Ko te reo te taikura o te whakaao-mārama.

Language is the key to understanding.

—

The appropriate use of Te Reo Māori in the scientific names of new species discovered in Aotearoa New Zealand.

A thesis submitted in partial fulfilment of the requirements for the degree of

Master of Science

By

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Abstract

Language is the key to understanding

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In this thesis I investigate the naming of new species that are being discovered in and around the waters of the coastline, across the vast landscape and in remote areas of Aotearoa New Zealand. These native species often endemic to Aotearoa New Zealand are often named with no reference to the native landscape and wear names that pay homage to or represent ancestors and traditions of another culture. Few of these species have been given scientific names that include Te Reo Māori and this study sought to explore why this was the case and how Te Reo Māori should be included in these names.

This study investigated the background, methods and the knowledge associated with matauranga Māori and scientific naming protocols and how these could be incorporated into the naming of new species of Aotearoa New Zealand. Data were gathered from historical manuscripts that mention naming or classification of species in Aotearoa New Zealand, literature about classification, and eight interviews with people knowledgeable in the Māori and western scientific naming traditions of nomenclature and classification. The interview data was transcribed and analysed using these themes drawn both from the literature and the data. The study considered the rightful place of Māori knowledge and western scientific systems of naming new species, including the appropriate use of Te Reo Māori in a uniquely Aotearoa New Zealand way.

My findings indicate that the practice of naming species in Aotearoa New Zealand by scientists is governed by international protocols and that any incorporation of Te Reo Māori varied, and this variation depended on individual researchers that have developed their own method of using Te Reo Māori in the names of new species. The findings indicate however that Te Reo Māori is of utmost importance to a Māori cultural context and must be used appropriately for the benefit of future generations of Māori.

In my conclusions I acknowledge the two systems of biological classification and matauranga Māori and their historical importance in the classification of species in Aotearoa New Zealand and on the international stage. I also recommend a set of

guidelines derived from the research findings on the appropriate use of Te Reo Māori in naming new species.

Dedication

This thesis is dedicated to my parents

Tioriori Wally and Vivienne Linda Papa,

For their love, strength and support of our family.

Acknowledgements

Me wehi ki te Atua te timatanga o te whakaaro nui,

Me whakahonore te kiingi Māori a Tūheitia, me te whare Kāhui Ariki whānui.

E nga reo, e nga mana, e nga karangarangatanga maha tēnā koutou katoa.

I would like to acknowledge the many who have helped me along the way. I would like to thank you all as your help and strength is much appreciated.

I would like to acknowledge my supervisor Dr. Chris Eames for his valued time and support in this research project.

I would especially like to acknowledge and thank the participants of this research who shared their stories and expertise. Without your contribution this project would not have been possible.

I would like to acknowledge Nga Pae o te Maramatanga Māori National Institute of Research Excellence and Tainui for your generous financial support and contribution to my research.

I always give thanks for the strength and support from my Mum and Dad to whom this thesis is dedicated, who are the backbone of our family. I am truly grateful for the love and support of my partner and beautiful children, all of my siblings, nieces and nephews, who will provide future Māori leadership,

I would like to thank my dear friends; wider whanau and my tribal groups in which I source my cultural strength and wisdom, those who have helped shape my life whose support and encouragement is the most wonderful gift.

Finally to all my fellow postgraduate students and support staff of Waikato University who have offered their help and encouragement which has all been of great appreciation.

Tēnā koutou, tēnā koutou, tēna rawa atu koutou katoa.

Paimārire.

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1.1 Pepeha - Background

He hōnore he korōria ki te Atua,

He maunga-a-rongo ki te whenua,

He whakaaro pai ki ngā tāngata katoa.

Ko Hoturoa, ko Hotuope, ko Hotu Matapu, ko Motai, ko Ue, ko Rakamamao, ko Kākati, ko Tāwhao, koTūrongo, ko Raukawa, ko Rereahu, ko Te Ihingarangi, ko Kuri, ko Hinemapuhia, ko Rautī, ka puta ko Korokī. Ko Hape, ko Puhipuhi, ko Taiko, ko Whangaroa, ko Tīoriori, ko Tairi, Ko Tupouri, ko Te Werawera, ko Te Reo, ko Tīoriori, ka puta ko ahau,

ko *Judy Wiki Papa* e mihi atu nei.

Ko Tainui te waka,

Ko Maungatautari te maunga,

Ko Waikato te awa,

Ko Pōhara te marae,

Ko Ngāti Korokī-Kahukura te iwi,

Tainui - the ancestral voyaging vessel captained by chief Hoturoa, which carried my ancestors across the Pacific Ocean to settle and inhabit the land of Aotearoa New Zealand.

Maungatautari - the ancestral mountain which has sustained my people with stability shelter, protection, fresh water and food for many generations.

The Waikato River; -the ancestor that has sustained the life of my people of Waikato since the arrival of my ancestors to Aotearoa, New Zealand.

Pōhara Marae - the homeland and communal gathering place of my family and wider tribal family group.

Ngāti Korokī-Kahukura, the amalgamation of descendants of two tribal ancestors Korokī and Kahukura, from whom my tribal family group descend.

Judy Wiki Papa – my name, my identity, symbols of my Māori and English ancestry.

This chapter began by outlining my ancestral lineage from the captain of the voyaging sea craft that brought my ancestors across the Pacific Ocean to Aotearoa. This lineage branches down to the ancestors from whom my tribal group descends, Korokī and Kahukura, hence my tribal name Ngāti Korokī Kahukura. My name, given to me by my grandmothers, represents my origins, my ancestors, and my identity. My name tells a sophisticated story of who I am.

I have been fortunate to have been steeped in Māori traditional systems of knowing and understanding. This background, together with my western learnings as a Māori scientist and my position as Māori science educator, have influenced why and how this research has been conducted. I chose to undertake this research project as it represents an interdisciplinary study of tikanga (cultural practices), whakapapa (genealogy), Te Reo Māori (The Māori language) and Western science taxonomy. This study developed out of previous research that included a report by researchers Tipa and Nelson (2007) that addressed cultural considerations in naming new species. The Tipa and Nelson report was based in the South Island and was carried out in collaboration with iwi members of Kai Tahu. It concluded that the Linnean classification system already existed in New Zealand and researchers sought feedback from iwi members of Kai Tahu on the potential for Māori participation to fit within or complement this extant classification system.

A subsequent scoping study was funded by the National Institute of Water and Atmospheric Research (NIWA) which investigated the setting up of a taxonomic reference group that could assist in the process of naming species(Papa, Roa, &

Karapu, 2009). The findings of that study demonstrated a need to research current practice and experiences related to naming species in Aotearoa New Zealand. The Ngā Pae o te Māramatanga National Institute of Research Excellence for Māori Development and Advancement funded further research to widen the scope of the study into traditional taxonomies and cultural considerations when naming new species. The knowledge and information gathered within this Master's thesis will contribute to that pool of knowledge on taxonomies and cultural ways of naming new species.

I have a great passion for language and support the following proverb coined by Māori language and cultural expert Dr. Wharehuia Milroy that states;

"Ko te reo te taikura o te whakaao-mārama"

Language is the key to understanding

Many languages are relevant to this study. They include: Te Reo Māori and its Polynesian relatives; the Greek and Latin languages, which are used within many areas of science and taxonomy; and English, the language in which this thesis is written. These languages have been a key to understanding species and the process of naming new species throughout the world and, more specifically species that are discovered here in Aotearoa, New Zealand.

The context of the study looks at the language used in the names of new species, specifically the use of Te Reo Māori, and the application and appropriate use of Te Reo Māori in this scientific process of taxonomy. The purpose of the research is to provide a cross cultural connection between Western science and Māori research communities about scientific naming processes and the use of Te Reo Māori in these official processes.

The scope of the study is to research the naming experiences of current taxonomists in New Zealand to gain a wider understanding of the experience and use of Te Reo Māori in those naming processes of new species. The scope of the research also included the experiences of those who have cultural expertise in tikanga, whakapapa, and Te Reo Māori that ranged from language experts to researchers and educators. The differences that exist between Māori and Western

world views are examined and explained in this thesis, particularly where distinct cultures come together in the scientific process of taxonomy.

The significance of this research is to establish the current state of practise in the use of Te Reo Māori in the scientific names of new species, and to look for evidence of a formal quality assurance process governing the correct use of the language. This could lead to a way that will ensure the correct use of Te Reo Māori and its appropriate use in the names of new species that is mutually respectful.

Questions arose as to whether it would be feasible to amalgamate two world views in a single scientific process - the naming of new species. Did pre-European Māori have their own traditional system for naming species? Can collaboration between scientific experts and Māori language and cultural experts assist in assuring the integrity of each world view?

1.2 Research problem

Research has shown that wider consultation regarding the use of Te Reo Māori must take place with taxonomists who are involved with naming new species in Aotearoa New Zealand (Tipa & Nelson 2007, Papa et al 2009).

This research is important because it addresses the lack of extended knowledge about the names of indigenous species names and the lack of recognition of indigenous naming in western classification processes. The colonial perspective on discovering indigenous species is reflected in the names of species, and early descriptions of species. Species were often named after people or objects which did not have any relevance or provide much detail or description of the species themselves. The influence of the Western scientific naming systems developed by early scientists, were used as a reminder of their visit to these shores.

English and Latin names took precedence over the Māori names, which only seemed to be used for species that bore no resemblance to the homelands of the colonisers. As an example the use of the French tern *Novae Zealandia* has been used historically for species that originate from New Zealand, rather than the use of Aotearoa (or a derivative of the word), which has become increasingly used as an identity marker for indigenous species.

The Western science view of taxonomy is related to identification and classification of species into their Kingdoms and more specifically down to their order, class and group. A Māori worldview differs from this western science view. In a Māori world view all creatures descend from Atua (often translated as Gods or Supreme Ancestors). Aspects of the environment such as waters, lands and the life within are seen by Māori as mutually dependent ancestors. So this world view is a holistic one. The Māori cultural construct of whakapapa or lineage recognises that every species has its place and their names reflect that whakapapa. Oral traditions talk of the features of great ancestors such as Tāwhaki who journeyed through the heavens seeking knowledge and enlightenment for the benefit of all humans (Smith, 1999). Other oral histories such as whakataukī (proverbs) and waiata (songs) embody the vast cultural knowledge of the Māori which informed naming traditions. Early settlers and botanists who worked with Māori communities (Colenso, 1865) commented on the diverse range of species names of animals and plants of the Māori. These observations recognised a Māori indigenous system of identification and classification of plants and animals, but still imposed a Linnean classification system in New Zealand to create order that already existed in this indigenous environment.

This research examines western scientific processes of taxonomy together with Māori naming protocols in the context of whakapapa and proposes a set of guidelines and processes that could enhance the appropriate use of Te Reo Māori and cultural considerations when naming new species.

1.3 Research questions

Following a literature review, the following research questions were designed:

1. Do scientific protocols of naming new species currently include the use of Te Reo Māori?

2. Do naming protocols recognise the appropriate use of Te Reo Māori in the scientific names of new species in Aotearoa New Zealand?

3. What differences exist in the knowledge, ideas and understanding about the appropriate use of Te Reo Māori and Western science naming protocols of new species?

These research questions focus on the three main areas of scientific knowledge of taxonomy and naming species in Aotearoa New Zealand; tikanga Māori; and the appropriate use of Te Reo Māori.

Interviews were arranged with experts in western scientific protocols of taxonomy, and with experts in Te Reo and tikanga Māori. Through these interviews I sought responses that would present views about the historical use of Te Reo Māori in naming new species. Through this process I sought to elicit any current examples of species that have been discovered within the last five years and to explore any intersections between Māori traditional knowledge and other knowledge systems in relation to naming.

The next section provides an outline of this thesis and introduces the content within each chapter to give an overview of the flow of discussion and the development of ideas.

1.4 Thesis outline

This thesis is divided into five chapters, headed by this introductory chapter – Te Pu, where all the chapters are named in recognition of the whakapapa of a plant, that begins with the root system and foundation in which the plant and the knowledge contained within this thesis can grow, and blossom. This introductory chapter is followed by a second chapter – Te Weu, that incorporates the literature review. The literature review canvassed literature on historical and contemporary forms of naming from both western scientific traditions and Māori cultural traditions.

Chapter Three – Te More, describes the sample and research methodology. It explains why particular research questions and methods were adopted as research tools to source and analyse information for this project. Ethical considerations, data collection and analysis approach are discussed together with the qualitative approach of the research and the corresponding issues of validity and reliability.

Chapter Four – Te Aka, presents the findings of the eight individual interviews that were conducted to source information for this research project. The findings are arranged under five main themes that cover a range of topics. The themes include participants' responses about the appropriate use of Te Reo Māori, the

context of the language, a kaupapa Māori approach to naming, a scientific approach to naming and communication and publication.

Finally, Chapter Five – Te Rea discusses the major issues highlighted throughout this thesis. It offers conclusions and recommendations. Chapter Five concludes with suggestions for developing of a proposed set of guidelines that can assist in assuring the appropriate use of Te Reo Māori in the naming of new species discovered in Aotearoa New Zealand.

Chapter 2 Literature Review – Te Weu

"Kotahi te kohao o te ngira e kuhuna ai te miro mā, te miro pango me te miro whero".

"There is one eye of the needle through which the white, black and red threads shall pass"

King Potatau te Wherowhero

2.1 Chapter Overview

This chapter presents literature relevant to the knowledge area regarding the appropriate use of Te Reo Māori in the scientific names of new species in Aotearoa New Zealand. It begins with discussing aspects that provides background knowledge such as a look at the prior history of the land, where the unique structure, formations of the land, and surrounding sea, encourages a wide array of species that dwell in, on and around the shores of New Zealand. The review then includes literature that reflects the cognitive processes and traditional thinking of people of Polynesian ancestry, and the acts of naming and how these have changed over time. This review then draws attention to the research topic of the appropriate use of Te Reo Māori in the names of new species, with literature that explains the two main focus areas of a kaupapa Māori research approach and a Western Scientific approach to naming new species. This chapter also reviews examples in the academic literature that describes New Zealand species classification protocols and provides examples of new species that have been named within the last 5 years that have included the use of Te Reo Māori.

2.2 Historical geographic overview of the landscape

Many millions of years ago a super continent called Gondwanaland existed. The site of New Zealand as it is today, once lay submerged off the eastern border of Gondwanaland. Between 80 and 100 million years ago, in a continuing cycle of geological events New Zealand broke away from the super continent in a series of earth movements that saw the land both rise and fall below the waves, although it appears that some parts of the land remained above the waves as islands (Purves and Orians, 1983). Descendants of the ancient Gondwanaland species have

adapted to the rise and fall of sea level over millions of years (Hamblin & Christiansen, 2001). New Zealand native species such as the tree Kauri (*Agathis australis)* and the reptile Tuatara (*Sphenodon diversum*) are still found today. While DNA analysis shows that they have survived from the earlier super continent period. The islands that make up New Zealand lie on a rather unstable portion on the boundary of the two tectonic plates (Indo Australian and the Pacific). To the east of the North Island where the ocean floor of two crusts meet, the Pacific plate is sub-ducting, or disappearing under the Indo Australian plate, forming the Kermadec and Hikurangi Trenches. As the Pacific plate is drawn under the North Island, it is heated until about 80-100 km deep; it melts and rises to the surface as magma, forming a line of active volcanoes from Ruapehu to Whakaari. In the South, the Southern Alpine Mountain Ranges have been forced up by the collision of the two plates (Hamblin & Christiansen, 2001).

As the landscapes of the world change due to tectonic pressure and environmental influences, the new phenomena occur alongside organisms that dwell within those landscapes. The presence of subtropical convergence has provided the optimum conditions for plentiful marine mammals, fish and birds of the shallow lagoons McGlone (cited in Sutton, 1994). With the surrounding coastline and sea creating a barrier for marauding mammal species form other lands, flightless birds evolved in safety at ground level and many diverse plants clothed the land. An environment like that of this island sanctuary and constant environmental change has given rise to a diverse range of species endemic to Aotearoa New Zealand (Gibbs, 2007). Many species within the range of Aotearoa New Zealand remain undiscovered, unclassified and unnamed.

2.3 The Act of naming

The act of naming something has many understandings and interpretations worldwide, represented in all cultures. The ancient peoples of the world set forth to name, describe and map their world. Population expansion and early developments in geographic mapping alongside ongoing developments in science encouraged further exploration of the world (Beaglehole, 1961). Many Māori and non-Māori sea faring explorers took to the great oceans of the world in search of land, and these explorers came across new found land where they encountered a

fertile land rich in diversity, from which samples were collected, and comparisons were made to species of their homelands, and species of both flora and fauna were classified and named. This act of naming was a method to label, identify, make claim to lands, honour past encounters, and experiences (Beaglehole. 1961). All explorers left behind names for species, areas of land, bays, capes and national parks that are still in use today. Making claim to the land through this method also gave rise to the colonisation of many foreign lands worldwide under the larger empires and dynasties of the world (Beaglehole, 1961). These names involve a number of indigenous languages of the world including the indigenous language of New Zealand, Te Reo Māori or the Māori language. It is the appropriate use and application of Te Reo Māori in both historical examples and new contexts of species names that is the primary focus of this research project. The following review of literature draws attention to Māori methods and views of names and the naming protocols which are important in explaining the conceptual understandings in a Māori cultural context.

2.4 Māori views and methodologies of names and naming protocols

This section discusses the role of historical ancestors and how these ancestors relate to socially constructed experiences that influence a wide range of indigenous protocols and processes of naming.

2.4.1 Traditional Ancestors Rangi and Papa

Māori beliefs reach far back in time to the great creator or Supreme Being, Io, where attitudes toward the natural world reflect the relationships created through historical ancestors such as Ranginui (Sky father) and Papatuanuku (Earth mother) (Binney, 1987; Hayes, 1998; Whatahoro, 1913). According to these beliefs, Rangi dwelt with Papa as one, he clothed the nakedness of her body with plants; the smaller trees and the upstanding trees of the forest were placed where Papa felt great warmth. This warmth was all embracing. After the last of all these things had been planted, Rangi and Papa then created their offspring (Whatahoro, 1913). The separation of this union that was initiated and executed by their own offspring created the development of this beautiful world. Due to the darkness created in their union none of these offspring could grow and develop, and conditions were unstable. Māori believe. The many offspring of

Rangi and Papa, both male and female, became Gods or guardians over the realms in which they dwelt. Their offspring in turn represented the many divisions of groups and species that inhabited the earth and the oceans (Foster, 2008; Riley, 2001), as discussed below.

2.4.2 Tāne

Tāne, guardian of Man and all forest dwelling creatures married several wives to produce different families of offspring. From one wife was born the healing trees, from another the building trees (M Marsden, 1975). Tāne shaped the māori goddess Hineahuone out of the earth, breathed life into her, and hence her name "Hineahuone" – "the maiden shaped of earth". Tāne and his brother Tawhirimatea (Guardian of the winds) disagreed over the separation of their parents Rangi and Papa, and this disagreement culminated in a war of the Gods. Having vanquished Tāne, Tāwhiri then turned his wrath on his siblings, including the oceanic domain of Tangaroa (Marsden, 2003)

2.4.3 Tangaroa

Tangaroa, guardian of the sea, also married several wives, and from each of the different wives arose the different species and genera of fish, shellfish and seaweed. Tangaroa's descendant Punga, produced Ikatere and Tu te wehiwehi. These descendants differed about how to escape the wrath of Tawhirimatea. The differences lead to a separation of species. Ikatere fled and hid in the depths of the ocean, to become the progenitor of fishes. Tu te wehiwehi fled inland to become the progenitor of reptiles. This form of genealogy indicates that Māori philosophers thought of fish and reptiles as being descended from a common ancestor (Walker, 1996).

2.4.4 Maui Tikitiki a Taranga

Māui a Polynesian ancestor documented all throughout the islands of the Pacific (Marsden, 2003), is also represented here in this land of Aotearoa New Zealand. Te Ika a Māui or the Fish of Māui, literally meaning the fish Māui, which refers to a historical account of how this landmass was discovered by Maui, and is another name for the North Island. Many geological and geographical features of this land support the knowledge that this land has been subjected to millions of years

of the rise and fall of sea level, and emergence from beneath the sea (Hamblin, 2001), from an area where the two continental tectonic plates meet. Māori see this ika or fish as an ancestor linked by ties of kinship to mother earth Papatuanuku and sea guardian Tangaroa. This account of historical knowledge has been passed down from one generation to the next through the names of these ancestors and the stories that those names represent (Ngata, 1945). According to the literature, maintaining this body of cultural ecological knowledge acknowledges that all creatures have a whakapapa or genealogy that has survived many generations, and Māori feel that we are here as caretakers for all of these descendants unique to this land.

Māori strongly believe and respect that all creatures, represented in whatever realm, are naturally tapu (sacred), being descendants of these Guardians or Gods. Man and other creatures are linked by ties of kinship. The interconnectedness by way of whakapapa explains why Māori relate to the environment from a position of parity rather than ascendancy, being descendants of Tāne (Foster, 2008; Hayes, 1998; Patterson, 1999; Riley, 2001).

2.4.5 Te Whare Wānanga Māori

In a Māori belief system, the wānanga or sacred knowledge was gifted by Io the supreme creator, and brought down to earth from the heavens. This knowledge was represented as the three baskets of knowledge. The contents of these baskets were distributed amongst the descendants. The baskets contained valuable contents of knowledge and direction; some branches of knowledge were allocated to different guardians to enable them to rule in their separate realms, therefore becoming the presiding deities of different classes of Māori phenomena (Riley, 2001; Whatahoro, 1913). Tohunga were priests of the wānanga, the keepers of knowledge in the schools of learning that preserved the sacred teachings of Io and the lore of their forebears; for example, the mythology of Polynesia, the tribal traditions of the Māori, the many whakapapa or genealogical lines, and to whom they belonged. There was also the knowledge of the hapu or sub tribal boundaries, the forest lore, the fishing methods, proper times for harvesting and planting and all the karakia and rituals relating to these practises (Jones, 1960). These Tohunga worked out a lunar calendar and an annual cycle of seasons

(Walker, 1996) and developed names that represented each of these phases (Whatahoro, 1913). Through the development of time and history, it was necessary for the sons of chieftains to devote a good deal of their time to the study and the memorising of the deeper and higher knowledge of the esoteric teachings of the whare wānanga . These pupils then became the tohunga or priests of the wānanga, keeping and maintaining this body of knowledge since the beginning of time (Jones 1960). Recorded in a table of whakapapa that extends back to the 7th Century is a recording of time that marks the far distant journey of Māori ancestors from parts of Indonesia into the Pacific Ocean (Whatahoro, 1913). The preservation of this knowledge that is embedded in the Māori language is sacred and must be protected and honoured.

2.4.6 Arrival of Māori to New Zealand

The arrival of Māori in New Zealand is thought to have occurred over a number of years between 1000 and 2000 AD through a number of migration voyages (Harlow, 2007). The arrival of Kupe (800 AD) and his relatives marked the first interactions with a land that was uninhabited by both human and mammalian predator species. Kupe named the lands he visited where some of the names are still referred to today. A monument dedicated on the Wellington waterfront represents Kupe, his wife Kuramarotiri and tohunga Pekahourangi (Riley, 2001), which acknowledge their discoveries in the Wellington Harbour and the names left behind as a reminder of that time period.

These uninhabited lands provided a rich environment for birds, and the presence and activity of birds were key environmental indicators for both navigation and settlement purposes (Riley, 2001). The North Island of New Zealand was almost completely forested. The earliest Māori settlements were established near large and varied sources of animal protein Mc Glone (cited in (Sutton, 1994). These early settlers would have lived at the coastline and then move inward to the interior of the forest to hunt for prey. The Tainui waka, for example, arrived here in 1350 AD (Kelly, 1986), captained by rangatira or navigating chief Hoturoa, guided and protected by chieftain priest Rakataura. The claim to land for both chiefs and leaders Hoturoa and Rakataura were confirmed in names, where they became responsible for naming many of the geographical features and areas

within the Tainui tribal boundary e.g. Maungatautari (Kelly, 1986). This is relevant here as the names of recently discovered species, such as *Mecadema manaia* (Seldon, 2002) have been named after the type of location they derive from, and often bear names that Māori ancestors gifted upon the land on arrival and exploration of a new land.

2.4.7 Kaitiakitanga

Mauri represents a life force in a Māori world view that is encapsulated within all living beings. Respect for this essence of mauri or life force involves understanding the nature of all creatures and ecosystems. In a Māori world view there is no inbuilt domination of nature by humans. All species are members of a single family (Patterson, 1999). Māori learned and developed a detailed environmental knowledge over many centuries that takes many forms and expressions, based on different tribal histories, local geographies, norms and practices, from an enduring and close association with the land and its resources (Clarke, 1990; King, 2008). This led to an environmental philosophy of understanding distinctive qualities, what their relationship is to one another and learning to respect them for what they are (Hayes, 1998; Patterson, 1999). This major philosophy demands that we treat the natural world with respect, and that we do this to the world as a whole and to each and every one of its constituent parts. Māori expressed these interrelationships in terms of kinship believing that they are related to all life forms. Māori have adopted the role represented here as kaitiaki (guardians), for Kaitiakitanga (guardianship) carries with it an obligation not only to care for the natural world, but also for each successive generation, by ensuring that a noble livelihood is passed on (Hayes, 1998). Knowledge that is embedded within the language is represented in names and stories of past experiences.

2.4.8 Tikanga Whakapapa

Whakapapa is a sacred knowledge system that encompasses a wealth of learning and a cultural way of connecting to the world and its surrounds. The Māori Gods of all things including humans have been linked with the processes that acknowledge a common life force (mauri) that is shared by all living things (Whatahoro, 1913). The Māori world view is threaded all throughout whakapapa,

the description of the world in the form of a genealogical recital. These are contained in the connections of whakapapa through ideas, orderliness, sequence, evolution and progress. The ideas are embodied in the sequence of myths, traditions and tribal histories. This we know through whakapapa recital, karakia (prayers) or sacred incantations that were left by the Māori forefathers and ancestors, which are both still being recited, and have more recently been published and recorded (Jones, 1960; Kelly, 1986; Ngata, 1945; Papa, Papa & Te Aho, 1994). These traditions trace the genesis of human beings from the creation of the first woman and thereafter, the development of culture and human institutions (Walker, 1996).

This systematic process of knowledge dissemination was transmitted though customary practice to people who had chiefly whakapapa links. Potatau Te Wherowhero, crowned first Māori King in 1858, was approached and nominated as being a strong candidate as King due to his chiefly whakapapa linkages; he was a high priest in the whare wānanga and a diplomat (Jones, 1960; Riley, 2001). Potatau maintained the dignity of his aristocratic lineage without giving cause for envy or jealousy over his success (Jones, 1960). As a genealogist of the first order, Potatau had made a close study of the subject and could quote innumerable instances of the tendency of like to beget like (Jones, 1960). The honour and dignity of this great chief is portrayed in the act of naming and the names that were gifted in remembrance of significant events or important people. For example, the bamboo orchid (*Winika cunninghamii*), whose Māori name, Te Winika, was given in 1838 to a Tainui war canoe because this orchid grew on the totara tree whose trunk was hollowed out to form the hull. Te Winika was smashed by the military leader von Tempsky in 1863 but after reconstruction was used on ceremonial occasions on the Waikato River from 1938 to 1971, and was then donated to the Hamilton Museum where it stands as a reminder of an ancient art form and a name that represents its identity and whakapapa (Moore & Irwin, 1978 p. 196). With reference to any land issue, tribal or environmental resource, historically a Māori land ownership system utilised genealogy to relate to a person's right to utilise his land (D. Williams, 2001).

This section has supported Māori theories of knowledge that encompass empirical traditions used to establish identity, confirm links of kinship with the gods of

creation and reach wider into many areas of Polynesia. These links of kinship transcend to relationships with the environment and members of Māori communities which seek to present responsibilities that Māori have assumed within roles of kaitiakitanga so that these traditions will be maintained with integrity for future generations.

2.5 Historical links to Polynesia

In further recognition of whakapapa, on the arrival of Māori to Aotearoa by waka (voyaging vessel) many explorers among the troupe discovered this new land untouched by large land-based mammalian species. Like many colonists, "Many locations and species were named after those that closely resembled locations and species of far off homelands" (Riley, 2001). The process of naming and identifying provided links for many generations to come to the home lands once inhabited by the ancestors of the Māori. The names of these species are common throughout the Pacific Island nations which also confirm links to the whakapapa of the Māori to the Pacific.

The New Zealand Pukatea (*Laurelia-novae zelandiae)* is similar to the Cook Island Pukeka; the plant species Miro (*Prumnopitys ferruginea)* found here in Aotearoa, is the same as the Toromiro found on Easter Island, Tahiti and the Cook Islands; the New Zealand Tawa (*Beilschmiedia tawa)* is similar to the Tava and Dava found in the Pacific; the Kotare or kingfisher (*Todiramphus sancta)* in Aotearoa and Rarotonga is similar to the otare in Tahiti and kotar in the East Carolinas (Foster, 2008). Much literature supports the fact that "each name of each living organism represents its own whakapapa, this whakapapa in turn creates its own knowledge system" (Wehi, 2009, p. 202) Shared vocabulary and species names confirms interrelationship of the pacific nations that provides a framework for reconstructing the history of Polynesian settlement and interisland communications. The following table highlights the number of shared vocabulary of general words identified in the Māori language and various other Polynesian nations.

Table: 1 Numbers of uniquely shared general words (Harlow, 2001)

Māori	Rarotongan	29
Māori	Tahitian	18
Māori	Hawaiian	46
Tahitian	Hawaiian	24
Rarotongan	Tahitian	55

Harlow, a current professor of Linguistics at the University of Waikato has studied the migration patterns of the Māori language that trace back through the migration patterns of the Māori throughout Polynesia. Harlow (2007) researched the voyages undertaken by Māori and their ancestors in the process of colonising habitable land in the South Pacific and recognised through his research a similarity of languages throughout the Pacific included in the names of many plant and animal species.

All colonisers carry to their new homelands plants and animals, genetic information, and a language that encapsulates a system for understanding the world around them. Māori and Te Reo Māori are no different. Some of the Māori plant names are revealing of the ways in which people have grouped or categorised plants in the past. The most ancient name is "whara", which originated when people left Taiwan to colonise the Phillipines. It refers to plants with sheathing leaves of the genera *Astelia, Collospermum* and *Phormium.* The name is derived from the Proto-Polynesian "fara", which in turn is believed to derive from a Proto Austronesian word which refers to Pandanus species that occur naturally in the Philippines and throughout the tropical Pacific (Campbell-Dunn, 2007 p. 7). Piupiu, which originated in the islands of South East Asia, is another name that describes a growth form, referring to fan palms in Sulawesi and mainly to ferns in Aotearoa, including the several *Blechnum* species found in Aotearoa. Ti, also from insular South East Asia, has throughout its history been associated with species of *Cordyline*. In Aotearoa New Zealand it refers to the cabbage tree (Ti Kouka). Another distinctive name is the Kahikatoa (the name for Manuka north of Auckland), deriving from the word kapika, which itself originated in the Bismark Archipelago. This name denotes a tall, graceful tree.

The name manuka, belongs to a later period, when the voyagers had settled the islands of Eastern Fiji and Western Polynesia. In the language of this period, the word nuka refers to plants with medicinal properties, and in Te Reo Māori relates to the antiseptic action of manuka leaves (Foster, 2008). The two names; Kahikatoa and Manuka, embody the dual wounding and healing purposes for which Māori used *Leptospermum scoparium* (toa, the word for warrior in Te Reo). One unexpected link was provided by Totara, which in Tahiti refers to the puffer fish, a prickly fish. It seems likely that the Totara's prickliness impressed Māori when they first arrived in Aotearoa. This knowledge and research of language patterns differs in thinking from the Linnaean system of classification through which most botanists view the world of plants, and is a reminder of how much language embodies our humanity.

The next section confirms traditional thinking and discusses how this relates to the Māori language and the Māori cultural naming protocols that may have an influence on future naming practises of new species discovered in Aotearoa New Zealand.

2.6 Language and Knowledge transmission

Genealogy is woven throughout all strands of Māori culture. Every class and species of things has their own genealogy. This is a reliable method for classifying different families and species of flora and fauna of the order in which processes occur and the order in which intricate cultural activities or ceremonies occur. Genealogy is a tool for transmitting knowledge from one generation to another (Marsden & Henare, 1992). Te Reo Māori, prior to the arrival of the European settlers, was transmitted in oral form and stored from one generation to the next within people's memories and expressed through stories, songs, dances and carvings. Myth and legend were used as a tool for knowledge transmission, and these were deliberate human constructs that condensed historical information into easily acquired forms, and methods of learning and retaining sacred and everyday Māori knowledge, ecological values, understandings and views of the world. From conception to performance histories, significant names were chanted or recited (Best, 1942; Binney, 1987; Thornton, 1999). This knowledge was then applied through community laws, agricultural practice, local language and day to

day living (Best, 1929; King, 2008). For example, the seasonal activities of the Taiko or Black Petrels (*Procellaria parkinsoni)* and Titi or Sooty Shearwaters (*Puffinus griesus)* were observed and utilised by navigators as clues to where land was. Petrels breed in New Zealand and the adjacent islands in the southern summer, and then migrate to the northern Pacific for the northern summer Harlow (cited in (Sutton, 1994). Māori people tend to liken themselves to the actions and movements of the birds, trees and the features of their surrounding environment. For example, the Miromiro or NZ Tomtit (*Petroica macrocephala)* in Māori history was the messenger of love; the strength and protection of the mighty Kauri tree (*Agathis australis)* whose attributes are large, supportive, dependable, and strong; the wisdom of the great Totara *(Podacarpus totara)* represents the hard work of a great chief (Brougham, 1996; Mead, 2010).

The use of story throughout Māori history is evident in Māori naming protocols, where names represent more than just an identity marker but more an understanding of the evolutionary journey and relationship species have to their surrounding environments. For example, the Pipiwharauroa or Shining Cuckoo (*Chrysococcyc lucidas*) offers a literal meaning of the bird's natural behaviour to circum navigate the world, travelling over 6000 miles each year as part of its migratory course (Gibson, 2007). "Pīpī . is a Māori word for young birds, "wharau" a Māori word for voyage, "roa" a Māori word for long, hence Pīpīwharauroa - The bird of the long journey (Williams, 1912) , Wehi et al (2009 p. 201) support this idea in stating "that the use of imagery was used to understand and convey history". Kawharu (2008) further describes that whakatauki (ancestral proverbs), purakau and korero (myths and stories), karakia (prayers), waiata (songs) are enduring and relevant as records of tribal memory which are often related to species names, for example the Kākā; that is loud and boisterous, as opposed to the Kūkū or wood pigeon that is quiet and cautious, and the call of Tūi in waiata, and whakatauki that signify or herald spring and springs activities.

The introduction of the Tohunga Suppression Act (1907) brought about a fear in Māori that this sacred knowledge could be tainted by foreign people who would have no respect for its values and understandings, and the persecution of those tohunga or cultural experts and further tribal members who practiced these

historical arts and cultural practises suffered at the hand of the colonial militia in New Zealand at the time under the leadership of (Governor Grey (1861 - 1868). This knowledge was then guarded and not shared commonly. Māori became sceptical in their knowledge dissemination (Marsden & Henare, 1992; Walker, 1996). The Act was repealed in 1964. The increasing influence and common place use of the English language also impacted on the number of native and fluent māori speakers of the early 1900's Karetu 1990 (cited in (J.C Moorfield, 1992).

2.6.1 Tribal variations and differences

Aotearoa New Zealands's 80 million years of isolation from other land masses, the low number of mammals and the wealth of natural habitats preserved some of the world's oldest and oddest life forms. Plants and animals have historical genealogical links originating from the ancient continent of Gondwana; an ancient landmass that is thought to have split apart during the Mesozoic time period to form the present day continents (Hamblin, 2001). Many tribal differences of names given to both plant and animal species occur in Aotearoa New Zealand, due to the variation of species and their uses to the Māori. The early Māori settlers that set about discovering this new land settled on the coastline first, and then moved inland. This early phase of settlement saw an extension of ecological knowledge, a heavy reliance on wild animal foods and rapid population growth McGlone (cited in (Sutton, 1994). Between 800- 600 years ago the early settlement phase of Māori in Aotearoa was over.

A favoured and versatile plant Harakeke (*Phormium tenax),* was often utilised by Māori for many reasons, and was known by a variety of names that differed throughout the country. The following names given to Harakeke reflect the primary location, dialectal difference, descriptive features and/or effective use of the species (Beever, 1991; Riley, 2001):

> Aoanga (variegated), Aohanga (variegated), Aorangi (striped), Atemangoo, Ateraukawa, Atewheke, Awanga (variegated), Hurahurahika, Maomao (dark edges), Oue, Parekoritawa (variegated), Paritaniwha (superior tihore), piikookoo (broad brown edge), Pootango, Raataaroa (superior), Rarehape, Rongotainui (long leaf), Rukutia, Taiore (light green

leaf, dark edge), Taakirikau (Strong fibre), Taaneawai (broze foliage), Taapoto (strong fibre), Taaroa (not finest), Tiihore (very strong fibre), Wharanui.

Furthermore Williams (1912) recorded the following unpublished names for the species Harakeke (*Phormium tenax):*

Kauhangaroa (flax leaved tihore), Maomao, Oue, Paritaniwha, Piikookoo, Pootango, Rerehape (fine), Rukutia (fine), Taakirikau (strong fibre fine), Taamue (obtuse leaves), Taaneawai (bronze), Taapoto (strong fibre), Taaroa (ordinary), Tiihore (best variety strong fibre), Tikumu (fine var Tahu) (Anderson, 1926) .

In another example, P Smith from the West Coast and Taranaki areas recorded the following names for Harakeke (*Phormium tenax), including:*

Ate mango, Ate raukawa, Ate whaka, huiroa (very thin bronze edge), Huruhuruhika, Karu manu (narrow dark edge), Kati raukawa (very thin edge), Maunu, Muka, Ngutu-nui, Ngutu paarera, ngutu wahine (wide dark edge), parikoritaua (variegated fine fibre), pare korewai, puutaiore, Taporo a maroro, Taapoto or Whiitau, Te Tuuao (thin dark red edge), Tiihore, Tiihore parariki, Tito Onewai, , Tukura (dark edge), Wharanui (large leaf), Wharawhara (Anderson, 1926).

Finally, Tuhoe also had a range of names for Harakeke (*Phormium tenax)* , including-

Huuhi (inferior), Ngutunui (good), Oue (one of the best), Paritaniwha (good), Raataaroa (good), Tutae manu (superior), Whararíki (inferior), Aohanga (striped), Aorangi (striped), Taamure (obtuse leaved) (Anderson, 1926).

These names were recorded in the lists compiled by early explorers, missionaries, botanists and others during their work among the Māori people in the 19th century and earlier (Anderson 1926; Beever 1991). Plants of special importance to Māori received a number of different names recognising their varieties, or important parts of the plants or growth stages (Foster, 2008).

The most comprehensive written records on Harakeke varieties are those of the Flax Commission who reported to the House of Representatives in the 1870's (Scheele, 2005). As part of their attempt to learn the best cultivars for industrial use, leading commissioners, Keely and Haultain - detailed the problems of matching the names to the plants. Rene Orchiston from Gisborne started a collection in the 1950's after observing the weavers in her area and their limited resources. In 1987, Orchiston offered her collection to the Department of Scientific and Industrial Research (DSIR) to form a cultural basis of a collection of New Zealand flax. Manaaki Whenua / Landcare Research in Lincoln, Canterbury took over stewardship of the collection when DSIR was disbanded in 1992 (Scheele, 2005).

A collaborative research project supported by the work of Landcare Research New Zealand and Te Roopu Raranga Whatu, the Māori weaver's forum of Aotearoa, examined the varietal and environmental influences on the properties of strands prepared from *Phormium* leaves for making the Māori garment piupiu. (Te roopu raranga whatu o Aotearoa, 2009).

This research project examined the cultural importance of this species and found that the traditional Māori knowledge of Harakeke, the various names, and meanings of those names, were useful for wider understanding of the species and conservation purposes. Manaaki Whenua continues to research Harakeke taxonomy and properties alongside traditional weavers and the Rene Orchiston Collection has become a resource base for weavers and other science researchers (Scheele, 2005).

In another example of names and identification an unfinished, unpublished work of researcher Elsdon Best titled *An index of names*" (Best, 1911), is his records that appears to include many variations of Māori names for many species. Many common species of flora and fauna that were used by Māori were represented by their many different names and recorded in this unpublished, handwritten form.

The literature here highlights the Māori language as a major vehicle for cultural transmission, and historical preservation through migration patterns and

colonisation of the wider Pacific. It is explained here that according to a Māori belief system that Māori methods of classification are embedded in the language patterns that have been developed since the creation of time. Examples of a species Harakeke, favoured by the Māori, support a variation of names dependent on their practical use and cultural importance.

The following section recognises the importance of the Māori language and highlights specific protocols associated with naming that include looking at the historical meanings of names, origins of those names with historical examples that either honour or disrespect the language and the implications of those two aspects on future generations of Māori and New Zealand citizens.

2.7 Māori Naming Protocols

2.7.1 Meanings of names and origins

> "To name something is the means of establishing a relationship, namely a whakapapa, between the person or group doing the naming and the thing named. It is the basis upon which connections are made, identity clarified and asserted, and mana over that thing is generated" Dr Manuka Henare (ICS Solutions, 1985).

The Māori tongue was described by many early explorers as being "prolific of names" (Anderson, 1921). Some 600 Māori names have been recorded for the 120 species of birds in New Zealand (Riley, 2001). In 1855, the melodious Māori language was spoken by the indigenous people of Aotearoa New Zealand in its pristine purity. Through the arrival of foreign explorers and governance, the language has become mixed with words from other languages, including English influences (Best, 1929; Riley, 2001; Whatahoro, 1913). Tāne, God of the forest, procreated the various species of creatures that dwell in the forest. The origins of names of the children of Tāne relate to the nature of these species and their uses. Kiekie (*Freycinetia banksii*) and Harakeke (Phormium species) in Māori genealogy were brothers: Kiekie, a climbing plant, clung to the father figure Tāne, and Harakeke, a ground dweller, clung to mother figure Hinemoana, thus relating to their environment in which both species dwell.

> Kiekie also has different names for its constituent parts; ‘Kiekie’ being the name for the leaf part of the plant, ‘Tawhara’ the māori name for the fruit, ‘Tawhara’ the fruit on the tree climbing plant, and ‘Tiore’ the fruit on the ground spreading plant. ‘Pehia’ is the name of the shoot of the aerial root. ‘Purapura inanga’ is the white shoot with little white spots (Te Roopu Raranga Whatu o Aotearoa, 2009).

Naming applies to many areas in many communities worldwide. There will always be a need to retain knowledge and information through this spoken language, and a sense of control over the meanings of the names, where the remnants of some ancient peoples of long gone communities are the names they left behind.

Naming is also seen in the naming of children, where names carry histories of people and events. As a result of Christian baptism practises which introduced Christian names and family names and schooling practises, teachers shortened names or introduced a generic name or a nickname as a result of not wanting to address the pupil’s indigenous name. Figures collected in 1846 showed that there were a little over 5000 baptised Māori and as a result of this influential change, many indigenous communities hid their indigenous names by using them only in indigenous ceremonies, or by positioning them as second names to protect the integrity of the meanings of those names (Smith, 1999). Children were also named with ancestral names and took on new names through life; both of these practices were common traditions of Māori as a result of a change of tikanga. Māori children and many others literally wear their histories in their names (Smith, 1999). This practise has seen the retention of knowledge and whakapapa from one generation to the next where Māori recognise the importance of names as the building blocks of the language and culture.

2.7.2 Traditional language and new language creation

The Māori language has its own sacred character, and its everyday nature. Pere (1999), describes that the Māori language is central to cultural practices and identifies to the world who and what the Māori people represent. The evolution of Te Reo Māori since the arrival of the European settlers has undergone inevitable change. With the introduction of many new tools for living, and new

language transmission techniques, such as reading and writing, the world as the Māori knew it expanded exponentially. Māori felt the need to adapt to the change and therefore the language adapted too (Moorfield, 1996). Many new tools, introduced animals and plants, and new governing systems and technologies needed new names and hence a new culture of naming than that of ancient times arose and developed. Transliterations of English words and Latin species names were adopted and became part of the Māori language, for example, the transliterations of Paihamu or Possum (*Trichosurus vulpecula*), and Makipae or Australian Magpie (*Gynmorhina tibicen Cracticidae)*. Latinised Māori words also began to appear e.g.: Okaritanus – named for a Māori place named Okarito, a township in Westland, New Zealand (Taylor, 2002); Nehuta meaning "dusty powdery" a latinised adjective of the Māori word nehu meaning fine powder, or dust; Pekeoides meaning "looks like a bag" from the Māori word pēke meaning bag or sack, combined with a Greek word oides meaning the resemblance of; and Rakaiensis – a species discovered on the Rakaia River in Canterbury, New Zealand, coupled with the Latin ending ensis meaning from that location. Furthermore, the recent work by scientists Buckley and Bradler (2010) who have discovered, described and named a new genus and species of stick insect from the far north of Aotearoa New Zealand - *Tepakiphasma ngatikuri*, named after an area with the Māori name Te Paki located in the far north, the only region where the genus has so far been found, and joined with a Latin stem word derived from the word *phasmatodea* meaning stick insect (an order of insect). The scientific name was considered in conjunction with the Ngati Kuri people who are the kaitiaki or local indigenous guardians of the Te Paki / North Cape area of Aotearoa New Zealand (Buckley, February 2010) . Names also differ within each of the many different localities throughout Aotearoa New Zealand, being specific to the stories and people of those areas (Foster, 2008; Riley, 2001; Wright, 1950).

2.7.3 Correct use / recording / pronunciation

The incorrect use and recording of the Māori language by early missionaries and settlers brought about many misunderstandings of the meanings of Māori words and the meanings of Māori names. Wiremu Maihi Te Rangikaheke, a northern Māori chief assisted Sir George Grey and became his Māori language teacher, in which Grey became competent in Te Reo Māori. While in Grey's employment

and at his discretion, Te Rangikaheke built up a large collection of Māori manuscripts, all written before 1854. Grey also encouraged other Māori chiefs to write down their accounts. In 1853 Grey left New Zealand to become the Governor of the Cape Colony. While he was located there, Grey published Māori material, without any Māori person checking his work (Curnow, 1990).

Grey incorrectly translated Te Rangikaheke's manuscript (1849), to name the North Island, Aotearoa. The following sentence in Rangikaheke's manuscript *"*Ka kite atu ia i waho i te moana i tenei motu i Aotearoa" was translated by Grey as: "He found in the sea this island Aotearoa" (Grey, 1956, p. 106). But in a subsequent book Grey co-opted, he used Aotearoa as the name of New Zealand, to use in the Māori title for a Māori name for New Zealand *"Proverbial and popular sayings of the New Zealand Race / Ka nga whakapepeha me whakahuareha a nga tipuna o Aotearoa"* (Grey, 1956**).** This was probably the first time that Aotearoa was published and used in this case as a national name for New Zealand. Other European and New Zealand scholars took their cue from Grey and began using Aotearoa as the Māori name for New Zealand.

The transformation of the use of certain Māori words is also evident in historical publications of the Māori King movement or Kingitanga from using the national name known widely in the mid 1800's as Niu Tireni, to replacing it with Aotearoa in three different editions of Te Hokioi, the first Māori published newspaper (Curnow et al, 2002). The first example was published on 15th June 1862 as *Te Hokioi o Niu Tireni e rere atuna, (The war-bird of New Zealand in flight to you).* In the next edition on 9th October 1862, the name of the newspaper changed to become *Te Hokioi e rere atuna*, noting that the name Niu Tireni had been removed. The reformatted title page published in 1863 shows that it is addressed, "o ia iwi, o ia iwi o Aotearoa me Te Waipounamu**"** (Darroch, 2009), to each individual tribe of Aotearoa *(the North Island)* and Te Waipounamu *(the South Island).* This transition shows a shift in the use of a standardised name that does not represent an indigenous language viewpoint that was slowly overtaken by a more culturally appropriate name for the North Island. The name Aotearoa is currently commonly known and used widely as the Te Reo Māori name for New Zealand, a name for the country as a collective as opposed to former maps which show names that represent each island and not a single name for all islands.

The Māori language contains only 60 syllables, and the frequent recurrence of those syllables has produced a sense of similarity in Māori names which can be confusing to the English ear (Williams, 1912). The use of a wrong vowel entirely alters the sense of the word. The continental pronunciation of the vowels being used in Spoken Māori made it difficult for early settlers to spell correctly and they would naturally use the English pronunciation, and therefore many errors occurred in the early records of foreign settlers (Roberts, 2004). A few examples in a list of many include the misinterpretation of Temuka, the shortened version of the Māori name Te Umu kaha, Otahuhu (Smith, 1892), a condensed version of O Tahuhu and finally, a more recent controversy, Whanganui or locally pronounced Wanganui. It is also generally unsafe to trust a mere translation of Māori names as you cannot always break down the word to find hidden or secondary meanings (Colenso, 1865). These examples imply that there is a danger of this native language and its meanings of being misrepresented for disregard of pronunciation and appropriate use in the names of new species discovered in New Zealand. In a current example, *Kopua nuimata* (Hardy, 1984) refers to a big-eyed clingfish, however, the use of the Māori words "nui" and "mata" is not a correct representation of the description, where it translates from Māori as "eye big", being back to front, and should read "matanui" meaning big eyed.

The near loss of the Māori language almost resulted in a dramatic cultural alteration and a form of extinction (Karetu, 2008). Subsequently the Māori Language Act of 1987 was passed, legitimising Te Reo Māori as an official language of New Zealand, and confirming Te Reo Māori as an integral part of New Zealand society. The Māori Language Commission was created to support initiatives that maintain and strengthen the language. One major focus of the Māori Language Commission was to collate and create new words to support those that speak Māori Karetu 1990 (cited in Moorfield, 1996). Te Pataka Kupu is a comprehensive Māori dictionary documenting 24,000 Māori words and meanings, and their reference to the Māori Guardians, in which they belong (Te Taura Whiri i te Reo Māori, 2008). There are many teaching and learning tools now available that provide wide understandings and meanings of Māori words. These tools are created to continuously update the additions to the information and support the language learning and use initiatives of both Māori and non-Māori

who interact with Te Reo Māori. An index of Māori names has been developed from the unpublished works by missionary Reverend Henry James Fletcher (1868 – 1933), who compiled a vast index of Māori names that have been referred to in books and journals, including the names of tribal boundaries, Māori individuals, canoes, trees, landmarks and geographical locations. This work, compiled around 1925, included 987 pages in its original form that have now been scanned, converted, proof read, edited and converted into web pages as a valuable online resource and stored within the electronic databases of the University of Waikato Library.

It has been described earlier that the Māori language is the core of Māori culture and pride of the people. The changing cultural identities of New Zealand through the arrival of early settlers and immigration have had an impact on the Māori language. There has been much work done to preserve the Māori language in its natural state, where it has been eroded over time but the only way for the language to survive is the increased use of the language. An opportunity where Te Reo Māori is recognised in species names is another forum where the use of the language aids its survival.

2.7.4 Future effects of the use of Te Reo Māori in new names; and how it may work.

The strength of Te Reo Māori will be determined by the use of the language, and its practical application through customary protocol. The depression of the early 1900's, the industrial revolution of New Zealand, and the rapid decline and extinction of indigenous species all impacted on the language. A recent increased awareness of the importance of Te Reo Māori as an official language of this country has encouraged a more common place bilingual society, where Te Reo Māori is used in names, public signage and instructional signage. This recent upsurge acknowledges that "full understanding of our world requires the capacity to learn from quite different systems of knowledge and to appreciate that each has a validity of its own within its own cultural context" (Pere, 1999 p. 8)

As a recent example, Seldon (2006) has described new species of *Mecadema* where there is currently little or no knowledge of the species and the taxonomy is poorly understood. Seldon has documented the use of Te Reo Māori within his

unpublished thesis, in six new species that he has discovered in his research in the northern territory of the North Island. The Māori species names *Mecodema manaia, Mecadema haunoho, Mecadema aoteanoho, Mecadema waipoua, Mecadema tenaki, Mecadema ponaiti* offered by the local indigenous people of the northern tribal area, who showed an interest to work alongside Western Science in the naming protocols of new species discovered within their tribal area.

The major factors that seem to underpin Māori naming protocols are most importantly knowledge and an understanding of whakapapa or genealogy. These whakapapa links are important connections to the environmental elements; these links determine the style, type and an appropriate name of a species. An appropriate and correct use of words of the Māori language is important as it shows honour and respect for the species as a descendant of the gods or guardians, and also respect for the indigenous Māori language, where language is a key to understanding our world. Maori theories of knowledge encompass empirical traditions for enumeration, measurement and comparison yet the historical storage retrieval and transmission of knowledge through oral culture means there is an ongoing orientation toward cultural stories as data (Cram, 2006).

2.8 Western Scientific protocols of naming new species

This section reviews literature that discusses the western scientific protocols for naming new species and highlights areas of consideration in terms of taxonomy and nomenclature as a scientific classification process. Literature is reviewed with specific relation to both New Zealand and international conventions of taxonomic nomenclature. There are references in the literature to historical species with scientific names incorporating Māori words and a small scale review of current examples of new species discovered in New Zealand

2.8.1 Relevance of the historical account of New Zealand

Western scientific thinking has developed over thousands of years. The great age of ancient Greek and Roman 600 AD played a major role in shaping the modern western world. This era contributed to discoveries in politics, philosophy and science. Many cultures of the world experienced a long development of many

world views (Ganeri, 2010). Advances in science after the 1500's, with the invention of the telescope and microscope, expanded scientific thinking, and the age of discovery represented a time when peoples of the world came into increasing contact with each other. Modern biological classification has its root in the work of Linnaeus, who grouped species according to shared physical characteristics. These groupings have since been revised to improve consistency with the Darwinian principle of common desent and molecular phylogenetics which uses DNA sequences as data. The works of Aristotle was followed by others, namely Augustus Quirinus Rivinus (1652–1723) and Joseph Pitton de Tournefort (1656 – 1708), who helped advance the naming protocols of species to specific combinations of generic names and modifiers within a hierarchical class system (Okasha, 2002).

Explorers worldwide set off in search of new lands for many reasons. The material gathered from these expeditions contributed to scientific knowledge, maps, charts, and references to the resources, geography and landscape. Until the 1500's, the great southern continent and the Pacific Islands remained unknown. The 1600's saw the expeditions of Dutch explorer Abel Tasman, who explored on two ships, charted and mapped many lands of the world, especially those of New Zealand, named then "Staten Landt", claiming it for Holland in 1642 (Beaglehole, 1961). A Dutchman named Hendrik Brouwer in 1643 proved that the originally described "Staten Landt" was in fact an island, and within a few years the name "Nova Zeelandia" appeared in documents. There was already a "Nova Hollandia", and so through further discovery and discussion "Nieuw Zeeland" became the name that stuck. Wilem Blaeu recorded the name on to the large terrestrial globe he published about 1648, and thereafter that name figured in the more comprehensive atlases used to teach geography in Europe (Beaglehole, 1961). Nova Zeelandia was the Latinised name assigned by the Dutch map makers. Nu Tirene, Nu Tarana, Nui Tireni and Niu Tireni are Māori interpretations and versions of this name (Beaglehole, 1961).

There has been a long historical impact of the naming and claiming of New Zealand. New Zealand was thought to have nothing to offer the East India Company in terms of trade, but the crews of both ships named the *Heemskerck*

and the *Zeehaen*, left some Dutch names as a reminder of their visit here. A few represented here are the "Three kings" of the Three Kings island being a reminder of Dutch; Cape Maria van Diemen, the name of that northern point (Wright, 1950) that preserves the memory of Anthony van Diemen's wife; and the Tasman Sea that still greets the Aotearoa New Zealand coastline. At this time, Europeans were increasing their power in the world through trade. European trade was done through the use of new technology, cannons and muskets. There was a restless search for new lands and wealth (Beaglehole, 1961).

By the 1600's several European countries had established permanent colonies throughout the world. The 17th century voyages of English Captain James Cook provided much information to the Europeans when he was put to sea in search of the great southern continent. This continent was to be explored and the nature of the people examined, if it was uninhabited it was to be annexed, but even if the continent was not found, there was still work to do (Beaglehole, 1961). Through the third voyage of James Cook in 1769-1770, his crew members Joseph Banks and Swede Daniel Solander introduced the flora of New Zealand to science (Beaglehole, 1961). When Cook was in Tahiti, he and other members of his crew engaged in learning some Tahitian language. A Tahitian helper named Tupaia, whom they brought on the voyage to New Zealand, learned some English (Wright, 1950). Tupaia was able to communicate with the Māori and then with Cook. Māori language was not a written language and there was no alphabet chosen to represent the sounds of the Māori language. Cook recorded what he had been told were the Māori names of the islands on his chart as Aehienomauwe (*Maui's fire- Ahinomaui)* a Tovypoenammu *(The Greenstone Water - Te Waipounamu)* Cook 1768, (cited in Darroch, 2009).

Cook's expeditions ranged the coasts of these new lands making a careful assessment of where the most abundant resources of food and raw material lay McGlone (cited in Sutton, 1994). Many names assigned by Cook remain today such as the Bay of Islands, Cape Runaway, the Bay of Plenty, Poverty Bay, Tolaga Bay, Cook Strait, Queen Charlotte sounds, Thames River on its account of its' bearing some resemblance to that river in England and many more. In 1840

Aotearoa New Zealand became a British colony through signing of the Treaty of Waitangi.

Relationships between the New Zealand Christian missionaries in the early 1800's and the Māori of Aotearoa New Zealand produced material towards a miniature dictionary of Māori words, entitled "*A grammar and vocabulary of the language of New Zealand,"* compiled for the use of the missionaries and settlers under the auspices of the church missionary society London, and printed by R Watts for the Church Missionary society (Riley, 2008; Wright, 1950). This book represents the first attempt to subject the language of the Māori to systematic treatment. It was the result of the cooperation of two men Thomas Kendall and Prof Samuel Lee (1783-1852) (Wright, 1950). The travels of English sailor and explorer Dumont D'urville to the Pacific and Aotearoa New Zealand, was responsible for a volume of large scale maps and charts with text (Riley, 2008; Wright, 1950). The voyages of the Astrolabe, carried out by order of the King in the course of years 1826, 1827, 1828 and 1829, was to present a more complete compilation of information that would prove more useful for reference to this area of the world. On coasts inhabited by the Māori people, where nothing had been left without having been assigned a name to it, it seemed strange to D'urville to see nothing but English names noted, and these names were often in rather poor taste, and it was much more interesting to him to discover the names given by Māori. D'urville who interacted with the Māori people "I hove to and shouted to them in their own language," recorded that he was able to make himself understood reasonably well by means of the words that he had learned from the vocabulary compiled by the missionaries (Wright, 1950 p. 75)

D'urville commented in his travel log that, "It is sacred to respect the names given by the first explorer to uninhabited places; these names should be given preference" (Wright, 1950 p. 146). There may come a time when these names are all that remains to the country of the language spoken by its earliest inhabitants. Māori informant Te Ranginui provided the Māori names of lands, and neighbouring islands (Wright, 1950 p. 146) "Te Ranginui and Tawiti, both anxious to satisfy my inquiries also gave me the names of the districts, channels,

and islands which lay all around us. This is how the following names came to figure on our maps". D'urville (cited in Wright 1950 p 146-147).

2.8.2 Western Science's taxonomy / classification / nomenclature

There continues to be a need to seek, record and explain information to build upon prior knowledge systems. The success in increasing understanding usually reflects an insight into how the world is, explanations help to create knowledge, to develop better theories and models of how things are, and to explain why they operate as they do (Purves and Orians, 1983). Scientific explanation has served as a paradigm for such accounts of explanation (Wilson & Keil, 1998). Western scientific approaches have been used to help explain phenomena of the Earth and the organisms that dwell here. One of those approaches to western based scientific thinking is termed "reductionism". Reductionism is an attempt to reduce explanations to the smallest possible entities (Cheung, 2008). This is experienced as a complex system which is nothing but the sum of its parts that can be reduced to the accounts of individual constituents (Cheung, 2008). Taxonomic classifications in the Western scientific system are a form of reductionism where millions of living creatures worldwide are classified further into kingdoms, these kingdoms are then further classified into smaller groupings by phylum, class, order, family, genus and species (Campbell, 1999). The species group of this taxonomic classification system is the most diverse where species are defined as those individuals that can interbreed with each other and produce fertile offspring. Estimates of the total diversity of life ranges from about 5 million to over 100 million species (Campbell, 1999), and the work and research of many taxonomists over the years have aided in the discovery and classification over two thirds of the world species. Gordon (2009) states that "there are many species that still remain undiscovered", and hence this area of science continues to be revised annually (Bisby, 2010; Gordon, 2009).

This practice of naming and classifying into groupings has occurred as a result of exploration and identification of the world. The exploration of parts of the world by Europeans produced large numbers of new plants and animals that needed descriptions and classification. Historical systems of classifying species made it difficult to study and locate all these new specimens within a collection and often

the same plants or animals were given different names simply because there were too many species to keep track of. A comprehensive system was needed that could group these specimens together so they could be found; the binomial system was developed, based on morphology with groups of species having similar appearances, supported by findings of previous research carried out by scientists. In the latter part of the 16th century and the beginning of the 17th, careful study of animals commenced, which, directed first to familiar kinds, was gradually extended until it formed a sufficient body of knowledge to serve as an anatomical basis for classification (Purves and Orians, 1983 p. 795).

The human behaviour of inquiry to investigate the world by naming and labelling has given rise to classification and taxonomy; the science of classification where all living species have been named and classified according to their physical features, physical attributes, interactions with other species or place of origin (Campbell, 1999; Foster, 2008). This worldwide scientific classification system of plants and animals has been developed over a number of years, and is a generally accepted protocol (Purves & Orians, 1983; Campbell, 1999). In the absence of a universal naming and classification system of all species, communication between those dealing with living organisms would be close to impossible (Derraik, 2008).

Latin was the chosen language for naming because it was historically the international language of science (Foster, 2008). In the binomial classification system, where the first word, written with a capital, represents the genus, to which the species belongs, and the second word, without a capital, represents the species, this is a specific reference to where it belongs in taxonomy. These names are normally written in italics or are underlined. For example, in the scientific name for flax of harakeke, *Phormium tenax* represents Phormium from the Greek word 'phormus', meaning basket wickerwork. The name was used by Aristotle for a plant for which mats were woven and hence adopted for the New Zealand Flax. Tenax- was derived from the latin word meaning tenacious or persistent with strong fibres (Campbell, 1999). Linnaeus' works helped to establish and standardise a system that was causing confusion among society. Linnaeus developed for the first time a method for naming species, and for organising and

grouping living things. Other scientists soon began to use his classification system, where it then developed and became the standard system for classifying life (Salmon, 1980; Heather & Robertson, 2005). For the rest of his life, Linnaeus continued to revise his scheme, and hence gathered a huge collection of plant and animal specimens. *Systema Naturae*, the published taxonomic work of Linnaeus (1758) represented a first uniform application of naming, with the classification of over 2000 species, which then became a platform for the future work of specialists in this field. (Dorit, 1991; Gordon, 2009; Walker, 1996).

Until the early part of the twentieth century, French was widely used as an international language. After the Second World War, the worldwide influence of the United States increased dramatically, and as a result, English, already widespread due to Great Britain's imperial influence, became increasingly utilised internationally. English has consequently become an essential language for any scientist, since the most important journals in any field are published in this language. As English established itself as the *de facto* international scientific language, the pronunciation of the Latin names from the binomial system seems to have been progressively corrupted (Derraik, 2008).

2.8.3 Taxonomic protocols

Each different type of living thing that has been formally classified has been given a place in the Linnaean classification system (Campbell et al, 1999; Gordon, 2009). The science of the classification of organisms is called taxonomy, and Systematics is the study of all relationships of all organisms (Purves and Orians, 1983 p. 794). Often when a new variety of life is discovered that has not been classified before, a new taxonomic branch is described and named. For example in the 1970's, scientists worldwide began a deep sea discovery programme that opened up new parts of the ocean floor that once laid undiscovered (Campbell et al, 1999 p. 498). The undiscovered species within 200 nautical miles of the exclusive economic zone (EEZ) of Aotearoa New Zealand are still being explored in deep sea discovery programmes facilitated by NIWA, the National Institute of Weather and Atmospheric research (Gordon, 2009; Nelson, 2009). Gordon (2009) indicates that there is also a wide and varied world of insects yet to be discovered and classified due to the size and scale of the various species".

Classification is an ongoing process; as more knowledge and information is learned about a particular living thing or group of living things (Buckley, 2000; Gordon, 2009), the way in which it is classified may also need to be developed and adjusted through further research (Heather & Robertson, 2005; Paulin et al, 2001).

The International Code of Botanical Nomenclature (ICBN) provides a set of rules that deal with formal botanical names that are given to plants worldwide. These recommendations were set out by members of the committee who are elected to represent their respective areas of botanical research throughout the world. These rules are set to provide clear guidelines and processes to those who are working in areas of classification and nomenclature of botanical species. The intent of the ICBN is that each taxonomic group ("taxon", plural "taxa") of plants has only one correct name that is accepted worldwide (Campbell, 1999). The value of a scientific name is that it is an identifier, and provides a brief description of the organism. The ICBN also includes the naming of other organisms traditionally studied by botanists. These organisms include blue-green algae (Cyanobacteria); fungi, including chytrids, oomycetes, and slime moulds; photosynthetic protists and taxonomically related non-photosynthetic groups (Greuter, 1988). Botanical nomenclature is independent of zoological and bacteriological nomenclature, which is governed by their respective codes (Greuter, 1988). For the naming of cultivated plants there is a separate code, the International Code of Nomenclature for Cultivated Plants.

These principles highlight the major considerations when assigning a botanical scientific name. A major component is the detailed knowledge of the species and which nomenclatural group they belong. This is important when describing the morphology and habitat of the species. The continued use of Latin as a language is a rule. Formal publication of the scientific name of the species and their nomenclature must be formally submitted to a reputable international journal, the species involved can only be assigned once and have only one scientific name. These scientific names are then accepted by the ICBN after correct formal publication specifications.

Western scientific methods of taxonomy include many factors that are the sum of all parts. A comprehensive diagnosis and discussion of the type data of species is explained, these data pertain to both male and female members of the species. Species classification also includes the locality of the species type and material examined and its common distribution. Etymology is explained in detail with the origin of the meaning of the name (Timms & McLayb, 2010). For the publication of new species there must also be evidence of a differential diagnosis that ensures integrity of the species, with further informed discussion. The naming of species according to morphology and discoverer of the species is of high relevance and occurrence within the scientific naming of new species.

The development and use of DNA technology has revolutionised many processes of science and especially the processes of species classification. Processes that require expert biological knowledge and genetic techniques are especially useful in deciding if two similar-looking living things should be classed as separate species or not, or placing an unusual species among its relatives, which can often look very different (Gordon, 2009). Species that have been re-described through the use of DNA sequencing techniques are gaining in numbers. The revision of the genus *Forstern* (*Stylidiaceae*) in New Zealand also occurred (Glenny, 2009). Three existing species and two new species were added; these differentiations were highlighted in the new chromosome records for the two species. These developments within areas of biotechnology and DNA will enhance molecular information and future reference of species classification.

2.8.4 Publication

Scientific information dissemination in Aotearoa New Zealand occurs widely through journal publication. There are a range of Aotearoa New Zealand science research journals that include the Journal of the Royal Society of New Zealand, an international journal of the Science and Technology of New Zealand and the Pacific region (rsnz.org.nz). The Royal Society of New Zealand has an important role in fostering debate and research across the applied, biological, earth, engineering, information, medical, mathematical, physical, social, and technological sciences. The Society also publishes the New Zealand Journal of Marine and Freshwater research, an international journal of Aquatic Sciences of

Australasia, South America, Antarctica, and the Pacific; the New Zealand Journal of Zoology, an international journal of the zoological science of New Zealand, the Pacific Basin, and Antarctica; and the New Zealand Journal of Botany, an international journal of Austral Botany. These journals are part of an integral group of New Zealand journals that play an important role in disseminating information to researchers in universities, research institutes, and other centres around the world (rsnz.org.nz). All of these international journals provide open access to information regarding new species, and the biodiversity of New Zealand. Information dissemination through scholarly journal publication is a key component of the process of naming a new species.

There has been a continuous trend (Table 2 below) of new species being discovered and reported by scientists in various fields and re-classification of species in New Zealand over the years. The ambitious international goal set down by the International Body of Species 2000 of cataloguing the entire known biodiversity, has initiated the creation of the New Zealand Inventory of Biodiversity (Gordon, 2009). This body recognised the need for an inventory of all known species of plants and animals worldwide. New Zealand also supported this initiative and began to collate information for the Inventory of New Zealand's biodiversity which includes land, sea and freshwater, native, introduced, living and fossil organisms (Gordon, 2009). The following data represents the work of this body where each statistic represents a full length classification and relationship to other members of the taxonomic tree. This information provides also a foundation for progress in areas of classification and taxonomic processes.

Table 2. Diversity of New Zealand biota (Gordon, 2009, p. 7)

Kingdom	**Total Species***
Bacteria	699
Protozoa	2,598
Chromista	1,868
Plantae	7,071
Fungi	7,065
Animalia	35,604
	Marine 12,971
	Terrestrial 20,445
	Fresh water 2,414
Total	54,905
*approximate	

2.9 New Zealand species classification

The limitations to taxonomic work in New Zealand, occurs predominantly because there are only a few specialists that study and name plants and animals in New Zealand. The resources and technology needed in taxonomic research at the ocean depths are also limited.

Much of the work on the inventory of biodiversity of New Zealand is a collaboration of many specialists who are based throughout the world. These specialists contribute their efforts and research findings towards an inventory of all of the world's species (Gordon, 2009).

One of Aotearoa New Zealand's earliest taxonomists Walter Buller (1838-1906), was raised by his missionary parents in the Hokianga, Buller grew up speaking and writing in both the English and Māori languages. Buller communicated well with communities while gathering information with regards to his collection of New Zealand bird specimens. The use of Te Reo Māori in the names of birds is evident in this collection of birds and the importance of this collection of

specimens from different localities highlights information for the study of geographic variation (Bartle, 2009).

Recent research articles have described work on new species discovered in New Zealand. Davidson (2010), reported on research relating to two additional indigenous species of Veronica (*Plantaginaceae*) from northern New Zealand: *V. jovellanoides*, a new and highly endangered species, and *V. plebeia*. Timms and McLay (2010), reported on findings with regards to a new species of *Eulimnadia* (Crustacea: *Spinicaudata Limnadiidae*) from Aotearoa New Zealand. With regards to offshore research Krzemi`nska (2001) reported on the Australian region discusses three species of the genus *Paracladura* from New Zealand that have been re-described: *P. antipoda*, *P. harrisi* and *P. māori* (Alexander, 1921). A new species related to *P. māori, P. oparara* is also described in this research by Alexander which shows an increasing use of Te Reo Māori words as identity markers of species that are discovered in this area of the world.

Many cases of newly discovered species have used Te Reo Māori, either by way of recognition of the location of discovery, or the physical descriptions or the local people of the area. For example *Tmesipteris horomaka*, a new octoploid species from Banks Peninsula in the South Island, is named after the Māori word for Bank Peninsula (Perrie 2010). Secondly, *Alternanthera nahui,* a fourth Aotearoa New Zealand species of the genus Amaranthaceae found in the Pacific and Australasia, was given its name after its Māori common name "nahui", known from throughout the North Island and Canterbury in the South Island (Heenan, 2009).

Historically plant species have been named having not adhered to the principles of the ICBN. Between 1882 and 1997 twenty-two names published for New Zealand flowering plants by Petrie (1846-1925) have as their second epithets Māori place-names in the nominative case, counter to the relevant ICBN recommendations (Gardner, 1998). In chronological order of publication they are:

> *Cotula maniototo* Petrie, *Carex wakatipu* Petrie, *Lepidium kawarau* Petrie, *Lepidium matau* Petrie, *Poa maniototo* Petrie, *Carex rekohu* Petrie,

> *Myosotis rakiura* L.B.Moore, *Hebe pareora* Garn.-Jones & Molloy, *Convolvulus verecundus* subsp. *waitaha* Sykes, *Crassula hunua* A.Druce, *Crassula mataikona* A.Druce, *Crassula ruamahanga* A.Druce, *Crassula manaia* A.Druce & Sykes, *Senecio hauwai* Sykes, *Senecio marotiri* C.Webb, *Coprosma waima* A.Druce, *Chionochloaflavicans* f. *temata* Connor, *xCelmearia ruawahia* Heenan, *Leucogenes tarahaoa* Molloy, *Hebe tairawhiti* B.D.Clarkson & Garn.-Jones, *Wahlenbergia akaroa* J.A.Petterson, *Wahlenbergia pygmaea* Colenso subsp. *tararua* J.A.Petterson.

In a more current context, as mentioned previously, in the unpublished research work of Seldon (2002), with species of beetles of the *Mecadema* genus:

> All six species have been given a Māori name as the second epithet of the scientific name. *Mecodema aoteanoho*; is referred to where Aotea is a Māori name for Great Barrier island, noho meaning from that place. *Mecadema haunoho* refers to Hau being the site of discovery Hauturu and noho meaning from that place. *Mecadema manaia* was a name selected from a number of different names provided by the people of Ngati Wai and is named after the type locality of the species. *Mecadema ponaiti*; a literal translation of the islands to which this species is endemic, "Ponaiti" refers to the Poor Knights Islands. *Mecadema tenaki,* a species named in honour of the first Māori tribe Te Naki to settle in the North Cape area. *Mecadema waipoua,* a species name that refers to the Waipoua forest, the largest Kauri forest that covers the Parataiko range where the species is found (Seldon, 2002).

The application of Te Reo Māori has been used in terms of type location, and nouns as physical descriptors, however there is scope for a wider meaning of a name and consultation for words to consider as names for new species. Given that there is an accepted worldwide system for taxonomic nomenclature, and through the legitimate nature of the language, there appears to be a continued use of Te Reo Māori as an indigenous identifier of species discovered in this area.

The following are examples of endemic New Zealand fish species that include Māori names:

> *Galaxias rekohua* Mitchell, 1995 - Chatham galaxias, *Echiodon pukaki* Markle & Olney, 1990 - southern messmate, *Caelorinchus matamua* McCann & McKnight, 1980 - Mahia rattail, *Gadomus aoteanus* McCann & McKnight, 1980 - filamentous rattail, , *Modicus tangaroa* Hardy, 1983 - eyespot clingfish, *Acanthoclinus rua* Hardy, 1985 - little rockfish, *Decapterus koheru* Hector, 1875 – koheru, *Ruanoho whero* Hardy, 1986 - spectacled triplefin. *Kopua nuimata* Hardy, 1984 – big-eyed clingfish, (Nelson, 2009).

Further species that have Māori names include;

> *Kaiwhekea katiki* Cruickshank & Fordyce, 2002 from the Katiki Formation at Shag Point, Otago; *Taniwhasaurus oweni* Hector, 1874; *Aechmella rangiauriensis* Taylor & Gordon, 2007 from Pitt Island (Rangiauria); *Awhiowhio osheai*, Kelly, 2007) where a Te Reo Māori noun is used to describe a distinctive characteristic of the microscleres in this genus, *Aciculites manawatawhi*, the name Manawatahi was chosen to reflect the locality. for the largest island in the Three Kings group, Manawa Tawhi (Great Island) (Nelson, 2009).

There are also species of squat lobsters discovered in New Zealand that feature Māori names;

> *Munidopsis maunga*, with the use of the noun maunga meaning mountain, with reference to the type locality of the Macauley volcano on the Kermadec volcanic arc, New Zealand. *Munidopsis papanui*, named for the type locality, Papanui Canyon off the Otago coast. Papanui is also a Maori word for palm of a hand, alluding to the apparent sexual dimorphism and lateral asymmetry of the cheliped palm (noun in apposition). *Uroptychus kaitara*, where the Māori word kaitara means coarse or rough, *U. paku* = small or tiny - very small species, *U. rutua* = bump or bulge that refers to this species where it has two large inflated regions at the front of the

carapace, *U. toka* = rock - locality of this record is from Esperance Rock, Kermadec Islands) (Nelson, 2009).

Species also named by overseas workers have used Te Reo Māori in the names;

Taihape karori Barnard, 1972; an Amphipoda species, intertidal in algae, found Wellington, Gisborne, Whangaparaoa, Leigh; *Waitomo manene* Barnard, 1972 an Amphipoda, 1860-1683 m off Oamaru, Castlepoint, and Cape Turnagain, (however no reason was given as to the etymology of the species name); *Microspio maori* Blake, 1984, a small spionid polychaete described by an American, without consulting in New Zealand, with etymology statement that "The epithet is selected in honor of the native Māori people of New Zealand" (Nelson, 2009).

The research objectives of this project is to examine the current use of Te Reo Māori in the scientific names of new species discovered in New Zealand and perhaps offer some possible guidelines on the appropriate use of the Māori language in those names that honour both the language and the species being named. The more recent names of species incorporating Te Reo Māori perhaps owe their form to a desire for political correctness. However, Māori people are becoming empowered to preserve their own forms of naming species and names rather than naming species within other language structures. The decline in common scientific use and standards of the Latin language and the increased use of common names have been seen as an easier way of understanding species and taxonomy and may also be suspected as reasons for the inclusion of Te Reo Māori in more current taxonomic protocols.

2.10 Worldwide status of species classification

The Catalogue of Life is an online dictionary of all known living organisms throughout the world (Catalogue of Life, 2012). This database of information is similar to a modern version of Linnaeus' work of classifying all species of the world. This digital catalogue provides information through a widely accessible checklist of known species worldwide. This initiative was a priority of the Global Taxonomy initiative of the United Nations convention on biodiversity (Gordon, 2009). An annual checklist ensures up to date and current statistics and

information. Three thousand taxonomists worldwide contribute and maintain 77 taxonomic databases. The New Zealand Inventory of Biodiversity (NZIB) database contributes information with regards to 54,905 New Zealand species (Table 2). The Catalogue provides information on 1,257,735 species and 98,075 infraspecific taxa. This Catalogue also includes 886,882 synonyms and 343,586 common names of species worldwide (Bisby, 2010). Until this project, there was no complete catalogue of all known species on Earth. The catalogue has provided useful information for the comparison of species for global bio security purposes (Bisby, 2010). Search results from the Catalogue for the entry "totara" indicated 20 worldwide entries for species containing or beginning with the word "totara" that are available as part of the catalogue of life annual checklist (Bisby, 2010). The Catalogue of Life maintains a standard dataset for all recorded species. The following dataset must be supplied for species to be considered as additions to the Catalogue.

(1) Accepted scientific name (and reference)
(2) Synonyms (and references)
(3) Common names (and references)
(4) Latest taxonomic scrutiny (name of person and date)
(5) Source database
(6) Additional data (optional)
(7) Family to which species belongs
(8) Classification above family, and highest taxon in database
(9) Distribution (Gordon, 2009)

This dataset presents research and knowledge with regards to species worldwide, in a western societal framework. The dataset does not make visible the cultural heritage surrounding species and organisms in each of their respective countries and does not include information of their cultural attributes which omits the contribution indigenous peoples can make.

2.11 Current contexts of species classification and situations with regards to New Zealand species

The Waitangi Tribunal claim named the "Wai 262" was filed against the crown in 1991 by members of six distinct Māori tribal groups, and was historically known as the "Flora and Fauna Claim". As a result, the claim aims to include areas of governance, policy and indigenous rights. On July 2 2011, the Waitangi Tribunal released its report within three issues on the claim relating to New Zealand's law and policy affecting Māori culture and identity with respect to flora and fauna of Aotearoa New Zealand (New Zealand Waitangi Tribunal, 2011).

The different points of emphasis in the report have been arranged into four categories being:

- Mātauranga Māori / traditional knowledge, concerning the protection and retention of Māori knowledge systems that are being increasingly targeted internationally,
- Māori cultural property / tangible manifestation of mātauranga Māori, as affected by failure of legislation and policies to protect Māori collective ownership of cultural taonga,
- Māori intellectual and cultural property rights, as affected by New Zealand's intellectual property legislation,
- Environmental, resource and conservation management.

This claim was lodged to address the nature and extent of treaty rights held by iwi and hapu in indigenous flora and fauna, cultural heritage objects and valued traditional knowledge. This is the first Tribunal report to consider what the Treaty relationship might become after historical grievances are settled, where the Waitangi Tribunal comments in the report summary that it is "time to move beyond grievance" (New Zealand Waitangi Tribunal, 2011).

The point that is significant in this research project is that it addresses iwi Māori participation in decision making in areas with regards to resources and species. Evidence presented by the Wai 262 claimants revealed that the focus and concerns

are mainly to address the adverse effects of intellectual property rights on traditional knowledge and associated cultural property and biological resources. There are fundamental differences between western intellectual property rights and traditional knowledge protection mechanisms of indigenous peoples. Māori have developed intimate and long standing relationships with flora and fauna, with particular interest in patents and plant variety rights. The rights that indigenous people assert are collective rather than individual, by nature (New Zealand Waitangi Tribunal, 2011).

2.12 Differences in Māori and scientific reasons for naming

The age of discovery set forth a time by all peoples of the world to discover and identify the world we live in. The following table summarises the attributes from this literature review that were used to assign names to species by both Māori and scientists

Table 3: Naming philosophies of species of Māori and Science both past and present

How Māori have named organisms	*How scientists have named organisms*
Natural attributes- bird song, movement *Behaviour of the animal* *Physical characteristics* *Significant event* *Spiritual nature* *Medicinal use* *Use as a food source*	*Physical characteristics e.g.: lacebark* *Gross morphology e.g.: whitewood, bluebell* *Type location* *Embryology* *Behaviour* *Hybridisation* *Medicinal use- e.g.: scurvy grass* *Use as a food source: Cabbage tree, tea tree* *Similarity to another familiar plant eg NZ Oak* *Humorous aspect* *After the researcher* *After some famous person.*

The key differences represented in Table 3 between how scientists and Māori have named organisms are varied. Māori name species based on a number of details that are holistic, and can include more than one reason for the name, and in some examples can have a number of different names for the same species. Māori name species based on the knowledge base and where the species fits within a Māori worldview. Scientific naming represented in Table 3 is often based on one main characteristic or feature, where a species has one formal scientific name that does not often get changed. Scientific names represent the time of species classification and identification, and species can be represented by the names of previous science scholars or those that discovered the species.

New species that have been discovered, re-classified or received taxonomic treatment are published in a number of scientific journals including those of the Royal Society of New Zealand (Table 4). The following table shows that there has been a continuous trend of new species discovered in Aotearoa New Zealand over the last past 5 years. The table contains examples of species names that include Te Reo Māori and some that have not. The variation of species names represented in the table is wide and name choices are dependent on the researching scientist. This information leads to the argument that some consistency in naming using Te Reo Māori and its appropriate use is important and is a major reason why this research project was undertaken.

Table 4: Names of new species published recently in New Zealand science journals

Author	Journal
2010 Perrie, L R. , Brownsey, Patrick J. and Lovis, John D.(2010) 'Tmesipteris horomaka, a new octoploid species from Banks Peninsula',	New Zealand Journal of Botany, 48: 1, 15, 29
Buckley, T. R., Bradler, S, (2010). "Tepakiphasma ngatikuri, a new genus and species of stick insect (Phasmatodea) from the Far North of New Zealand."	New Zealand Entomologist **33**: 118-126.
2009 Heenan, P. B. , de Lange, P. J. and Keeling, J.(2009) 'Alternanthera nahui, a new species of Amaranthaceae indigenous to New Zealand',	New Zealand Journal of Botany, 47: 1, 97 — 105
2008 Caldwell MW, Konishi T, Ikuwo O, Muramoto, K. (2008) A new species of *TANIWHASAURUS* (MOSASAURIDAE, TYLOSAURINAE) from the upper Santonian-Lowers Campanian (Upper cretaceous) of Hokkaido, Japan.	Journal of Vertebrate Paleontology 28(2):339–348, June 2008
2007 Heenan, P. B. and de Lange, P. J.(2007) 'Two new species of Dianella (Hemerocallidaceae) from New Zealand',	New Zealand Journal of Botany, 45: 1, 269 — 285
2006 McCosker J. E ; Stewart, A. L (2006). Additions to the New Zealand marine eel fauna with the description of a new moray, Anarchias supremus (Teleostei: Muraenidae), and comments on the identity of Gymnothorax griffini Whitley & Phillips	New Zealand Journal of Botany, 2006, Vol. 44: 41-46

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2.13 Chapter Summary

The traditions in thinking with regards to both Māori cultural ways of knowing and understanding, and a western scientific approach to names, and naming processes have many similarities. Māori respect language, not just a make-up of words, but being the key to the understanding of Māori knowledge systems. Māori names represent a holistic view of identity and generational transmission of knowledge of the world. A Western Science approach is categorical and methodological that is directed by a series of developed scientific processes. These two approaches to understanding the world can come together where Linnaeus' scientific works helped to establish and standardise a system of species identification and classification that was causing confusion among society, and the progression of this system through the years that has now included species that have Māori in the scientific names of species.

Referred to earlier in this chapter was a prophetic saying of the First Māori king Potatau that expresses "Kotahi te kohao o te ngira e kuhuna ai te miro mā, te miro pango me te miro whero, where there is but one eye of the needle in which must pass the white, black and red threads". This was stated to explain to Māori that there will come a time where tikanga Māori will interact with the protocols of other cultures and to embrace these cultures in order to work together.

Literature presented in this chapter addresses research to inform the appropriate use of Te Reo Māori in the names of new species in Aotearoa New Zealand. Māori cultural concepts of naming are reviewed as a representation of identity. The literature refers to the socio- cultural view of learning, where individuals develop their sense and meaning of the world through social interactions within a cultural context. The literature review includes examples of tribal and geographical variation of species that have been named both historically and more recently, and these recent examples of new species have incorporated cultural consideration and the use of Te Reo Māori.

The review revealed that whakapapa or connectedness is central to the Māori world view, whakapapa links māori back to the Supreme being, Io, and is a constant connection and reminder of a higher form of existence. Whakapapa forms a foundation for the culture that guides the actions of the Māori people.

Names are expressed as representations of these whakapapa links, reminders of historical accounts and acknowledgement of past ancestors. Te Reo Māori is the language and native tongue of the Māori, in which this information is carried and passed. There has been an increase in the awareness of Te Reo with the more common use of Te Reo Māori in the media arena of television, and the development of Māori television as not only an avenue to view Māori language content but to also help in learning Te Reo Māori. Māori people are active participants where the use of Te Reo Māori is concerned, and the integrity of its use.

Within a Western Science framework there is a depth of historical knowledge and an array of accepted protocols for naming all forms and species. Scientific protocols of assigning names to species are predominantly based on the morphology of the species and the habitat that it occupies. With regards to the names of species, there is a huge consideration for the discoverer of the species, an acknowledgement of knowledge and expertise in areas with regards to the species that includes naming rights. New species are continuously being discovered and named within Aotearoa New Zealand, and within worldwide environments. Currently there is no process or protocol for the use of Te Reo Māori in the naming of new species, which highlights its importance, as there seems to be many historical and current references to Te Reo Māori in the names of New Zealand species. Due to the nature of scientific research and exploration being an ongoing process, there will also be an ongoing need for consideration of this issue where Te Reo Māori interacts with these scientific protocols of naming new species.

This review has focussed on literature that examined the development of knowledge, attitudes and values and the use of Te Reo Māori in the names of new species and how those considerations interact with a Western Scientific framework. This study then focussed on investigating current ideas amongst New Zealand scientists and iwi representatives about ways to create protocols for naming new species in Aotearoa New Zealand. The following chapter explains the research methodology of how this study of the views of these scientists and iwi was conducted and how the data was collected and analysed that is represented in following chapters.

Te More (Lateral Roots)

Chapter 3 Methodology

3.1 Chapter overview

This chapter outlines the methodology used in this research project that addresses questions pertaining to the appropriate use of Te Reo Māori in the scientific protocols of naming new species in New Zealand. The chapter begins with the research questions that guided the methodological framework used to collect the data, followed by a discussion about the theoretical frameworks applied; being both an interpretive and a kaupapa Māori approach. The following sections discuss the research method used, followed by a discussion of the research processes that include data collection, thematic analysis and interpretation. This is followed by a section that discusses the quality of research and ethical consideration and the chapter closes with a summary.

3.2 Research questions

This research is designed to investigate the appropriate use of Te Reo Māori in the scientific names of newly discovered species in New Zealand. In conducting this research my approach was to address a series of questions.

The research questions were:

1. Do scientific protocols of naming new species currently include the use of Te Reo Māori?

2. Do naming protocols recognise the appropriate use of Te Reo Māori in the scientific names of new species in Aotearoa New Zealand?

3. What differences exist in the knowledge, ideas and understanding about the appropriate use of Te Reo Māori and Western science naming protocols of new species?

These research questions were used to guide an appropriate approach to data collection that would enable answers to these questions to be gained. The next

section discusses two methodological frameworks used to examine these questions in this research.

3.3 Theoretical frameworks

As this study involved examining an aspect of Māori culture and several Māori participants, it was appropriate to consider a research approach that fitted with this culture and its participants. One such approach is known as a Kaupapa Māori approach, but at the same time the study was interested in the participants' views and perspectives, and this led to consideration of an interpretive methodology. These two approaches are now discussed.

3.3.1 Kaupapa Māori approach

The understandings of the participants are often reflected in their knowledge, values and actions, and represented in the data provided with regards to the appropriate use of Te Reo Māori in the scientific names of new species. A Kaupapa Māori theoretical approach is applied to research where Kaupapa Māori principles of 'taonga tuku iho', which means intergenerational traditional treasures, passed down through links of kinship, are important. This approach that includes the use and application of Te Reo Māori (language), tikanga (cultural practice) and mātauranga Māori (Māori knowledge systems), is found within kaupapa Māori-related research such as this, which privileges both indigenous values and attitudes which are encouraged to be practised, rather than disguising them (Smith, 1990). This theoretical framework is important as it investigates the understandings of individual participants and how these individuals are influenced by their cultural and professional societies.

A Kaupapa Maori approach is centred around the guardianship of knowledge so that it can be used for the good of the community, where talk and conversation is justified knowledge and within this research project is essentially the raw data. This approach was the right choice for this study because researching in this context affirms the importance of Māori self definitions and self valuation. This research approach also provides a critique of colonial constructions and definitions of Māori and provides articulate solutions to Māori concerns in terms of Māori knowledge (Smith, 1999).

3.3.2 Interpretive Methodological framework

An interpretive methodological framework is often used to "help understand the subjective world of human experience, to retain the integrity of the phenomena being investigated, and to support the notion to understand from within" (Cohen et al, 2007 p. 23). Therefore an interpretive framework was an appropriate method to explore the considerations of participants that explore the appropriate use of Te Reo Māori in the scientific names of new species in New Zealand.

An interpretive approach to research distinguishes features where people are deliberate and creative in their actions. Humans act intentionally and make meanings in and through their activities. This approach acknowledges that situations are fluid and changing, not static and that events and individuals are unique. There is a need in this research to examine situations through the eyes of participants rather than the researcher. Interpreting the professional and personal views from the participants was a key focus of this research project.

This interpretive approach applied indicates the use of a qualitative research method which includes the use of semi structured interviews "attempting to gather evidence that will reveal qualities of life and these are reflected in participant's perspectives."(Cohen, 2000, p 23). This interpretive methodology connects well with a kaupapa Māori approach.

The similarities between a Kaupapa Māori approach and an interpretive paradigm include the importance of the individual as the knowledge base and their responses as the data. People actively construct their social world within a social setting, constructing knowledge, collaboratively creating a small culture of shared meanings (Cohen, 2000). These shared meanings add to a collective knowledge base that helps understand the subjective world of humans. The similarities in research paradigms allow them to be used together in this study.

This combination of research approaches supported an appropriate method for collecting such a wide range of ideas and data for my research project that showed first hand that values and attitudes are linked to experience and knowledge.

3.4 Research methods

Research methods are best suited to the data that needs to be collected. Cohen et al, (2000) describe that research methods must reflect a true representation of the sample and be conducted in the most appropriate manner. Of interest to this research project were the interpreted understandings of the participants, therefore it seemed most appropriate to conduct a series of semi structured interviews to collect data as this allowed for participants to elaborate on their responses. The following section describes the use of interviews as the data collection method in this research and the advantages and disadvantages of this particular research method.

3.4.1 Interviews

Interviews are a process of talking and listening to people. People are usually more willing to talk than to write down their responses and the synchronous nature of an interview provides the researcher with an opportunity to probe for further information at the time of the interview. This opportunity is not present in written responses. According to (Bell, 2005), "interviews can provide answers that written answers would conceal" and allow also to test the limits of the respondent's knowledge and views. This is most useful in this research project where respondents may have had difficulty with wider understandings of both Māori and scientific languages that were of interest as part of the research questions.

The traditional nature of oratory preserved by the Māori people as a means of conversation and discussion has dominated the cultural practice of Māori. Haami and Roberts (2002) confirm that knowledge through whakapapa is a mental construct that is encoded and recorded in the minds of the Māori participants. The use of interviews supports the participant to express their view on important matters in a face-to-face manner that portrays a positive difference to Māori (Haami and Roberts 2002; Gray 2004). The flexibility and nature of the interview promotes the use of semi-structured interviews in this project which was the preferred research method. Semi-structured interviews can be conducted as a conversation, and depending on the degree of structure can allow some freedom to cover unanticipated aspects that surface during the interview (Cohen L, 2000).

For the purpose of this research, these semi-structured interviews were conducted on a one to one, kanohi ki te kanohi or face-to-face basis.

Interviews provide a way to exchange views and explore new pathways. An interview is an important data collection method used by qualitative researchers (Denzin & Lincoln, 2003). Qualitative research data that reveals the understandings of the participants' worlds through their interactions and experiences, and their contribution has been explored and examined in this project with reference to the appropriate use of Te Reo Māori in the scientific names of new species in Aotearoa New Zealand.

For a number of reasons, including the small sample size and the qualitative nature of the data, interviews seemed most appropriate as a data collection method. The small sample size was a consideration because only a small number of people in New Zealand can speak on this topic, therefore, alternative methods of data collection such as questionnaires, and group interviews would not be as effective, and perhaps less appropriate for this research project. Because an interview was an adequate way to gather information without inconveniencing the participants to write long statements or to fill out questionnaires, the decision was made to conduct a series of interviews and audio tape them for later transcription. The semi- structured questions guided the interviews (see Appendix A).

While highly structured interviews have an advantage of producing highly reliable data, a less structured interview can be used to follow up questions that may arise during the interview and provide greater insights into understandings. Semi-structured interviews still maintain some structure, which can be a list of previously worded questions or a general structure of topics that are of interest for the interviewer (Cohen, 2000) For the purpose of this research I designed a plan for semi structured interviews with one person at a time.

The adaptable nature of interviews has enhanced this project by allowing participation by current practitioners from within the different knowledge areas, who have formed ideas and have had first hand experiences of naming new species in New Zealand, and those whose expertise is recognised in areas within Te Reo Māori and Māori cultural practises in Aotearoa New Zealand.

Conducting the interviews was influenced by the experiences and stories of experts that work within fields of taxonomy and Māori participants that have expertise in these areas of knowledge. Participants originated from various areas of New Zealand and therefore travel requirements were also considered when planning the interviews. Due to the sample size there was also an opportunity for a follow up verification or clarification of data. (Patton, 2002: p.341) writes that "we interview to find out what is in and on someone's mind." This is beneficial where few people work in these areas of taxonomy and where Māori theories of knowledge through an oral culture means that there is an ongoing orientation top,ward the stories and experiences of experts to suggest guidelines for the use of Te Reo Māori in the names of new species to be considered.

3.5 Research Design

This section looks at the overall design of the data collection. This includes the selection of participants as the represented sample of this study, details of the interviews and the thematic analytical framework that was adopted to further understand and interpret the data set.

3.5.1 Sample

The sample population was chosen purposefully to ensure that the data represented a wide range of views on the topic. The factors that determined sample selection required that all participants were a representation of different levels of expertise and experience, cultural and educational backgrounds. Purposeful sampling is used in the context of this study where participants are individually selected as they are able to give first-hand experience and information on what this study is trying to examine (Cohen, 2000). For the purposes of this research project all participants were selected based on their scientific expertise of naming new species in Aotearoa New Zealand and or a proficiency in Te Reo Māori with a sound knowledge of Māori cultural practises.

A series of eight semi-structured interviews were conducted as part of this research project. Four participants of the sample had a scientific background and four had a Māori cultural based knowledge, of which one participant of the sample set was a Māori scientist. The majority (6/8) of the sample population

were male, and the remainder (2/8) being female. All of the science participant population had named or assisted in naming a new species in Aotearoa New Zealand. The educational backgrounds of the participants varied, however, most participants had completed at least one tertiary degree, and had taken part in various fields of scientific research, and/or those of Te Reo Māori and tikanga.

Because the sample size was small and the limited field of practising taxonomists, out of respect of participants' identity it was necessary for them to remain anonymous. The participants were assigned a gender-related pseudonym in attributing their responses within the findings. This sample size was also sufficient enough to offer a current view of the practice of naming new species in Aotearoa New Zealand and the appropriate use of Te Reo Māori in new names while remaining small enough for a series of in-depth interviews and the collection of rich qualitative data.

3.5.2 Interviews

Different approaches to data collection by asking people can be defined by the methodological approach, the degree of structure and the number of participants (Cohen, 2000). One-on-one interview may be the most common interview compared to group interviews. Interviews can be highly structured with close ended questions or as a conversation that is only partly structured or not at all.

For this research I conducted a series of individual one-on-one semi-structured interviews. For these 60 minute interviews, I devised questions that asked about a certain area of interest. These questions could be used or not depending on the participant's response and the general flow of the interview, but were also a reminder if a topic did not emerge on its own. This is also suggested by (Banister, Packer, Taylor, & Tindall, 1994) in order to follow the participants' trail of thoughts and avoid simple yes/no answers

I interviewed experts who were asked about their views on topics where they have experience in Māori and science naming protocols. When being asked about their thoughts and opinions of the subject, the interpretation of the data was dependent on the topic of conversation

The use of research processes that are open and transparent are important in any research but are relevant here where the use of interviews helps develop relationships between research and the community. Themes, narratives, case studies, and our participants' voices are privileged in this sense where they are the source of knowledge about their own context and their kaupapa (subject), and it's not up to the researcher to question the truth but to treat them as valid and discuss them in this light. Information from interviews allows the researcher to analyse and report the findings fully and truthfully.

For the purpose of this research I contacted practitioners directly. The group of participants consisted of eight people. Because I was interested in the experience and practise of naming species in Aotearoa New Zealand, I welcomed different areas of expertise when considering taxonomic processs in NZ. I also welcomed different views, both male and female, of Māori participants.

An indication of the questions used asked involved asking participants to explain their profession and expertise in the field of naming new species in Aotearoa New Zealand. Participants were also asked to explain in detail the protocol they followed for giving a name to a new species with particular reference to the Linnaean classification system of taxonomy and Māori culture, to describe their thoughts and experience about the use of Te Reo Māori in the scientific names of new species, and to discuss any thoughts about consultation when checking the correct use or context of the appropriate use of Te Reo Māori in these names.

3.5.3 Interview analysis

The process of analysis required a full transcription of all interviews. The recording of the interview allowed for accuracy and an opportunity to cross check transcripts with the audio recording.

The process of interpretation from knowing to understanding required me to listen to and document word analysis very carefully. From broader themes within the research relevant topics emerged from the data. Research data was then analysed

by the themes into topics to make understanding the data easier. The connections between those topics were then analysed and helped to further explain the data (Cohen, 2000). An analysis that organises interview data "in relation to specific research questions" (Cohen, 2000 p.282) is called thematic analysis. A thematic analytical framework was adopted to form a representation of the participants' views.

3.5.4 Thematic analytical framework.

Major themes that arose from within the data were identified that represent the areas of further discussion in the following chapters. There were two distinct themes; one being a process of taxonomy where species are classified and named according to a set of processes, and another of Te Reo Māori and cultural practises of the Māori in relation to naming new species. The interpretation of the data was conducted with the knowledge that this research aims to construct the meaning of the individual's reality, where the evidence has revealed qualities of life and professional experiences that are reflected in the participant's perspectives of the appropriate use of Te Reo Māori in the scientific names of new species in Aotearoa New Zealand.

3.6 Validity, reliability and ethics

Valid, reliable sources of information and ethical conduct are very important when considering people's ideas and creating new knowledge, where these values may determine the accuracy of information. Cohen et al. (2000) discuss validity and reliability as being important for the process of collecting and analysing the data. When researching within an interpretive paradigm there is more than one way to interpret this data. The narrative nature of the interview highlights a focus on how different all people are and celebrates these differences. Constructing a meaning of these individual realities by interpreting the results is difficult where interpretive analysis is subjective (Cohen, 2000). Māori language and culture is seen as central to their knowledge systems, and is included here as Māori realities and knowledge are seen as legitimate.

3.6.1 Validity

For this series of 60 minute interviews, questions were designed that inquired about certain areas of interest with reference to naming species within a western scientific taxonomic format and the inclusion and use of Te Reo Māori. In this series of interviews it was possible that participants could or could not see the questions prior so that they could contribute when they wanted and perhaps not contribute when they wanted. Whether or not all of these questions were used depended on the participants' area of expertise or the general flow of the interview. The questions were also utilised as a reminder, if a topic area did not emerge by itself. Based on the information provided in the interviews, conclusions were drawn that outline a current situation of scientific taxonomic processes in New Zealand and naming new species in New Zealand. This information was important when considering the inclusion and appropriate use of Te Reo Māori in the scientific names of new species discovered in New Zealand.

Validation of responses to improve the accuracy, credibility and validity was done both at the end of the interview making sure responses were understood correctly by restating and summarising responses, and by allowing participants to check for accuracy by checking the transcripts and returning with any changes or further comments (Cohen, 2000 p 126). Interview questions were peer reviewed by both a science educator and a Māori educator to enhance the construct validity of the responses. The overall goal was to provide findings that were authentic.

3.6.2 Reliability

Quantitative research produces sound and repeatable data that can be generalised onto a bigger sample (Cohen, 2000). In comparison, data gathered from qualitative research has to withstand a similar scrutiny in regards to is congruity. The quality of the actual conduct of the research is thus the determining factor for the presence of dependability and reliability. A high standard of research methods application is needed for both approaches, quantitative and qualitative.

Qualitative research is concerned with topics that are not necessarily repeatable due to their qualitative nature. A comprehensive research design can provide enough information to repeat the research, even if that doesn't lead to similar

results. Quantitative reliability in this kind of analysis is thus difficult to produce because of a small sample and the in depth analysis that is in conflict with the ability to generalise results.

The small sample size means it could not be useful for a statistical analysis in order to show reliability in terms of generalisation but by using a transparent method for analysing data I can create a credible interpretation that withstands critique. The unique situation of my participants is explained and their answers put into context.

Maintaining the confidentiality of research participants is always important in presenting points of views and values due to the sensitive nature of the data. The confidentiality of participants was maintained by the exemption of further biographical data of age and location, and also avoidance of identification through association to research projects where species have been named.

It is important that participants can reveal understandings of their world with the knowledge that their identity will remain confidential and will therefore provide valid data. There is always a possibility of the researcher being subjective in the responses that they choose to represent and a possible danger of bias when analysing responses, but the participants involved in this research project were clearly informed of the research topic and all came prepared in their thinking and their contribution to the knowledge in this area was well thought out.

3.6.3 Ethics

A consideration of ethics in this study involved making sure all respondents provided informed consent to participate in this research and were reserved the right to withdrawal from the project up to a given time, in such a way that "The consent form makes the power relations between the research and the researched concrete" (Smith, 2006 p. 8). There is a risk that research opportunities are unsafe for both the participant and the researcher, where research ethics cover the individual's participation, but not necessarily the protection of collective knowledge, where the knowledge of the collective may be at risk. I didn't anticipate that any harm would come from the participants providing information and, as a measure of safety, contact details of both researcher and supervisor

within a cover letter was an added approach to the ethical safety of participants. If the ethical processes are not discussed then the participants and the researcher could end up feeling betrayed. The schedule of both research and interview questions were developed to provide an accurate representation of the participant's stories and lives in a way that is true to them.

Research is about the people, it is about being accountable to the production of knowledge that is for the good of the community and informs how we live our lives. The ethical conduct regarding this research and series of one on one semi-structured interviews has been enhanced with the use of open ended questions (see Appendix A). The questions have provided the respondents an opportunity to give full and precise replies while attempting to avoid any possible biases stemming from the social desirability, conformity, or other constructs of disinterest with regards to the appropriate use of Te Reo Māori in the scientific names of new species.

3.7 Chapter summary

The data collection and analysis of that data in this research was based on the social constructivist approach that examines the values and attitudes of the participants in an interpretive way to develop themes that formed the basis of the interpretation of the data. This chapter provided an explanation and overview of the research methodologies that guided the research project. The research questions were designed to direct the type of information that was to be gathered and also helped to determine the sample that was purposefully chosen. This research incorporated both kaupapa Māori and interpretive paradigms as methodological frameworks. These frameworks guided the research because of the inclusion of Te Reo Māori and the need to interpret the qualitative responses of the different participants. Within a scientific approach Māori are compared to universal norms that are irrelevant within our cultural contexts, hence the need to include both research paradigms. The chapter discussed the research design and how the participants were selected, the interview process and how the data was analysed. The data was collected through a series of semi-structured interviews of a select sample size of eight participants where all of the respondents had

firsthand experience of either naming new species and/or expertise with respect to the application and use of Te Reo Māori in naming protocols. Analysis of the data was conducted by sorting into themes that related to both scientific processes and Te Reo Māori, these broader themes then were refined down into topics discussed in the findings chapter that follows.

Te Aka – The Rhizome

Chapter 4 Findings

"Whatungarongaro te tangata, toitū te whenua"

"Although man shall disappear, the land will remain"

4.1 Introduction

This chapter presents the participant's stories in a way that is true to them in a manner in which the data represents each participant's voice as the source of knowledge about their own context. The chapter is divided into four major sections. These four sections portray the participants' views that reflect their practical experience of naming species which include a range of species, both flora and fauna, that have been named. Participants' views are portrayed with relation to attitudes regarding the use of Te Reo Māori in the scientific names of new species, views that reflect the scientific and traditional Māori knowledge in the appropriate use of the language, and naming protocols associated with naming new species in Aotearoa New Zealand. Quotes are taken directly from the participant's interview transcripts, and are identified within the writing with the use of an individual pseudonym.

4.2 Participant support of the use of Te Reo Māori in the scientific names of new species

4.2.1 Section overview

This section describes the support of the use of Te Reo Māori in a number of ways. All participants in this research project were active participants in their own areas of expertise and held portfolios within the areas of Science or Te Reo and Tikanga Māori. These experts have discussed, included and incorporated the use of Te Reo Māori. This use of the language would also include cultural considerations with regards to naming processes and protocols of species, and the appropriate use of the language being recognised as important. This section

illustrates the different levels of support of participants of the use of Te Reo Māori in the scientific names of new species and their reasons for their support in areas that include; Endemic species, where an endemic language seems fitting, the recognition of Te Reo Māori as a living language still spoken by many but also still struggling for survival; Te Reo Māori as an official language of New Zealand; the development of language learning resources that can aid in the learning of the language; and a process that honours Whakapapa, and supports matauranga Māori and a Māori world view. There are two distinct views but both views are supportive of the use of Te Reo Māori in the scientific names of new species.

"Ko te reo te mauri o te mana Māori"

"The language is the essence and pride of the people" Sir James Henare (1986)

4.2.2 An endemic language for an endemic species

The Māori language is endemic to New Zealand, and Māori knowledge confirms that Te Reo Māori is utilised as a tool to communicate the ideas and values of the people, it is the method in which our ancestors passed on intergenerational knowledge, so that we now become keepers of the seed of Knowledge, and where our korero (talk) is a tribute to Papatuanuku. It is also important to recognise the cultural values associated with the process and protocols of naming that are highly valued where names are concerned. As a Māori participant Jerome, explained:

> These species are our tuakana (elder brother / sister) that we are referring to and our whakapapa links are still valid; Māori people would like to ensure that in this process we are doing justice and equity to our tuakana, to our traditions and to our own ancestors.

This appeared to be an important point of view that was strongly represented in all Māori interviewee responses.

This support of the use of Te Reo Māori was also present in the science expert responses through the scientific names of new species, as affirmed here by Daniel, as he commented, "The use of Te Reo Māori is desirable", which also supported the idea of "an endemic language for an endemic species". It was reported by

Daniel that he was not aware of recommended guidelines surrounding the use of Te Reo Māori in this manner, and often due to the limited knowledge and protocols in this area, scientists would not use Te Reo Māori, in order to cause no culturally based offence. One science participant working in the field of taxonomy has put in place a self imposed "embargo" on the use of Te Reo Māori for those with very limited understanding of Māori naming protocols.

Without any apparent formal process or recommended guidelines for the use of Te Reo Māori, it was evident through the responses gathered that the process of naming was very different in all situations of naming new species, and the naming protocols varied accordingly. Both scientific researchers and iwi had adapted over time to these informal processes regarding the use of Te Reo Māori in the scientific names of new species. An example of this was described by Richard;

> When doing research on a supposed new species, I always try and consult local people to try and find out whether they have knowledge related to that species already. Where they have, possibly even a name that they use, a local name, and where possible I try and build that information into the publication, with their consent of course, but when I make the final choice to name, I will consider, where appropriate, using a local name if possible.

A Māori scientist Piri adds further that if the International Code of Botanical Nomenclature is not inclusive of local culture, it is also not exclusive as he commented:

> There are taxonomists that speak other languages who would perhaps use other words that are different, from minority languages, the cultural rules associated with the language might be different so you would have to know what is feasible and what's not, to work the code out where the people around you are not offended by the name.

Ultimately, the final decision for naming new species lies with the researcher or person who discovered the species, and there is formal recognition that is attributed to those scientists who discover new species and name species. Iwi participants felt that it was important to see Te Reo Māori being considered in species naming and used in this way as commented on here by Jerome , "thanks to

science for considering the use of Te Reo Māori", this being seen as another way to keep the language included and recognised as an official language of Aotearoa New Zealand.

Piri added further to the discussion of the use of Te Reo Māori in the names of new species saying:

> I don't think that it is something taxonomists should be doing lightly, but for most parts I don't think that taxonomists do it lightly, because it is a profession that has a long history all the way back to Linnaeus, they are careful about the use of names when they know the rules, but when they don't they are kind of feeling their way around. New Zealand has been involved in a long battle around who has the rights over Māori culture in this country and Māori icons, which includes names, those kinds of things there is sensitivity at the moment with the educated and the highly educated like taxonomists are, where the business of names is their core business.

Temepara a Te Reo Māori participant, described a holistic kaupapa Māori view when describing all species as being descendants of the ancestors and their names that form bonds of kinship through whakapapa, stating that "Te Reo Māori is the perfect vehicle in Aotearoa for conveying the spiritual meaning as well as a cultural meaning to species native to Aotearoa". Temepara requested that, if possible "Māori names be always used for all species discovered here in Aotearoa, this will support those that are learning Te Reo Māori in schools and elsewhere also". This request was supported by Noeline, a Te Reo Māori participant, as she explained that "Te Reo Māori only is also desirable" in naming species.

This support for the appropriate use of Te Reo Māori recognises the importance of the Māori language in the names of new species by both science and Māori participants. Responses here represent the realities of these participants to wider audiences and leads to further discussion regarding cultural and linguistic sensitivities around the correct use of Te Reo Māori for identification purposes in the scientific names of new species discovered in Aotearoa New Zealand.

4.2.3 Te Reo Māori, a Living language

Te Reo Māori and the importance of language to the people reflect a cultural belief and value that language is a form of healing and is the core of the Māori culture, where language is a tribute to Papatuanuku or the traditional earth mother. The tribal knowledge is embedded in many oral forms including (karakia) chants and incantations, whakatauki (proverbs), waiata (song), and purakau (stories) such that which you put in place will stay like that from generation to generation. This inclusion of Te Reo Māori and the discussion spoken about surrounding this research topic keeps the Māori language on the tongues of those who are working in these areas of expertise, where "a spoken language is a living language" described by Jerome, as he stated:

> If there was to become a time when the language was no longer a living language, like that of the Latin language, then there would be no problem, but Te Reo Māori is a living language spoken in homes, schools, and community environments throughout Aotearoa, a living language that spans all generations. There is a difference where Te Reo Māori is still a language that reflects the thoughts and feelings of the Māori people and supports those that enjoy, speak and learn the language.

There is an opportunity here to maintain a Māori cultural perspective in the names of new species that are currently being discovered, and Temepara adds in full support of the use of Te Reo Māori in all areas possible, "all things discovered in Aotearoa are Māori and should therefore have a Māori name". This practise asserts the centrality of Te Reo Māori, Tikanga and matauranga Māori.

4.2.4 Te Reo Māori as an official language of New Zealand

The official status of the language, Te Reo Māori, makes it accessible to all people of this country; however, it does not guarantee the appropriate use of the language to honour the language and not cause offence. Jerome commented on the action of "early scientists", and "how species in New Zealand were new to these foreign botanists, and I understand they borrowed the Māori name incorporated with a Latin scientific name to establish a name for that species, that was quite random to my knowledge". Although this was before the Māori

language became an official language of New Zealand, it does show that the early explorers referred to the Māori name of the species but did so in quite a random way.

Three of the Māori participants expressed in their comments support for an example of a Māori classification system of words regarding a project that has arisen out of the Māori language commission Te Taura Whiri i te Reo Māori. *Te Pataka Kupu*, a recently published Māori language dictionary mentioned earlier in Chapter 2 was invoked by one participant who said it was a book "which has placed all words under Gods, the genesis is the Atua and from that they include a process of naming a genus under the God categories, at a broad level, but then you get to the specific name" (Jerome). This method of language classification could be a possible avenue for classifying species names but would require some careful considerations of the species names and their meanings. This would also assert the legitimacy of Te Reo Māori in the taxonomic processes of naming new species in Aotearoa New Zealand.

4.2.5 Honouring Whakapapa or ties of kinship

Whakapapa was a common thread throughout the conversation with the Māori participants, whereas the non-Māori participants had no comment in terms of whakapapa. Within the minds of all of the Māori participants there was an importance to "honour the genealogy links that connects members of the current generations to the ancestors and Gods" (Jerome). Temepara added to this context in saying "We are all aware of Tane, the great guardian of the forest, however, there are also many feminine 'deities'that represent areas of the environment". Temepara further explains that "one must always consider the feminine, especially if there is a female species discovered", where Māori recognise that some species are of a male form, such as that of the Kahikatea (*Dacrycarpus dacryoides*), and the female representation of the form such as the Pukatea (*Laurelia novae-zelandiae*). These cultural concepts of kinship could present "as a difficulty for our Māori people where we [Māori] have two worlds to maintain and keep those things that are fast disappearing from our Māori world and how do we accommodate them in this changing world" (Jerome). Kaupapa Māori research

practises set out and explained by Smith (1999) and discussed earlier in Chapter 2 act as an appropriate code that could guide interdisciplinary science research.

4.2.6 A possible language learning resource

In areas that concern the use of Te Reo Māori an opportunity is presented to provide support in the area of language learning as Sonny Bill, a Māori language teacher said, "Even though this is a representation of the names of species, there is always further understanding that accompanies that name" which is important for the next generations of children and grandchildren "these descendants that may look at this knowledge embedded in the understandings and explanations of these species that have Māori names" (Sonny Bill). This is a way of including the language and the learning that will anchor this new knowledge of the world within a changing world. This language learning tool could be beneficial for all as expressed by both Piri and Temepara. Piri suggested this as "a possible area of professional development for scientists" that would also "aid those that would like to include Te Reo Māori in the names of new species".

Jerome reminisced on the words of his forefathers and insisted that "our thinking is changed in terms of insects, we don't think of them as a means of healing as we used to in previous times". Jerome continues on to discuss the medicinal use of insects such as "ants and maggots in the healing of skin-infected wounds in the times of both World Wars, where resources in Māori diets were impacted by a food shortage, where Māori worked to send food to the officers involved in the Wars."

This change in survival mechanisms and thinking represents a time where survival is now influenced by many different factors to those of previous times, mentioned here by Piri as "when there was a time where naming was perhaps not a major cultural activity, and perhaps survival was high priority". There was a time when stories were used as a means of passing on knowledge through generations. This awareness brought about by naming new species also highlights areas where the development of these cultural stories can be included. Sonny Bill offered a comment that "even though we would like certain cultural considerations represented when naming new species, there are names like Tuna, and Tohora where they have Māori names but I am unsure of what they mean or why they

were named that". In this comment, Sonny Bill brings attention to future names of species but also highlights the need to develop dialogue around existing names of species. Cultural knowledge is not always easily accessible and traditional knowledge of names has eroded over time but this opportunity can provide an awareness of this knowledge area of names and naming new species.

4.2.7 Section summary

This section represented the participants views that demonstrated the support of all (8/8) participants for the appropriate use of Te Reo Māori in the names of new species discovered in Aotearoa New Zealand. These participant views contain a wide spectrum of ideas and experiences that shape the characteristics and thinking needed in naming protocols where the use of Te Reo Māori is present. The comments supporting an endemic language for an endemic species are discussed, referring to Te Reo Māori as a living language with official status in Aotearoa New Zealand. Whakapapa or ties of kinship are discussed as important considerations when proposing a Māori name, where this is seen by all (4/4) Māori participants as a cultural connection to an historical time in Māori culture. This discussion seeks to present the Māori traditional knowledge of names where these classifications and taxonomies may have eroded over time and building communities of learning are seen to extend upon Māori cultural structures and knowledge systems.

Next I move from the discussion of participant support of the appropriate use of Te Reo Māori to the relationships established between science and iwi groups that provide possible consultation forums of communication around naming of new species.

4.3 Communication, consultation and publication

4.3.1 Section overview

This section highlights the views and comments that were noted for the need for clear communication by all parties involved in areas of scientific naming and Māori cultural practices. Areas discussed noted that it is part of the international protocol and formal classification process to publish the species name in a reputable or recognised scientific academic journal. Scientific publication

involves the publication of research findings; there is a section within the research on etymology which is a formal way of explaining the name in an official capacity. There was also an importance on behalf of Māori to have involvement in the process, where there is a report back to the people where there are instances when Te Reo Māori has been used. Communication and consultation have also been highlighted as an important determining factor when discussing and understanding the needs of iwi Māori and the processes of Science. Time constraints are also discussed in ways that perhaps inhibit the use of Te Reo Māori in the naming process, and a Kanohi ki te kanohi or a face-to-face approach being identified as an important method to follow when consulting with Māori communities.

4.3.2 Scientific publication

The formal contexts in which species names become official occur within the pages of scientific journals and publications. Daniel who publishes in highly recognised international scientific journals such as *Zootaxa* or *Nature* are targeted specifically for their scientific audiences worldwide, "as these journals are the most prestigious science journals". This notion is similar for Keven, who, although he "chooses to publish in New Zealand and Australian based specific journals", sees that most people in his field are trying to get their publications into the highest impact journals, so that they can get a wider recognition in scientific communities. With regards to particular species, Keven mentions that, "publishing in Australian scientific journals helps support application proposals for research funding, and the recognition as an author and a researcher in that field". The information about the new species discovered here does not often get disseminated in Aotearoa New Zealand as the journals are published to a set audience with wider readership, and amongst more well known researchers in the science community. This could present as a loss of knowledge and the names to overseas audiences, where New Zealanders would not have access to this information. Richard supports this saying "I could publish in other places but the reason I choose to do it in the NZ Journals, because that is where the New Zealand audience would find it. If you publish in an international journal, they might not get access or easy access to the information, so I prefer to put it where the local audience will find it more easily". This discussion highlights that

scientific publication is a formal part of the process of doing research however, the choice of journal and therefore audience is at the discretion of the person who names the species. This process then treats these names as a data source which is stored and classified external to the Māori population and communities.

4.3.3 Communication

All of the areas of discussion mentioned earlier highlight the importance of relationships. This may seem easy to achieve, although clear communication may be a way that these relationships can be maintained. All (4/4) science practitioner participants have noted that in the naming process, sometimes it would be good for them to connect to local people but there are also challenges in doing so and one of those basic challenges includes "knowing how to find the right people" (Keven). This process that could seem simple, can also seem quite difficult in areas where Richard says "a lot of European and foreign taxonomists will attempt a process but they will get easily disappointed because they don't know where to find the appropriate people to talk to". Richard continues that "it could be quite useful in the future where some guidelines could be put in place that made the consultation process a bit easier".

That Iwi consultation can prove to be a challenge was supported by both Keven and Richard, where Keven commented that "although we have to often deal indirectly with Iwi through the Department of Conservation (DoC), that too can be an interesting process as DoC are seen often as representatives of the crown". Richard also claimed that work in this area can be interesting and also difficult and that "when scientists usually get to the first blockage they give up". Richard finds the easiest way to consult is to" go and introduce yourself. I learnt to do it when I was involved in a survey and to get permission to do that survey, we had to call in to every marae (Māori communal meeting place) in that area". This was a process of communication but also aided in information gathering specific to the project. This may not have to be difficult where Richard describes that "sometimes all you had to do was have a quick chat to people and they would say 'oh no you don't have to do this formally', that was enough, but other times you were expected to show up in formal settings. We got local people to be involved and help us and be involved in the project and that made it really easy".

What could happen is that these processes of consultation could end up being a process of miscommunication, where Piri affirms that "an explanation of the application of the name is necessary and also helpful" when consulting with iwi about naming new species and the use of Te Reo Māori in those species names. By incorporating Māori views and knowledge systems there is a space that acknowledges a Māori voice in the naming process that continues to uphold the mana (pride) of the language and the integrity of cultural values.

4.3.4 Consultation

Consultation can be seen as the direct contact and communication that occurs when asking for a specific name, which usually comes from a specific geographical area. All Māori participants confirm that consultation was important, and one said that "If the species is found in a specific area and there is mana whenua (local indigenous authority) then why not consult with that local iwi" (Piri). Iwi participants suggest that iwi prefer to be consulted and included rather than being excluded from the process. According to both Noeline and Temepara, these names should be sought in the most peaceful way and Temepara also added, "You might be able to include a localised story from that area, and that could be included in the name also". This is important to iwi participants as histories and cultural knowledge are often embedded in the stories of that area.

With regards to gaining access to iwi contacts for consultation, Keven noted that he was unclear of reasons but that when working on his own research it was "hard to get iwi contacts of specific areas from government agencies ". He then commented that "maybe they are afraid that I would go and muck up their relationships, maybe we may get on too well". While no evidence was presented to back up this view, it shows that the process beforehand could present as difficult. As an example of challenges to consultation, Keven noted that "Māori Trust Board members also change; you must build up those new relationships, and maintain the prior established relationships".

Scientists who are foreign to Aotearoa New Zealand but research species in this country "often find and discover things without consulting anyone in New Zealand" (Richard), who also makes the point that, "They have no concern for our [Aoteroa New Zealand] processes; they just go ahead and do it. Some go as far as

taking material out of the country without permission, this happens quite often". Richard commented further that "It would be even more difficult, if they [foreign researching scientists] come to NZ and they don't know what the processes are, they would find it difficult to negotiate their way through the processes I think", in considering what appropriate consultation measures should be taken. This work by foreign scientists could be seen as a colonial approach, where scientific colonialism occurs where scientists believe they have unlimited right of access to any data source and any information belonging to the subject population or area, including flora and fauna. Science can view knowledge as an external power base, where the centre of knowledge and information about a people or community is located outside of the community of people themselves and therefore assumed to be universal science knowledge.

Regarding species that are found throughout Aotearoa New Zealand that are not specific to one particular area and therefore naming may not be relatable to one locale, Sonny Bill commented that "one could still discuss ideas" and suggests further "that possibly Research Institutes or a similar academic institution could perhaps be an avenue for where this work fits". This is important with regards to a species that occurs more widely that a central body or institution could be useful in the naming process of those species.

A possible best practise or recommendation as suggested by Keven, a science participant, with regards to a process of consultation that includes a suggestion that to make first contact; you need to have a list of people that you can contact, "often you get a list of names of people that just deals with the permitting process, they don't necessarily want to deal with the other stuff, so having people that are available to be contacted would be helpful". He added further that "a meeting is always a good method; I'm a face to face person". People can also be resistant at times to the research process and not want to meet with you, but Keven has also noticed that "when people actually see the species that I collect their perception of the process changes".

Timeframes given to discuss a new species with full understandings of its physical features, its diet and any other relevant information specific to the species should all be considered. Sonny Bill commented that "although Māori are quick to name

things and have names for each place and geographical features based on surrounding knowledge of the area", Māori find that in the current context of naming new species it is "appropriate to be fully informed prior". Noeline provided an example of that the Williams Māori dictionary, a reputable Māori language dictionary that was being compiled, "There was a board or consultation committee that was set up to represent all iwi groups".

This example captures the wide and varied nature of the Māori language and the names therein. Noeline described how in the compilation of the dictionary that "experts across all fields were included and now the fruit of that labour is left as a rich and comprehensive resource for the Māori language and a precious resource for many generations to come". A possible consultation board could be a suggested way forward for the processes of naming but there are also issues of capability and time constraints that are mentioned elsewhere.

This, however, could present a positive opportunity, as Temepara stated that "there will be many questions from both parties (Māori and science)" and she also suggested that for iwi Māori groups, this business of naming is "not just a job for kaumatua or elders, but there may be some younger members of the tribe that may have a better knowledge and understanding of these processes". It does remain culturally important to consult with kaumatua or elders where this ensures that "you have their input and support" (Temepara). This is important to note that often consultation with wider tribal members is useful as there are tribal members that represent iwi on organisational boards and committees that could be suited to carry out this work. Daniel, a science participant, and all other science participants also expressed the view that "iwi contacts have to be receptive" and perhaps development of a process that is inclusive of iwi could be a positive development for both science in Aotearoa New Zealand and iwi development. Respect for both science and Māori knowledge systems and processes, recognises the diversity and uniqueness of all peoples and individuals.

4.3.5 Report back to Iwi

Consultation with local Iwi has become part of a number of government agency processes, including those of the Resource Management Act 1991, and process and applications for conservation land permits. There is also a chance to provide

valuable feedback to iwi in this regard in the use of Te Reo Māori in the scientific names of new species. Keven who consults directly with iwi with regards to appropriate names commented "I send them [the iwi] the scientific publications". This allows for iwi seeing the names of species in context after they have been formally named. An iwi consultant who works with Keven has also "asked for a non-science version of the publication for newsletter purposes". This is a way that Keven maintains his relationship with the iwi by "letting people from that tribe know what's going on". Keven has also extended on that iwi based relationship where "we have taken iwi out with us collecting specimens". This was seen as extremely beneficial as "we [researchers] got the spiritual and cultural connectivity between them and us", indicating that it was beneficial for all.

From a development point of view, Keven who has worked with iwi in naming species using Te Reo Māori, explained that one particular iwi "have continued a prefix for their naming processes". This particular iwi have adopted and continued with the use of a prefix for species named within their tribal boundaries to acknowledge the local knowledge and iwi processes involved in naming new species. This shows a self-sustained development of a process that aligns with the cultural practises of Māori in areas of naming. From an education point of view, this would also provide a foundation to extend upon in the future.

Noeline made an observation about the current lack of iwi capacity in areas of scientific protocols within established Trust Boards and councils throughout Aotearoa New Zealand, and that an "increase in human capacity within these iwi governance structures would be useful as an approach of consultation with regards to the appropriate use of Te Reo Māori in the scientific names of new species discovered in New Zealand". This process could allow for individuals and communities to become involved as part of collaborative research projects.

4.3.6 Kanohi ki te kanohi approach / Face to Face approach

Wananga (discussions) and hui (meetings) are two common names for cultural practices of debating and discussing ideas that are of importance to a wider group of people. Historically, these were practised at the marae or common meeting places in large forums where each person would have a speaking right. This culturally accepted form of discussing ideas is conducted face to face and has now

continued on through processes similar to meetings and forums. All iwi participants have commented that this method would be most preferable as this allows opportunities to meet the researchers and possibly sow seeds of relationships, and also a time to ask any questions and request follow up information. Keven, a science participant, explained that "when I have met with iwi and government representatives there has been a slight tension in the room, perhaps because of the nature and relationship with the governments in some areas, the people were more fixated on their prescence", and he added that "perhaps science and iwi could meet first and then have a letter to write to these government departments involved?" This has become common in areas where researchers and iwi have established good working relationships. Respect, recognition and involvement in scientific processes where indigenous languages and cultural practise are concerned are what indigenous communities have been working towards as recognition of cultural practices that form the basis of indigenous understanding.

4.3.7 Section summary

This section has highlighted participants' views of the importance of establishing and maintaining working relationships between scientists and Māori through communication and consultation with iwi groups. Consultation, negotiation and mutual understanding of both science and Māori cultural perspectives seeks to be present in research relationships, where understanding each other can help people better relate to one another. This becomes most effective amongst both iwi and scientific researchers and recognises language and cultural values as the basis of indigenous understanding.

This examination of the role of communication leads to discussions around the context of Te Reo Māori in the scientific names of new species.

4.4 Context of Te Reo Māori in the scientific names of new species

4.4.1 Section overview

This section discusses comments made in relation to the context of Te Reo Māori in the possible names of new species. Because the appropriate use of Te Reo Māori is a major contributing area within this research data, there have been many

comments that seek care with regards to certain aspects of the use Te Reo Māori. Participant views will be highlighted that comment on the use of Te Reo Māori with regard to sacred topics such as Nga Atua Māori or Māori guardians, the use of tupuna [ancestor] names, names that are descriptive, names that represent place names or location, and names that represent those of people and chiefs accordingly. It is important here to establish key characteristics that could possibly help define a suggested model for the appropriate use of Te Reo Māori in the scientific names of new species.

4.4.2 Care and respect to be accorded by both Māori and non-Māori

The following comments represent those views of participants for whom Te Reo Māori and cultural tradition is of high importance. All Māori participants expressed a deep relationship with the need to protect and care for the language in a respectful manner, and commented on the care that must be taken into consideration when using Te Reo Māori. For example, Piri commented on "the nature of the language as a spoken language that was used to communicate the views of the people" and would like to see "care taken with a language that is still in jeopardy of survival". Noeline also added that "care must always be taken with names" and continued on that "it could be dangerous to introduce strange names with strange meanings for future generations", indicating that this could prove to be confusing for future generations.

Maintaining one's cultural values whilst working within areas of science can prove challenging, as Piri argued that care must be taken with the appropriate use of the language "should be considered by both Māori and non-Māori." Jerome added strongly that because of the increased levels of consultation with iwi groups that "iwi are working to maintain these working relationships" but commented further that "the modern world is asking us to create, and the old world is asking us to maintain so there is a fear of a less likely possibility to be able to sustain and maintain a Māori focus on things".

Maintaining a sacred body of knowledge has provided challenges and is a matter of protection, where Jerome felt that although this is a positive step forward with regards to the development of the language, he also sees a danger of not maintaining the Māori cultural values therein. Jerome also mentioned the

WAI262 report recently released (July 2011) by the Waitangi Tribunal in which there have been ideas to try and "be able to give greater protection to things that have a Māori name by applying Intellectual Property principles". Jerome saw this as a possible way of protecting the use of the language and appropriately according recognition of the name and the species. He then commented that "no matter what situation you could find yourself in you may be pulled by Te Ao tawhito or the ancient world to hold fast to those traditions that are sown within us, that shall never be taken away, to be held strongly within, because this knowledge and thinking is sacred, it is sourced from great whakapapa lineage, all of those values that make this world a Māori world." This comment echoes the whakatauki or proverb referred to earlier to express a Māori worldview that recognises that "although man shall disappear, the land will remain, Whatungarongaro te tangata, toitū te whenua" and is explained further as that in all finality we humans and our processes will pass on and the land that is here now that sustains us, will remain.

4.4.3 The use of Whakapapa

Whakapapa or Lineage is a sacred foundation of Māori cultural tradition and custom. All (4/4) of the Māori participants; and a large proportion (3/4) of science participants commented on the care taken when using language appropriately. All (4/4) of the Māori participants consider the whakapapa of creatures as a possible development model to follow when naming species. Both Jerome and Temepara commented on the fact that "at this point in time the Māori names of species are still in the books of the scientists" along with Noeline who commented that "my preference would be to follow the Māori whakapapa, if the new species is from a hybrid of many, my first instinct would be to base it on whakapapa coming from the Atua Māori or Māori Guardians, like the base framework initiated by the Te Taura Whiri or the Māori language commission". This model mentioned here that could possibly classify all creatures under the guardian gods, utilising this type of language, would require careful consideration and consultation because of the sacred nature of the knowledge, where preservation of these names are to be maintained for the benefit of the collective rather than the individual.

In a Māori cultural belief system, all creatures are a product of their lineage; their distinguishing features are represented in their physical, mental and spiritual makeup. All other (3/4) Māori participants agreed with Jerome's views as he mentioned the importance of "the use of Whakapapa to associate it [the species] and keep an approach that is to be consistent, our tupuna / ancestors are no longer around to guide our actions". This highlights the cultural responsibilities that Māori may feel they are left to maintain, and this is supported by Jerome as he described how science affects the people and that "we [Māori] have to keep pace with the changes both linguistically and scientifically". Jerome and all other Māori participants agreed that "if we are going to be using Māori words we need to show an association to Māori traditions in which, I have a whakapapa book that starts off with Io [the Supreme Being, and creator] down to all species in the whakapapa lines". It was a little unclear to some participants of the origins of the names as they point out that "trees, birds, animals etc were all created before Man, who were created last" This could perhaps cause some confusion as to the origin of some of the names of species and why they are named like that. A common importance noted by all Māori participants reflected that "Whakapapa has a direct relationship to the traditional stories and" these stories define Māori as a people who are connected by ties of kinship that are held sacred within tribal histories. This repository of knowledge that was passed down through intergenerational communication is continually growing and enriching the Māori culture.

4.4.4 The use of Tupuna (ancestor), Atua Māori (Māori guardians), descriptive and place names

Within a scientific approach, Māori are compared to universal norms that are irrelevant within our cultural contexts. Māori language and culture are seen as central to the knowledge where Māori realities and knowledge are seen as legitimate. The use of names such as tupuna names, names of Atua maori, descriptive names, and place names have created much discussion but all with an overarching respect of the sacred nature to preserve and respect the language and culture.

The use of Tupuna names was a sensitive topic of discussion for all (4/4) Māori participants. Jerome strongly opposed the use of Tupuna names and he

commented that "names that I would avoid would be tupuna [ancestor] names" mainly due to the Māori cultural respect of elders. This is a strong comment by Jerome but said with much respect and caution. Ma'a also commented that "with regards to the names of ancestors, their use in the names of species could cause debate and possibly offence". Noeline also strongly argued against the use of names of ancestors as "that was a name that belongs to them, they have recognition amongst their people and that is where their honour should lie, amongst their people to celebrate". Finally, Jerome commented that "I wouldn't use ancestor names as a personal matter, and because those names are used when whakapapa are being quoted, people may get upset if you use these names without sanction".

Names that are based on the descriptive features of animals and trees are common in Māori species names. Species names were different because these species served different purposes, such as that of survival. Temepara also contributed "that birds have names such as the Tui or the Kōkō [the same bird], that are a reflection of the bird call that they make". This makes for easy identification in the bush. Jerome affirmed that "animals weren't given just a random name, with respect to cultural activities such as hunting for feathers and food, the name is a form of identification, mainly because they had a strong cultural association with the people who live with and around them". It is also noted by Jerome that "when using Māori words, for example, "weri "meaning scared, or the Māori name for centipede in a Māori context, its name reflects how it affects one's initial responses to that animal". With respect to naming species, Jerome added that perhaps "general nouns for the names could possibly be the safest to use as to not cause offence".

With regard to the use of geographical names, Jerome commented that "I would be careful when considering the name of a location. Māori names of geography often refer to an historical event that may have occurred in that area". He continued to say "People are quite sensitive to those things and have got precious about having these types of names". There also was a comment by Piri with regards to the district and geographical names where there could possibly be

"Issues with iwi affiliations". The use of this type of language would require careful consultation with the local tribal group.

There was much comment with regards to mixing the Māori language with that of the scientific naming Latin language, in which Ma'a firmly supported the "use of Te Reo Māori only", where the mixing of the two languages could create an illegitimate language. Although Noeline supported this comment she also noted that "science has the final decision and when these names will remain forever", as long as things are done with respect and in a peaceful manner then she agrees with supporting the decisions of science. Language teachers and enthusiasts Temepara and Sonny Bill both agree with the use of Te Reo Māori only if possible, but as long as there is some discussion around the topic can see no real issue with the use of the Latin language.

Mentioned earlier is the possible centralised support from Te Taura Whiri or the Māori Language Commission, however, Jerome noted here that "it is not the business of the Māori Language Commission". This may be why this debate has ended up in the community but many like Ma'a, a Maori language teacher, have commented that "the commission has the resources to access information and assistance". Temepara, an iwi representative, added that "some tribal or iwi groups may not have that capacity; most iwi groups will require consultation". Māori knowledge is often stored within the protection of the collective and is usually for the benefit of the collective rather than the individual. A collective approach to naming species that throughout Aotearoa New Zealand where there is a cross cultural approach to knowledge sharing may be a suitable approach.

4.4.5 Issues with descriptive names

There are documented examples of species that have been named with Te Reo Māori mainly according to their physical features. Piri, a researcher who has been consulted on the naming of a species due to the fact that he was "the Māori guy next door", described one consultation that resulted in assisting the scientist in the fact that grammatically the name sat incorrectly "bass ackwards", where the published scientific name "was a Māori name made of two Māori words, it appeared to him as adjective first and noun second, eg; "nui" meaning big, "mata" meaning eye "nuimata", as opposed to a Māori cultural way that would

see a name as noun first “mata” adjective “nui” second” hence “matanui” or big eye”. This was a minor consultation in hindsight of a publication, however, mention was made by Piri “that this was a common fault of non-Māori scientists who were not aware of the grammatical placement of Māori words”. Piri then continued “So then they came and asked me the next time, fortunately they were names constructed of descriptive words so there wasn’t really any major protocol issue and it was just a grammatical case between the meanings of the words Whatu / kanohi / mata words that are all talking about the eye of the fish”. Daniel added in this regard that “there would require a wide understanding for the correct use of the language, currently there is no clear way of understanding, reference or guidance for the use of Te Reo in a culturally sensitive way”. This cross cultural bridge where western scientific processes of taxonomy and Māori cultural values of naming interact provide an opportunity for both cultures to engage with each other’s knowledge systems. This engagement could provide an opportunity to further define processes and understandings in the areas that concern the appropriate use of Te Reo Māori in the scientific names of new species in Aotearoa New Zealand.

4.4.6 Section summary

Māori minds have entertained the thought of a time when the Māori culture will interact with the modern world in a way that is respectful of the cultural practices and traditions of the people. This section discussed major topics highlighting the care that must be taken with regards to sacred names such as those of ancestor and god names even further beyond to the names of people where consultation should take place regarding the nature of these names. This section examined possible areas for recommendation on the types of Māori names and words that are possible to use in the names of species and the context of the language that they represent. Next there is a shift from a language based point of view to a Kaupapa Māori approach to naming new species where the first part discusses wider themes of kaitiakitanga (guardianship) and whakapapa (genealogy) further to more specific topics including the representation of names and their contexts.

4.5 A Kaupapa Māori approach.

4.5.1 Section overview

This section represents views that draw attention to a Kaupapa Māori research approach that provides a space for the voices and perspectives of both Māori and science participants. This research approach is an attempt to highlight a Māori epistemology that honours the Māori traditional ecological knowledge that can be used for the benefit of the Māori and science communities.

4.5.2 Kaupapa Māori approach to naming

4.5.2.1 Kaitiakitanga

An act of kaitiakitanga or guardianship as alluded to in the Treaty of Waitangi 1840, allows for iwi Māori of Aotearoa New Zealand to retain tino rangatiratanga or direct responsibility over resources which are within their tribal areas. Guardianship of environmental resources and the protection of conservation through careful management can be complemented with Māori traditional knowledge that includes naming protocols. Māori view themselves, and all Māori participants agreed that "iwi act as kaitiaki (guardians) of their tribal resources, and assume the roles of guardians with respect and honour" (Jerome). The Māori world sees three realms as an integrated whole, these cultural values are also assumed over the resources of the land where Māori recognises Man as the guardian of the three realms of the land also.

4.5.2.2 Whakapapa / Genealogical links

Whakapapa or Genealogy is the founding base of the histories of the Māori culture. This was an extremely sacred concept culturally and whakapapa was a large determining factor in the order and ranking hierarchical system of Māori. The process and protocols followed by Māori are those examples handed down from ancestors. Sonny Bill acknowledges the names of Atua Māori or Māori guardians as an example to follow in the process of naming new species in Aotearoa New Zealand.

This notion is supported here by Jerome where, “all things fall into categories of names that have some association with the Atua”, and the names that follow on which then becomes and “extension of the name”. This has a cultural association where “the ancestors respected that the presence of trees, birds, animals were here in this world and this land before the arrival of humans”. These genealogies have a direct link and a strong relationship to the traditional stories told to maintain this knowledge base of classification and identification of species.

The example of a naming process has also been set by the Atua Māori or Māori guardians as the various names for the same Gods represents different levels and stages of development and therefore a process of naming. Māori cultural values of female deities are linked back to Papatuanuku or Mother Earth from where it is believed that all creatures derive. Just as the baby is nurtured by its mother, Māori also believe that man has been nurtured by the Earth mother and is an integral part of the natural order of life.

4.5.2.3 Names include cultural values

The Māori participants indicated that there was cultural value in naming Aotearoa New Zealand native species for Māori people. This value can create a sense of identity between that species and the people in the area in which it is found. For example, Ma’a said “It is common for some species to have different names according to the different tribal area that they may be in. There is no set rule that something must only have or be limited to one name”. This is important when cross checking to see if names are relevant for the species and area they were discovered. This is contrary to the process of taxonomy where allowing more than one name is completely counter to western taxonomy. With regard to Latin scientific species names, Sonny Bill looks at an example of a Latin scientific species names and quotes “I look at this Latin word and know that Māori people will have no association with that word or the meaning, it has no relevance to me or my family and therefore would probably disregard the names and give it a common name of our own”. He also commented that “in the creation stories of the world the introduction of the species to the world was represented as an announcement of their name, this indicated the depth of this knowledge and the cultural importance to Māori”.

4.5.2.4 Names represent histories

Names represent histories including words that have travelled with the early sea-faring voyages and settlers to New Zealand. Piri describes "locations of his upbringing having names that are sourced from wider areas in the Pacific that perhaps reminded these early travellers of their homes and families they had left behind. Many names for species of trees and birds also travelled with the ancestors and now represent similar species of the same genus found in the wider Pacific". These names represent memories of love and fondness of a far off homeland and are connected here through their names and their stories that accompany those names.

4.5.3 Section summary

This section discussed a Kaupapa Māori approach to naming new species and the influencing factors that are taken into consideration where Māori names are concerned. This discussion sought to present an indigenous view that by assuming the role of the kaitiaki or guardian, a Māori epistemology that honours the Māori traditional ecological knowledge will reflect cultural values such as whakapapa, and a view that acknowledges that Māori names represent Māori cultural values, and are a reminder and connection to tribal knowledge and history.

The final section in this chapter highlights discussions on views of a western scientific approach to naming new species.

4.6. A scientific approach to naming.

4.6.1 Section Overview

Scientific inquiry is generally intended to be as objective as possible; this is to reduce bias when interpreting the results. Documenting, archiving and sharing all data and methodology are a scientific approach to allow for careful scrutiny by other scientists. This scrutiny gives science an opportunity to verify results, and receive full disclosure to allow for statistical reliability of the data. A scientific approach to naming is driven by process which is founded in these principles

where names are a representation of the scientific dimensions and observations, which are different to those protocols of a Kaupapa Māori approach.

4.6.2 Scientific processes of naming

A scientific approach refers to a body of techniques that are used for investigation, testing of ideas and knowledge systems or creating new knowledge and ideas. These scientific methodologies or approaches are based on observation, measurement, experimentation, testing and the modification of the hypothesis or predictions. These methods define the scientific approach for naming new species also. An international scientific approach of naming was described by all (4/4) science participants who practise naming new species which "adheres to the regulations set out in the International Code of Zoological Nomenclature" as mentioned in Chapter 2. This scientific infrastructure of centralised knowledge of species classifications is regulated by an international convention.

4.6.3 Following a set of scientific naming protocols

The international code of taxonomic nomenclature is a set of worldwide standards that science participants indicate must be included in the naming process of new species. Daniel explained the process that he has followed when officially naming a new species: "This [refers to a copy of the book] book of guidelines is written in both French and English languages where the rules set out there are used as a reference or a guide, this code takes a bit of understanding, however a name is not valid if it is not published according to these standards".

Richard affirmed that "this process also involves first of all checking to see if what you have found really is new, and doing some research on what its relationships are to species that have already been named, putting all of that information together and publishing a paper which contains all of that information and proposes the new name". This approach demonstrates that it is a common process that includes all animals and plants. Keven also added that "whatever group you are studying you can find out the rules and regulations for that group", this is reflected here where the code works across other organisms, and each one has their own separate international committee. This process represents a method of naming that is included within the protocols of species classification and

identification of new species. This process is similar to a kaupapa Māori approach where taxonomic regulations are based on the categorisation of species but is different with regards to the values on which the categories are organised. A western scientific approach to taxonomy and classification is based primarily on the morphology and movement of the species, whereas a kaupapa Māori approach is more holistic and determined largely by wider cultural values that are instruments by which Māori view, interpret experience and make sense of the world.

4.6.4 Section summary

Scientific approaches to naming new species developed through procedures based on observation. The need for scientists to measure and make comparisons is often the main focus when classifying or identifying new species. The naming process becomes a secondary process that requires formally identifying the species and then naming the species. This section focused on the formal scientific process that is followed when naming new species. The comments portrayed describe a process that is focussed on the classification of species into groups with names that represent these species as a form of identification by descriptive feature or other forms of names. This discussion sought to present a scope of the current naming practise internationally and nationally. This highlights that there is currently no formal process for the use of Te Reo Māori or any other indigenous language in the code. This has resulted in taxonomists and biosystematists having to develop their own individual process where Te Reo Māori is concerned. There could be room for the use of Te Reo Māori within this set of guidelines but at present this is only done on a small scale basis.

4.7 Chapter Summary

This chapter presented the knowledge that lay within the responses of the participants of this research project. Research often seeks to present the views of participants as defining the context of the research, and in this context participants have been given an opportunity to express their views in their own terms. The statements were taken from transcripts of the semi-structured interviews about the

appropriate use of Te Reo Māori in the scientific names of new species discovered in Aotearoa New Zealand.

Māori Communities are made up of a group of people held together by whakapapa *kinship ties,* where the guardianship of knowledge is community based so that it can be used for the good of the community. This relationship of kinship supports collective knowledge being not for individual gain but for collective gain. A kaupapa Māori research approach is applied here and is an attempt to retrieve space for Māori voices and perspectives, methodologies and analyses where Maori realities and knowledge are seen as legitimate. All participants both Māori and non-Māori supported the use of Te Reo Māori with a very general application to taxonomic classification of species discovered here in Aotearoa New Zealand.

Scientific colonialism was discussed where science often treats knowledge as an external power base, where the centre of knowledge and information about a people or community is located outside of the community of people themselves and therefore is seen as universal science knowledge. This process of naming new species is usually defined within the rules of the dominant group. Within a scientific approach, Māori are compared to universal norms that are irrelevant within a Māori cultural context. Taxonomic systems depend on language for knowledge transmission, and the responses portrayed here highlight a major fact that western scientific and traditional Māori knowledge systems have different historical understandings and the use of names as a method of identification of species. Although traditional Māori knowledge of names, classifications and taxonomies may have eroded over time, it appears important to include a kaupapa Māori approach to naming new species in Aotearoa New Zealand and the influencing factors that are taken into consideration where Māori names are concerned. Matauranga Māori and western science practises are represented in the discussion as a cross cultural bridge where the cooperation of both Māori communities and science communities can work together within areas of science in order to establish successful working relationships and also to establish a meaningful partnership.

This chapter sought to present qualitative research data collected within a kaupapa Māori research framework. The formal scientific process that is followed when naming new species in Aotearoa New Zealand was explained with examples, where the discussion described a process that is focussed on the classification of species into groups with names that represent these species as a form of identification by descriptive feature or other forms of names. There is currently no formal process for the use of Te Reo Māori or any other indigenous language in this scientific naming process. This has resulted in taxonomists and biosystematists having to develop their own individual process where Te Reo Māori is concerned. Māori have become the other in the process of naming new species that is presented as a constructed deficit. There could be room for the use of Te Reo Māori within this process of scientific naming new species in Aotearoa New Zealand.

The discussions presented by the research participants support the notion that research is about the people, about being accountable in the production of knowledge that is for the good of the community and informs how we live our lives. A commitment to communities and people is discussed further in the following chapter that presents the concluding summaries of discussion with regards to the appropriate use of Te Reo Māori in the scientific names of new species discovered in Aotearoa New Zealand.

Te Rea - (Hair Root)

Chapter 5 Discussion, Conclusions and Recommendations

5.1 Chapter Overview

In this chapter I discuss the findings, present the conclusions, and make some recommendations for the thesis. In discussing the findings, I address my research questions that set out to guide this research project and furthermore draw conclusions on the appropriate use of Te Reo Māori in the area of scientific research and language. The final sections of this chapter contain conclusions, recommendations and suggestions for further development in this area where scientific protocols and matauranga Māori work together.

5.2 Discussion

The general aim of the research was to investigate the appropriate use of Te Reo Māori in the scientific names of new species. New species are currently being discovered in Aotearoa New Zealand, and being named using Te Reo Māori. Based on participant responses, there was no issue with the use of Te Reo Māori in western science protocols and processes; however, there was an area of in depth discussion about the appropriate use of Te Reo Māori.

In an attempt to determine whether Te Reo Māori is being used appropriately in scientific protocols of taxonomy, a series of semi-structured one-on-one interviews were scheduled with a group of eight male and female participants. The findings of this research were a representation of views from these eight participants where four of those participants were science based, and four participants were Te Reo Māori experts.

A review of literature found that there continues to be a need to seek, record, and explain information to build upon prior knowledge systems. An insight into how the world is explained helps us to create knowledge and to develop better theories.

Scientific explanation has served as a paradigm for such accounts of explanation (Wilson & Kiel, 1998) and continues to do so. The naming of new species in Aotearoa New Zealand is combining western scientific protocols with recognition of Māori cultural heritage, and the next section discusses findings related to this current practice.

5.2.1 Current practice of naming new species including the use of Te Reo Māori

The following section summarises the data that responds to the question concerning the current use of Te Reo Māori in the names of new species. It was evident that there is strong support for the use of Te Reo Māori in the names of new species discovered in Aotearoa New Zealand, and this support was represented in the responses of all eight participants.

Participant comments supporting an endemic language for an endemic species were expressed, referring to Te Reo Māori as a living language with official status in Aotearoa New Zealand. Māori participants described how in a Māori worldview that all species are related, including to humans, and that use of Te Reo was appropriate to recognise those relationships. Māori participants also noted that Te Reo Māori was "the perfect vehicle in Aotearoa for conveying the spiritual meaning as well as a cultural meaning to species native to Aotearoa New Zealand". Whatahoro (1913) supported this notion where he described ancient tribal knowledge as an education system and a way of life and living not just words that make up a language, but names that have spiritual and cultural meaning.

The formal scientific process of naming is discussed by the science participants with examples of species discovered and named with Māori scientific names. Gordon (2009) has worked on an international stage to publish and present all species classified in Aotearoa New Zealand. The findings of the research suggest that the practice of naming species in Aotearoa New Zealand varies according to individual situations, and examples are discussed by scientists who try to use a local name or knowledge if possible in the names of the species they discover and name. It was discussed that ultimately the decision for the choice of the name is the responsibility of the scientist that discovered and classified the species,

however, participants discussed that the use of a local name was an important consideration in the identification and naming of species. Historical links to Polynesia described by Foster (2008) and Benton (2007) describe localised names of plants that are similar in features that appear within the migration pathway of the Māori, and those names are present here in Aotearoa New Zealand, signifying a connection of knowledge systems to the wider Islands of the Pacific. The participants of my research indicated their careful use of language when they were familiar with the rules of nomenclature; however, caution was needed when they were unsure as to the appropriate use of Te Reo Māori in the names of new species.

Issues arising from discussions in the data presented in Chapter 4 show that there were concerns about the historical use of Te Reo Māori in scientific names and that it was done in quite a random manner. These acts of random naming that occurred in the time of the arrival of Cook (Beaglehole, 1961) still remain in use today and many of those names still refer to plants that have been re-described and are no longer relevant to their original meaning. The use of Te Reo Māori was often done in an incorrect linguistic context or without full understanding of the meanings of the words or names. In a more current example, a species of fish named by Hardy (1984), was named with full integrity to use Te Reo Māori, but a slight incorrect linguistic meaning. The findings of section 4.3.2 report that taxonomists, who are aware of Māori cultural considerations with regards to Te Reo Māori, will acknowledge these when using Te Reo Māori in the scientific names of new species. The responses showed that the naming protocols of foreign taxonomists were also questionable with regard to the use of Te Reo Māori. This concludes that there is clearly a relationship between Māori cultural considerations and appropriate use of Te Reo Māori in the names of new species discovered in Aotearoa New Zealand, and that a set of guidelines would be useful to taxonomists from overseas discovering and naming species in Aotearoa New Zealand.

5.2.2 Communication, consultation and publication

Establishing and maintaining working relationships between scientists and Māori can be achieved through communication and consultation. Communication and

consultation allows for sharing a mutual understanding of both science and Māori cultural perspectives present in research relationships, where understanding each other can help people better relate to one another. This becomes most effective amongst both iwi and scientific researchers and recognises language and cultural values of both science and Māori knowledge systems as the basis of indigenous understanding. Seldon (2002) describes in the naming of six new species of stick insect that communication and consultation was an important factor of his research and provided an avenue to cross-check his names of choice for appropriate use with the local iwi. This examination of the role of communication, led to further discussions around the context of Te Reo Māori in the scientific names of new species (Tipa and Nelson, 2007), reported on the cultural consideration of naming new species and found that a wider scope had to take place to get a full understanding of the current use of Te Reo in the scientific names of new species discovered in Aotearoa New Zealand.

There is a chance that these processes of scientific consultation could end up being a process of miscommunication. One science participant affirmed that "an explanation of the application of the name is necessary and also helpful" when consulting with iwi about the names of new species and the use of Te Reo Māori in those scientific species names. By incorporating Māori views and knowledge systems there is a space that acknowledges a Māori voice in the naming process that continues to uphold the mana (pride) of the language and the integrity of its cultural values. This was evident in the research of Seldon (2002) who appreciated the local knowledge of the people and their inclusion in the process of naming these new species was welcome.

Publication of scientific names are distributed for review by the wider international science community where often the audience of the general New Zealand public do not get to view these names or species. This is discussed as an issue to scientists who consider information dissemination in New Zealand important for knowledge transmission, and Māori who consider these species as descendants of Gods.

5.2.3 The appropriate use of Te Reo Māori in the names of new species

The process of consultation between science and iwi ensures an appropriate use of Te Reo Māori in the context of names and naming species. This was discussed by participants, and in particular one science participant who negotiated with an iwi group did so on the basis of a mutual understanding that both science and Māori cultural perspectives would be considered in the process and the name of the species.

The literature reviewed within Chapter 2 (e.g.Darroch, 2009), and the data portrayed in Chapter 4 discuss that some of the English translations of Māori words or names were presented as grammatically and culturally incorrect (Hardy, 1984), and due to a lack of recognition within the field of western science, matauranga Māori as an indigenous way of knowing and understanding, was not recognised. Examples of the earlier translation works by Grey as described in Darroch (2009) highlights a need for a revision of the inclusion of Te Reo Māori names in the appropriate use of Te Reo Māori so they align to a culturally correct paradigm.

As a result of this cultural ignorance these incorrect names have been published and still remain today (Hardy, 1984). Due to this lack of understanding, science participants indicated and agreed that a set of guidelines with regards to the appropriate use of Te Reo Māori would be helpful to them in their work of naming new species in Aotearoa New Zealand.

The types of Māori names and words that are possible for use in the names of species and the context of the language that they represent were discussed with full consideration of Māori cultural values. Discussion around issues that concern care that must be taken with regards to sacred names, such as those of Gods, or ancestors' names, and further including the names of people and places, highlighted a need where consultation should take place regarding the nature of these names. It was portrayed in Section 4.4 that there is a responsibility here for Māori as kaitiaki (Hayes, 1998), because kaitiakitanga carries with it an obligation not only to care for the natural world, but also for each successive generation, including the knowledge present in the names of the species discovered and named within Aotearoa New Zealand. The Māori language is more than a cluster

of words brought together to form sentences and paragaraphs, and follow a set of grammatical rules, the Māori language, as described by Sir James Henare, is the mauri or life force that form the core of the Māori culture.

5.2.4 What differences exist in the knowledge, ideas and understanding about the appropriate use of Te Reo Māori and western science naming protocols of new species?

A science worldview differs to that of a Māori world view. The following discussions portray findings by which Māori and western science view, interpret, experience and make sense of the world. These discussions allowed for an interpretation from knowing to understanding of both knowledge systems.

The interview questions in this research project sought the views and experience of both Māori and western science taxonomists in Aotearoa New Zealand that have named new species discovered in this country. It was expressed from a science point of view that although this was not a topic that many researchers have discussed or investigated in detail, there have been many cases where Te Reo Māori has been used in scientific names of new species.

5.2.4.1 A Māori world view and perspective to naming new species

A Māori worldview differs from a western science view as discussed in Section 4.5 where Māori acknowledge all creatures descend from Atua (often translated as Gods or Supreme Ancestors). Participants noted that aspects of the environment such as waters, lands and the life within are seen by Māori as mutually dependent ancestors. So this world view is a holistic one. The Māori cultural construct of whakapapa or lineage recognises that every species has its place and their names reflect that whakapapa. Oral traditions explained by Māori participants talk of the features of great ancestors such as Tāwhaki, who journeyed through the heavens seeking knowledge and enlightenment for the benefit of all humans (Smith, 1996). Other oral histories such as whakataukī (proverbs), waiata (songs) embody the vast cultural knowledge of the Māori which informed naming traditions. These were described by Marsden (1992) as being social constructs by Māori as tools of retaining knowledge and the transmission of knowledge from generation to generation.

This was supported by both Clarke (1990) and King (2008) who described that Māori learned and developed a detailed environmental knowledge over many centuries. This is important where a tikanga Māori participant who expressed that an opportunity to maintain a Māori cultural perspective in the names of new species is important to recognise for species that are currently being discovered in Aotearoa New Zealand. As discussed in detail, Māori participant responses indicate that a kaupapa Māori approach to naming is holistic and determined largely by wider cultural values.

A Kaupapa Māori approach to naming new species includes the cultural representation of names and their contexts. Participants described stories of creation recited by many generations of descendants that contain cultural information of classification and identification of species. By assuming the role of a kaitiaki or guardian, a Māori epistemology as described by participants, reflects Māori traditional ecological knowledge, and will reflect cultural values such as whakapapa, with a view that acknowledges that Māori names that represent Māori cultural values, and a connection to tribal historical knowledge and history. Names signify identity and this was shown to be important where six iwi brought their issues and claims to the Waitangi tribunal under the Wai262 flora and fauna claim because they wanted to see a change in how matters are dealt with concerning flora and fauna of Aotearoa New Zealand. The scope of the claim was broadened by the Tribunal to include New Zealand Law and policy affecting Māori culture and Identitiy. The Tribunal describes this claim as a cross roads in history that offers choices and many possible paths into the future. I have attempted to acknowledge the historical view of two knowledge systems of matauranga Māori and western science and offer choices through a set of recommendations that could assist in creating these many possible pathways into the future.

5.2.4.2 A Scientific approach to naming

As discussed by different science participants, taxonomic research and the naming of species in Aotearoa New Zealand is currently done on a case by case basis and often over vast geographical areas. The literature described a western scientific worldview and approach to naming new species that has developed through

procedures based on observation and measurement (Campbell, 1999; Purves and Orrians)

Discussion highlighted the need for scientists to measure and make comparisons as the main focus when classifying or identifying new species. The naming process discussed becomes a secondary process that requires formally identifying the species and then naming the species. The formal scientific process that is followed when naming new species allows for validity of research outputs. It was commented that there are however, no formal processes for the use of Te Reo Māori or in the scientific process of naming. Based on the research questions it was evident that the Western science view of taxonomy is related to identification and classification of species into their Kingdoms and more specifically down to their order, class and group. This reductionist approach of western science differs markedly from a holistic approach enclosed in a Māori cultural view.

5.2.4.3 Differences in kaupapa Māori and scientific approaches to naming

In a Māori worldview, it was common for a species to have different names according to the different tribal area that they may be in. It was described in discussions that there is no set rule that something must only have or be limited to one name. This becomes important in scientific processes when cross checking to see if names are relevant for the species and area they were discovered. A western scientific approach, as described by the science participants, refers to taxonomy and classification, based primarily on the morphology, location and movement of species. In scientific processes allowing more than one name is counter to western taxonomy. As described by a science participant, first research must be done to identify the species as a new species, and once the research is established, a name is applied.

A Māori world view of naming describes species that are not based primarily on measurement, observation and establishing new content, but rather include more of a connection of that species to its cultural environment, and the connection back to traditional ancestors. In comparison to this kaupapa Māori view many western science approaches to naming species including naming species after a discovering scientists or prominent person in western science. Discussions suggest that protecting the use of Te Reo Māori and ensuring the appropriate use of the

language is maintained is of utmost importance in the process of naming new species. These differences imply that a scientific view based on rules and regulations as set out by the ICBN that are created internationally and enforced by an international convention differs to that of a Māori naming protocol and process for naming that is created locally.

5.3 Conclusions

This research is concerned with the appropriate use of Te Reo Māori in the scientific names of new species that are discovered in Aotearoa New Zealand. I have attempted to highlight the views of both Science and Māori experts who are recognised as key knowledge holders of the information discussed in the research findings.

I have drawn on key concepts that highlight differences in taxonomy and a kaupapa Māori approach to naming new species in order to establish a current view of the naming process of new species in Aotearoa New Zealand.

In doing this I am aware that it is not possible to represent all views of Science and Kaupapa Māori in New Zealand but the small sample of key knowledge holders represents a cross section of those with expertise in this field, nevertheless it is hoped that this research will have broadened the scope of this topic and informed a greater awareness of the use of Te Reo Māori, alongside cultural and scientific considerations in the names of new species discovered in Aotearoa New Zealand.

Māori Communities are made up of a group of people held together by whakapapa kinship ties. The guardianship of knowledge is community based so that it can be used for the good of the community. This relationship of kinship supports collective knowledge being not for individual gain but for collective gain. A kaupapa Māori research approach is applied here and is an attempt to retrieve space for Māori voices and perspectives, methodologies and analyses where Maori realities and knowledge are seen as legitimate.

Scientific colonialism occurs where science often treats knowledge as an external power base, where the centre of knowledge and information about a people or community is located outside of the community of people themselves and

therefore universal science knowledge. This process of naming new species is usually defined within the rules of the dominant group. Within a scientific approach, Māori are compared to universal norms that are irrelevant within a Māori cultural context. No formal protocols have resulted in taxonomists having to develop their own individual based process where Te Reo Māori is concerned. Māori have therefore become the other in the process of naming new species.

Taxonomic systems depend on language for knowledge transmission, and the responses portrayed here highlight a major fact that western scientific and traditional Māori knowledge systems have different historical understandings and the use of names as a method of identification of species. Matauranga Māori and western science practises are represented in the discussion as a cross cultural bridge.

Although no code of practice or set of rules can anticipate or resolve the problem, there is a great advantage of developing a set of possible recommendations as to the use of Te Reo Māori in the names of new species, where science researchers can develop a consistent, culturally-sensitive approach within their subject area of naming new species where the use of Te Reo Māori is concerned.

There is a general consensus about what is acceptable and what is not by both Māori and science participants in the naming process, and the following recommendations can help guide taxonomists in their work of naming species and offer an complementary way of understanding the Māori language in the names of new species.

A set of guidelines on the appropriate use of Te Reo Māori in the names of new species can offer scientific researchers an organisational tool to help develop a sensitivity that will help them in dealing with the use of the language and its appropriate use, and bring discipline to the researchers awareness of cultural considerations' of a matauranga Māori and a Māori world view of naming species.

5.4 Recommendations

The principles of the International Convention Biological Nomenclature (Greuter, 1988) are to guide scientists in the nature and formal protocol of their work in naming new species. These protocols of naming new species do not include the use of Te Reo Māori. The findings of this study suggest that scientists are interested in the use of Te Reo Māori in new species discovered in Aotearoa New Zealand, but there appears to be variable knowledge of Te Reo Māori and cultural understandings amongst scientists about how this should be done. Participants in this study stressed that a good understanding of these elements for the correct use of the language in naming species would be necessary. Currently there is no clear way of understanding, or providing reference or guidance for the use of Te Reo Māori in a culturally sensitive way. Differences that exist in the knowledge, ideas and understanding about the appropriate use of Te Reo Māori and western science naming protocols of new species, could present a positive opportunity to increase the awareness of species discovered in Aotearoa New Zealand, and could be a possible way forward for educating in both areas of science and matauranga Māori.

The participants of my research identified strongly with the idea of a set of guidelines as a step forward to recognise the appropriate use of Te Reo Māori in the scientific names of new species in Aotearoa New Zealand, and the development of a set of guidelines that could assist non-Māori in the appropriate use of Te Reo Māori in the names of new species discovered in this country.

5.4.1 Guidelines for the use of Te Reo Maori in the scientific names of new species.

The following statements are offered for consideration in the development of suitable guidelines with regard to the use of Te Reo Maro in the scientific names of new species:

- When names are designed, described or created, participants recommend that an etymology includes the meaning of the name and why that name is used. A cross- check of the name beforehand with Te Reo Māori online

databases and language dictionaries, or a Māori liason staff member is recommended where there is capacity to do so.

- Names associated with people were created with caution by all Māori participants and some science participants as the use of ancestor names or whakapapa may offend tribal members. Geographical names of place or location are similar in nature. Careful consideration and consultation is advised when considering the name of a location in a species name.

- The careful consideration of Atua Māori, or Māori guardians, and the realms that they occupy, in the naming process is advised when using Te Reo Māori to connect the species to the wider context of cultural understanding and knowledge.

- Informal reporting back to iwi groups would be appreciated in both maintaining a local body of matauranga Māori or Māori knowledge systems and the importance of knowledge dissemination amongst wider tribal members.

- The possibility for fully functioning relationships is important where both Māori and science can work in collaboration to meet the needs of the future scientific naming processes of species discovered in Aotearoa New Zealand.

- It seems strange that science provides for no particular recognition of the interests of iwi and hapū community groups in their traditional knowledge, or the relationship between these communities and culturally significant species of flora and fauna. Much more can be done to respect Māori culture and identity.

- There is a risk of losing a connection with the environment by ignoring this opportunity to engage with Māori cultural beliefs, These cultural beliefs are important in conservation activities of the environment where science and Māori communities are working together on current conservation issues.

5.5 Final comments

Research is about the people, it is about being accountable to the production of knowledge that is for the good of the community and informs how we live our lives. Future investigations could include localised stories and experiences of knowledge that refer to naming new species that will increase the matauranga Māori and science knowledge base, and to fill in gaps in our understanding. Further research would be required to establish how widely these findings apply to the Aotearoa New Zealand science community, and could possibly compare participants of other iwi, science groups, and other fields of science.

The findings of this thesis commented on the appropriate use of Te Reo Māori in the scientific names of new species discovered in Aotearoa New Zealand. The implications of these findings are related to broader issues of taxonomic protocols and Māori cultural considerations. I have clarified my thinking, where the taxonomic processes of naming new species in Aotearoa New Zealand are concerned and conclude that scientific protocols of naming new species should include the use of Te Reo Māori. There is both an interest and place for Te Reo Māori in the names of new species but there is often little or no understanding amongst scientists and taxonomists of Māori cultural considerations.

This thesis acknowledges that differences exist in the knowledge, ideas and understanding about the appropriate use of Te Reo Māori and western science naming protocols of new species. I have expanded on the conclusions of the findings that show the need for the appropriate use of Te Reo Māori in the scientific names of new species in Aotearoa New Zealand, and finished with the suggestion of the development of a set of guidelines that fit within the formal process of naming with possible policy implications. This allows for future research to focus on further understanding and development of knowledge where the use of Te Reo Māori is utilised in scientific processes. The name of a species should represent a wider contextual meaning rather than just a formal protocol and these different elements should be included when and where appropriate.

References

Alexander, C. P. (1924). Undescribed species of Anisopodododidae from New Zealand - Part II. *Insecutor Inscitiae Menstruus, 12*, 10-213.

Anderson, J C. (1921). Popular Names of New Zealand Plants. *Transactions and Proceedings of the Royal Society of New Zealand 1868-1961, 56*.

Banister, P., Packer, J. M., Taylor, L., & Tindall, C. (1994). *Qualitative methods in Pschology;: A Research Guide*. Buckingham, England: Open University Press.

Bartle, J., Tennyson AJD. (2009). History of Walter Bullers Collection of New Zealand Birds. *Museum of New Zealand, Te Papa Tongarewa, Tuhinga*(20), 81-136.

Beaglehole, J. C. (1961). *The Discovery of New Zealand* (2 ed.). Wellington, New Zealand: Oxford University Press.

Beever, J. (1991). *A dictionary of Māori plant names* (Second revised edition ed.): Auckland Botanical Society.

Bell, J. (2005). *Doing your research project: A Guide for first time researchers in Education, Health and Social Science*. Maidenhead, England: Open University Press.

Best, E. (1911). Name Lists (unpublished). Te Papa Museum Library.

Best, E. (1929). *Fishing methods and devices of the Māori*. Wellington, NZ: Dominion Museum.

Best, E. (1942). *Forest Lore of the Māori*. Wellington NZ: Polynesian Society with the Dominion Museum.

Binney, J. (1987). Maori oral narratives: Pakeha written texts - two forms of telling histories. *New Zealand Journal of Botany, 21*, 16-28.

Bisby, F., A, Roskov YR, Orrell TM, Nicolson D, Paglinawan LE, Bailly N, Kirk PM, Bourgoin T, Baillargeon G., eds. (2010). Species 2000 & ITIS Catalogue of Life: 2010 Annual Checklist., from http://www.catalogueoflife.org

Brougham, A. E. (1996). *The Reed book of Māori proverbs = Te kohikohinga whakataukī a Reed / A.E. Brougham & A.W. Reed ; revised by Tīmoti Kāretu.* Auckland , New Zealand: Reed Books.

Buckley, T. R., Bradler, S,. (February 2010). Tepakiphasma ngatikuri, a new genus and species of stick insect (Phasmatodea) from the Far North of New Zealand. *New Zealand Entomologist, 33*, 118-126.

Catalogue of Life, (2012): http:www.catalogueoflife.org

Campbell, N. A., Reece, J.B, Mitchell, L.G. (1999). *Biology* (5th ed.): Addison, Wesley Longman, USA.

Campbell-Dunn, G. (2007). *Māori The African Evidence*. Christchurch: Penny Farthing Press.

Cheung, M. (2008). The reductionist – holistic worldview dilemma, *MAI Review, 3*(Research Note 5).

Clarke, W. C. (1990). Learning from the past: traditional knowledge and sustainable development. *The Contemporary Pacific, 2 (2)*, 233-253.

Cohen L, M. L., Morrison K. (2000). *Research methods in Education* (5 ed.). New York: Routledge.

Colenso, W. (1865). *On the Māori Races of New Zealand, Written for the New Zealand Exhibition 1865*. Christchurch: Kiwi Publishers.

Cram, F. (2006). Talking ourselves up. *Alternative an International Journal of Indigenous Scholarship, Special supplement; Marginalisation*.

Curnow, J. (1990). *Wiremu Maihi Rangikaheke, in Dictionary of New Zealand Biography* (Vol. 1): Allen & Unwin New Zealand Ltd and the Department of Internal Affairs.

Curnow, J., Hopa, N., & McRae, J. (2002). *Rere atu, taku manu! Discovering history, language and politics in the Māori - language newspapers.*: Auckland University Press.

Darroch, K. (2009). *Demystifying 'The Great New Zealand Myth': The social construction of the naming of New Zealand and its islands.* (Revised ed.). Christchurch.

Davidson, G. R., De Lange, P. J., & Garnock-Jones, P. J. (2009). Two additional indigenous species of Veronica (Plantaginaceae) from northern New Zealand: V. jovellanoides, a new and highly endangered species, and V. plebeia R.Br.' *New Zealand Journal of Botany, 47*(3), 271-279.

Denzin, N. K., & Lincoln, Y. S. (2003). *Handbook of Qualtitative Research*. Thousand Oaks, CA.

Derraik, J. G. B. (2008). The binomial nomenclature, the English language and the Tower of Babel. *Journal of the Royal Society of New Zealand, 38*(3), 229-230.

Dorit, R. L., Walker, W, Barnes, R,. (1991). *Zoology*: Saunders college Publishers, USA.

Fletcher,H.J.from http://wwwwaikato.ac.nz/library/resources/nzc/fletcher/A1.shtml

Foster, T. (2008). *Plant Heritage New Zealand, Te Whakapapa o ngā rakau. Interpreting the special features of native plants.*: Penguin group, New Zealand.

Ganeri, A., Martell, H.M, William, B. (2010). *Encyclopaedia of world history. The ultimate guide to the worlds past.* Bath, UK: Parragon.

Gardner, R. (1998). Orthography of some geographical epithets in the New Zealand flora. *Royal Society of New Zealand, Te Apaarangi*.

Gibbs, G. (2007). *Ghosts of Gondwana, The History of Life in New Zealand*. Nelson, New Zealand: Craig Cotton Publishing.

Gibson, P. (2007). *New Zealand Birds - a diverse selection*. Whanganui, New Zealand: Unique Pictorials.

Glenny, D. (2009). A revision of the genus Forstern (Stylidiaceae) in New Zealand. *New Zealand Journal of Botany,, 47*(3), 285-315.

Gordon, D. (2009). *New Zealand Inventory of Biodiversity* (Vol. one).

Greuter, W. (1988). *International Code of Botanical Nomenclature: Adopted by the fourteenth Botanical Congress*. Konigstein, Germany: Koeltz Scientific books.

Gray, D. E. (2004). *Doing Research in the Real World*. London: SAGE Publications.

Grey, G. (1956). *Polynesian Mythology*. Christchurch: Whitcombe and Tombs.

Haami, B., & Roberts, M. (2002). Genealogy as taxonomy. *UNESCO*.

Hamblin, W. K., Christiansen, E. H. (2001). *Earths Dynamic Systems* (9 ed.): Prentice Hall, U.S.A.

Hardy, B. (1984). A New Genus and Species of Deepwater Clingfish (Family Gobiesocidae) From New Zealand. *Bulletin of Marine Science, 34*(2), 244-247.

Harlow, R. (2001). *A Māori Reference Grammar*. Auckland, New Zealand: Pearson Longman.

Harlow, R. (2007). *Māori, A Linguistic Introduction*. New York: Cambridge University Press.

Hayes, S. (1998). Defining Kaitiakitanga and the Resource Management Act 1991. *Auckland University Law Review: Ko ngā take ture Maori, 8 (3)*, 893-899.

Heather, B., & Robertson, H. (2005). *The Field Guide to the Birds of New Zealand* (Revised Edition ed.): Penguin Group Publishing.

Heenan, P. B. D., P. Keeling, J (2009). Alternanthera nahui, a new species of Amaranthoraceae indigenous to New Zealand. *New Zealand journal of Botany, 47*, 97-105.

ICSolutions (1985) *A scoping report prepared for the New Zealand Government on indigenous views of Bio prospecting in Aotearoa New Zealand*.

Jones, P., T. (1960). *King Potatau. An account of the life of Potatau te Wherowhero the first Maori King*: The Polynesian Society.

Karetu, T. (2008). *"Once the fire is dead, then what?"* Paper presented at the Inaugural Māori Research Symposium.

Kawharu, M. (2008). *Tāhuhu kōrero: the sayings of Taitokerau.* Auckland, New Zealand,: Auckland University Press.

Kelly, L. G. (1986). *Tainui*. Christchurch: Caper Press Ltd.

King, D. N., Skipper, A, Tawhai W.B. (2008). Maori environmental knowledge of local weather and climate change in Aotearoa New Zealand. *Springer Science and Buisness Media B.V 2007, 90*(Climate Change), 385 - 409.

Krzeminska, E. (2001). Genus Paracladura Brunetti of the Australian Region. I. Characteristics of the antipoda group of species; a new species described (Diptera: Trichoceridae). *New Zealand Journal of Zoology, 28*, 373-385

Marsden, M. (1975). God, Man and Universe: a Māori view. *Te Ao Hurihuri*.

Marsden, M. (2003). The Woven Universe. Selected Writings of Rev Māori Marsden. The estate of Rev Māori Marsden.

Marsden, M., & Henare, T. (1992). Kaitiakitanga: a definitive introduction to the holistic worldview of the Maori.

Mead, S. M., Mead, June. Te Rina. (2010). *People of the land : images and Māori proverbs of Aotearoa New Zealand* Wellington, N.Z.: Huia.

Meyer, A. Alpha 136 In the footsteps of Linnaeus. *Royal Society of New Zealand, Te Apaarangi*.

Moore, L. B., & Irwin, J. B. (1978). *The Oxford Book of New Zealand Plants*. Wellington, New York: Oxford University Press.

Moorfield, J. C. (1992). *Te Whanake 3 - Te Māhuri* (Vol. 3). Auckland, New Zealand: Longman Paul.

Moorfield, J. C. (1996). *Te Whanake 4 - Te Kōhure* (Vol. 4). Hamilton: Waikato Print.

Nelson, W. (2009). Cultural Considerations when naming new species. . Unpublished A PowerPoint presentation presented to the Tainui Taxonomy Reference Group meeting held in October 2009 at Hopu Hopu Endowed College.

New Zealand Waitangi Tribunal. (2011). *Ko Aotearoa Tenei - Te Taumata Tuatahi: A Report into Claims Concerning New Zealand Law and Policy Affecting Māori Culture and Identity, Waitangi Tribunal Report* (Vol. 1). Wellington, New Zealand: Legislation Direct.

Ngata, A. (1945). *Ngā Moteatea* (Vol. 1). Wellington, NZ: Polynesian Society.

Okasha, S. (2002). *Philosophy of Science; A very short introduction*. New York: Oxford University Press.

Papa, J. W., Roa, T., & Karapu, R. (2009). He Kauwhanga Koiora' A tracking of the process in the setting up of a Tainui Māori Reference Group with NIWA in the taxonomy of newly discovered species. The University of Waikato.

Papa, R., Papa, P, Te Aho, L. (1994). He kete waiata, Collection of tribal songs.

Patterson, J. (1999). Respecting nature: The Maori way. *The Ecologist, Proquest Science Journals*.

Patton, M. Q. (2002). *Qualitative Research and Research Methods* (3rd ed.): Thousand Oaks: Sage Publications.

Paulin, C., Stewart, A., Roberts, C., & McMillan, P. (2001). *New Zealand Fish, A Complete Guide*. Wellington, New Zealand: Te Papa Press.

Pere, R. T. R. (1999). Māori language and Māori culture practises,. *Māori education commission newsletter*, (2), 7-10.

Purves, W., & Orians, G. (1983). *Life, The Science of Biology*. Massachusetts: Willard Grant Press.

Riley, M. (2001). *Maori Bird Lore an Introduction*. Paraparaumu, New Zealand: Viking Sevenseas NZ Ltd.

Roberts, M., Haami B, Benton R, Satterfield T, Finucane M, Henare M, et al. (2004). Whakapapa as a Maori mental construct: some implications for the

debate over genetic modification of organisms. *The Contemporary Pacific, 16*, 1-28.

Royal Society of New Zealand (2012): http:www.rsnz.org.nz.

Scheele, S. (2005). *Harakeke. The Rene Orchiston Collection*. Lincoln, New Zealand: Manaaki Whenua Press.

Seldon, D. (2002). *A comparison of ground insect distributions from several New Zealand fragmented forest habitats.* Auckland University, Auckland.

Smith, L. T. (1999). *Decolonizing Methodologies: research and indigenous peoples*. New York: Zed Books, Dunedin: Otago University Press.

Sutton, D. S. (1994). *The Origins of the First New Zealanders*. Auckland: Auckland University Press.

Taylor, M. (2002). *Meanings and origins of botanical names of New Zealand plants.*: Auckland Botanical Society.

Te roopu raranga whatu o Aotearoa. (2009). *He Rito, He Ranga. Kiekie: Our Taonga Plant*. Wellington: Toi Maori Aoteroa.

Te Taura Whiri i te Reo New Zealand Māori Language Commission. (2008). *He Pātaka Kupu, te kai a te Rangatira*. Wellington, New Zealand: Raupo.

Thornton, A. (1999). *Maori oral literature as seen by a classicist.*: Huia Publishers.

Timms, B.V, & McLayb, C. (2010). A new species of Eulimnadia (Crustacea: Spinicaudata: Limnadiidae) from New Zealand. *Journal of the Royal Society of New Zealand*.

Tipa, G., Nelson K. (2007). *Cultural considerations when naming new species* o. Document Number)

Walker, R. (1996). *Ngā pepa a Ranginui*. Auckland: Penguin Books.

Whatahoro, H. T. (1913). *The Lore of the Whare Wananga; or teachings of the Maori College, on Religion, Cosmology and History part 1 Te Kauwae-runga, or 'Things celestial'*. New Plymouth, New Zealand: Thomas Avery publisher.

Williams, D. (2001). *Matauranga Maori and Taonga.* Retrieved. from.

Williams, H. W. (1912). A Plea for the scientific study of Maori names. *Royal Society of New Zealand, Te Apaarangi, 45*, 1868-1961.

Wilson, R. A., & Keil, F. (1998). The Shadows and Shallows of Explanation. *Minds and machines, 8*, 137-159.

Wright, O. (1950). *New Zealand 1826-1827, from the French of Dumont D'Urville* (O. Wright, Trans.).

Appendix A

The appropriate use of Te Reo Māori in the scientific names of new species

Interview Questions and prompts

1. Please explain your profession and expertise in the field of naming new species.

2. Please explain with examples the protocols you follow for giving a name to a new species?
- Linneaus classification system
- Tikanga whakapapa

3. Please describe your thoughts and experience about the use of Te reo Maori in the scientific names of new species?

4. What are your thoughts about consultation / checking the correct use / context on the use of Te reo Maori in these names?

5. Do you have any further thoughts, feeling or views on the use of Te Reo Māori in the names of new species?