaka Point, Otago	A demon fish lived here. A child fell into a coastal lake nearby (Lake Kaitiria) and it was felt that the demon had got it so they called the place Kai-takata.	Beattie, 1919
Open Bay Islands, South Westland	A taniwha lived around the rocks.	Beattie, 1994b
Lake Wakatipu, Queenstown	There are often different legends to account for the origin of prominent features. Interestingly, the rising and falling of the water in Lake Wakatipu has been explained by the beating heart of an evil giant that although killed because of his liking for capturing young women, continues to cause the lake water to rise and fall by a few centimetres every few minutes. A group of scientists established the rising and falling was due to a 'seiche' – up and down movement of the whole the water caused by oscillation of the whole water body due to the northwest wind pushing water towards the southern end, which back when the wind stops continuing to slosh back and forwards with gradually diminishing movement until the next wind storm accelerates this process again (seiche placed under tsunami section).	McCraw, 1993b
Ruapuke Island, Southland	The Wai-o-tokarire lagoon has a taniwha in it – the place is still regarded with awe and was tapu for a long time.	Beattie, 1919
Orawia, Southland *	Near some rocks can be seen the petrified remains of a karara/taniwha. It killed men out hunting wekas and chased a man called Taiari. He ran to escape it and it became trapped between two trees and was killed. Another account says that the karara lived on the west side of Bald Hill.	Beattie, 1919
Orepuki/ Waiau, Southland (+ Fortrose)	According to Maori tradition, 1820 or thereabouts, was a year of great disturbances, earthquakes in the north and tidal waves in the south. A great tidal wave swept over Orepuki and many hundreds of Ngati Mamoe were drowned where it was a custom to meet at the mouth of the Waiau River to catch fish for the winter. A similar "adventure" is also recorded from an area beyond Fortrose. A great wave (Tai-koko) sweeps away people of Te-	Saunders, ca 1936 Beattie, 1915

	Manu-o-te-Rapuwai travelling along the beach near the Waiau River. Pahia – near Orepuki This used to be a large pa. There is a tradition of the catastrophe of the great tidal wave which overwhelmed a whole tribe at Kaitangata Point (note similarity to Beattie story for Kaitangata by Clutha River) while they were travelling along the beach between Orepuki and Waiau Beach. This seems to have occurred after a large battle between northern and southern Maori. The country around Invercargill was inundated during the time of Te Rapuwai.	Smith, 2003 Stack, 1877
Te Wae-Wae Bay, Southland	"When Tamatea and his crew lay opposite Waiau between the White Cliff (west of Te Wae-Wae Bay) and Wai-tangi, his tohunga Rua-wharo and Te Tu-rongo-pa-tahi (Uenuku's grandson) said, "This place will do, we will turn in here". So the Taki-tumu canoe was turned, but as they paddled in to the shore, lo, she stuck fast on a sand bank, and the united efforts of all of the crew could not get her off. When Tamatea found himself in this plight he became very angry, and cried out to Rua-wharo, "What do you mean by this, have you brought me here to drown me?" Rua-wharo also grew angry, and standing up he called to the sea to rise to his help. Immediately a great tidal wave came to his assistance; the canoe was lifted right into the river, where they all held her fast, while the scour back of the great wave made that river the deepest in Aotea-roa.	Downes, 1914
Takitimu Mountains, Southland (+ Gore, Otago)	The Takitimu canoe is said to have been wrecked in Foveaux Strait and the Takitimu Mountains were named in memory. There are two stories: The Takitimu canoe had run down the east coast till just below the Otago Peninsula, when she ran off a great wave which the legends says is represented by the Mauka-atua (now called Maungatua) range. The canoe ran off this sea and broached-to and dropped her tata (bailer) which turned into rock, and now is the Hokanui hill near Gore. Then the other wave (represented by the Okaka ridge west of the Waiau River) struck her and she upset, and there she lies as the Takitimu Mountains. When the first wave struck her one of the crew named Aonui was washed overboard, and being turned into stone, still stands on the Tokomairaro beach as the tall basaltic pillar known as Cook's head.	Beattie, 1915

	At the time Southland was under the sea, with Bluff Hill being an island, and the sea was at the foot of the Hokanui Hills. The canoe had come around the coast and was somewhere near where Gore is when disaster overtook her. The first wave struck her unexpectedly, and she dropped her bailer right on the spot, and then two more seas completed the disaster. These three waves are now represented by ridges; Okaka is "The Hump" at Waiau Rive, Oroko (Orokoroko) is the southern portion of the Hokanui Hills, O-te-wao is "a ridge up Oreti river way". The Takitimu canoe was wrecked by three waves: O-te-wao, Oroko, Okaka. Three ridges in the landscape bearing the three names commemorate the event.	Beattie, 1915
Foveaux Strait, Southland	A famous shark/taniwha "Kaitiaki-o-tukete" lived in Foveaux Strait.	Beattie, 1994b
???	"The people who broke the laws of tapu were often dragged into the water (by a taniwha) and drowned by them, but those who respected them were usually safe".	Orbell, 1985
???	The Maori explanation for the occurrence of tides was due to the powerful and regular respiration and regurgitation of water by a huge ocean monster named Parata: which is commonly used figuratively and proverbially for anyone unexpectedly meeting with great trouble that such a person has "fallen into the great throat of Parata".	Colenso, 1889
Location unknown.	Tinirau uttered great spells to bring fish to his wife's destitute village – a great rushing sound was heard at night (they all had their doors closed as instructed). In the morning all inside the pa was filled up with fish.	Taylor, 1870
???	"…the sea grew dark and troubled and angry, and presently a great wave, which gathered strength as it came, swept towards the shore. It advanced over the beach, sweeping Titipa and all his fish before it till with the noise of thunder it struck the cliff on which the people stood……The great wave receded, sucking with it innumerable boulders and the helpless, struggling Titipa. Then another wave, greater than the previous one, came with tremendous force and, sweeping the shore, struck the cliff with a thunderous roar. This was followed by a third which, when it receded, left the beach scoured and bare Titipa and all	Grace, 2003

	his fish had disappeared." The description of these waves is like that of a tsunami.	

Earthquakes

Location	Event	Reference
Mt Maunganui, Tauranga	"A brief Kahungunu note contains a statement that the Ru a Mahutaonga or earthquake of Mahutonga is said to have been the name of a very severe earthquake that destroyed much land at the island of Rangiatea, and states that many tribes occupied that land in remote times. A dreadful earthquake caused a large area of land to disappear into ocean depths, and many people perished, whole tribes were lost. A numerous people known as Ngati Kaiperu so perished, leaving no survivors. It was the western area of Rangiatea that disappeared, and on it stood a great mountain named Maunganui. That mountain was shattered and engulfed in the ocean, it had been there before, when its 'parapara' (ejecta) was deposited in the ocean, but the final explosion was a terrific one and that part of Rangiatea known as Whaingaroa disappeared forever.	Best, 1976
Waihou, Waikato	The area was hit by an earthquake in 1600 or so and parts of the Hauraki Gulf subsided. In response many Waihou people raised their settlements up on shell mounds, and above ground storehouses and platforms were constructed.	Phillips, 2000
Rotorua/ Taupo area	Motu-a-tara: In the middle of Lake Rotoma there once was an island that supported quite a village but it disappeared into the lake many generations ago because the people there offended a tohunga. He began to curse…until a grinding, dull, faraway sound began to come from below. All about them the water was hissing and foaming and soon the island began to heave and sway. Their houses and fences tumbled over and slowly amid all the confusion their island began to sink into the lake. The lost isle of Rotoma as told by the Awa folk: Some five or six generations ago the isle of Motutara in the lake known as Rotoma became lost to the world following the call of a taniwha to destroy the land. There occurred such a storm as man had never seen at Rotoma, amid the roar of terrific thunder *and the terrible motion of the reeling earth* the isle of Motutara sank below the waters of the lake. So, perished the inhabitants of Motutara. A somewhat similar tale refers to the lost village at	Stafford, 1999 Best, 1976

	Ohinemutu, Rotorua, where a few massive posts are still seen projecting above the lake waters, these are all that remain of the drowned village. Two different taniwha seem to claim the honour of having destroyed the lakeside pa, their names being Te Ihi and *Hurukareao*. Here there is probably some confusion of names, for Ko*hurukareao* is given as the name of a village at Taupo destroyed by Te Ihi. That is, two (maybe four) fortified villages named Kohuru-kareao and Whakao-hoka were destroyed by Te Ihi and subsequently they sank into the depths of Lake Taupo. According to Te Hueheu Tukino the taniwha Hurukareao destroyed the pa at Ohinemutu. Evidently this submergence of the village was *caused by one of the minor land movements* of which there must have been many in the district. "The story concerning the part taken by Hurukareao is an origin myth evolved in order to account for the occurrence (refer also to Storms, Floods and Landslides section).	
Wellington	Wellington: The Hao-whenua earthquake (the land swallower) story occurred in the time of Te Ao-hare-tahi, about 18 generations ago. Hao whenua: Great earthquake which occurred in the time of Te Ao haere tahi. It was said to be the final factor in the conversion of Motukainga into a peninsula (Miramar). The name suggests the configuration of new land. A large earthquake called the Haowhenua raised Miramar Island and joined it to mainland, and probably causes a large tsunami. This was dated to about 18 generations prior to 1900, about AD 1460. Local geological evidence supports an uplift in the area (refer also to Storm surge and Tsunami section). Best was suspicious of the name of Hao-whenua earthquake, because he thought it meant the "Land-swallower" but it can also mean "to sweep the land clean" and likely relates to the tsunami generated by the EQ (refer also to Storm surge and Tsunami section).	Best, 1918 Adkin, 1959 Best, 1918 Goff et al., 2003
Charlton, Otago	A man on an eeling trip near at Whareoka (near Charlton) experienced a violent earthquake and thought that the taepo was around. This was somewhere near the Otama and Otama-iti lagoons.	Beattie, 1919
South Riverton,	South Riverton was once an island. A great earthquake struck and drove the sea back. In the	Beattie, 1994

Southland	mountains to the north of the Waimea Plains water spouted 2 miles into the air through a hole in the base of Lake Wakatipu. Now the Ararima River flows only to one side of the Purupurukene River.	

Volcanic eruption

Location	Event	Reference
Lake Omapere, near Kaikohe	"Lake Omapere near Kaikohe: Five villages lay on a fertile plain with a forest nearby. A thirsty chief not wishing to be seen drawing water at the public spring, sneaked off to dig a well for himself. To his amazement flames shot out and quickly set fire to the forest and the villages. As the flames died down water gushed from the hole and quickly covered the plain, the remains of the villages and the forest with a broad, shallow lake. So was formed Lake Omapere." (The legend describes a volcanic eruption which was then followed by the filling of the lake Omapere is a shallow lake with submerged tree stumps and logs. It was formed when lava damned the Waitangi River valley. Water ponded behind the dam until a new outlet was found which now drains westwards into Hokianga Harbour. Although the legend may appear to be describing the actual event, the lava flow has been dated at more than 80ka BP. However, the lake has drained and reformed a number of times, with the present lake forming only about 100 years ago).	McCraw, 1993b
Southwest of Te Awamutu	The Battle of the Mountains: Southwest of Te Awamutu there is a lonely mountain, a landmark in the district, called Kakepuku. He was given his name by Rakataura, the priest of the Tainui canoe. This mountain was not where he is now; he came from the south looking for his father. When he reached the Waipu plains, he saw the soft round form of Kawa, the female mountain, standing a little to the south. He loved Kawa, but he had rivals in Puketarata and Karewa. These two resented Kakepuke's coming and they tried to get rid of him, especially when they saw that Kawa favoured him. Puketarata, small and unshapely, was soon defeated, but Karewa fought fiercely. The two rivals hurled molten rocks and streams of liquid at each other; the earth shook and the heavens trembled. Even today the countryside is covered with some of the huge boulders they threw. Finally Kakepuku won and Karewa withdrew. He uprooted himself in the night and retreated to the west, pursued by the flaming rocks hurled by his victorious rival. He ran all night, but was stopped by the first rays of the morning sun. He settled down in the Tasman Sea off Kawhia Harbour and his name is now Gannet Island.	Anon, 1957

Mount Tarawera, Bay of Plenty	Tare Wetere te Kahu of Otakou considered that the great fish of Maui (North Island) became restive and shook itself with a result that a scale had flown out through Mount Tarawera thus creating the eruption of 1886.	Beattie, 1919

Multiple hazards

Location	Event	Reference
East Coast, North island	A giant taniwha named Ngarara Huarau lived in a cave at Makorotai on the Heretaunga Plains (Hawke Bay). He was lonely and tired of living by himself in a cave so he decided to visit his sister Parikawhiti in the Wairarapa. With a great roar he came out of his cave and, with his mighty talons, split the land open leaving a huge chasm (*Landslide/Volcanic eruption*?). In doing this some of his scales fell off and became Tuatara. Setting out for the ocean he burst the land open and cut a big channel. This channel and the chasm filled with water and became the Tiraumea River (*Flood*?). Arriving at the great ocean of Kiwa he began his journey south to the Wairarapa. On his way he stopped at every river, lifting his head up high (big waves) and sniffing to see if he could smell his sister (*Storms/Tsunamis*?) On arriving at the mouth of the Pahaoa River he swam up into the Wainuioru River and finally the Marumaru stream. When he reached the far side of the Maungaraki hills behind Gladstone he was stopped by a very high steep hill. He tried to jump to the top of the hill, but he kept slipping back (E*arthquakes/Landslides*?). Later, he moved on down into the Kourarau Valley where he made a lair among the Kahikatea trees. From there he finally reached sister Parikawhiti, who lived in a cave in the side of the hill at a place near the present Gladstone Hotel. This place is named Te Ana o Parikawhiti. He terrorised the local people and also raided further afield. A young warrior called Tupurupuru, who lived in a nearby pa took it upon himself to kill this beast by setting a trap. With a great roar the taniwha rushed out of his lair thrashing his tail about (*Floods*?). Ngarara Huarau managed to survive the brutal attack only to be driven into the swamp at Uwhiroa where he later drowned	http://wwwtkiorg nz/r/maori/nga _purakau_maori/ ngake.ephp

Appendix 2: Place names

The place names below are grouped by region and follow the regional division's current in New Zealand as established by the 1991 Local Government Act. Interpretations of the place names below are derived from the reference author.

Northland and Auckland Region

Place name	Meaning	Location	Reference
Haukapua	Known as Torpedo Bay, its translation here is given as 'wind scoop'. The area caught the easterly sea winds and gave shelter to inner harbour waters 'Cloud bank carried above the wind'	Torpedo Bay. A beach at North Head	Graham, 1980 Simmons, 1979a
Haupapa	Flat wind	Haupapa Point, South Auckland,	Reed, 1975
Hauturu	Wind standing up The standing wind 'Resting place of lingering breeze'. Toi observed a cloud over the summit of the mountain which stands at its highest peak at 722m	Little barrier Island	Graham, 1980 Simmons, 1979b Turoa, 2000
Horotiu	Crumbling away'. This was formerly a pa site Crumbling away	South Auckland	Graham, 1980 Simmons, 1979b
Kaiwaka	Refers to a long band of dark cloud, which sometimes forms towards sunset above the western horizon, effectively diverting the shafts of light from the waters close to the shore	Kaiwaka, North of Wellsford.	Diamond and Hayward, 1979
Kamo	To bubble up. Descriptive of the hot springs	Northland	Reed, 1975
Kohunui	This bay is often filled with a thick mist (kohunui) which becomes trapped in the bay during stormy	aka North Piha	Diamond and Hayward,

	weather by the steep surrounding hills		1979
Kororipo	Eddy	Panmure Basin	Simmons, 1979b
Mangapai	Stream of good water	A district in North Auckland (also the name of a river in North Auckland and a stream in South Auckland)	Reed, 1975
Matangi	Breeze	A district in South Auckland (and also Otago)	Reed, 1975
Matangirau	Wind among the trees	A North Auckland district	Reed, 1975
Matarangi	"Weather point" now called South Redhead point.	A South Auckland district	Ashwell, 1998
Maungapohatu	Rocky mountain	Northland	Reed, 1975
Moanataiari	The stormy ocean	Name of stream in South Auckland	Reed, 1975
Motukoreha (Browns Is.)	Island sinking out of sight – in certain weather conditions the low lands disappear or appear above the sea = signs of an easterly. Another name = Motutohuhau "the island indicating the weather to come"	Hauraki Gulf, Auckland	Simmons, 1979b
Motutohuhau	Island indicating the wind to come, a pa of Ngati Paoa	Motukorea	Graham, 1980
Ohaeawai	Place of thermal water	Northland	Reed, 1975
Okaka	The second of the great waves	Northland	Davis et al., 1990
Onetapu	Sacred sand	Kawhia	Reed, 1975
Ōpaheke	Place where slip occurred	South of Auckland	Reed, 1975
Oratia	Place where the sun shines brightly	West Auckland	Diamond and Hayward, 1979
Panguru	Rumbling sound	North Auckland	Reed, 1975

Paringawhana or Paringawhara	Crumbling cliffs of foreshore	North end of Narrow neck beach	Graham, 1980 Simmons, 1979b
Puhoi	Slow water; referring to the tide slowly creeping up the river to make it navigable for canoes	North of Waiwera, Auckland	Reed, 1975
Pukekohe	Hill of mists, misty hill	Auckland	Davis et al., 1990
Pukematekeo	Frosty hill or hill of frosts	North Auckland	Davis et al., 1990
Punakītere	Swiftly flowing spring	Hokianga	Reed, 1975
Rangiriri	'Stormy sky'	South Auckland	Vangioni et al., 1970
Rongohau	Nook sheltered from the wind	Kendall's Bay, Kauri Point	Simmons, 1979b
Taiharapaki or Taiharapapaki	Sea beaten cliff front	Orakei Wharf to Mission Bay	Simmons, 1979b
Taiharuru	Thundering sea	Whangarei	Reed, 1975
Taipuha	Very high tide	South of Whangarei	Reed, 1975
Taniwhanui Point	Place of the large taniwha	Waiheke Is.	Beattie, 1915
Te Araiatiriti	The wind shelter of Tiriti	A bay about half way up Paremoremo Creek	Simmons, 1979b
Te horohoro or Te Hororoa	'The long land-slip'. A place east of Pt. Britomart. It is an area of a pa that slipped away and many people perished. Perhaps a tohu (indicator) pre warning a disaster. The slip happened prior to the invasion by Ngati Whatua. A place which rapidly washed away and formed a cave	South Auckland district	Graham, 1980 Simmons, 1979b
Te Ihu a Mataoho	'Nose of Mataoho'. Mataoho was a giant (god of earthquakes) who invoked the gods to send subterranean fires for his comfort. This resulted in many topographical features of the country side. The hill is said to be	Ihumatao Mangere, Auckland	Graham, 1980

	Mataoho's nose and all earth seismic phenomena are called 'nga huringa o Mataoho' 'turnings of Mataoho'		
Te Kohuwai	'Misty sea'. Kohuwai is a Maori name for green moss/seaweed which covers the rocks and stones in sheltered places	South Head, Northland	Vangioni et al., 1970
Tiritiri Matangi	Blown in the wind – the island appears to move and appear in different places	North Island	Simmons, 1979b
Wairoria	The whirlpool or swirling waters – referring to a strong rip tide	West of Kauri Pt.	Simmons, 1979b
Whangateau	Channel with a strong current	Auckland	Davis et al., 1990
Whatipu	Whatipu has been spelt this way on most maps since early European times. However, it is said that Waitipua (meaning sea monsters – namely Haumai, Kaiwhare, and Paikea) frequented the sheltered bay inside Paratutae Island and the name for the area was Waitipua	West Auckland	Diamond and Hayward, 1979

Waikato Region

Place name	Meaning	Location	Reference
Hauraki	The North West wind (Hauraki is really the name for the present settlement of Thames)	Thames	Simmons, 1979a
Kohukohunui	'The great misty mountain'. It is the highest peak in the Hunua Ranges and is associated with Ngati Whanaunga. Kohukohunui is also a poukingi, which is a mountain set aside as a 'support' for the King movement	Hunua Ranges	Turoa, 2000
Mangakino	Dangerous stream	Mangakino	Davis et al., 1990
Moanataiari	The stormy ocean	Thames	Reed, 1975
Ngataiparirua	The twice flooding tide	Between Mokau and Mohakatino	Phillips, 1995
Ngāuruhoe:	There are two literal translations; One is based on the story that Ngatoroirangi threw his grandson Hoe into the crater, and the plumes of smoke represent hi hair. Nga (the) uru (hairs) Hoe - The hairs of Hoe. The other gives meaning as nga uru (the act of arranging hot stones in a hangi) hoe (to toss out). When the mountain is erupting it tosses out hot stones	Ngauruhoe, Taupo	Reed, 1975
Nukuhau	'shifting winds'	Located near the Waikato River outlet at Taupo	Phillips, 1995
Ōngāru	Place of shaking (as in earthquake)	Waikato	Reed, 1975
Patetonga	Village swept by the South wind	Waikato	Reed, 1975
Pukeota(u)	Stormy or strong hill	Coromandel	Davis et al., 1990
Rotokohu	Misty lake 'Lake of mist'. It was a settlement area for the people of Ngati Tamatera	A settlement 5km south of Paeroa	Reed, 1975 Turoa, 2000

Te Tutu	'Where the wind blows from several quarters'	Settlement at Hauraki	Phillips, 1995
Waikato	The nibbling river – because it is always cutting away at its bank and changing its course	Waikato	Simmons, 1979a
Waikino	'Harmful waters'. The narrow passage is known to cause a raging torrent of destruction. Waikino was also the name of a taniwha that inhabited the river	A settlement 5km west of Waihi	Turoa, 2000

Bay of Plenty / Rotorua & Taupo districts

Place name	Meaning	Location	Reference
Arikikapakapa	'Fluttering hot spring'	Lake and thermal area, Rotorua	Reed, 1975
Hauparu	'Dust laden wind'	Bay on the south shore of Lake Rotoiti.	Stafford, 1985
Huka	'A great body of foam' - hukanui	Rotorua	Stafford, 1985
Huritini	'Ever circling', a large boiling lake at Tikitere, perhaps a geyser	Tikitere	Stafford, 1985
Komuhumuhu	'Whisper/murmur' of wind/wave, South shore of Lake Rotoiti	Lake Rotoiti	Stafford, 1985
Mangatapu	Forbidden stream	Bay of Plenty	Reed, 1975
Matata	Dividing waters	North of Whakatane	Reed, 1975
Maunga kakaramea or Maunga kakaraua	Mountain of clouded earth	Rainbow mountain on the main Taupo-Rotorua Road	Stafford, 1985
Ōpūrere	Flying mist	Bay of Plenty	Reed, 1975
Otūmoetai	Tide standing still as if asleep	Tauranga	Reed, 1975
Puarenga or Puaranga	'Flowers of Sulphur', refers to sulphur particles floating on its surface	Rotorua	Stafford, 1985
Rangipo	Place of darkness - name given to the barren tephra plain downwind of Ruapehu and Tongariro/Ngaruahoe volcanoes.	Taupo Volcanic Zone	Cronin and Cashman, 2005
Rotoehu	Turbid lake	Lake in Rotorua district	Reed, 1975
Rotomahana	'Warm lake'	Rotorua	Stafford, 1985
Ruawāhia	Gulch cleft by volcanic action.	Mountain in Rotorua, by Mt Tarawera	Reed, 1975
Taheke	'Rapids'	Where the waters of Kaituna river	Stafford, 1985

		meet Lake Rotoiti	
Tarawera	'Burnt peak', refers to the mountain top bearing traces of volcanic fire. This name is also applied to red scoria	Rotorua	Stafford, 1985
Te Tapahoro	'The edge of a landslip', a pa which once stood but was destroyed in the Tarawera eruption	Tarawera	Stafford, 1985
Te Wahaparata Te ahaoteparata	The mouth or throat of the taniwha. This refers to a great storm that Te Arawa survived	Rotorua	Buchanan, 2004
Waikorohihi	Spurting/hissing water		Stafford, 1985

Gisborne and Hawke's Bay

Place name	Meaning	Location	Reference
Ahuriri	Named after Tu Ahuriri, who found the lagoon blocked. The flood destroyed the shellfish. He organised a working party to clear a channel to the sea, and the area was named after him. William Colenso states that the name means 'fierce rushing' and allusion to the swift current in the channel where the river runs into the sea	Napier, Hawke's Bay	Reed, 1975
Awatere	Fast river	East Cape	Reed, 1975
Haumoana	Sea breeze	Hawke's Bay	Reed, 1975
Haunui	Place of strong winds	Gisborne	Reed, 1975
Haupapa	Flat wind	Haupapa Stream, Gisborne	Reed, 1975
Kawatiri	Swift river	Hawke's Bay	Reed, 1975
Haupouri	'Dark Wind', name given to the southern end of Ocean beach. South of Whakapau	Ocean Beach, South of Whakapau	Buchanan, 2004
Mangahe / Managaheia	Stream of troublesome waters / Rushing stream	Hawkes Bay district	Davis et al., 1990
Maungaharuru	When the Takitimu canoe travelled down the east coast on its way to search for greenstone, a high inland range was seen. The tohunga took a piece of wood, which received life and flew to the top of the range in the shape of a bird. The mountain gave forth a rumbling sound	Hawke's Bay	Reed, 1975
Parihoro	The name of the point just past the cemetery gate pari ' cliff' horo 'crumble' which could translate as the crumbling cliff	Gisborne	Vangioni et al., 1970
Taniwha Bay, Mahia Peninsula	Bay where a taniwha lived	Hawke's Bay	Beattie, 1915

Wanganui/Manawatu

Place name	Meaning	Location	Reference
Eketāhuna	Eke (to run aground); tāhuna (shoal or sandbank). This place was as far as the Makakahi River could be navigated by canoes on account of the shoals	Manawatu	Reed, 1975
Horowhenua	Great land slide. Refers to a land block running from seaboard to crest of the Tararua ranges	Horowhenua (near Otaki)	Adkin, 1986
Mangapehi	Stream of trouble	Taranaki stream	Reed, 1975
Ngaere	Swamp	South Taranaki	Reed, 1975
Oanui	The place of a large cloud	Taranaki	Reed, 1975
Ohuora	Place of good wind	Taranaki	Reed, 1975
Ōkato	Place of the tidal wave, or the full-flowing tide	Taranaki district	Reed, 1975
Ōngārue	Place of shaking (as in earthquake)	Taranaki district	Reed, 1975
Parikino	Evil/unpleasant cliff	Whanganui River	Davis, et al., 1990
Parinui	high cliff or strong tidal flow	East Taranaki	Davis, et al., 1990
Puke-haupapa	Ice Hill	Taranaki	Reed, 1977
Rotokohu	Misty lake	Taranaki	Reed, 1975
Te Horo	Slide/landslip	near Otaki	Adkin, 1986
Waiaroriri	Angry water	Taranaki	Reed, 1977
Waiau	swirling current	Taranaki	Reed, 1975

Wellington

Place Name	Meaning	Location	Reference
Hao whenua	Great earthquake which occurred in the time of Te Ao haere tahi – descendent of Tara. Said to be the final factor in the conversion of Motukainga into a peninsula (Miramar). The name suggests the configuration of new land – "the land swallower". dated the earthquake 18 generations prior to 1900 about AD1460; local geological evidence supports uplift in the area This may have a connection with Taowhenua meaning 'Windy land' - meaning is obscure "To sweep the land clean"	Miramar	Adkin, 1959 Vangioni et al., 1970 Goff et al., 2003
Haunui	Place of strong winds	Wellington	Reed, 1975
Kohangapiripiri	Means "strongly clinging nest" = VERY WINDY.	South coast of Wellington region, Palliser Bay	Adkin, 1959
Kohangaterai	Means "nest in the sun" = SHELTERED.	Lake: South coast of Wellington region, Palliser Bay	Adkin, 1959
Mangatapu	Forbidden stream	A Wellington district	Reed, 1975
Maungahuka	Snowy mountain	Hill and district in Wellington	Reed, 1975
Ngāwapurua	The blocked-up waters or meeting of waters	North Wairarapa	Reed, 1975
Ōpūrere	Flying mist	Porirua	Reed, 1975
Te rae-kai-hau	"Wind-scourged point".	Wellington coast	Adkin, 1959
Waimeha	Water lost in the sands/ insipid water	Lagoon in Wellington	Davis et al., 1990

Marlborough/Nelson and Canterbury

Place name	Meaning	Location	Reference
Arapaoa	Ara (path) paoa (smoke or blow). This place received its name in one of two ways. It was close to Queen Charlotte Sound, where Kupe with a downward blow (paoa) killed the enormous octopus Muturangi The second meaning is that early Maori peered through the mist across the strait which they called 'the misty pathway'	Marlborough Sounds	Reed, 1975
Hekehekerau	'Quicksand'	Taumutu	Beattie, 1945b
Horoirangi	"Washing of the skies" - when bad weather threatens Nelson, Horoirangi is enveloped by clouds	The highest peak at back of Glenduan, Nelson	Peart, 1937
Kawatiri	Swift river	Nelson	Reed, 1975
Mākerikeri	Mā (stream) kerikeri (rushing violently). Turbulent stream	Makerikeri stream, Canterbury	Reed, 1975
Ōaro	A boggy place	Kaikoura	Reed, 1975
Ohau (point)	'Place of winds'. May have been named after a man named Hau, supposedly a bold, rocky formidable point	Kaikoura	Elvy, 1950
Parikawa	forbidding cliff	Clarence River	Davis et al., 1990
Te Pa nui o Hau	'Home of the wind' or 'a large pa belonging to a chief called Hau' Meaning 'the great/ chief, home of the spirit of the wind'. Translated to mean strong southerly. Hau was a navigator/chief	Onawe, Banks Peninsula	Anderson, 1927 Vangioni et al., 1970
Tuhau	Tu – to stand; hau- the wind. 'The standing wind'	Near Waimate	Beattie, 1945b
Waihora	Spreading water	Lake Ellesmere	Davis et al., 1990
Waimakariri	The name describes the cold	Christchurch	A.

River	temperature of the water when it comes from snowmelt		McKercha r, pers. comm., 2006

West Coast / Southland / Otago / Stewart Island

Place name	Meaning	Location	Reference
Aweawe (beach)	'Floating in the air'. Tells of when Maori liked to travel in the early morning time when mist was prevalent 'me haere tatou ma te aweawe' (let us go by way of the mist). 'Misty way'	Riverton	Beattie, 2001
Awhiorangi	"Whirlwind"	Shingle Creek, South of Alexandra	Griffiths, 2002
Haunui	Place of strong winds	Otago	Reed, 1975
Hauroto	Windy lake	Southland	Beattie, 1944
Hautere	Swift winds	Solander Island (the mean wind speed is 34 km/hr, it is the windiest place in the country)	Ashwell, 1998
Kakokiao	'The returning clouds', referring to a rock outside of Horseshoe Bay	Stewart Island	Beattie, 1944
Ka one rehu	Hazy or misty coast	Hellfire Beach, Stewart Island	Ashwell, 1998
Matangi	Breeze	District in Otago	Reed, 1975
Maukarara	Noisy mountain – where wind creates strange muttering rolls of sound as if the range were grumbling	Otago	Beattie, 1944
Maungawera	Hot/burnt mountain	District in Otago	Reed, 1975
Mimihau	Pissing wind	Near Gore	Beattie, 1944
Nehenehe	A wild deserted place	Refers to Mt Repulse near the McKenzie county.	Beattie, 1944
Okato	Means 'place of a great tidal wave', a description that may relate to catastrophic flooding in the Okato district following a post-	Otago	Lowe et al., 2002

	eruptive flood event		
Oreheke (swamp)	Maori regarded it as strange ground and avoided crossing over it. Translated as 're' – meaning over there or bad weather and 'heke' – slipping down or boggy place. 'The place of the sloping swamp or slipping bog'	Clutha	Beattie, 2001
Ori	Bad weather/gale'	Haast coast, near Open Bay Islands	Roberts, 1999
Pororari (river)	Poro 'broken off', rari 'uproar' translating to the end of an uproar'. The waters of the river are reputed to rise with very little warning and create a great uproar and quickly subside. In its upper reaches when the stream is confined between the steep rocky banks there is a great turbulence in times of flood	Buller River area	Mitchell, 1948
Poteretere	Dripping wet	Southland	Beattie, 1944
Pukeawa	Puke may carry the meaning 'flood' as well as 'hill'	North West of Balclutha	Roberts 1999
Purehurehure Lagoon	'Cloud divided up or 'mist lying in small detached portions'	Otago Peninsula	Adkin, 1986
Riporipo	'Whirlpool', reference is made to disturbed water caused by outgoing tide from Bluff harbour and its effect can be felt and seen in the Foveaux Strait	Bluff Harbour	Ashwell, 1998
Taipo	This translates as noisy night sea or tide	Oamaru	Colenso, 1889
Tamihau	Pressed down by the wind	Stewart Island	Ashwell, 1998
Te Ahi-a-ue	The fire of ue - refers to the Burning Flat where a seam of lignite apparently has been smouldering for many generations. Maori regard this as strange ground and avoid crossing it	Clutha	Beattie, 1944
Te Anau	So wet the lake was named Roto-ua (Raining Lake), later called Manapouri	Fiordland	Beattie, 1949

Te ara pokipoki	'The mood of the eddy wind' which is the proper name for Awarua	Awarua	Roberts, 1999
Te Wairere	The hurrying stream referring to a narrowing of the Molyneux	Otago	Beattie, 1944
Te Whakao	'cloudy harbour'	Location uncertain, may be near Mokamoka	Beattie, 2001
Te Whiu	The plague	Part of the old village at Riverton	Beattie, 1916
Waiparapara	Muddy water	A lagoon in Southland	Beattie, 1944
Wairiri	Angry water	Point Matakitaki, Otago Peninsula	Beattie, 1944
Wawa-waiau – also known as Hau mate.	WNW - "Death wind" because it upsets canoes	Stewart Island	Beattie, 1994a
Whaitiripaku	'Claps of resounding thunder'	A name of an old settlement near Blueskin Bay	Beattie, 2001
Whaitiripapa	Crashing thunder	Taieri River	Beattie, 1944
Whakaao	Cloudy harbour, small sandy beach where canoes were hauled ashore on the coast at the back of Greenhills.	Greenhills	Ashwell, 1998
Whaka-papaa	"To cause teeth to chatter with cold"	Birch Creek, Waitaki	Beattie, 1944
Whakatipu	Growing bay	Queenstown	Beattie, 1919b
Whangapoua or Hakapoua	Bay of showery weather	Southland	Beattie, 1944

Appendix 3: Environmental indicators

The following table presents a selection of environmental indicators used by iwi across New Zealand.

Name	Indicator	Expected Outcome	Iwi / Region
Nga ngaru (Waves)	The sound of breaking waves up the valley	Approaching rainfall / inclement weather	Te Röroa: NW North Island King et al., 2006
Pakake (Sea kelp)	The furling and unfurling of hanging kelp	Approaching rainfall or storm	Ngäti Wai: NE North Island King et al., 2006
Pukeko (Swamp hen)	Pukeko head for higher ground	Imminent storm and flooding	Ngäti Wai: NE North Island King et al., 2006
Ngä Kapua o Te Manaia (The Clouds of Manaia)	The shapes and colours of clouds in the sky above Mt. Manaia	Approaching rainfall or storm	Ngäti Patuharakeke (Ngäti Wai): NE North Island King et al., 2006
Kaka (Native parrot)	Kakas begin acting up, twisting and squawking above the forest	A storm is on its way (Imminent storm)	Ngäti Pare NE North Island King et al., 2006
Koekoea (Long-tailed cuckoo)	The Koekoeä returns	Improved weather is on the way	Ngäti Pare NE North Island King et al., 2006
Kowhai	Beginning of flowering	The 'kina' are fat and juicy – warmer weather has arrived	Ngäti Pare NE North Island King et al., 2006
Nga kapua o te Moehau (The clouds of Mt. Moehau)	The shapes and colours of clouds above and below Moehau mountain	Rainfall; winds (calm periods, squalls, etc) and snow	Ngäti Pare NE North Island King et al., 2006
Pipiwharauroa (Shining cuckoo)	The return of Pipiwharauroa	The beginning of warmer weather (spring)	Ngäti Pare NE North Island King et al., 2006
Puriri	Early flowering	Long summer	Ngäti Pare NE North Island King et al., 2006
Ruru (Morepork)	The shrill cries of more than one Ruru can be heard calling and responding to each other at night	Approaching rainfall / inclement weather	Ngäti Pare NE North Island King et al., 2006

Puahou (Five Finger)	1. The lower branches blossom first 2. The top branches blossom first	1. 'Tau ruru' - A warm, bountiful season will follow 2. 'Tau matao' - A cold, unproductive season will follow	Ngäti Awa: N Central North Island Best, 1942
Marama (Moon)	In the first five nights of the lunar month: 1. The moon is lying on its back 2. The moon is at an angle or straight up and down	1. A month of spilling water is ahead 2. A dry month lies ahead	Te Whanau a Apanui E North Island King et al., 2006
Nga ngaru (Waves)	1. The booming sound of waves across the land 2. The sound of waves hitting local rocks	1. A storm is coming 2. Rough or calm weather conditions are expected	Te Whanau a Apanui E North Island King et al., 2006
Parearau 9 (Jupiter)	The shimmer of Parearau is light and misty	Wet conditions for the next month	Te Whanau a Apanui E North Island King et al., 2006
Poanganga (Clematis)	Periodic blooming	A warm season lies ahead with gentle breezes	Te Whanau a Apanui E North Island King et al., 2006
Ra (Sun)	A ring around the sun	Bad weather is expected	Te Whanau a Apanui E North Island King et al., 2006
Tihirau (Mt. Tihirau)	The clouds in the sky above Tihirau	Approaching rainfall or storm	Te Whanau a Apanui E North Island King et al., 2006
Whakaari (White Island)	1. The plume lies to the left 2. The plume stretched intact across the horizon	1. Rainfall is expected 2. Fair weather is expected 3. Watch out extreme	Te Whanau a Apanui E North Island King et al., 2006

[9] Remarks by Whakatohea and Tuhoe Maori about the wandering motion of the planets provide evidence of Maori understanding the difference between planets and stars. [Best, 1972: 810]

	3. The plume flattens and the end breaks off	weather is expected	
Whakaari (White Island)	1. The plume of smoke drifts up the coast 2. The plume of smoke drifts towards Opotiki	1. Good weather is expected 2. Watch for the rain	Te Whanau a Apanui E North Island Binney and Chaplin, 1986
Karaka	Heavy flowering	Drought	Ngai Tuhoe: NE Central North Island Best, 1925
Kowhai	Beginning of flowering	The beginning of more favourable weather (spring season)	Ngai Tuhoe: NE Central North Island Best, 1925
Kuaka (Godwit)	The return of Kuaka	The season of warming has begins	Ngai Tuhoe: NE Central North Island Best, 1925
Matariki (Pleides star cluster)	1. The stars of Matariki appear wide apart 2. The stars of Matariki appear close together	1. Warmer seasonal temperatures and plentiful season expected 2. Cooler seasonal temepreatures and lean season expected	Ngai Tuhoe: NE Central North Island Best, 1925
Matariki (Pleides star cluster)	1. The stars in Matariki are indistinctly seen, or appear to be 'quivering', or moving, when the group first appears about June 2. Each star of the group stands out clear and distinct	1. A sign of a cold, unproductive season to follow 2. A warm, prolific season will ensue"	Ngai Tuhoe NE Central North Island Best, 1972
Meteors (Tu-mata-kokiri)	1. Tu-mata-kokiri flies downwards 2. Tu-mata-kokiri flies more horizontally through space	1. A windy season follows 2. A fine season ensues, with easterly winds, a prolific season	Ngai Tuhoe NE Central North Island Best, 1972
Rironiro (Grey Warbler)	1. By the way the Rironiro built its cosy nest much could be foretold of coming weather conditions. If the side entrance faced north	1. The prevailing wind of spring would blow from the south 2. The prevailing wind of spring would blow from the north 3. A mild and fruitful	Ngai Tuhoe NE Central North Island Gordon, 1938

	2. If the side entrance faced south 3. If the entrance faced west 4. If the entrance was east-facing	season was to be expected, lulled by the warm east wind 4. This gave promise of cold showers from the west wind	
Te Tatua o Te Kahu (A horizontal bank of clouds illuminated by the setting sun)	1. Te Tatua o Te Kahu is curved 2. The form of Te Tatua o Te Kahu is more upright	1. Betokens bad weather 2. Betokens wind or bad weather	Ngai Tuhoe NE Central North Island Best, 1972
Tioreore and Tuputuputu (Magellan Clouds) Tuputuputu is the big Magellan Cloud, and Tioreore the lesser one. The clouds resemble fog and are seen on all nights	1. The smaller one is diverted to the side of the heavens, or appears to shelter the larger one 2. The smaller one is the wind leader and brings the wind. When Tioreore is in front of Tuputuputu	1. The following day will be windy 2. It is a sign of fine weather	Ngai Tuhoe NE Central North Island Best, 1972
Torea	The Torea bird changes its ordinary cry “Tokia, Tokia!” to “Keria, Keria!”	Warning of an approaching storm	Ngai Tuhoe NE Central North Island Best, 1976
Whanui (Vega)	1. Whanui appears to move slowly 2. Whanui appears to move quickly, as if blown along by the wind	1. A fruitful season is at hand 2. A lean season is expected	Ngai Tuhoe: NE Central North Island Best, 1925
Whanui (Vega)	1. Whanui appears to move slowly 2. Whanui appears to move quickly, as if blown along by the wind	1. A sign that a fruitful season is at hand Cultivated crops will be bountiful, while birds and all forest products will be plentiful 2. A lean season follows	Ngai Tuhoe NE Central North Island Best, 1972
Pohutukawa	1. The tree flowers only on the upper branches or the blossoming begins there and only goes	1. A ‘tau –huka’ or cold and winter-like season will follow 2. A ‘tau-mahana’ or warm and pleasant	Te Arawa: N Central North Island. Best, 1925

	slowly or partially downwards 2. The tree starts to flower at the bottom and goes upwards in the ordinary manner	season lies ahead	
Pohutukawa	Early flowering	Long summer and drought	Ngäti Porou E North Island. Best, 1925
Kohoperoa (Long-tailed cuckoo)	The kohoperoa stops singing	The wind is about to blow from the south	Te Ati Awa: SW North Island Murdoch, 2001
Matuku (Bittern)	The continuing cry of the bittern as it moves around at night	Floods are likely	Ngäti Ruanui: SW North Island Murdoch, 2001
Rawaru (Blue Cod)	Stones in the belly of the rawaru	Bad weather is coming	Ngäti Koata: N South Island Personal Comm: Hori Elkington
Kötuku (Heron)	The heron are plentiful in summer	Gales and a heavy winter will follow	Ngäti Apa: N South Island Murdoch, 2001
Aniwaniwa / Uenuku (Rainbow)	Apearance of the rainbow	Clear weather is expected	Kai Tahu: E South Island Beattie, J.H., 1990
Atutahi (Canopus)	Atutahi is standing far apart from the milky way in about October	"Te paki o Atutahi" – "The calm of Atutahi". A dry summer will follow	Kai Tahu: E South Island Beattie, J.H., 1990
Atutahi (Canopus)	Atutahi twinkles brightly on one side, but is dim on the other	The wind will blow hard from the bright side	Kai Tahu: E South Island. Beattie, J.H., 1990
Kapo (Lightning)	Lightning flickering above the horizon	The side on which the flashes are strongest indicates the direction from which the wind will come	Kai Tahu: E South Island Beattie, J.H., 1990
Mangaroa (Milky way)	1. Mangaroa is curved 2. Mangaroa is straight	1. Bad weather is expected 2. Fine weather is expected	Kai Tahu: E South Island Beattie, J.H., 1990
Marama (Moon)	1. A complete ring around the moon 2. A new moon lying on its back	1. A heavy fog 2. Rainfall; bad weather	Kai Tahu: E South Island Beattie, J.H., 1990

Mohua (Yellowhead)	When a flock of mohua "rises from the tree-tops and falls back among their green haunts, they appear, viewed from above, like a skein of golden butterflies …"	Warning of approaching storm	Kai Tahu: South Island. Gordon, 1938
Patiti (Grass)	1. The grass is wet with dew 2. The grass is dry.	1. A north-east wind is likely 2. A southerly wind is likely	Kai Tahu Cormack and Orwin, 1997
Puaka / Puanga (Rigel)	1. Puaka appears south of the sunrise 2. Puaka appears north of the sunrise 3. Puaka appears directly in the path of the sun	1. Bad weather is expected 2. Fine weather is expected 3. Much heat and dryness is expected	Kai Tahu: E South Island. Beattie, J.H., 1990
Rä (Sun)	1. A vivid halo encircles the sun 2. A pale and dim halo encircles the sun	1. A storm is approaching 2. A storm is far way	Kai Tahu: E South Island Beattie, J.H., 1990
Riroriro (Grey Warbler)	1. The Riroriro builds high in the tree-tops 2. The Riroriro chooses to build a home low down among sheltering branches.	1. The mild warm winds of the west … would ensure a good summer 2. Cold southerlies expected - bad for the food crops	Kai Tahu: E South Island Gordon, 1938
Nga whetu (Stars)	In fine weather, if you go out and the stars are twinkling up north and not down south	A light northerly is likely the next day	Kai Tahu: E South Island Cormack and Orwin, 1997