TE WHARE WĀNANGA O AWANUIĀRANGI

FOR THE DOCTOR OF PHILOSOPHY IN ENVIRONMENTAL STUDIES

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TE REO O TE KĀKAHU: AN ETHNO-ORNITHOLOGICAL CHRONICLE OF THE HISTORY AND LANGUAGE OF MĀORI FEATHER CLOAKS

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ABSTRACT

"Te Reo o te Kākahu", 'the voice/ language/ story of the cloak' encompassed for the first time western scientific research alongside Māori knowledge to explore the origins and evolution of Māori feather cloak making. The research acknowledged the layers of information contained within the terminologies, whakapapa (genealogy), and tikanga (customs) associated with cloak production, and more specifically the knowledge contained in the use of birds and feathers. This thesis focussed on recovering and recording iwi knowledge pertaining to how feather cloaks have been made and used in Māori customs and traditions over time. Additionally, the research created areas of new knowledge by utilising scientific techniques to verify materials in order to tell the full history of Māori feather cloaks from an integrated scientific and Māori perspective.

Many museum kākahu no longer have a recorded connection to the weaver or owner and important information was not documented or retained at the time of acquisition. However, by studying some of the intricacies of public museum collections, aspects of this knowledge were recovered. This study highlighted the inherent connection between people and the birds within kākahu Māori that previously had not been fully acknowledged. In that it recognised the Polynesian, historical, European, and current influences in the materials, techniques, and functions of feather cloaks in Māori society. Considering specific environmental, geographic, social, religious, personal, and economic factors that have been adopted or adapted by Māori over time in Aotearoa. Examples of Polynesian, historical and contemporary feather cloaks, in the literature, and from ethnographic and ornithological accounts were documented pertaining to how and why different types of Māori feather cloaks have been made and used, and what they may be communicating. Additionally, this thesis focussed on recording the knowledge of weavers and northern iwi (tribe/ peoples) pertaining to feather cloaks in marae (Māori meeting grounds) customs and traditions. Finally, current issues, trends and research pertaining to how iwi Māori access birds for weaving and relate to taonga (treasures) in museums were discussed, including an objective examination of various scientific methods that have potential to provenance Māori feather cloaks in museum collections and reconnect taonga with iwi Māori.

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tuia i roto
tuia i waho i te here tangata
ka ranga ki te pō
ka ranga ki te ao
tuia te muka tangata i takia mai
i Hawaiki nui
i Hawaiki roa
i Hawaiki pamamao ki te hono i wairua
ki te whaiao…
ki te Ao mārama…Tihei mauri ora!

1.0 Abstract

"Te Reo o te Kākahu" encompassed for the first-time scientific research alongside Māori knowledge to explore the origins and evolution of Māori feather cloak production. The research acknowledged the layers of information communicated in the terminologies (language), whakapapa (genealogy), and tikanga (customs) associated with cloak manufacture and use, and more specifically the knowledge contained in bird and feather selection (Harwood, 2011a, 2011b).

In order to establish an accurate knowledge base of Māori feather cloaks, the following themes were highlighted as relevant discussion points in the production and use of feather cloaks in Māori society over time. They were the language and classification of cloaks; the materials and techniques employed in cloak production; the spiritual concepts of cloaks (such as whakapapa and tikanga); and the cultural significance of the birds incorporated into kākahu Māori. The themes weave across time periods from Polynesia through to today, and the locations, and environmental and social influences in which Māori have been known to make and use cloaks in Aotearoa helped to measure the degree of change over time.

1.1 Introduction and Background to study

A 2007 study of 110 nineteenth century Māori feather cloaks at the Museum of New Zealand Te Papa Tongarewa (Te Papa) identified at least 10 introduced bird species alongside more than 20 different native species (Harwood, 2011a). This study initiated further enquiry regarding the relationship between birds and Māori within kākahu, namely whether certain birds were preferred over others, and whether the use of a particular species reflected a degree of significance of the bird, an event, the weaver, wearer, the whānau (family), or wider iwi group (Harwood, 2011b). From this, questions arose as to how cloak weavers communicated information from the feathers and species used, whether the birds themselves, the feather colour or cloak design and type symbolised the importance of a cloak and therefore the person wearing it. Wherein, this dictated the tikanga (customs) surrounding how and when to use the cloak. This theory also suggested that certain birds and feathers represent the mana (pride, authority, and status) and Mātauranga (knowledge) surrounding the wearer and weaver (Harwood, 2011b). Today, most of the original weavers and owners of museum cloaks are no longer here to relay this knowledge, and records pertaining to many kākahu were not recorded or have been lost. The proposed principles had never been previously addressed in detail and unlocked a body of knowledge surrounding Māori feather cloaks in museum and private collections with implications for iwi Māori.

In 2011, Hakiwai initiated a virtual database on the taonga (treasures) held in museums around the world and recorded that more than 16,000 Māori treasures were held in overseas museums, art galleries and allied institutions".[1] Hakiwai asserted that the knowledge connected with many of these taonga had been mainly confined to "museum personnel, academics and scholars who have visited these institutions" and that "Māori people have been largely dislocated and alienated from their taonga and been the passive observers of the research and knowledge about them".[1] At the time of collection, as is often the case with many museum taonga Māori, the materials and origins of the Te Papa cloaks were misplaced or not recorded (Harwood, 2011a). Of the 352 Māori cloaks in Te Papa's collection, the largest collection in the world, only 64 have documented iwi affiliations (Tamarapa, 2011, p. 15). Unfortunately, a large number of

[1] http://www.maramatanga.ac.nz/project/virtual-repatriation-database-m%C4%81ori-taonga-overseas-museums

museums have limited information recorded from the collector or donor, making research and dissemination (sharing) of this information with iwi Māori important (Pendergrast, 1987, 1997; Starzecka, Neich, & Pendergrast, 2010; Tamarapa, 2011; Tapsell, 2006).

1.2 Aims, significance and justification

This research aimed to create new areas of knowledge by utilising scientific techniques to tell the full history of Māori feather cloaks from an integrated scientific and Māori perspective. Substantial research was undertaken in the late 19th, and 20th centuries by ethnologists and scholars such as Roth (1923), Hīroa (1926), Mead (1969), and Pendergrast (1987,1997) pertaining to the evolution, classification, production and function of Māori cloaks. Unfortunately, few have contributed ornithological knowledge pertaining to feathered kākahu, specifically whether Māori preferred certain species and feathers over others. Ethnologist, Elsdon Best (1856-1931) was in the unique position to answer this when he documented Ngāi Tūhoe weaving (Best, 1898) and forest lore (Best, 1977), yet did not. Additionally, these established authorities on Māori weaving were male and only one, Mick Pendergrast, was considered a practitioner. From the late twentieth century female scholars, researchers, and weavers such as Te Kanawa (1992), Blackman (1998, 2007), Lander (2011), Maihi (2011), and Wallace (2002) have contributed invaluable perspectives pertaining to Māori cloak weaving.

This research required the scientific verification of materials and techniques of Māori cloaks in museum collections, and to document this information before it was lost. The study intended to review the change and evolution of the language, tikanga (customs), and construction of Māori feather cloaks from our origins connecting us to peoples throughout the Pacific, stemming from an ancient knowledge of birds and feathers and how they are used in weaving and clothing. Essentially, the questions to be answered were: How and when did Māori weave feathers into cloaks? What bird feathers have been used in cloaks over time and why? How are feather cloaks made and used today? And finally, how do iwi Māori relate to feather cloaks in museums and what is the future for Māori weaving? The subsequent knowledge resulting from these enquiries was used to determine or measure how Māori feather cloak production and use has changed over time, and whether certain iwi Māori specialise (or specialised) in making types of feather cloaks.

From a research point of view, documented museum cloaks can and should be included in a study of the evolution of Māori cloaks. Museums house our nation’s treasures. They can also hold some of the information needed to unlock the knowledge and history contained in taonga Māori. From a scientific point of view, this study highlighted new and relevant scientific analyses in the identification and possibly provenance of materials in museum taonga. As such, the scientific findings of bird distributions corroborated Māori oral histories and material evidence in taonga. From a Māori point of view, some of this knowledge had not been recorded or discussed previously, and was not always available for iwi Māori. Finally, no single piece of literature existed that acknowledged in depth the intrinsic value of certain birds in kākahu Māori. By creating new knowledge and recovering and interpreting old knowledge one could better understand Māori cloaks in an historical and contemporary context. The importance of sharing knowledge and resources was integral, so that kākahu Māori housed in museums around the world could be made accessible in some form, and kākahu in private collections and on marae could be re-examined for new information.

1.3 A summary of the evolution of Māori feather cloaks

The two perceived integral points of difference for ‘traditional’ nineteenth century Māori cloak weaving is the use of harakeke (New Zealand flax: *Phormium tenax*) as the foundation material, and the technique of twining (whatu) to attach the feathers, described as loom-less finger weaving in which horizontal weft threads are woven around vertical warps (Harwood, 2011a; Hīroa, 1926). Hīroa (1926) and Mead (1969) outlined that this method was the most evolved and the final installment in Māori feather cloak weaving, which was highly developed by the end of the eighteenth century. As there were no examples recorded of Māori cloaks to draw on for observation from the time Māori arrived in Aotearoa, it was proposed for this study that analysis of the material evidence from Polynesian and early (pre-European) Māori feather cloak forms could elucidate as to where, how and why some of these influences may have been implemented and evolved in Aotearoa.

1.3.1 Historical and Geographical context

***Figure 1.1*. Kahu raranga (plaited cloak). Harakeke, hīnau (*Elaeocarpus dentatus*) bark dye; dyeing, plaiting / weaving. Made c.1800-1850. Hamilton collection, purchased 1914. Te Papa ME001685. Right: weaving detail.**

Twined clothing is not a recent practice, it was developed throughout Europe, Africa, Asia, the Americas and then the Pacific over thousands of years (Blackman, 2011, p. 77). A fascinating early example of finger twining was associated with Ötzi, a 5,300-year-old mummified iceman who was found on the border of Italy and Austria in the Ötztal mountains in 1991 (Hall, 2007, 2011). Preserved for thousands of years in a glacial environment, he was discovered with numerous tools, food and a degraded twined textile that resembled a cape or mat of bundled grass (*Brachypodium pinnatum*) tied with linden (*Tilia* spp.) bast (inner plant) fibres (Acs, Wilhalm, & Oeggl, 2005). Ötzi's twined textile likely functioned as both a mat and cape. Some of the oldest Italian textiles of European flax linen (*Linum usitatissimum*) date from around 6,000 years B.P. in Rome, and confirm twining, thread, and cultivation as contributing factors in the historical stages of this type of clothing (Harris, 2013).

Māori cloaks were worn, sat on, slept on or in, and were often indistinguishable from mats, hence the European labelling of several early cloaks as 'maori mats' in museum records (Hamilton, 1892; Henare, 2005a, p. 127; Malo & Emerson, 1903; Tamarapa, 2011, p. 12). This was likely an interchangeable function from or between bedding and cloaks, in which mat-like textiles were also worn as garment-like mats (whāriki), as seen in prehistorical examples and throughout Polynesia including the fine mats of Tonga and Sāmoa. Māori woven clothing can be distinguished as raranga (plaiting), which is rarely seen today, and whatu (twining) common today (Fig. 1.1) (Blackman, 2011, p. 77; Tamarapa, 2011, pp. 156–157). Hīroa (1926) and Simmons (1968) suggested this form of clothing was potentially an important stage in the evolution of Māori clothing, that it was largely unstudied as reflected in the number of 'old mats' in museum collections that likely also functioned as clothing.

***Figure 1.2*. Nuu-chah-nulth (Nootka) sound cloak. North America. Cedar bark, nettle, mountain goat wool, sea otter fur; twining, plaiting. Made before 1796. Vancouver collection. ©Trustees of the British Museum Am,NWC.54. Right: detail of designs. CC BY-NC-SA 4.0.**

Useful comparisons of material and technical practices in Māori examples of twining and feather cloak adornment could be made between Pacific textiles including North and South America. Twined cloaks were collected by Captain James Cook (1728-1779) in the late eighteenth century from the Pacific Northwest coast of North America in the Nuu-chah-nulth (Nootka) Sound (a misnomer), west of Vancouver Island in British Colombia. Roth (1923) and Hīroa (1926) recognised the similarities, as did the early European collectors. Native North Americans constructed twined cloaks out of processed cedar bark, with added animal fur and skin (like otter and seal), and coloured fibres in geometric patterns (Emmons, 1991; Willoughby, 1922). An example in the British Museum, London (Am,NWC.54) had similar designs to tāniko in some Māori cloaks with borders of coloured geometric patterns (Fig. 1.2). A comparable tāniko border was observed in a Te Papa kahu kiwi (kiwi feather cloak) (Te Papa ME015351).

Figure 1.3. **Tupinambá (Tupi) feather cloak. Brazil. Red ibis and parrot feathers, natural plant fibres; weaving, tying. 17th century. Niels Erik Jehrbo, The Ethnographic Collection, The National Museum of Denmark H.5931. CC BY-SA.**

Prehistoric clothing comprised of plant fibre textiles, and sewn animal skins, with bird skins and feathers, and have been described in textiles as functional and aesthetic additions throughout numerous indigenous cultures. Netted cloaks also attributed to North America and collected in the eighteenth century were manufactured from goat wool and bird skin (Kaeppler, 1978, p. 265). North American feathered headdresses, blankets (also worn as cloaks), and cloaks (or capes) denote status and craftsmanship (Pearlstein, 2010; Willoughby, 1922). The Museum of the Cherokee Indian in North Carolina have several feather cloaks incorporating feathers from different species including turkey (*Meleagris gallopavo*) (D105/98 and 2006.9). The Denver Art Museum in Colorado have a condor (*Gymnogyps californianus*) feather cloak (1950.150) made by the Wailaki of California with large wing and tail feathers attached to a knotted backing. In the South Americas, brightly feathered costumes were often worn for festivities in Perú (King, 2012). Feathered blankets or wall hangings in Mexico depict historic and mythical traditions, augmented by feather knotting and spinning (Johnson, 1957). Striking feather cloaks from the Tupinambá peoples of Brasil (Brazil) demonstrate the beauty and significance of red feathers in South America. One of five such feather cloaks in the National Museum of Denmark in Copenhagen (H.5931), comprise of vibrant red, blue, and yellow feathers (Fig. 1.3) (Hill, 2012, p. 190). The stunning feathered headdresses and capes from the Amazon and coastal regions used the bright red scarlet ibis (guará: *Eudocimus ruber*) feathers (Françozo, 2015, p. 110). The importance of birds to the indigenous peoples of North and South America before European arrival is reflected in the traditions of bird hunting, taming, raising and eating of domestic birds; as well as the harvesting and trading of feathers to create art and adornment; the mimicking of birds in ritual performances; auguring (foreseeing an omen), and in deifying birds (worshipping like gods) (Norton, 2013, p. 63). All indigenous cultures clearly share aspects of the material culture, technical practices, language, bird use, and the social and physical function of feather cloaks. However, it was the unique combination or accumulation of these factors exclusive to Polynesia and ultimately Aotearoa that made it vital to isolate aspects and verify how, when, and why they were implemented here.

1.3.2 Māori Clothing traditions

Historical Māori clothing was initially developed out of necessity, and over time adorned with animal hair, feathers, coloured tags and designs for status and personal creativity, and worn at important life events such as birth, death, and ceremonial gatherings (Mead, 1969). Distinct were woven items that were made by women, in which genealogical lines could be traced from weaving styles and patterns. While both men and women were both capable of weaving, it is understood the finer artform of cloaks was specifically dedicated to women through the female deity Hine-te-iwaiwa (Best, 1898). In Māori traditions the sister of demigod Māui, Hina (Hina-uri) was so ashamed when her trickster brother turned her husband Te Irawaru into a dog that she cast herself into the ocean (Anderson, 1928). Emerging as the goddess of the moon and tides she reached land and settled in life with Tinirau. During a difficult birth she uttered a karakia (incantation) to assist her and was thereafter also known as Hine-te-iwaiwa or Hina-te-iwaiwa the deity of childbirth, women, and the domestic arts (weaving) (Anderson, 1928).

1.3.3 Māori arrival in New Zealand

It was accepted that the evolution of Māori feather clothing developed in linear chronological stages from Polynesia, adapted from bark cloth to plaited cloaks, then skin cloaks to twined rain capes, that developed into fine twined cloaks, and finally twined feather cloaks where the technique of twining was a later development that had become more refined over time (Hīroa, 1926; Simmons, 1968).

***Figure 1.4*. Model of a Giant eagle (Pouākai/ Hōkioi/ Hakawai/ Hakuwai: *Aquila moorei*). Made by Noel Hyde and Tom Tischler. ©Te Papa S.035330. CC BY 4.0.**

The migrating waka from Hawaiki reached Aotearoa around 1300 A.D, and current literature formed a picture of the environment in which Māori arrived and our subsequent adaptations to it. Unlike other Pacific islands, New Zealand has a relatively large land mass, over 260,000 km². Over 3,000 years ago approximately 85-90% of the land was dominated by conifer-broadleaved and podocarp forests (Holdaway, 1989; McGlone, 1989, p. 116). Introduced kiore (Māori rat: *Rattus exulans*) and kurī (Māori dog: *Canis lupis familiaris*) supplemented the Māori diet of seafood, marine mammals, and at least 245 breeding species of sea and land birds (Atkinson & Millener, 1991, p. 129; Holdaway, Worthy, & Tennyson, 2001, p. 119). Of the breeding forest birds 33% were flightless and 21% nocturnal or semi-nocturnal (Atkinson & Millener, 1991). Geographic isolation contributed to the evolution of unique endemic giant eagles (*Aquila moorei*) (Fig. 1.4) (extinct); flightless moa (Dinornithiformes) (extinct); and kiwi (*Apteryx* spp.) and kākāpō parrot (*Strigops habroptilus*) (Worthy & Holdaway, 2002).

***Figure 1.5*. Kapa (Hawai‘ian textile). Barkcloth, dye; stripping, beating, and dyeing. Made 1770s. Gift of the Trustees of the Turnbull Estate, 1918. Te Papa FE001475/3.**

Light clothing was wrapped around the body in the temperate Pacific, made from basic plant materials of tapa, or barkcloth from the paper mulberry tree (aute: *Broussonetia papyrifera*), banyan (*Ficus* spp.) or from breadfruit or kuru (*Artocarpus altilis*) trees (Fig. 1.5) (Colchester, 2003; Küchler & Were, 2005; Neich & Pendergrast, 1997, 2001). These plants require warm climates so are limited to the more temperate regions of the North Island in New Zealand (Hīroa, 1966). Early kūmara (sweet potato: *Ipomoea batatas*) plantations and aute trees were seen in the Bay of Islands, Northland (Colenso, 1877, p. 145; Parkinson, 1984, p. 110). On Cook’s first voyage, naturalist Joseph Banks observed six ‘aoute’ (aute) plants in Moturoa (North Island’s west coast) in December 1769, he said they looked like the Tahitian plants, but were rare, likely from the colder climate, and that Māori valued it yet could only produce small pieces at a time (Beaglehole, 1962a, p. 444). Māori were certainly wearing tapa clothing upon arrival in Aotearoa, providing inadequate protection (Davidson, 1984). Iwi retained the preparatory knowledge, as seen in an historical find of a waka huia (carved wooden box) in a South Island cave, that contained tapa fragments, and huia (*Heteralocha acutirostris*) and kākā (parrot: *Nestor meridionalis*) feathers (Otago Museum D33.1892/a) (Rowley, 1966).

Pacific islanders fashioned bark cloth into everyday clothing, the bark skin was painstakingly beaten, washed, then dried and skilfully decorated. Variations of the name tapa (Māori, Sāmoa, Mangarevan), taba (Tonga), and kapa (Hawai‘i) underly its connection in Polynesian genealogical traditions in which the fashioning of man revolved around the creation of wearing plant bark skin as his own skin, and designs often resembled tattoos (Fig. 1.5) (D’Alleva, 2005, p. 49; Tregear, 1891). Polynesian bark cloth clothing consisted of a male girdle (maro / malo) and female waist garment (pa‘u/ pareu) (Hīroa, 1944, p. 7). Tahitians of rank wore cape-like tīputa and ahu fara (in Māori, kahu whara) or pressed clothing (D’Alleva, 2005, p. 47).

***Figure 1.6*. Harakeke, New Zealand flax (*Phormium tenax*) plant. Image by Hokimate Harwood, Whakatāne, Bay of Plenty, 2019.**

The cooler New Zealand climate instigated a change of materials to harvest the harakeke (New Zealand flax: *Phormium tenax*) and adaptation of raranga (weaving) for warm clothing (Fig. 1.6). Harakeke is native to New Zealand, the Chatham Islands, and Norfolk Island and known as a treasured taonga species that is important for fauna (birds and insects) and in generating materials for housing, bindings, baskets, mats, netting, ropes and clothing (Hīroa, 1923, 1924a; Pendergrast, 1996; Tregear, 1904). The harakeke plant signifies the whānau (family) unit so the plant and its leaves were highly valued in weaving families (Harwood, 2011b).

1.3.4 Adaptation of techniques

Figure 1.7. **‘Īnaki (Cook Island eel/ fish trap). Fau (hibiscus fibre) and aka niu (coconut roots), string; twining, miro (twisting). Made c.1900, purchased 1907. Te Papa FE002308. Right: detail of twining. CC BY-NC-ND 4.0.**

From Hīroa’s (1926) expansive work it is understood that twined Māori cloaks evolved from twined baskets and traps. The aerial roots of pandanus or ‘ie‘ie (*Freycenetia*), coconut (*Coco nucifera*), and olonā (*Broussenetia*) were some of the local Polynesian plants harvested for twining. With the pandanus bark removed, Polynesians fashion the roots into twined fish traps, and spherical twined baskets (Arbeit, 1990, p. 14). It is likely that Māori used and experimented with numerous methods to produce protective clothing. A refinement in techniques and need for warmer more comfortable clothing certainly facilitated this change. Twining, plaiting, knotting, binding, and coiling in fishing and storage equipment have all been adapted to certain degrees to produce clothing in the Pacific and later New Zealand. Twining was initially adapted from one-over-one-under weaving, vertical and horizontal weaving of two or more threads. A Cook Island ‘īnaki (hinaki, trap) in the Te Papa collection (Te Papa

FE002308) has double pair twining where two pairs of horizontal elements (wefts) have been twisted around and between pairs of vertical warps (Fig. 1.7). Over time, the close weaving of whatu (finger twining) evolved into more refined objects and items of clothing (Hīroa, 1966, p. 264; Pendergrast, 2005, p. 86).

***Figure 1.8*. Pākē (Māori rain cape). Harakeke; scraping, twining, plaiting. 18th century. Forster collection (107). Pitt Rivers Museum, University of Oxford, Oxford, England 1886.1.1124. Right: detail of tag attachments.**

From necessity, Māori scraped (scutched) the outer plant leaf fibres of harakeke to create rain capes and with further working of the leaf a soft warmer inner thread, muka, for warmer clothing. The thatching in rain capes is formed from the warp plant fibres (a hieke) or from attaching the plant fibres at each whatu (twined or wrapped section), then secured by the weft around the warp (a pākē) (Fig. 1.8) (Hīroa, 1926).

1.3.5 Māori feather cloaks

***Figure 1.9*. Kahu kiwi (kiwi feather cloak). Muka, brown kiwi feathers (& albino kiwi), dye; spaced double pair twining, tāniko, plaiting. Made 1850/ 1900. Gift of Alexander Turnbull, 1913. Te Papa ME002701. Right: detail of twined kiwi feathers. **

Māori possibly arrived in Aotearoa waka wearing feather cloaks, certainly traditions tell of Rangatira (chiefs) adorned with cloaks of dog pelts (Hīroa, 1966). Throughout Māori occupation, bird feathers and skin, and kurī (dog) skin and hair attachments have been incorporated for warmth, experimentation, status, and aesthetic value in Aotearoa. As no feathered cloaks or textiles survived from the first Māori arrivals, we have relied on archaeological examples of feathered cloaks from the 16th and 17th centuries. These historical cloaks had feathers, bird skins, plaiting and knotting that resembled other Polynesian styles; and sewing and variations of single and half-hitch twining were also documented (Blackman, 2007; Hamilton, 1892; Simmons, 1967; Trotter, 1972; Wallace, 2002).

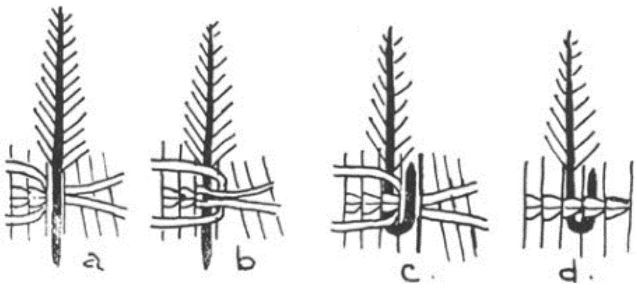

***Figure 1.10*. Orthodox Māori feather attachment, using two pair-interlocking weft twining. From Hīroa (1925); [Fig. 78.].**

The longest technical phase in Māori feather cloak production can be studied starting from European settlement in the nineteenth century. From the 1850s onwards, the prominent technique in museum cloak collections is termed spaced double pair twining (whatu aho rua), defined as a pair of horizontal wefts (aho rua) twined or wrapped (whatu) around the feather(s) and a vertical warp (whenu) (Figs. 1.9 & 1.10). Practiced in cloaks today, the base of the feather shaft is secured to the vertical backing muka warps (whenu) using two pairs of smaller horizontal weft threads (aho rua), and the feather shaft bent back on itself to hold it in place (Harwood, 2011a, p. 125; Te Kanawa, 1992, p. 34). The cloak is commenced in the bottom right hand corner, and the feathers twined in facing upward and incorporated along each row, and the rows added down the cloak so that when completed the cloak is turned the right way up and the feathers layered with the tips pointing towards (facing) the base of the cloak (Harwood, 2011a).

1.4 Research Design

The study integrated relevant literature and employment of science and Māori frameworks that incorporated several methods designed to answer the research questions. The theories that encompassed the research methodologies did not necessarily align so closely that they defined and dictated the research processes.

The research was designed around the major timelines of Māori feather cloak evolution in which tangible material evidence and literary references could be examined. They included Polynesian feather attire; and early Māori clothing between 1500-1700 A.D. where physical archaeological examples of transitional Māori feather cloaks were discovered in the South Island. Then physical examples, and anecdotal portrayals of Māori feather cloaks made 1700-1800 A.D. acquired and recorded from eighteenth century European-Māori encounters were analysed. The study of cloaks at the time of post-European settlement in the nineteenth century was integral in terms of the substantial increase in feather cloak production in conjunction with how cloaks were made, used and obtained for private and museum collections. Finally, contemporary and current cloak practices and future scientific research was explored, including how iwi Māori access materials, how the production and tikanga (use) of kākahu is perceived; how Māori relate to and access cloaks in museum collections; and the possible implications of cloak research.

1.4.1 Research Questions

The research looked at the major questions or lines of enquiry to understand what birds and feathers were used in the evolution of Māori feather cloaks, also why and how were they made, and whether these aspects dictated how the cloak was used. Essentially, what bird feathers have been used in cloaks over time and why? How are feather cloaks made and used today? Then finally, how do iwi Māori relate to feather cloaks in museums? and what is the future for kākahu Māori.

1.4.2 Research Themes

Within each timeline the following themes were formulated to demonstrate how the change in Māori feather cloaks could best be analysed. They were the language of feather cloaks, the origins of the terms, the names or classifications of the types of cloaks, and what the cloak communicated or symbolised. The materials (e.g. birds, harakeke), and techniques (e.g. twining, sewing), styles (designs), and functions (how, why, and when it is worn) employed to make and use Māori feather cloaks, as they dictated who might wear a cloak. Temporal and environmental factors such as the production location, climate, and weaver access to resources such as birds and plants, as well as the time in which the cloak was made were integral to the research design. The spiritual knowledge and kōrero (history) associated with a cloak can originate from the whakapapa (genealogy) or whānau (family) of the weaver, and/ or the wearer, and is hence inherently imbued within a cloak. Knowledge also stems from the significance of the birds used, or the patterns within the cloak that is unique to a weaver or area. The intangible information that encompassed the name of a cloak or stories (kōrero) pertaining to it could be retained for generations. The tikanga (customs, practices) and use or significance of Māori feather cloaks and how these were adapted from Māori arrival in Aotearoa to present day informed the value and therefore use of feather cloaks over time. These themes were interwoven throughout the research timelines highlighting the inherent connections in all aspects of weaving. Justifications for theme selection are outlined below.

<u>Language and classification</u>

Hīroa (1966) stated that “the garments themselves tell us what did occur but to understand them, we must learn their language through the minute details of technique” (p. 177). This proclamation reiterated the importance of researching and recording the many different layers of knowledge within and around kākahu Māori. One aspect of the chronology of Māori feather cloaks could be traced by studying the language associated with the origins and change over time in the naming (classification) of cloaks. Another interpretation of Hīroa’s (1966) comment is that the language, te reo, is not just in the etymology of naming cloaks, although that is a small yet important component. For this research, language referred to what the weaver was trying to communicate through her artwork and in the use of certain birds and feathers, and in the designs and colours in their kākahu.

Many of the classifications of Māori feather cloaks originated from our Pacific origins and were based on the relationship between the languages of New Zealand Māori and similar Polynesian nations. The commonalities in the vowels *a e i o u* and variations of the consonants representing the same words between the languages is observed in the description of cloaks. For example, the term for a red (feathered) cloak in Māori is kahu kura, in Hawai'ian it is 'ahu 'ula where the 'k' is silent, and the 'r' is replaced by a 'l' (Hīroa, 1944, p. 10). Hīroa (1957) suggested that originally this term described a red, or red feathered cloak, today it encompasses all Hawai'ian feather cloaks and capes (p. 216). Tregear (1891) defined kākahu and kahu (generic Māori names for clothing, or cloaks) and associated them with equivalent verbs such as *'ahu* (Hawai'i), *'afu* (Samoan), *ahu* (Tahitian), *kafu* (Tongan), *kahu* (Marquesan, Mangarevan, and Paumotan), and *kakau* (kākahu in Mangaian) (p. 113).

From the nineteenth century, studies of the language in the naming and terminology associated with Māori cloaks stemmed from the types of cloaks in Māori society and how, if at all the names, status, use and cultural value of these changed. In general, the most prestigious cloaks were kaitaka (finely woven cloaks with coloured woven tāniko borders), kahu kurī (dog skin cloaks), kahu kura or kākahu kura (red or red feather cloaks), kahu kiwi (kiwi feather cloaks), and kahu huruhuru (feather cloaks). Finally, the korowai (tagged cloaks) were for everyday use. The more prestigious cloaks were time consuming to produce, so they were less common. Kahu kura are precious due to the colour red and could feature the red belly and orange underwing feathers of the kākā, where several birds would cover a cloak making it more valuable (Hīroa, 1926, p. 58).

The terminologies and practices surrounding cloaks are inter-related and in turn have relevance to whakapapa Māori and whenua Māori, or genealogical connections to each other and to the land in which we are tied to. Not just in the materials and techniques of the cloak but in that they were made, named and worn by our tūpuna (ancestors), and over time the cloak, the knowledge and the language have been transferred to the descendants. The weft thread, known as aho, translates simply as a line, on a cloak it is the thin horizontal muka thread that forms the weft (Williams, 1957). In terms of familial relationships te aho matua and te aho tūpuna are the parental and ancestral lines respectively (Henare, 2005b). The warp thread, or whenu, is an abbreviation of whenua, and translates as land and placenta (Maihi, 2011, p. 39; Williams, 1957). Kahu is a generic term for a cloak and today is generally a precursor to the type of cloak described e.g. kahu kiwi (kiwi feather cloak). Williams (1957) also defined kahu as the protective embryonic sac that surrounds the foetus in the womb. This validates how cloaks are perceived as providing warmth and protection, spiritually and physically. It also reiterates the strong vital and familial link between the physical and spiritual realms of kākahu and whakapapa (tāngata, people). The classification of cloaks, much like for birds, was likely not always universal for all iwi Māori. Each whānau, people, or area have their own names and titles for each class of cloaks, including individual names for kākahu. For example, the term Arikiwi could also describe a prestigious kiwi feather cloak, worn by high ranking people (Rangatira or Ariki) through whakapapa lines (Tregear, 1904, p. 235; Williams, 1957).

The Māori taxonomy (whakapapa) of naming bird species was also investigated, such as the naming of New Zealand's birds based on physical or behavioural characteristics. For example Māori also developed onomatopoeic naming systems, where a bird's name is based on the sound it makes, like the ruru (morepork: *Ninox novaeseelandiae*) and whio (blue duck: *Hymenolaimus malacorhynchos*) (Williams, 1906). One bird, the kākā, exemplifies many of these traits including the etymology of the Māori name, for example, kākā=parrot, kākāpō=night parrot, kākāriki= little green parrot (parakeet: *Cyanoramphus novaezelandiae*). Variations of the name kākā in the Pacific can describe a parrot species (Watling, 2001). The word kā in Māori also refers to fire (red), or a screeching sound (i.e. the bird's call) (Williams, 1957). Numerous other Māori bird names have derived from Polynesian languages in that the New Zealand bird order Dinornithiformes which is known collectively as moa in Māori, is the generic name for fowl or chicken (*Gallus gallus domesticus*) in some Pacific islands (Christian, 1916; Finney, 1973; Watling, 2001). Kukupā, or kuku, is the northern Māori name for the kererū (N.Z. pigeon: *Hemiphaga novaeseelandiae*) and is also the fruit dove in the Cook Islands and French Polynesia (Emory, 1947; Holyoak, 1980). The inter-related naming systems of weaving terms and bird species served the same purposes of waiata (songs), pūrākau (traditions) and whakataukī (sayings), in that they were invaluable mneumonic devices. In re-using them, it re-affirmed these close genealogical connections.

Materials, techniques, colours, and designs

The materials and techniques observed in museum cloak collections demonstrated that weavers were influenced by their surroundings, their whakapapa, and their own creativity, innovation, and skills, often experimenting with what was available to them (Harwood, 2011a). Typically, Māori feather cloaks of the 19th and early 20th centuries comprised of muka threads of scutched (lightly scraped) flax, woven together using a finger twining method (Blackman, 1998; Fischel, 1951; Fraser, 1989). Single-pair twining (whatu aho pātahi) was employed for some coarser rain cloaks or capes, whereas double-pair twining (whatu aho rua) secured decorative attachments such as feathers (Pendergrast, 1987, p. 14). Feathers were typically bunched or butted together and woven into the cloak as it was being made (Fig. 1.10). Literature that provided useful technical information included Pendergrast (1987, 1997) who offered basic descriptive diagrams of cloak production, and Hīroa (1926) who contributed detailed variations of feather attachment. However, master weavers Te Kanawa (1992) and Puketapu-Hetet (1989), present valuable resources in which to learn Māori weaving techniques.

It is widely accepted that the colour red is significant in Māori society, in which numerous names for the shades of red were recorded; and red cloaks (kahu kura) of red kākā feathers and red ochre (kōkōwai) were amongst the most prestigious types of cloaks (Colenso, 1881; Hīroa, 1966; Mead, 1969). Material analyses of birds and feathers identified in Māori feather cloaks to date pertaining to feather colour preferences was undertaken for this research. The geometric designs that appeared in Māori feather cloaks in the nineteenth century have resembled tāniko patterns in the esteemed kaitaka cloaks and historical weaving and tapa (bark cloth) designs from the Pacific, a theory that was explored further in this study. While some designs have names specific to an iwi (tribe, peoples), in that the triangular patterns in tāniko related to mountain landscapes such as Taranaki (west coast) (Hīroa, 1926, p. 224). However, it was argued that some of these designs were ubiquitous and that as cloaks were often gifted or exchanged with other whānau (families), hapū (sub-tribes) and iwi, that it would not be prudent to incorporate area-specific designs in a gifted cloak (Hīroa, 1926, p. 224; Maihi, 2011, p. 41). It also made analysis and provenance determination of historical patterns challenging as design selection could be influenced by social (whānau or iwi) perspectives or personal preferences.

The Spiritual concepts of cloaks

Many of the spiritual elements of iwi Māori also transferred from Polynesia and dictated daily customs through to ceremonial events (Gudgeon, 1905). Taonga can be defined as having intrinsic qualities that differentiates their status from everyday tools and artforms, that dictates how they are used, when and why (Tapsell, 1998). As life and death form central paradigms in the Māori world, the use of cloaks in these situations is an integral part of acknowledging the tapu (ancestral sanctity) and connection of the cloak between the descendants and the ancestors. For instance, cloaks have been found wrapped around people in ancient death customs and are still used today in this manner (Hīroa, 1926; Malcolm-Buchanan, 2014; Mead, 1969). Tapsell (1998) intimated that taonga have the following aspects imbued within and around them incorporating whakapapa; tangata whenua (the people of the land in which the taonga has derived); mana (status, power and authority); tapu; marae (the area in which the taonga performs a role); kōrero (an oral device in which to remember and pass on the knowledge surrounding the taonga); karakia (the ancient ritual of remembering the knowledge, sacredness and genealogy of the taonga); and mauri (which is viewed as a life force within a taonga) (pp. 11–15). The whakapapa, mana and kōrero associated with a taonga can dictate the tikanga (customs and protocols) required in how to use it, and what was socially or culturally acceptable. Important kākahu that are synonymous with a named tūpuna or ancestor and in which the kōrero or history is known, must be treated with the appropriate care and ritual afforded it (Tapsell, 1997, 1998). The kōrero surrounding a cloak can come in many forms, the stories of who made it, who it was made for, and when and why, all contribute to its rich history. Cloaks that were traded, exchanged, or gifted can claim to include this transaction as kōrero, particularly if it initiated important tribal or political relationships (Tapsell, 1998). Maihi (2011) asserted that the reason why a weaver starts a cloak was fundamental as this would dictate all other aspects of how it was made including materials, techniques, designs, appropriate cultural use, and the naming of the cloak (p. 40).

Environmental, temporal, and social factors

The type of cloak made and worn can also be determined by environmental factors such as climate and the plants and animals available to the weaver (Firth, 1959). The weaver's gender could reflect what is made and when, as well as their position in society and the knowledge, skills, and creative purposing granted them. Certainly, one of the most important determinants that influences the type of cloak made include social factors which in turn can be determined by time and location. These can incorporate the rank and position of the wearer; the religious or social uses of the cloak; and economic factors such as how valuable and rare the cloak and materials are to make it, and whether the cloak can be used for trading, gifting, or selling.

The significance of certain birds and feathers

This connection traces Māori ancestry and translates between the tangible, physical world and the intangible, spiritual world. Birds and people (Māori), our history and origins are intertwined. The whakapapa of humans and birds stem from the traditions of Ranginui (sky father) and Papatūānuku (earth mother), who were separated by their son the atua Tāne-nui-ā-rangi (Tāne), the father of all living earth bound beings, including people and birds (Grey, 1928, 1956; Orbell, 1998).

Literature based on pre-20th century Māori society gave examples on how birds featured strongly in whakataukī or pepeha (Colenso, 1891; Kohere, 1951; Mead & Grove, 2001). Birds are also mentioned in waiata (McLean & Orbell, 2004); pūrākau; in our whaikōrero; and in tikanga (Smith, 1975) including karakia (Gudgeon, 1905; Johansen, 1954, 1958; Papakura, 1938). Orbell (2003) and Riley (2001) demonstrated the scientific and cultural histories of New Zealand birds, incorporating whakataukī, waiata, and pūrākau, for most bird groups, however there were some references to feather use non-specific to an area or iwi group. As each iwi practices their own dialect, and traditions and connection to certain birds, it is imperative to know and record this when documenting Māori knowledge in this field.

The physical and spiritual attributes of birds for Māori have been scattered throughout the literature over the last 150 years. The appearance or presence of certain birds can signal a message or omen of an arrival or event in the future like the ruru, pīwakawaka (fantail: *Rhipidura fuliginosa*) and kōtare (kingfisher: *Todiramphus sanctus vagans*) that act as messengers of news regarding visitors and even death (Orbell, 2003; Phillips, 1963; Schwimmer, 1963). Feathers added to carvings moved in the wind, giving the impression of life, a life force or mauri (Maihi, 2011, pp. 34–35). Bird feathers were an ideal means of expression and were fashioned into clothing and personal adornment to indicate position or rank. In high ranking Māori, white kōtuku (heron: *Ardea modesta*) (piki kōtuku) and seabird feathers from toroa (albatross) and gannet (tākapu: *Morus serrator*) were worn in the hair and ears, and skins worn around the neck (Hamilton, 1972). Raukura, red or treasured feathers referred to important feathers such as kōtore or huia tail feathers, including all twelve huia tail feathers or marereko (Best, 1977; Tregear, 1904).

The literature is lacking information that correlates the birds used in kākahu Māori, and how and why they were used at different times, and whether the symbolism for a bird could be translated into its presence in a kākahu. Nineteenth century ornithologists, Olliver (1955) and Buller (1888a, 1888b) published extensively on the natural history of New Zealand birds. Elsdon Best, having studied the customs and traditions of Ngāi Tūhoe weaving and bird lore in the late nineteenth century was probably in the unique position to interpret the significance of birds in cloaks yet only published exclusively on these topics.

1.4.3 Methods for data collection

Research methods incorporated the collation of examples of feather cloaks in public museum collections and a small private collection. The study was conducted in conjunction with references to Māori feather cloaks in the literature, museum, graphic and photographic records as well as archival documents. The material evidence found in physical examples of cloaks and in primary sources that detailed the materials, techniques, and sometimes use, were deemed important data sources. Many of the historical Polynesian and Māori customs detailed have limited verifiable evidence, in that they were no longer practiced, so a full interpretation of these customs fell outside the scope of the research. Therefore, primary sources that recorded these practices were mentioned but not analysed in detail. The recording of oral narratives from northern iwi members and weavers regarding birds, weaving and feather cloaks supplemented gaps in the literature, and served to corroborate other material and written sources. Specific methods were adapted according to the narratives of each timeline or chapter. Traditionally qualitative research is designed to show depth rather than breadth as seen in quantitative methods, in the case for this research it was not feasible (nor appropriate) to try and measure the depth of all iwi Māori knowledge pertaining to kākahu.

Māori have complex social structures that are unique to each iwi/ tribal group, hapū (sub-tribe) and area (Fig. 1.11). Numerous works recorded thorough accounts, paintings, and ethnographic studies of various iwi Māori. Elsdon Best documented some of the extensive knowledge based on early Māori customs, particularly of Ngāi Tūhoe from the late nineteenth century pertaining to weaving, waiata (songs), karakia (incantations), whakapapa (genealogy), bird and forest lore, and tikanga (customs and traditions) (Best, 1898-1977; Holman, 2010). Whānganui iwi bird use was recorded in hunting practices (Downes, 1928, 1976; Ranapiri, 1985). Māori on the East Coast was studied by Gudgeon (1894, 1895a, 1895b) and Colenso (1868); and South Island Māori oral histories and literature pertaining to birds included Beattie (1918-1994), Cowan (1905), Te Maihāroa (1957), and Pauling and Stevens (2007). Pertinent archaeological records were contributed by Skinner (1924, 1960), Teviotdale (1932), and Duff (1952). Limited studies were published by Māori. As many cloaks from the North Island's East Coast, Bay of Plenty, Waikato, Taranaki, Whānganui, and areas of the South Island were apparently well represented in 19th and 20th centuries museum collections, it is important to present local Māori knowledge (Simmons, 1996-1997, 1982).

Oral and Iwi narratives and traditions

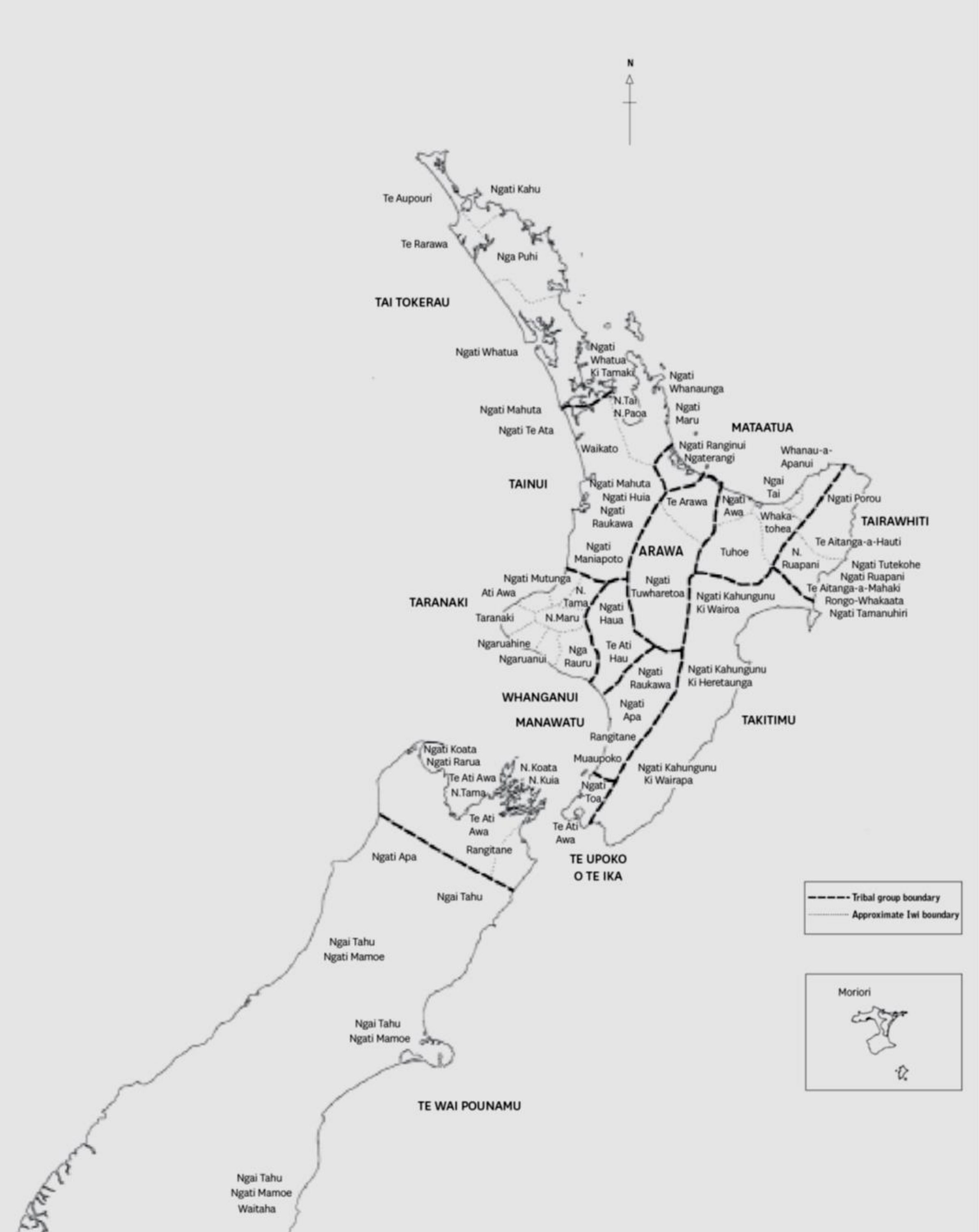

***Figure 1.11*. Iwi (tribal) Māori map, Courtesy of Department of Māori Affairs, 1993.**

Northern iwi traditions have been documented to some extent, however the lack of literature and collection records of northern iwi bird use and feather cloaks could suggest that weaving was not prominent in this area (Cloher, 2002; French & Hakopa, 1993; Hay, 1882; Hohepa, 1964; Howearth, 2003; Kawharu, 2008; McCully & Mutu, 2003; McRae, 1981; Nicholas, 1817). Current weaving and Northern knowledge was obtained for this study through oral history interviews conducted in 2017. A total of seven oral history interviews were undertaken with selected northern iwi members including Ngāpuhi (Te Tai Tokerau), Ngāti Hine, and Ngāti Wai and described as conservationists (kaitiaki whenua), practitioners/ weavers, artists, and cloak owners, and are listed:

1. Kevin Prime of Ngāti Hine, Ngāti Whātua, Tainui and Welsh descent is a prominent northern kaumātua and kaitiaki, farmer, and resource manager and conservationist.
2. Hori Parata of Ngāti Wai, Te Waiariki descent is a prominent northern kaumātua and kaitiaki, and resource manager and conservationist.
3. Mita Harris of Ngāpuhi (Ngāti Toro) descent has had leadership roles in resource and conservation management and cultural heritage.
4. Toi Te Rito Maihi of Ngāti Kahungunu and Ngāpuhi descent is an accomplished author, educator, weaver, and artist.
5. Dr Maureen Lander of Ngāpuhi (Te Hikutu) and Scottish, Irish, and English descent is a published academic, weaver, and multimedia installation artist.
6. Te Hemo Ata Henare of Ngāti Kahu, Ngāti Hine, and Te Whakato descent is a northern master weaver, author, teacher, and artist in traditional techniques.
7. Dante Bonica of Italian descent is a nationally recognised practitioner, teacher, and academic in the field of Māori material culture, including weaving and stone tool construction.

The participants were interviewed based on a semi-structured, conversational method with questions that centred around the following themes to ascertain their knowledge, experiences and views regarding birds, feathers and kākahu Māori:

- Knowledge and experience regarding birds. Relationships to birds, such as harvesting, eating, and the significance of certain birds.
- Knowledge and experience in making cloaks. Materials and techniques and what the significance of these mean, how to attach feathers, and selecting feathers.

- Knowledge and experience regarding the use of cloaks. What events feather cloaks have been/ are used for.
- Views and understanding of use and access to native materials for traditional purposes.
- Views and understanding of access and relationships of museum taonga and iwi Māori.

The interviews have been cited in the text (e.g. Prime (2017)) to recognise the knowledge of each participant and the importance of the information imparted for this research (See Appendix One for ethics approval and Appendix Two for an example of an interview schedule).

Oral history interviews concentrated on weaving practices, and bird use including northern iwi traditions. As Royal (1992) suggested, Māori research should begin by understanding "one's own family, and people" (p. 9). Six of the seven participants were based in the Hokianga, Kaikohe, Motatau, Bay of Islands, and Whāngārei areas. The participants were male (4) and female (3), aged between 47 and 80 years old with varying degrees of knowledge and experience relating to bird use, and cloak production and function. Case studies of northern iwi knowledge-holders, cloak owners, and weavers responded to Ngāpuhi language and traditions using an informal method of enquiry, given that they had some input into the interview questions, how they were interviewed, and how their responses were portrayed, interpreted and disseminated. This research detailed and acknowledged current issues and is evidence that each iwi Māori have a deep historical connection to bird life and kākahu Māori that continue to be used and talked about at important events.

Literature, archival, and photo/ graphic sources

This thesis research involved an examination of a large and varied body of work compiled from over 600 pieces of literature, records and images spanning from 1642 A.D. to present day, that related to Polynesian and Māori clothing, weaving, cloaks, bird use and language, and covered a timeframe of 1300 A.D. to present day. It answered many of the research questions that other enquiries could not. The major primary sources of literature covered observations and examples of weaving items, cloaks, and cloak fragments in museum and private collections and historical or archaeological sites. Drawings, paintings and journal entries of artists and crew from early (pre-1800) voyages; first-hand ethnographical or oral history accounts; as well as archival manuscripts or documents including direct observations made about these sources were included. Secondary sources consisted of additional literature that interpreted, discussed, or reviewed the primary sources.

Rare, yet relevant graphic evidence from early European voyages (1769-1820 A.D.) contained some dates, locations, the artist, or writer as well as basic descriptions or depictions of Māori feather cloaks. Some bird specimens, descriptions, and accounts were recorded, but the botanical specimens collected on Cook's voyages had better documentation than the ethnological items (Gooding, Mabberley, & Studholme, 2019; Whitehead, 1969). Both Mead (1969) and Wallace (2002) examined some of the accounts and artworks associated with the following voyages:

1. Cook's first voyage in 1769 - Cook, Banks, Monkhouse, Parkinson, and Sporing.
2. Cook's second voyage in 1773 - Bayly, Wales, Forster, and Hodges.
3. Cook's third voyage in 1777 - Edgar and Weber.
4. Jean François Marie de Surville's expedition in 1769 - Monneron and L'Horne.
5. Marion du Fresne's expedition in 1772 - Roux, Du Clesmeur and Crozet.
6. Lieutenant-Governor King who visited New Zealand in 1793 (Mead, 1969, p. 17).
7. Bellingshausen-Lazarev's Antarctic Expedition - in 1820, artist Mikhaylov (Wallace, 2002, pp. 48–49).

A comprehensive cross-examination of reports, journals, paintings, etchings, drawings, and secondary sources of literature by Beaglehole (1962a, 1962b, 1968), Banks (1896), Joppien and Smith (1985), and Parkinson (1773) allowed for interpretations of accounts from early New Zealand voyages that captured corroborating aspects and observations of Māori feather cloaks. Mead (1969), Roth (1923), Salmond (1991) and Wallace (2002) also supplied valid analyses of these sources.

A review of the literature and studies conducted in the twentieth century recognised three compositions that were fundamental in understanding the changing themes within the periodic timelines that characterised Māori feather cloak production. They were *The Maori Mantle* (Roth, 1923), *The Evolution Of Maori Clothing* (Hīroa, 1926), and *Traditional Maori Clothing: A Study of Technological And Functional Change* (Mead, 1969). More recently, the doctoral thesis *Traditional Maori Dress: Rediscovering Forgotten Elements Of Pre-1820 Practice* (Wallace, 2002) also contributed some relevant information and evidence pertaining to bird and feather use in historical clothing and personal adornment. Other authors of note included Elsdon Best's work with Ngāi Tūhoe, and Hamilton's (1972) large volume on Maori Art, that provided valuable late nineteenth century European perspectives on Māori weaving and classifications. A review of the major works is provided.

Henry Ling Roth (1855-1925) was a British ethnologist and museum curator, anthropologist, and author. He presented a rough, yet detailed catalogue of selected Māori clothing describing weaving materials and techniques, including provenance and museum collection information (Roth, 1923). Despite lacking first-hand knowledge or observations of weaving in New Zealand, he was one of the first ethnologists to describe unique 17th, 18th and early 19th century Māori cloaks that incorporated feathers and bird skins in weaving. Using crew artwork and journal entries from some of the first European voyages, Roth (1923) recorded the types of cloaks seen and estimated their distribution and abundance in the late eighteenth century. He compared the twining and feather attachment techniques in Māori cloaks with Polynesian, Asian and native North and South American weaving, which he deduced had notable similarities (Roth, 1923). Some of his conclusions however were questioned based on his lack of personal knowledge and experience with the Māori language and weaving, as highlighted by Hīroa (1924b).

Te Rangi Hīroa, or Sir Peter Buck (1877-1951) was a prominent member of the Ngāti Mutunga (Taranaki) iwi and worked as a doctor, military leader, health administrator, politician, anthropologist, and museum director. Hīroa's studies of weaving, and experience with the Māori language were invaluable in his analyses of clothing in museums and his own private collection. From extensive research, recorded observations and accounts from weavers and informants, Hīroa (1926) contributed one of the most comprehensive pieces of literature detailing the many, varied aspects of the materials and techniques used over time to produce the higher artform of Māori feather cloaks seen previously and since. He also proposed a legitimate timeline in his compilation of the local evolution of clothing that traced Māori clothing from its Polynesian origins. His work covered Māori arrival in Aotearoa around 1300, to 18th century burial cloaks through to early European encounters and weaving into the early 19th century. He documented with extensive studies and applied logic the inherited skills and knowledge in Polynesian plaiting, netting and basketry that were brought to New Zealand and adapted to produce warmer, more protective clothing in the colder climate. His work formed the foundation of this research, by detailing material and technical production over time, but not the functional aspects of Māori cloaks. More importantly, he also did not discuss bird and feather use in detail, only to confirm that Māori likely adapted the important symbolism of red feathers from Polynesia (Hīroa, 1944).

Sir Hirini (Sidney) Moko Haerewa Mead (of Ngāti Awa, Ngāti Tūwharetoa, Tūhourangi) is a prominent New Zealand anthropologist, historian, artist, teacher, author, educator, and Māori leader. In his comprehensive study of Māori clothing, Mead (1969) gathered evidence from written descriptions, sketches, illustrations, paintings, museum collections, some archaeological items, and fieldwork studying weavers and Māori chants. Mead (1969) initiated a useful discussion on the functionality of Māori clothing that was systematic, and articulated the classification and operation of Māori clothing that co-ordinated academic and traditional Māori knowledge. He based his study on three different aspects of change: namely the technology (technique) of clothing, the functionality (why and how it was used) and finally the relationship between the two (Mead, 1969, p. 15). His work is a complete list of classifications of Māori cloaks, and one of the most accessible guides in understanding the value and use of the different types of cloaks, and how these principles in functionality have changed over the last 200-300 years. He produced an invaluable contribution to the timeline of Māori clothing by detailing early Māori-European encounters from Abel Tasman in the mid-1600s through to 1800 in the Classical period (Mead, 1969). Mead (1969) like Roth (1923) analysed crew accounts of early encounters in the 17th and 18th centuries, and both concluded that full feather cloaks were rare at this time, which is reflected in the limited examples in museum collections. Mead (1969) distinguished that after European settlement, between the Transitional period 1800-1900 A.D. and the Modern period of 1900-1950 A.D. (today), and in these later phases, how cloaks functioned as costume dress rather than clothing. In that clothing was distinguished as attire that was more practical, whereas costume portrayed a subjective message to observers (Mead, 1969, p. 22). Mead (1969) validated the criteria for each time period he studied by referencing the social context, the range of clothing used, decorations on clothing, the materials and techniques used, the prevalent fashions of the time and finally the functionality of the attire, be it instrumental or expressive (p. 21).

Of relevance to feather cloaks, is Mead's (1969) mention of the use of function in Māori clothing concepts, where he stated that "symbolism is a way of saying something, and the message has to do with something valued by the culture" (p. 24). The transition in the practices and value of cloaks is vital in establishing the tikanga around gifting, trading, and selling cloaks as well as their role in ceremonial situations such as tangihanga (funerals and burials). Mead's (1969) analyses of the 1800-1900 time-period, found that the production of feather cloaks increased towards the end of the nineteenth century due to the economy, which altered their value from cultural to monetary.

Wallace's (2002) thesis placed feather use in personal adornment and Māori clothing as important 'forgotten elements' in the current perceptions of traditional Māori dress. Her thesis recognised that previous studies by Roth (1923), Hīroa (1926) and Mead (1969) have contributed much of the knowledge surrounding Māori clothing, but that technologies such as traditional sewing, particularly of bird and animal skins, have been somewhat overlooked as an important practice in the timeline of Māori cloak production before European settlement (Wallace, 2002, p. 141). Wallace's (2002) detailed descriptions of sewing techniques employed for animal skins in garments made 1600-1800 A.D. were valuable, however, her expertise and interests in Māori textiles aligned more with these techniques so many of the accounts of bird and feather use and symbolism, and hence interpretation of why particular species were used in cloaks at this time, was limited.

International Register of Māori feather cloaks in public museum collections

Brigham (1899), Hīroa (1944) and Kaeppler (1978) have contributed catalogues over the last 100 years of Hawai'ian feather cloaks in public museum, and some private collections. In 1978, David Simmons, an ethnologist at Auckland War Memorial Museum collated, described, and imaged many of the Māori artefacts in the United Kingdom, Europe, Australia, and North American museums. His work consisted of several unpublished manuscripts (Simmons, 1996, 1997) and published catalogues (Simmons, 1982). Simmons essentially presented the first comprehensive inventory of Māori feather cloaks in public collections providing museum names and locations; museum identification numbers; provenance, production locations and dates and collection history; and cloak descriptions including materials, techniques, and sometimes images and measurements. Some of his estimations on production dates and attributions for taonga however have been scrutinised (Anson, 2004; Neich, 1996). Therefore, the cloaks included in this research with a recorded provenance assigned by Simmons were clearly stated. Other lists of Māori collections compiled for the register included the works of William Brigham (from 1892-1918) for the Bernice Pauahi Bishop Museum in Honolulu and included some international museum collections. Gathercole and Clarke (1979) and Roth (1923) focussed on collections throughout the United Kingdom; Kaeppler and Stillman (1985) in North America; and Bolton and Specht (1984) recorded Māori museum collections in Australia. Previously, no full international catalogue of New Zealand Māori feather cloaks in public museum collections had existed.

Initiated in 2015, an International Register of New Zealand Māori feather cloaks recorded permanent collections held in public national and international museums (see International Register). Based on Simmons' 1978 initial research, over 300 museums in New Zealand, Australia, Asia, South America, North America, Canada, Europe and the United Kingdom and the Republic of Ireland were contacted for this research. Around 100 museums with feather cloak collections contributed with approximately 600 cloaks catalogued. Museums were asked to provide information on the Māori cloaks in permanent collections that contained feathers, including information on titles, museum numbers, images, descriptions of the cloak including known materials and techniques, provenance and collection history, and any literature, or archival images the cloak had appeared in. Cloak images that required reproduction fees, or where copyright clearances and iwi (stakeholder) permissions could not be obtained were excluded. Māori feather cloaks were classified as being made with and/ or influenced by New Zealand Māori materials, techniques, or designs. Cloaks and capes were defined as shoulder attire, and garments that were also catalogued as waist garments or skirts were excluded. The register itemised museum cloaks dating from the 16th century through to the 21st century. This comprehensive yet incomplete list gave an indication of the wide range of bird species incorporated, what were most common, and what cloaks were also collected for museums. As this was a scoping exercise, feather identifications were limited, and were documented in the register based on collection records supplied online or by museum staff, and verified for this study from personal observations and images provided by museums between 2015-2019. Most of Te Papa's feather cloaks had been identified in 2007, and ethnologist Mick Pendergrast identified the cloaks in the Auckland War Memorial Museum and British Museum in London (Harwood, 2011a; Pendergrast, 1987, 1997; Starzecka et al., 2010). This project progressed as a working digital repatriation of affiliated kākahu Māori in museums and sought to 'open' museum collections and encourage research capabilities for iwi Māori in this study area (Hakiwai, 2014; Ngata, Ngata-Gibson, & Salmond, 2012; Te Awekotuku & Nikora, 2003).

Garment analysis - feather and hair identification

Microscopic feather identification has applications in taxonomy to distinguish within and between bird orders, and groups (Brom, 1986; Chandler, 1916; Dove, 1997, 2000; Dove & Agreda, 2007). This method has been used in forensics (Dove & Koch, 2010), identifying birdstrike remains (Brom, 1984), and in conservation and wildlife management (Day, 1966). The method is an invaluable tool in the verification of museum specimens (Brom & Prims, 1989), in ethnological items (Dove, 1998; Harwood, 2011a; Pearlstein, 2010; Rogers, Dove, Heacker, & Graves, 2002) and paleontological and ancient artefacts (Dove, Hare, & Heacker, 2005; Dove & Peurach, 2002; Pedergnana & Blasco, 2016). Importantly, feather identification can also facilitate in the preservation of historical textiles (Gutierrez & Román, 2000).

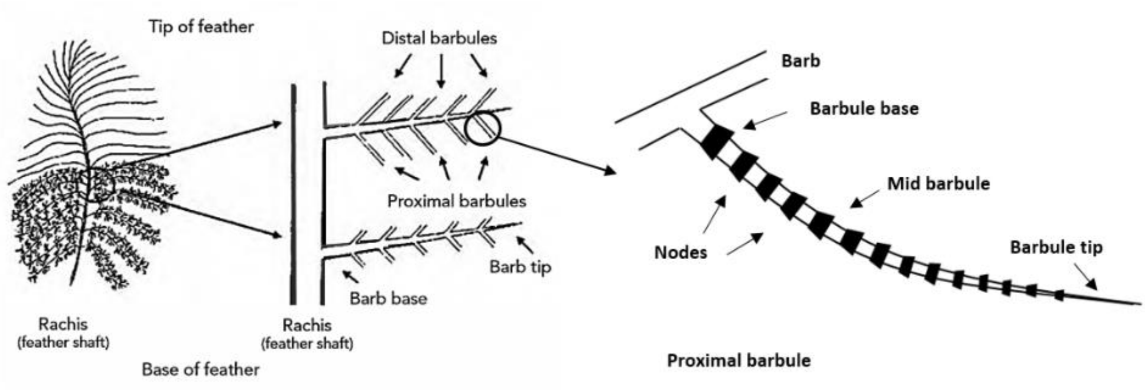

***Figure 1.12*. Down feather diagram showing positioning of diagnostic structures, modified from Day (1966), Dove & Koch (2010).**

Between 2015-2019 the feathers in selected museum and private cloak collections were identified based on personal observations, and images provided by museums. Identification involved the study of feathers on museum bird skins and the microscopic detail of feather down (Figs. 1.12 & 1.13) (Harwood, 2011a). Microscopic analysis involved comparisons of the feather down (plumulaceous barbules) of cloak feathers to a reference microscopic feather image database to determine the bird order (type of bird) (Harwood, 2011a). Diagnostic microscopic characteristics incorporated descriptions and measurements of barbs, barbules, and nodes or prongs including distribution and colour (Figs. 1.12 & 1.13). Other aspects involved the space between the nodes, barbule width, and the presence of villi (cilia-like projections) at the base of barbules (Brom, 1991; Dove, 1997). Methods and conventions describing the microscopic differences in feathers followed Chandler (1916) and Day (1966), while depictions of nodes and pigmentation observed Dove and Koch (2010).

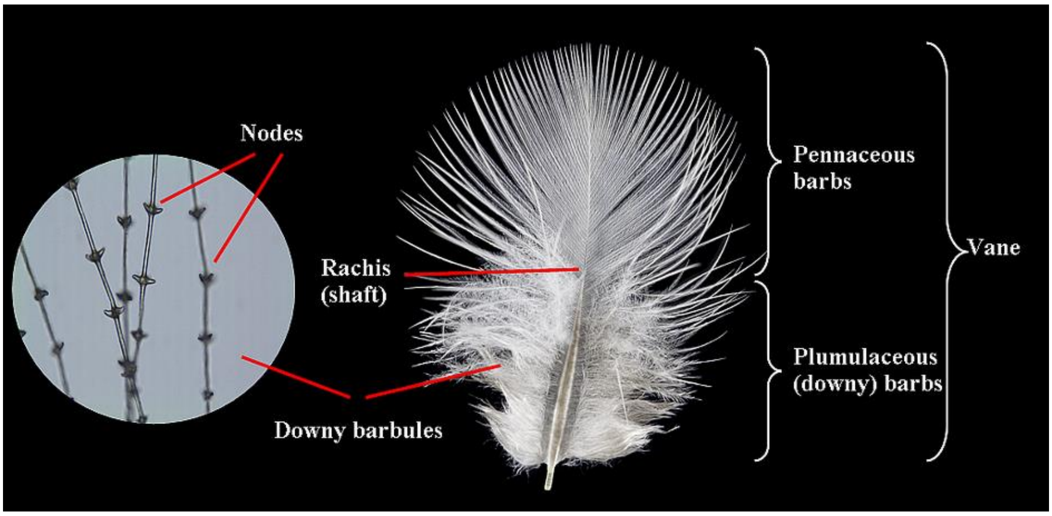

***Figure 1.13*.** **Kererū (New Zealand pigeon) contour feather showing pennaceous barbs, plumulaceous (downy) barbs and nodes on downy barbules. Feather image by Raymond Coory (Te Papa), 2006. Photomicrograph and diagram by Hokimate Harwood, 2007.**

Macroscopic analysis involved comparing the physical characteristics of cloak feathers such as the feather colour, shape, size, and patterning against a reference image database of museum bird skins to distinguish species and feather types (Harwood, 2011a). Bird nomenclature and vernacular names for New Zealand birds complied with the *Checklist Of The Birds Of New Zealand* (Checklist Committee (OSNZ), 2010). Descriptions of feather colours followed Svensson (1992). Descriptions of New Zealand bird feather morphology continued from Harwood (2011a), the *The Field Guide To The Birds Of New Zealand* (Heather & Robertson, 1996), and the *Handbook Of Australian, New Zealand And Antarctic Birds* (HANZAB), published between 1990 and 2006, and co-published by Oxford University Press and the Royal Australasian Ornithologists Union (RAOU) now BirdLife Australia.

Microscopic hair identification in textiles was still advancing in New Zealand, but had shown to be an effective international tool in forensics, in the conservation of materials and textiles (Goodway, 1987; Petraco & Kubic, 2004; Tridico, 2005); and in ecological studies and wildlife management (Day, 1966; Kennedy, 1982). Replicable reference hair identification keys and guides have been prepared by Hausman (1920), Mayer (1952) and Teerink (2003). Microscopic hair identifications conducted between 2009-2010 of the Māori cloaks in the Te Papa collection that dated from the nineteenth century and on recorded kurī, modern dog breeds, merino wool (*Ovis aries*), wild goat (*Capra hircus*), and angora goat (Tamarapa, 2011).

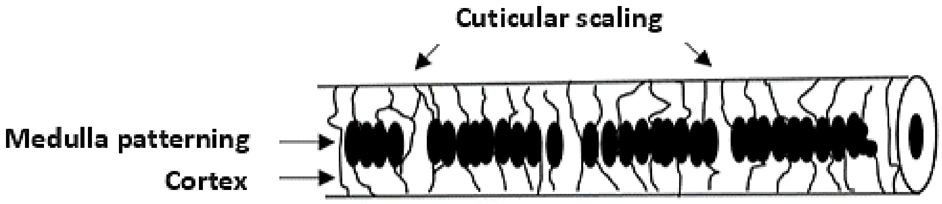

***Figure 1.14*. Diagram of a typical guard hair shaft showing cuticular (outer) scaling and medulla (inner) patterning. Diagram by Hokimate Harwood, 2017.**

Most mammalian hairs grow close to the skin, referred to as fine 'underfur'; the slightly longer, coarse 'guard hairs' provide more diagnostic features for identification; and the 'overhairs' are longer still and relatively sparse (Hausman, 1920, p. 507; Tridico, 2009). The hair shaft is predominantly comprised of keratin, and consists of the cortex within the shaft made of closely packed fusiform cells; the medulla, of loosely packed cuboidal cells varying in pigment content and patterning when present; and an outermost layer or cuticle of unpigmented cells that form differing scaling patterns (Fig. 1.14) (Hausman, 1920, p. 497; Mayer, 1952, p. 481). Hair identification involved light microscopy and analysis from the hair root to the tip along the shaft to identify the various patterning of cuticular scaling and medulla type (Hausman, 1920, p. 509). Where, the patterning and depth of the scaling, and changing pigment distribution along the shaft in the medulla served as primary diagnostic indicators. Another relevant feature included the measurement of the ratio of the diameter of the medulla in relation to the diameter of the hair shaft, known as the Medulla Index (MI).

For this research, detached feathers and hair samples were temporarily dry-mounted onto glass slides and examined using light microscopy (Leica DM500 at 40x, 100x and then 400x magnifications). Photomicrographs were captured using a fitted microscope camera (Leica ICC50W), and the Leica LAS EZ program employed for processing images and recording measurements.

1.4.4 Methods for analysis of data, literature, and evidence

Data analyses was conducted for kākahu by cross-referencing the main themes against the production location and time periods in which they were situated. From initial investigations certain themes and subthemes appeared regarding the various tangible and intangible aspects of feather cloaks. In thematic analysis these themes were often described as categories, codes, or concepts that 'control behaviour or stimulate activity' (Opler, 1945, pp. 198–199; Ryan & Bernard, 2003, p. 87). For each cloak or reference the following matrix was tabulated to record important aspects of knowledge associated with production and use (Table 1.1).

***Table 1.1*. Matrix method of data collection for each cloak relating to the main research themes and where they are placed in the temporal space, and physical and social environment.**

	Time period the cloak was made	*Where the cloak was made, climate*	*Birds & Plants available*	*Social & religious factors*
Who made/ wore the cloak				
The birds & plants used				
How were the feathers attached				
Why were the materials & techniques used				
What was the cloak called				
What did the cloak communicate				

As the data varied depending on the source, information was interpreted based on a Thematic Analysis where patterns within the research themes recorded and measured change between the historical timelines of each chapter (Table 1.1) (Martin, Weisenfeld, & Bekmeier-Feuerhahn, 2009). Comparative matrix models have had success in comparing data in mathematical and sociological studies (Vallier, 1973). The research matrix demonstrated the corresponding relationship between variables that influenced how and why a cloak was made and worn. In that 150 years ago, a twined kiwi feather cloak (kahu kiwi) worn at a temperate time of year and location, would most likely be worn for status and not warmth. It was a simple method that had potential in this study to at least reveal essential knowledge that proved Māori were often taking culturally important birds that were widespread and for consumption, and warm and prestigious feather cloak production was an ensuing usage. From the matrix model, the framework for this research was loosely based on the engineering model for Asset Utilization which was defined as: Availability x Rate x Quality x Demand. In cloak manufacture, the cloak materials of interest (birds) were measured by the availability and distribution of the species; the rate or the amount the species appears in cloaks; the quality (the superior aspects) of the materials and techniques; and societal or personal preferences (demand) for certain cloaks, birds, skins, feathers, or colours.

1.4.5 Methodologies

The Māori framework was based on aspects of known Māori methodologies. The premise was not to intentionally align with one specific theory or methodology, that could limit or retract from the objectives and results of the research, the rationale for which is outlined. A Māori research framework integrates with the general ideals behind indigenous methodologies by detailing Māori research from a Māori point of view (Smith, 2012). The parameters and extent of how much these aspects are followed and adhere to academic protocols is dependent on the research and the researcher. Essentially, this research aimed to elevate Māori research into a critical realm of analyses, by incorporating Māori values and principles that helped to ultimately benefit Māori knowledge and aspirations (Pihama, 2010; Smith, 1997). Maintaining that this research was conducted by, for and with Māori, whereby ensuring that all practices, communications, and outcomes were managed in a way that was ethical, respectful, and reciprocal.

How this research benefited Māori centred on the concept of Māori knowledge, where it came from and how it should be used. Pihama (2001) defined Kaupapa Māori theory as a process in which we can engage more deeply with Māori knowledge, Māori language and Māori customs and practices, in ways that can reveal culturally-based frameworks and structures (rather than restrictive paradigms or models) to provide a foundation of Māori indigenous analyses. Mātauranga Māori should therefore incorporate all aspects of Māori knowledge. Māori, as a term was not used to represent all iwi in pre-European times, in that Māori used iwi and hapū associations to discuss themselves (Royal, 2012, p. 31). Mātauranga, similarly as a word, was likely used in a different context in pre-European times. It can incorporate traditional, contemporary, and scientific knowledge, and includes te reo, tikanga, whakapapa and kōrero. In this context, Mātauranga Māori involved the knowledge that was primarily Māori pertaining to science, language, tikanga and the skills and experience in the production of kākahu Māori, including how this knowledge changed over time. As this terminology elicits a general understanding of Māori knowledge as a whole, it did not acknowledge who it belonged to, and that iwi Māori have their own distinct knowledge systems just as their own whakapapa, language, tikanga, connection to the whenua, and to each other that is intrinsic. Mātauranga ā-Iwi recognised that 'Mātauranga Māori' created a disconnect between Māori as a group of peoples not as a whole. Where Mātauranga ā-Iwi was situated clearly in the rohe or geographic boundaries of a tribal group (Doherty, 2009). In undertaking oral histories of northern iwi, this framework asserted to honour the knowledge, language, and traditions within and between tribal, hapū and whānau boundaries of the iwi Māori of Northland.

The Waka Mātauranga framework outlined by Black (2014) specified aspects of Māori knowledge development and management processes (pp. 6–7). Its premise was based on the following: Te Waka Mātauranga o te Reo (Reo Knowledge) - language identity and distinctiveness and essence. Te Waka Mātauranga Tuku Iho (Knowledge Transfer) - interface of historical and contemporary knowledge transmission (Black, 2014, p. 7). Te Waka Whakahou Mātauranga (Knowledge Creation) - generating potential new knowledge acquisition. Te Waka Whakahau Mātauranga (Knowledge Reclamation) - create, strengthen, retain, maintain pathways to knowledge and scholarship (Black, 2014). The Waka Mātauranga framework engaged in the various aspects of the research in that it fostered the relationship between acquired and retained language and information, essentially what each cloak communicated in how it is made, and endorsed the knowledge transfer from our Polynesian origins to present day through to the future. This paradigm encouraged the generation of new information in gaps of knowledge regarding how and why certain birds have been used by Māori to adorn clothing over time, that while some aspects of language and knowledge have perpetuated, other kōrero was either not recorded or preserved. As this tapu (sacred) information was known by the weaver at the time a cloak was made, this detail has therefore not been recorded (at least in the literature). Finally, it is argued that combined science and Māori frameworks can be integrated to appropriately re-examine and interpret material evidence, but it could also build capacity for future Māori research and endeavours in understanding, reconnecting with, and caring for our taonga.

The concepts of ‘Te reo me ona tikanga’, where Māori language and customs of communicating information orally has been adopted from Irwin (1994). It accepted that te reo Māori and tikanga Māori formed an inherent part of Māori knowledge systems and needed to be incorporated or at least considered in Māori research methods (Irwin, 1994). The concept of face-to-face, ‘Kanohi kitea’ oral communication is the preferred method for most Māori research participants, and was highly recommended by Irwin (1994), and Bishop and Glynn (1992) for conducting interviews. Conversational methods using semi-structured interview questions was deemed the most appropriate method to capture the knowledge of participants in a respectful and reciprocal manner, having been found to be conducive in recording indigenous knowledge (Eni & Rowe, 2010; Kovach, 2010). These indigenous methodologies maintain that the research records knowledge to supplement or complement the literature and is not necessarily for analysis (Weber-Pillwax, 2004).

The Scientific framework combined the feather identification and verification of material evidence in private and museum collections to ascertain the bird species and feather types in cloaks. The framework also provided data for analyses of bird distributions and abundance to be compared to cloaks of known iwi provenance (Bull, Gaze & Robertson, 1985; Long, 1981; Robertson, Hyvönen, Fraser, & Pickard, 2007; Thomson, 1922). It was anticipated that this could establish whether certain iwi use specific birds for their cloaks, and whether these birds were common, widespread, and easily taken and consumed regularly by Māori (Harwood, 2011a, p. 145). This framework also tested the potential of current and future research to identify and provenance bird feathers in museum cloaks, and what the implications of this research might mean for museums and iwi Māori (Wehi, Whaanga, & Trewick, 2012).

The complementary areas of ornithology and Māori weaving knowledge from a bicultural science perspective supported a more robust argument in favour of undertaking this research within both a Western (Pākehā) scientific and Māori knowledge framework. Where Māori knowledge incorporated a personal, social, and scientific understanding of the world. It is important to reiterate that this research was Māori focussed and western scientific tools were employed to assist in answering the research questions and highlighted the dynamic synergies of understanding the importance of appropriate Māori research. Combined Western and Māori knowledge can be successfully captured when the research is mutually robust, reciprocal, respectful and cohesive in that they complement and even validate each other.

As large numbers of kākahu are now located in museum environments, and disconnected from their original marae settings, it was vital that concepts of taonga Māori regarding Mātauranga Māori (knowledge), te reo Māori (language), tikanga Māori (practices), and whakapapa Māori (genealogies) were followed. The language needed to be relevant to Māori and English speakers, but that te reo Māori be central, discussed in an appropriate context, and for the sake of a cohesive and consistent catalogue of cloak descriptions, be incorporated throughout the research so that it adhered to museum terminology and reference information for future research. The language should engage Māori concepts within the academic community and inform the museum sector as to what language and tikanga for taonga Māori is appropriate. The accessibility in terms of the language used, opens discussions leading to honest, sincere, and ongoing communication between parties, and research that is shared, ethical, and transparent.

These three areas of positioning regarding Mātauranga (knowledge), te reo (language) and tikanga (protocols) were interminably interwoven throughout the thesis, as they are in a cloak. As all three can be misheard, misinterpreted, and misused, it was important to find corroborating sources in the material evidence, literature, and interviews to verify information, as well as be surrounded with experts to support and engage in the research process. Both Irwin (1994) and Bishop (1994) referred to this as whānau support, which is not necessarily familial support, but provision for access to te reo Māori (language) and tikanga (practices) throughout the process. Vital whānau support was provided by Mrs Haupuru Harwood (née Wilcox) (Ngāpuhi) who attended the interviews in 2017 and assisted with translations, anecdotal examples, and advice regarding tikanga for conducting the interviews and research with ngā kākahu tuku iho (the study of historical Māori cloaks).

1.4.6 Challenges, assumptions, ethics, and restrictions

The most important pieces of physical evidence of Māori feather cloak production materialised from the tangible objects in the form of cloaks or cloak fragments in museum or private collections. There are sometimes reasons only known to the weaver regarding the use of birds, where accounts from outsiders and observers can be recorded, but without the context in which it was made, few conclusions can be formulated from isolated studies of material evidence. Major assumptions from previous research asserted that Māori weaving was governed by temporal and environmental factors, that certain cloaks were only made at specific times and areas. This can be tested using qualitative and quantitative methods examining historical and contemporary cloaks, and cross-referencing species to cloaks in different known locations.

Appropriate permissions were sought for the incorporation of cloak images and use where required in the thesis and International Register. Photographs of tūpuna Māori, and specific locations of burial cloaks were intentionally omitted from the research. This may appear as a disassociation between kākahu and Māori that made, wear, wore, or own them, however it is anticipated that kōrero pertaining to these mana taonga (highly valued treasures) can initiate conversations amongst hapū and whānau and recorded and shared by descendants first.

A lack of museum records can usually be traced back to the collector. A major limitation of this research was the missing or lack of recorded provenance data, coloured images, and detailed descriptions of cloaks in museum collections. Many museums had limited access to resources and personnel, and while this made aspects of the research challenging, it was expected that institutions had rare or unique examples of kākahu Māori and did not realise it.

It is becoming more important for iwi Māori to reconnect to taonga housed in museums and that access to taonga and associated information be shared between and amongst iwi and museums. As taonga in public museum collections are crowned-owned, stewardship and control over use and access has caused concerns and confusion for both iwi Māori and the museum sector (Tapsell, 1998). Likewise, the 'opening' of museum collections could perpetuate concerns regarding public (non-iwi) access to museum taonga. The primary role of museums is for education, and shared knowledge and histories of communities, and while the focus of this thesis was not on kākahu in museum exhibitions, it aimed to share collections in another more accessible format. It was expected that the outputs of the study would have other ongoing benefits for kākahu in museums and marae regarding storage, display, care, and research. When conducted respectfully, informed taonga research should record and revive knowledge that supports open communication between museums and iwi Māori.

1.5 Overview of Thesis

This thesis explored Māori cloak making over generations not strictly as a linear timeline, as Māori continue to draw from numerous influences and inspirations, re-using and reforming old ideas. Each chapter was written as a separate paper with an introduction, methods/ methodology, findings, discussion, conclusions, and sources. This was to allow easy referral to information and bibliographic resources regarding specific timelines and influences for future iwi Māori research. The two papers published in 2011 contributed to the body of knowledge and were reformatted for consistency. The thesis structure followed the development of this research from 2007 from methods of feather cloak identifications; to interpreting the possible factors that influenced the selection and use of birds and feathers in kākahu over time; and current and future trends that should be considered regarding iwi Māori and our kākahu. This entire body of work aimed to deliver an accessible working resource for iwi Māori, researchers, weavers, and museums to understand and share this knowledge.

1.5.1 Chapter Two presents the Diagnostic features of microscopic feather down for the 21 New Zealand bird orders

From research conducted in 2015-2016 it described the diagnostic features specific to the feather down of one species belonging to each of the 21 New Zealand bird orders including a species of extinct moa, a New Zealand first. The research tested microscopic feather analyses of New Zealand birds and their taxonomic placement for future identification research.

1.5.2 Chapter Three presents the following published paper:

Harwood, H. P. (2011a). Identification and description of feathers in Te Papa's Māori cloaks. *Tuhinga*, 22, 125–147.

The paper outlined 2007 feather identification research conducted on 110 Museum of New Zealand (Te Papa) Māori cloaks, the largest collection in the world. For the first time it introduced the importance of bicultural research in how scientific tools can be used to interpret Māori museum collections. Feather identifications from comparative reference image databases of microscopic feather down and museum bird skins recorded over 20 native and 10 introduced birds, and the significance of individual weaver markers such as hidden feathers in nineteenth century cloaks (Harwood, 2011a).

1.5.3 Chapter Four presents the following published paper:

Harwood, H. P. (2011b). Ngā tohu o ngā kairaranga: The signs of the weavers. *Memory Connection Journal*, 1(1), 437–450.

This paper is continued from associated research and the feather identification of mainly nineteenth century Māori feather cloaks in the Te Papa collections and expanded on weaver knowledge contained and communicated in Māori feather cloaks (Harwood, 2011a). The paper highlighted examples of mnemonic aspects such as hidden feathers, the use of significant bird species, feathers, and colours, and writing that identified a connection to the weaver, wearer, event, or relationship to a bird (Harwood, 2011b).

1.5.4 Chapter Five presents the possible Polynesian influences on Māori feather cloaks

The chapter reviewed and analysed similarities in Māori and Pacific feather attire in museum collections, including significant Hawaiʻian and Tahitian examples. The research conducted between 2016-2018 highlighted how language, bird and feather use, techniques, social and genealogical factors, and environmental and temporal factors in Polynesian clothing added to an understanding of how Māori later developed and used a unique style of feather cloak.

1.5.5 Chapter Six presents Early Māori feather and bird skin cloaks 1500-1800 A.D.

From research conducted between 2017-2019, the chapter catalogued material evidence and literature of lesser known examples of historic pre-European feather cloaks dating from 1500-1700 A.D. found in the South Island of New Zealand. It also reviewed correspondence, literary, anecdotal, graphical, and archival sources compiled from late eighteenth century Māori-European encounters and subsequent collection of feather cloaks. A study of the material evidence of cloaks dating from Cook's voyages located in the United Kingdom and European museums exemplified unique material and technical information for this period when contact was limited. Cloak origins and bird distributions at these times tested theories regarding resource availability versus application of certain cloak species and feathers.

1.5.6 Chapter Seven presents the European influences on 19th century Māori feather cloaks

Analysis and theories from research conducted 2015-2019 revolved around the changing themes of language, access and use of traditional and native materials, techniques and function of cloaks, birds, and feathers after European settlement in the 1800s. Examples and narratives of post-European Māori feather cloaks were selected that exemplified the social, cultural, political, economic, religious, and environmental impacts on Māori society that may have instigated a large-scale production of collectable kākahu for museums.

1.5.7 Chapter Eight presents the Current iwi relationships with Māori feather cloaks and future trends regarding feather cloaks and research in museums

A study of material evidence of kākahu and oral histories of Northern iwi from 2015-2018 highlighted a long-standing connection with birds, feathers and individual kākahu on marae. Anecdotal records of cloak production and use, access to birds, and taonga in museum collections have dictated present and future relationships between iwi and Government organisations including museums. Recommendations for how iwi can participate in the physical and cultural care in museums was considered. Scientific research projects with potential to determine material identification and geographic provenance of Māori cloaks were reviewed that covered microscopy, isotopic and genetic analyses. Undertaking scientific provenance analyses of museum cloaks was outside the scope of this research, therefore critical analyses of the objectives, assumptions, methods, methodologies, results, and implications of these types of research were performed based on relevant literature.

1.5.8 Chapter Nine presents a summary of thesis findings, conclusions, recommendations, and future research

Chapter Nine summarised the major findings and answered the questions emerging from this research drawn from the major conclusions and recommendations from each chapter. The comprehensive study of material evidence, oral histories and literature established an understanding of the fundamental influences in the study of the language and history of Māori feather cloaks.

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CHAPTER TWO: DIAGNOSTIC FEATURES OF MICROSCOPIC FEATHER DOWN FOR THE 21 NEW ZEALAND BIRD ORDERS

2.0 Abstract

From research conducted in 2015-2017 the microscopic feather down characteristics of the 21 New Zealand bird orders were described using the Museum of New Zealand Te Papa Tongarewa (Te Papa) bird skin collection, including for the first time the microscopic feather traits of an extinct moa (Dinornithiformes). Chandler (1916) provided detailed descriptions and illustrations of the diagnostic microscopic features of the feather down in selected species of the world's bird orders to assign taxonomic positioning. Microscopic feather identification has since proven useful in the fields of ecology (Day, 1966), birdstrike analysis (Brom, 1984, 1986 & 1991), conservation, and forensics and biosecurity (Davies, 1970; Dove & Kovach, 2010). The practical applications of microscopic feather identification has shown potential in archaeological research (Dove, Hare, & Heacker, 2005; Dove & Peurach, 2002; Rogers, Dove, Heackers, & Graves, 2002), in studying historical avian museum specimens (Brom & Prins, 1989), and in museum ethnological collections (Dove, 1998; Harwood, 2011; Pearlstein, 2010). This research created a replicable detailed reference of microscopic feather down for species representing the 21 New Zealand bird orders to guide biological and museum personnel in New Zealand feather identifications.

2.1 Introduction

Descriptions of feather types, size, colour, and patterning is the primary method of bird species identification in the field (Heather & Robertson, 1996; Svensson, 1992). Detached, damaged or feather fragments, or feathers of various species mixed-together, present challenges regarding identification particularly if they are plain white, black, or brown feathers. Analytical and microscopic studies in feather morphology have categorised the structural components of feathers and how they can determine the type of bird and feather (Carlisle, 1925; Chandler, 1916; Hargrave, 1965; Wray, 1887). Chandler (1916) examined in detail the structural components in most bird orders documenting the downy (plumulaceous) and pennaceous barbs, feather colour, and shaft characteristics. Later, Carlisle (1925) explored the taxonomic significance of barbule positioning in pennaceous barbs at the feather tips. Feather identification keys based on taxonomy have been compiled by Day (1966) and Brom (1986) and have had useful applications in bird ecology and in identifying birdstrike remains.

Microscopic feather characteristics are a valid method for species identification in that it is relatively quick and cost effective. Major relevant studies cataloguing bird order and species in the minute details of feather down include Chandler (1916), Day (1966), Brom (1986, 1991), and Dove and Koch (2010). These studies demonstrated that the feather barbule length, and the node size, shape, pigmentation, and distribution along downy barbules assisted in distinguishing taxonomic positioning for bird groups. The microscopic examination of feathers in Māori cloaks in the Museum of New Zealand Te Papa Tongarewa (Te Papa) collections identified 11 of the 21 New Zealand bird orders based on analyses of feather down in museum reference feathers and skins (Harwood, 2011). A taxonomic study of the feather down from 18 Australian bird orders and 62 species with a specific focus on parrots, provided reference guides for wildlife and forensic purposes (Lee, Sarre, Joseph, & Robertson, 2016).

Microscopic feather identification techniques have applications in taxonomy to distinguish within and between bird orders and groups (Brom, 1986; Chandler, 1916; Dove, 1997, 2000; Dove & Agreda, 2007). This method has also been used in forensics (Dove & Koch, 2010), identifying birdstrike remains (Brom, 1984), and conservation and wildlife management (Day, 1966). It is also a valuable tool in the identification of museum specimens (Brom & Prins, 1989), in ethnological items (Dove, 1998; Harwood, 2011; Pearlstein, 2010; Rogers et al., 2002) and paleontological and ancient artefacts (Dove, Hare, & Heacker, 2005; Dove & Peurach, 2002; Pedergnana & Blasco, 2016).

Scanning electron microscopy in feather identification has yielded similar effective results recorded by Davies (1970); Reaney, Richner, and Cunningham (1978); Robertson, Harkin, and Govan (1984); and Laybourne, Sabo, and Morningstar (1992). Dove (2000) also successfully combined light and scanning electron microscopy in studying feather morphology. Physical comparisons of feathers with well-documented reference bird-skin collections is still the most common method of feather identification, where patterning and colouring in the feathers have facilitated the positive identification of New Zealand bird species (Gill, 2006, 2014; Gillette & Bartle, 1982; Seaton, Hyde, Holland, Minot, & Springett, 2008). Other feather identification techniques involve differentiating morphological features in New Zealand species-specific lice (Tennyson, Palma, Robertson, Worthy, & Gill, 2003).

Genetic (DNA) analysis has become one of the more widely accepted and accurate forms of species identification (Rudhick, Katzner, Evgeny, & DeWoody, 2007). It has advanced regarding archaeological and ethnological feather research (Hartnup, 2012; Hartnup et al., 2008), and museum specimen phylogeny (Houde & Braun, 1988; Leeton, Christidis, & Westerman, 1993; Payne & Sorenson, 2003; Wanderler, Hoek, & Keller, 2007). It has also facilitated the development of genetic models in understanding extinct and extant New Zealand bird species (Cooper, 1994; Haddrath & Baker, 2001; Rawlence, Wood, Armstrong, & Cooper, 2009; Seabrook-Davison, Huynen, Lambert, & Brunton, 2009; Shepherd, 2006). Identifications from mtDNA analyses on the feather barbs and rachis (shaft) have recently contributed to important forensic and wildlife management solutions (Boonseub, Johnston, & Linacre, 2012; Rawlence et al., 2009; Speller, Nicholas, & Yang, 2011).

2.2 Methods and Conventions

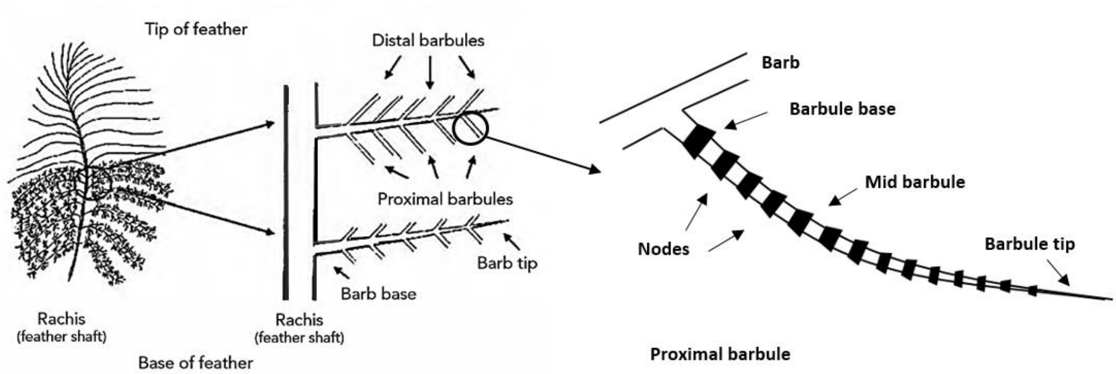


***Figure 2.1*. Down feather diagram showing positioning of structures and trapezoid-shaped nodes, modified from Dove & Koch (2010) and Day (1966).**

Contour feathers from adult skin specimens used for microscopic identification are described as feathers with 'fluffy' down at the base of the feather, a distinct central shaft or rachis, and vanes (barbs) on either side, covering the body of the bird (Figs. 2.1 & 2.2) (Dove 1997, p. 47; Marchant & Higgins, 1990a, p. 38). Contour feathers can also be found on the upper sections of the wings and tail. The pennaceous barbs at the feather tip typically have small hooklets that link together for stability. The plumulaceous barbs (down) at the feather base have perpendicular barbules attached and provide insulation (Dove & Koch, 2010, p. 21).

Feathers originating from the 21 New Zealand bird orders were observed under the microscope and compared using one species to represent each bird order. Classification of New Zealand bird taxonomy is based on molecular studies that support previous nomenclature declared in the *Checklist Of The Birds Of New Zealand* in 1990 (Checklist Committee, 1990). Species and subspecies have since been distinguished more accurately using DNA analysis.

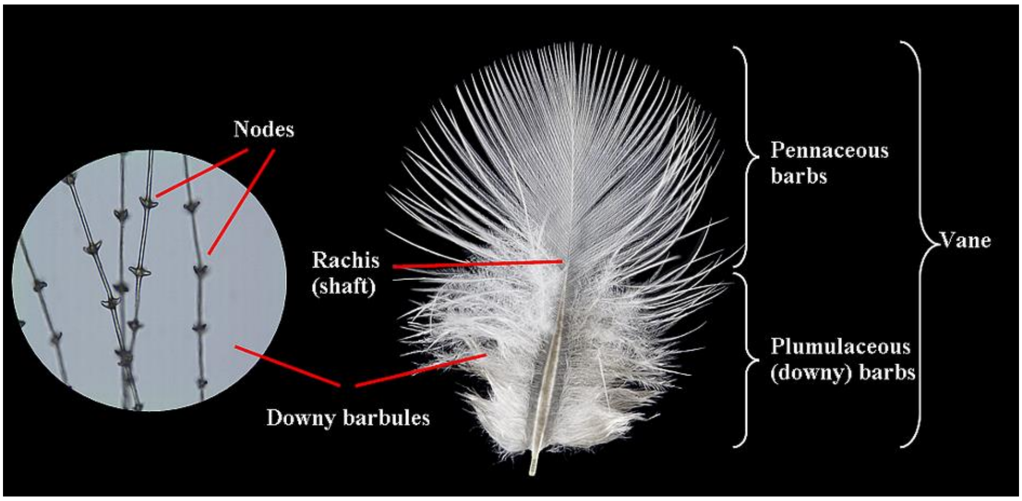


Figure 2.2. **Kererū (New Zealand pigeon) contour feather showing pennaceous barbs, plumulaceous (downy) barbs and nodes on downy barbules. Feather image by Raymond Coory (Te Papa), 2006. Photomicrograph and diagram by Hokimate Harwood, 2007.**

Preparation of feather down for microscopy followed aspects of Laybourne and Dove (1994), and Laybourne et al. (1992). Downy barbs exhibiting diagnostic characteristics from the feather base or mid section of the down were extracted from contour feathers of a verified museum skin and temporarily dry-mounted on to glass slides. The down samples were then examined using light microscopy (Leica DM500 at 40x, 100x and 400x magnification). Photomicrographs were captured with a fitted microscope camera (Leica ICC50W), and the Leica LAS EZ program processed the images and recorded measurements. For bird orders, diagnostic features can vary among species, feather types, and even between barbs and barbules on a feather. Therefore several barb samples were extracted and analysed from whole (intact) feathers where possible, and feather types and specimen numbers recorded for future reference and comparisons.

Barbs at mid-down were defined as the downy barbs in the middle of the down between the feather base and pennaceous barbs (towards the feather tip), seen as the intermediate area of down (Fig. 2.2) (Dove & Agreda, 2007, p. 194). The space between two nodes was typically measured as the internodal length (Dove, 1997, p. 51). The average length and width of the downy barbules varied depending on the bird order, position on the feather, barb, and barbule. Additional parameters useful in systematic feather studies can be the size, shape, and distribution of nodes along the barbules, and pigmentation within the nodes and along the barbules is also variable among birds.

Feather samples were studied for nodal morphology, pigmentation patterns, barbule length, presence of villi (transparent cilia, fringe-like projections at the barbule base) and other diagnostic characters (e.g. rings, prongs, triangular nodes) to assist in the classification of bird groups to which it belonged (Dove & Koch, 2010, p. 21). Detailed node and pigment descriptions have been provided by Dove and Koch (2010, pp. 26–27). Feather colour and types followed Svensson (1992), and the *Handbook Of Australian, New Zealand And Antarctic Birds* (1990). New Zealand bird nomenclature, vernacular names and order sequence observed taxonomic organisation in the *Checklist Of The Birds Of New Zealand* (Checklist Committee (OSNZ), 2010). Some taxonomies differed from international classifications in that New Zealand herons and egrets are placed in the order Ciconiiformes, and Pelecaniformes overseas.

2.2.1 Feather down analysis

For each bird order, species, and feather, macroscopic features were described, and measurements taken of feathers including the down area, colouring, patterning, shape, and size recorded. Feather down was analysed at the feather base or mid-down, depending on the feather condition and where the characteristic (diagnostic) features were present. Microscopic images and measurements of downy barbs were taken at the barb base, mid-barb, and barb tip, and at the barbule base, mid-barbule, and barbule tip (see Fig. 2.1). The average number of nodes/ sites were counted along barbules, and nodes/ sites measured for length and width, including appendages (prongs). Node (or prong) size, shape, colouring and distribution were recorded at each site at the barb base, mid-barb and barb tip and the barbule base, mid-barbule and barbule tip. Barbule width and internodal length were also measured between node sites.

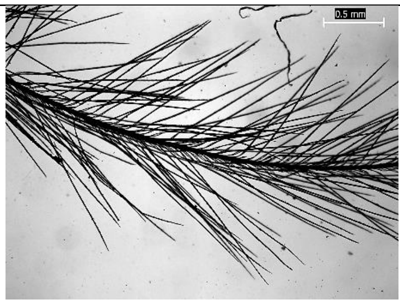
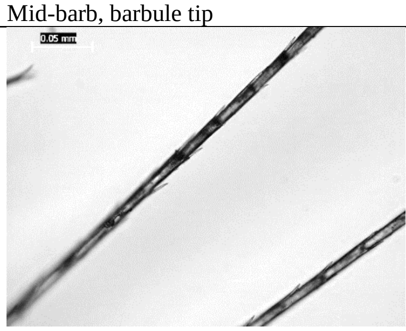
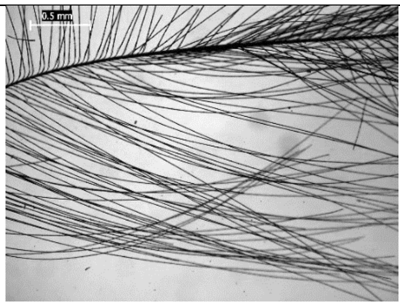
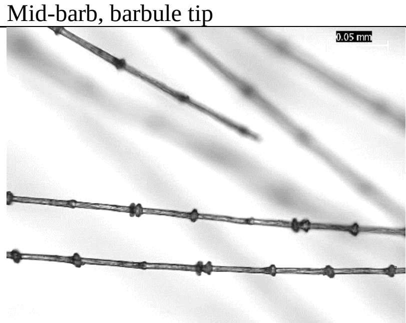
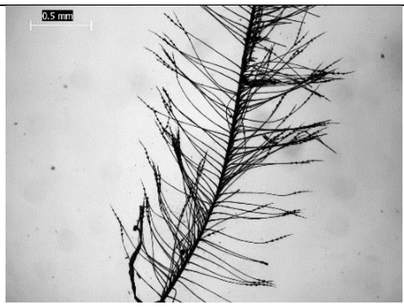
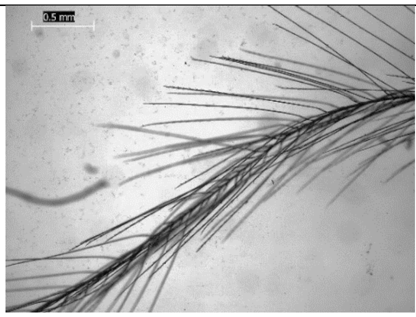
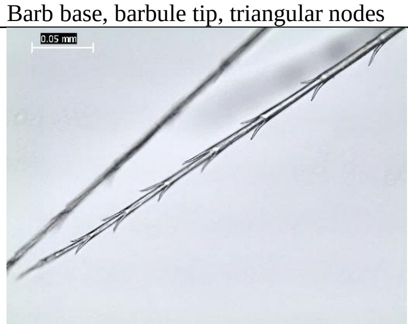
Bird specimens belonging to 20 bird orders were selected by the Te Papa curator of vertebrates from the museum bird skin collection. Feather collection was conducted in accordance with the Te Papa Natural Environmental sampling policy and restricted to one feather per bird specimen, in that 20 feathers from 20 species were removed and analysed (see Table 2.1). Species selection was based on geographical distribution, cultural importance, and characteristic microscopic traits representative of the bird order. Skin and feather selections were dependant on the number and condition of the museum skins. Contour feathers were selected and removed from the ventral (front, underside) area of most birds, as these feathers typically have adequate colouring to distinguish from other body feather types and have both pennaceous and plumulaceous barbs for analysis. The moa (Dinornithiformes) feathers were selected from specimen boxes in the fossil vertebrates collection by the Te Papa fossil vertebrates curator (Table 2.1). Analyses were conducted between 2015-2017.

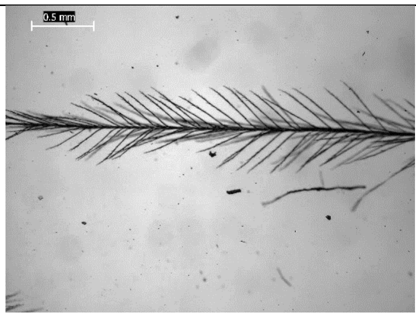
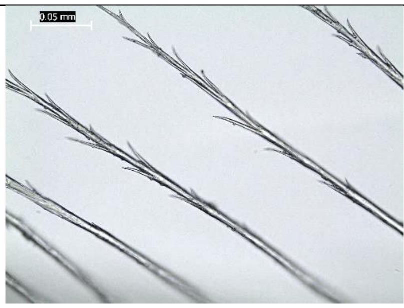
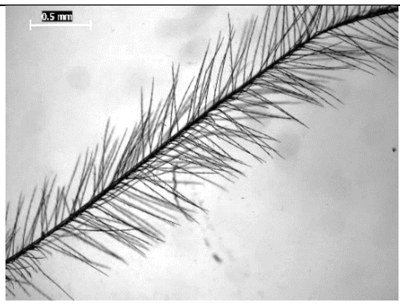
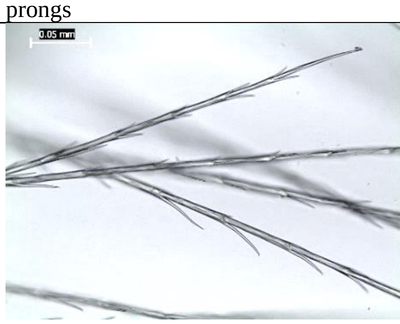
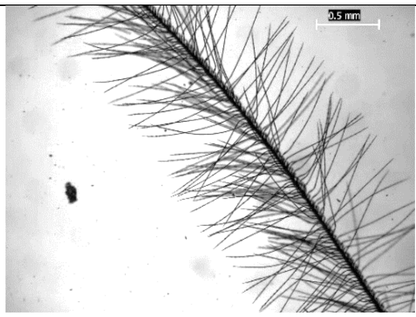
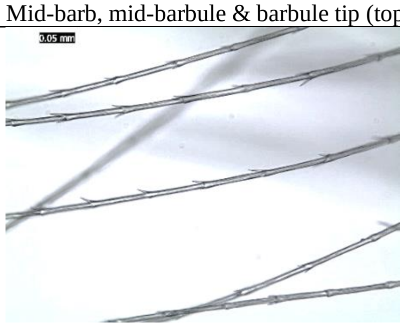
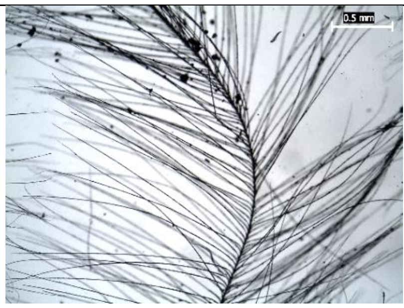
***Table 2.1*. List of 21 bird orders and species studied for microscopic characteristics.**

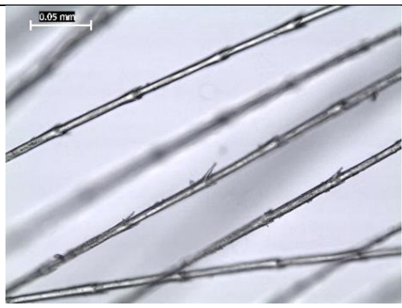
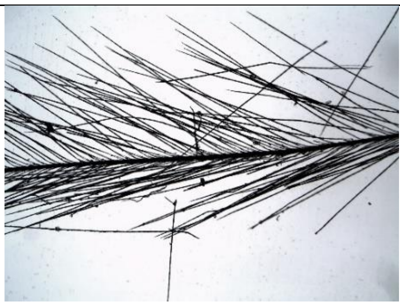
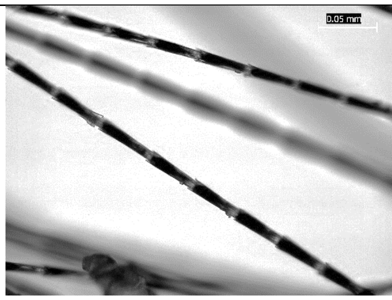
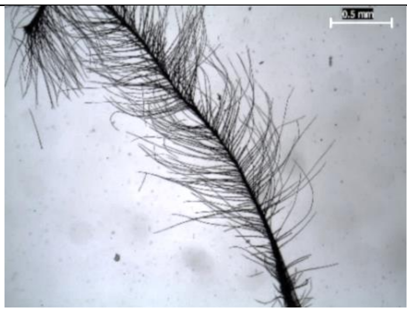
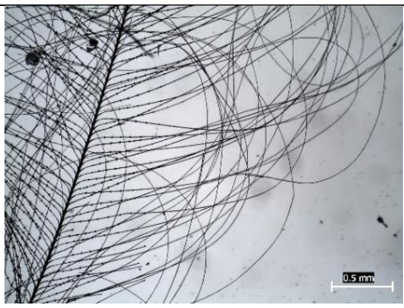
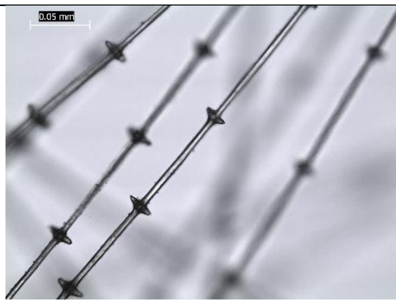
SELECTED BIRD ORDER AND SPECIES
1. DINORNITHIFORMES. Moa - unverified species (?)
2. CASUARIIFORMES. North Island brown kiwi - *Apteryx mantelli* (Bartlet, 1852)
3. GALLIFORMES. Common pheasant - *Phasianus colchicus* (Linnaeus, 1758)
4. ANSERIFORMES. Mallard - *Anas platyrhynchos* (Linnaeus, 1758)
5. PODICIPEDIFORMES. N.Z. dabchick - *Poliocephalus rufopectus* (G. R. Gray, 1843)
6. SPHENISCIFORMES. Little penguin, kororā - *Eudyptula minor* (J. R. Forster, 1781)
7. PROCELLARIIFORMES.Gibson's albatross - *Diomedea antipodensis gibsoni* (Robertson & Warham, 1992)
8. PHAETHONTIFORMES. Red-tailed tropic bird, amokura - *Phaethon rubricauda* (Boddaert, 1783)
9. PELECANIFORMES. Australasian gannet, tākapu - *Morus serrator* (G. R. Gray, 1843)
10. CICONIIFORMES. White heron, kōtuku - *Ardea modesta* (J. E. Gray, 1831)
11. ACCIPITRIFORMES. Swamp harrier, kāhu - *Circus approximans* (Peale, 1848)
12. FALCONIFORMES. New Zealand falcon, kārearea - *Falco novaeseelandiae* (Gmelin, 1788)
13. GRUIFORMES. Western weka, *Gallirallus australis australis* (Sparrman, 1786)
14. CHARADRIIFORMES. Southern black-backed gull - *Larus dominicanus* (Lichtenstein, 1823)
15. COLUMBIFORMES. N.Z. pigeon, kererū - *Hemiphaga novaeseelandiae* (Gmelin, 1789)
16. PSITTACIFORMES. North Island kākā - *Nestor meridionalis septentrionalis* (Lorenz, 1896)
17. CUCULIFORMES. Long-tailed cuckoo - *Eudynamys taitensis* (Sparrman, 1787)
18. STRIGIFORMES. Morepork, ruru - *Ninox novaeseelandiae novaeseelandiae* (Gmelin, 1788)
19. APODIFORMES. White-throated needletail - *Hirundapus caudactus* (Latham, 1802)
20. CORACIIFORMES. Sacred kingfisher, kōtare - *Todiramphus sanctus vagans* (Lesson, 1828)
21. PASSERIFORMES. Tūī - *Prosthemadera novaeseelandiae* (Gmelin, 1788)

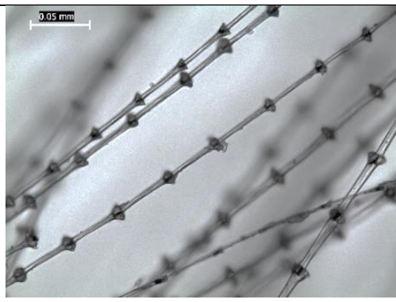
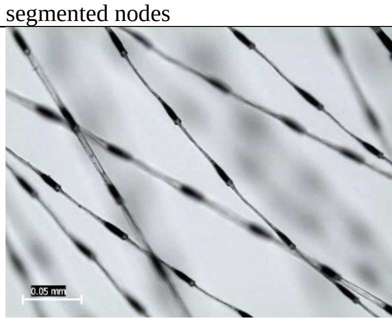
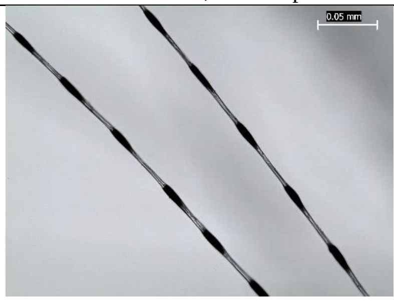
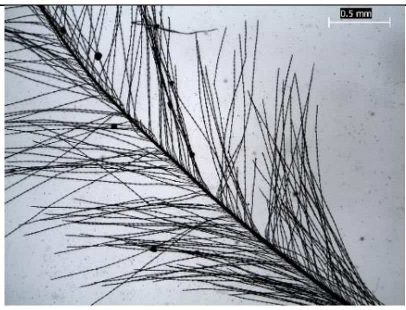
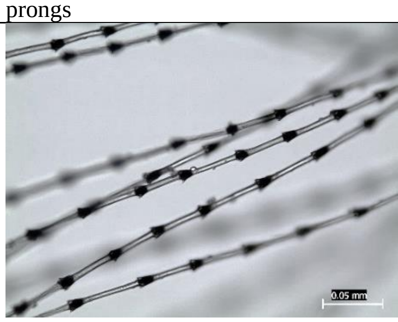
2.3 Microscopic feather down descriptions of the 21 New Zealand bird orders

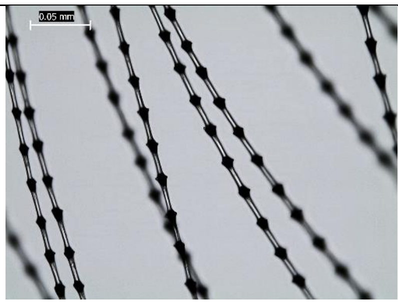
***Table 2.2*. Microscopic feather down images of 21 bird orders showing diagnostic characteristics.**

SPECIES - FEATHER	MAGNIFICATION 40x	MAGNIFICATION 400x
DINORNITHIFORMES moa, upland moa (?) - *Megalapteryx didinus* (Owen, 1883) S.44046/1 Brown body feather Mid-down analysed	 Mid-barb	 Mid-barb, barbule tip
CASUARIIFORMES Family Apterygidae North Island brown kiwi - *Apteryx mantelli* OR.012851 Brown back feather Mid-down analysed	 Mid-barb	 Mid-barb, barbule tip
GALLIFORMES Common pheasant - *Phasianus colchicus* OR.017021/1 Brown belly feather Mid-down analysed	 Barb base, distal barbules	 Barb base, mid distal barbules, ringed nodes
ANSERIFORMES Mallard - *Anas platyrynchos* OR.013547/1 White & brown speckled belly feather Mid-down analysed	 Barb base	 Barb base, barbule tip, triangular nodes
PODICIPEDIFORMES N.Z. Dabchick - *Poliocephalus pufopectus* OR.016431 Black side belly feather Mid-down analysed	 Barb tip	 Barb & barbule tip, med-long prongs

SPHENISCIFORMES Little penguin - *Eudyptula minor* OR.009144/2 White belly feather Mid-down analysed	 Barb tip	 Barb tip, mid-upper barbule, med-long prongs
PROCELLARIIFORMES Gibson's albatross, toroa - *Diomedea antipodensis gibsoni* OR.012639 White flank feather Mid-down sampled	 Mid-barb	 Mid-barb, mid-barbule & barbule tip (top)
PHAETHONTIFORMES Red-tailed tropic bird - *Phaethon rubricauda* OR.002732 White belly feather Mid-down analysed	 Mid-barb	 Mid-barb & barbule, short prongs
PELECANIFORMES Australasian gannet - *Morus serrator* OR.008451/2 White belly feather Feather base analysed	 Mid-barb	 Mid-barb, barbule base, very long prongs
CICONIIFORMES White heron - *Ardea modesta* OR.000977 White side feather Mid-down analysed	 Mid-barb	 Mid-barb & lower barbule, minute prongs

ACCIPITRIFORMES Swamp harrier - *Circus approximans* OR.007086 Brown flank feather Mid-down analysed	 Mid-barb	 Mid-barb, barbule base, asymmetric prongs
FALCONIFORMES N.Z. Falcon - *Falco novaeseelandiae* OR.004799 Cream & brown belly feather Mid-down analysed	 Mid-barb	 Mid-barb, barbule base, small nodes
GRUIFORMES Western weka - *Gallirallus australis australis* OR.021889 Black & brown back feather Mid-down analysed	 Barb base	 Barb base, mid-barbule, pigmented nodes
CHARADRIIFORMES Family Laridae Southern black-backed gull - *Larus dominicanus* OR.013100/2 White belly feather base analysed	 Barb base	 Barb base, barbule base, segmented dark nodes
COLUMBIFORMES Family Columbidae N.Z. pigeon, kererū - *Hemiphaga novaeseelandiae* OR.011559.2 White belly feather Upper mid-down analysed	 Barb base	 Barb & barbule base, large crocus-shaped nodes

PSITTACIFORMES Family Strigopidae Subfamily Nestorinae North Island kākā - *Nestor meridionalis septentrionalis* OR.028918 Red-tipped belly feather Mid-down analysed	 Barb base	 Barb & barbule base, large dark segmented nodes
CUCULIFORMES Family Cuculidae Long-tailed cuckoo - *Eudynamys taitensis* OR.021805 White belly feather with brown vertical central line Mid-down analysed	 Barb base	 Barb & barbule base, bell-shaped nodes
STRIGIFORMES Family Strigidae Morepork, ruru - *Ninox novaeseelandiae* OR.010279 Cream & brown mottled belly feather Mid-down analysed	 Mid-barb	 Mid-barb & barbule, dark globule-shaped nodes
APODIFORMES Suborder Apodi Family Apodidae Subfamily Apodinae Tribe Chaeturini White throated needletail - *Hirundapus caudactus* OR.000489 Light brown back feather Mid-down analysed	 Barb base	 Barb & barbule base, pigmented barbules, prongs
CORACIIFORMES Family Halcyonidae Sacred kingfisher, kōtare - *Todiramphus sanctus vagans* OR.009878 Cream belly feather Mid-down analysed	 Barb base	 Barb & barbule base, dark trapezoid-shaped nodes

PASSERIFORMES Family Meliphagidae Tūī - *Prosthemadera novaeseelandiae* OR.011140 Black belly feather Mid-down analysed	 Mid-barb	 Mid-barb & barbule, dark hexagonal-shaped nodes

2.3.1 Order Dinornithiformes - Moa

Dinornithiformes make up the extinct New Zealand birds collectively known as moa. This order had not been previously studied in detail using light microscopy. At the time of study, no loose moa feathers in the Te Papa Museum fossil vertebrate collections had been positively identified to species level. Viable Te Papa feathers were selected for study and tentatively catalogued as moa, one an upland moa (*Megalapteryx didinus*) in the family Megalapterygidae (Szabo, 2017). Giant moa (family Dinornithidae) incorporate the subclass Paleognathae, Paleognathous birds (Worthy, 2010f). Moa belong to the Parvclass: Ratitae (ratites), and include other flightless birds like the New Zealand kiwi (*Apteryx* spp.); and Australian emu (*Dromaius novaehollandiae*) and cassowaries (*Casuarius* spp.) found in Australia, Indonesia and Papua New Guinea, located in the order Casuariiformes they share genetic and morphological commonalities (MacDonald, Serventy, & Slater, 1992; Worthy, 2010f). Other ratites constitute African ostriches (*Struthio camelus*) (order Struthioformes); the South American rhea (*Rhea* spp.) in the Rheiformes order; and the South American tinamou (order Tinamiformes) (Worthy, 2010f). Tinamou and Emeid moa are sister taxa and located in the subclass Palaeognathae (Worthy, 2010f). As ratites share similarities in feather morphology, it was anticipated moa and kiwi feathers would exhibit similar microscopic traits (Chandler, 1916).

Moa feather descriptions can vary depending on the species and feather type (Hamilton, 1894). Previous analyses of ratite feather morphology studied aspects of kiwi, emu and ostrich plumage in that feathers could reach 20cm long and had short, uniform pennaceous barbs up to the tip of the shaft (Hutton, 1871; Rawlence et al., 2009; White, 1885). For this study, four moa feathers were removed from a box of moa feathers (S.44046) in the Te Papa fossil vertebrate collection.

***Table 2.3*. Comparisons of diagnostic microscopic feather characteristics of the 21 New Zealand bird orders.**

Species - sample	Feather and down description	Diagnostic features	Barbule description	Node / prong description
Order Dinornithiformes ?Upland Moa - *Megalapteryx didinus* S.044046/1 Mid-down analysed	Light to medium brown body feather 3.5cm long x 1cm across, 1.5cm was dense light brown down. Shaft med-dark brown. Downy barbs light brown and tree-shaped, downy barbules absent towards barb tips.	Previously unstudied/ unpublished. Ratites have medium length barbules with medium length prongs along length (Chandler, 1916).	Barbules at the barb base were scale-like, with small prongs, and brown pigment along barbules between prong sites. Little or med pigment in nodes, no pigment in prongs. Av. barbule length at barb base 1.3mm; av. barbule length at mid-barb 1.3mm; av. barbule length at barb tip 1mm.	Two pairs of prongs, evenly distributed at each node site, some asymmetrical (Table 2.2). Av. no. node sites on barbules at barb base 26, at mid-barb 25, and at barb tip 22. Av. prong length including node site at barb base, barbule tip 0.018mm, at mid-barb, barbule tip 0.018mm. At barb and barbule tip, av. prong length 0.02mm.
Order Casuariiformes North Island brown kiwi - *Apteryx mantelli* OR.012851 Feather base analysed	Brown back feather 4cm long x 1.5cm across, 1.5cm dense med-dark brown down. Dark brown shaft and hair-like pennaceous barbs, black at tips. Dark brown downy barbs med-long, barbules absent at tip.	Hair-like barbules with non-distinct nodes, small prongs along length, and little pigment before node sites (see above).	Barbules were pointed, straight and hair-like. Slight brown pigment at node sites, with small prongs evenly distributed at barb and barbule base. Barbules scale-like when prongs reduced. Average barbule length at the barb base 1.41mm, at mid-barb 1.5mm, and at the barb tip 1.3mm long.	Prong size gradually increased along barbules at mid-barb. Reduced prongs at barb tip, barbule base, some pigment instead at node sites. Av. no. pronged node sites along barbules at barb base 18, at mid-barb 27, and barb tip 25. Av. prong length at barbule tip at barb base 0.019mm; at mid-barb and barb tip 0.018mm.
Order Galliformes Common pheasant - *Phasianus colchicus* OR.017021/1 Mid-down analysed	Male, brown belly feather. Measured 6cm long x 3cm across, 4cm was down. White shaft, down light grey/ brown and white.	Long barbules. Multiple, mobile ring-shaped nodes towards the middle of distal barbules at the barb base.	At mid-down barbs were grey and med-long. Barbules up to 3mm long, gradually decreased in length and width towards barb tip. Nodes all along barbule. At barb and distal barbule base, nodes were triangular then ring-shaped after four nodes. Little to med pigment in barbules.	Multiple ring-shaped nodes towards middle of the distal barbules at the barb base. Average number of nodes on barbules at the barb base was 76, at mid-barb 40 nodes, and at the barb tip 47 nodes. On average the size of the ringed nodes measured 0.005mm long x 0.01mm across (see Table 2.2).
Order Anseriformes Mallard - *Anas platyrhynchos* OR.013547/1 Mid-down analysed	Male, white belly feather with brown speckling towards tip. Measured 6cm long x 2.5cm, 3cm was dense down. Shaft was light brown, white in upper half. Most of down white, bottom of down light grey/ brown.	Short barbules. Large triangular nodes at the barb base, and barbule tips only.	White downy barbs med length. Short thin barbules 0.8mm long at barb base, with little pigment. Minute nodes at barb and barbule base, large triangular nodes at barbule tips at base of barb only. Mid-barb had pronged nodes, with prongs on some at some barb and barbule tips.	Between 2-5 large segmented triangular nodes at barb base and barbule tips (Table 2.2). On av. 17 node/prong sites along barbules at barb base, at mid-barb 17, barb tip 18. At barb base and barbule tip, the av. size of large triangular nodes was 0.014mm long x 0.015mm across, internodal space 0.02-0.04mm, and barbule width 0.004mm.
Order Podicipediformes N.Z. Dabchick - *Poliocephalus pufopectus* OR.016431 Mid-down analysed	Black side belly feather 4cm long x 2.5cm across, 1.5cm was sparse down. Black shaft. Grey down at feather base, and upper down almost white, with sparse pennaceous barbs.	Short downy barbules with 1-2 pairs of med-long prongs in the upper half of barbules.	Med-long grey downy barbs and barbules, at barb base measured 0.7mm long, mid-barb 1.26mm, barb tip 1.3mm. Prongs appeared in upper half of barbules at the very base of barb. More pigment in barbules towards base of feather and barb base.	Between 2-4 prongs per node site in upper barbules at barb base. An av. of 20 node/prong sites along barbules at barb base, 25 at mid-barb, and 22 at barb tip. Av. prong length at node sites at mid-upper barbules at barb base 0.033mm; mid-barb and barbule tip 0.029mm; barb and barbule tip 0.028mm (Table 2.2).
Order Sphenisciformes Little penguin - *Eudyptula minor* OR.009144/2 Mid-down analysed	White belly feather. Measured 2.5cm long x 2.5 cm across, 0.5cm was white down.	Med-long prongs with little to no pigment along most of the length of barbules.	White barbs med-long, average barbule length at barb base 0.6mm; mid-barb 0.6mm; barb tip 0.5mm. Pronged nodes all along barbules, slightly longer at mid-barbule and barb tip. Some pigment in nodes in barbules at barb tip.	Two sets of long prongs faced outward towards mid-barbule. An average of 9 prong/node sites along barbules at barb base, 9 prongs/node sites at mid-barb, 7 prong/node sites at barb tip. The average prong length at node sites 0.039mm, ranged 0.035mm-0.04mm (see Table 2.2).
Order Procellariiformes Gibson's albatross - *Diomedea antipodensis gibsoni* OR.012639 Mid-down sampled	White flank feather, long and curved, light brown/ grey speckling at tips. Measured 18.5cm long x 4cm across, 4cm was down. At 2cm up from the feather base, hooklets appeared on barbules at the base of barbs.	Short barbules with very long sets of prongs at the base of barbules that gradually decreased in length towards tip.	Long straight barbs with very short barbules with an av. length 0.8mm at barb base, 0.66mm at mid-barb, and barb tip 0.66mm. Closely spaced prongs along barbules longer at barbule base, that decreased in length. Barbules had little or no pigment.	Two pairs of prongs, with some asymmetry. At barb base, barbules had on av. 15 prong/node sites, at mid-barb 12, at barb tip 10. At mid-barb and barbule base, the longest prong was 0.05mm, mid-barbule 0.035mm, and barbule tip 0.017mm (Table 2.2).

Order Phaethontiformes Red-tailed tropic bird - *Phaethon rubricauda* OR.002732 Mid-down sampled	White belly feather, with yellow-orange tip. Feather was 5.5cm long x 3.5cm across, 1cm was down. At 0.5cm the base of downy barbs had hooklet-like barbules.	Widely spaced short-medium length prongs that gradually increased in length along barbules.	White short-med barbs. Av. barbule length at barb base 0.64mm, at mid-barb 0.77mm, at barb tip 0.74mm. On most barbs, 1-2 small nodes at the barbule base, then pronged nodes increased in length along the barbules towards barbule tip. Little to no pigment in barbules.	Prongs widely spaced, on av. barbules at barb base had 13 prong/ node sites, at mid-barb 15, and barb tip 14. At barb and barbule base, node sites then paired short-med prongs that increased along barbule. At mid-barb av. prong length 0.013mm at barbule base, 0.019mm at mid-barbule, barbule tip 0.02mm (Table 2.2).
Order Pelecaniformes Australasian gannet - *Morus serrator* OR.008451/2 Feather base analysed	White belly feather with yellow tinge at tip. Feather 4cm long x 2.5cm across. Down formed V shape at feather base. Downy barbules had hooklets at the barb base, and on the outer edge of barbs.	Very long curved prongs closely spaced along barbules.	Short white barbs and barbules. Av. barbule length at barb base 0.38mm, at mid-barb 0.4mm, barb tip 0.32mm. Close med-long prongs along barbules at barb base. Long sparse prongs at mid-barb shorten at barb tip. Barbules wide at base of the barb. Little or no pigment in barbules.	Prongs generally symmetrical, long spindly pairs wrapped around barbules. At barb base and mid-barb, av. 9 prong/ node sites along barbules, barb tip 7. Prongs longer at mid-barbule and shorter at barbule tip. At mid-barb and barbule base, the average prong length was 0.06mm, at mid-barbule 0.1mm, and barbule tip 0.03mm (Table 2.2).
Order Ciconiiformes White heron - *Ardea modesta* OR.000977 Mid-down analysed	White delicate side feather, measured 5cm long x 3.5cm across, of which 1.5cm was down. Hooklets appeared on downy barbules at the base of barbs.	Long barbules had widely spaced, minute node sites with very short prongs, unevenly distributed along barbules.	Long downy barbs with long, dense, thin, and whip-like barbules. Av. barbule length at barb base 1mm, at mid-barb 1.8mm, at barb tip 1.5mm. Some widely spaced minute nodes had pairs of very short prongs unevenly distributed along barbules. Little or no pigment in barbules.	Nodes minute and non-descript. At barb base, av. no. of node/ prongs sites along barbules 18, at mid-barb 24, 20 at barb tip. At mid-barb and barbule base, pronged node sites measured on av. 0.01mm long x 0.007mm across. At mid-barb, barbule base the av. internodal space was 0.06mm, and barbule width 0.004mm across (Table 2.2).
Order Accipitriformes Swamp harrier - *Circus approximans* OR.007086 Mid-down analysed	Brown flank feather measured 11cm long x 5cm across at widest point, 6cm was down. The pennaceous barbs were brown. The down was dense and light grey at the feather base, and white then cream towards middle of the feather.	One pair of asymmetrical prongs sometimes at pigmented node sites along barbules.	Bare barbules at barb tips. White downy barbs 3-4cm long. Downy barbules at barb base max. 2.7mm long, av. 1.9mm. Av. barbule length at mid-barb 2.6mm, at the barb tip 2.4mm. Prongs prominent at barbule base and tip, with short prongs and slightly swollen nodes at mid-barbule. Little pigment in barbules.	Four pronged nodes unevenly distributed, sometimes asymmetrical at node sites. Av. no. of node/ prong sites along barbules at barb base 30, at mid-barb 33, 28 at barb tip. At mid-barb, barbule base nodes/ prongs reached 0.02mm long x 0.01mm across. Internodal space 0.06mm, and barbule width 0.006mm across (see Table 2.2).
Order Falconiformes N.Z. Falcon - *Falco novaeseelandiae* OR.004799 Mid-down analysed	Cream belly feather with central vertical brown line. Measured 4.5cm long x 2.5cm across, 2cm was down.	Small pigmented nodes all along barbules, sometimes with small prongs.	Bare barbules at barb tips. Downy barbs 2-3.5cm long. Av. barbule length at barb base 2.9mm, at mid-barb 2.1mm, and barb tip 1.8mm. Small nodes with little pigment in or just before node site all along barbules at barb base. At mid-barb and barb tip small pronged nodes along barbules.	Average number of node/ prong sites along barbules at barb base was 35, 42 node/ prong sites at mid-barb, at barb tip 36. Node shapes trapezoid or hexagonal. At mid-barb and barbule base, av. pronged node length 0.012mm long x 0.009mm across. Internodal space was 0.05mm, and barbule width 0.0055mm across (see Table 2.2).
Order Gruiformes Western weka - *Gallirallus australis* OR.021889 Mid-down analysed	Black back feather with brown tip. Feather measured 8cm long x 2.5cm across, 5cm was down. Dark brown pennaceous barbs at feather tip.	Heavy pigmentation along barbules, particularly just before end of pronged node sites.	Black downy barbs 2-2.5cm long. Short barbules at barb base on av. 1.8mm long, at mid-barb 1.7mm, barb tip 1.4-1.5mm. Dark barbules with small pronged nodes lacking pigment in and after prongs. Barbules wide at barb tip and node sites. Pronged nodes longer in barbules at barb tip.	Dark pronged nodes at heavily pigmented intervals, with little-med pigment after prongs. Av. no. nodes along barbules at barb base 26, at mid-barb 38, barb tip 32. Nodes at barb and barbule base 0.04mm long x 0.01mm across at the widest point (see Table 2.2). Av. area with reduced pigment 0.006mm. At barb base, pronged nodes longer and darker at barbule tip, prongs 0.01mm long.
Order Charadriiformes Southern black-backed gull - *Larus dominicanus* OR.013100/2 Feather base analysed	White belly feather measured 5.5cm long x 4.5cm wide, 2cm was down. Down consisted of 1cm of light grey barbs at feather base, then white downy barbs and barbules.	Short barbules. Down at feather and barb base had large dark triangular nodes at the base of barbules only.	Downy barbs light grey and short. Barbules at barb base short-med length, curved, and shorter and straighter towards the middle and tip of the barb. Barbule length varied, at barb base it reached 1.0mm long, at mid-barb and barb tip 0.5mm. At barb base and mid-barb, large pigmented nodes in the lower section of barbules.	Barbules had c.4 large dark triangular nodes at the base that abruptly decreased in size to globule-like nodes. Node extremities lacked pigment. Av. no. nodes on barbules at barb base 12, at mid-barb and barb tip 10. At barb and barbule base, nodes 0.01mm long x 0.01mm across. Internodal space between 0.01-0.06mm after 4 nodes. Barbule width c.0.004mm across (Table 2.2).

Order Columbiformes N.Z. pigeon, kererū - *Hemiphaga novaeseelandiae* OR.011559/2 Upper mid-down analysed	White belly feather measured 6cm long x 4cm wide, 4cm was down. Down was dense, with long and light grey at mid-down, and white at the feather base.	At the barbule base 6-14 large crocus-shaped nodes, then nodes abruptly decreased in size, then gradually decreased along barbule to tip where nodes were minute.	Barbs light grey and med-length. Barbules very long and whip-like at ends, decreasing in length at barb tip. At barb base and mid-barb, barbules longer than 3mm, at least 2mm at barb tips. At barb and barbule base, large crocus–shaped nodes abruptly decreased in size to minute nodes at barbule tip. Little or no pigment in barbules.	Barb base had 11-14 large crocus-shaped nodes at barbule base, at mid-barb c.8 smaller nodes, at barb tip c.6 small nodes at barbule base. The av. no. of nodes on barbules at barb base was 49, at mid-barb 41, barb tip 31. At barb and barbule base crocus-shaped nodes measured 0.01mm long x 0.02 wide (Table 2.2). Internodal space ranged 0.05mm-0.1mm. Barbule width 0.004mm.
Order Psittaciformes North Island kākā - *Nestor meridionalis septentrionalis* OR.028918 Mid-down analysed	Red-tipped belly feather had a white shaft and grey down. Pennaceous barbs at the feather tip were red with black at the ends. Feather had a downy after-shaft. Measured 5cm long x 3cm across, 2cm was down.	Pigmented gumnut-shaped nodes at barb and barbule base. Nodes gradually developed into hexagonal or trapezoid-shaped nodes along rest of barbules.	From mid-down, barbs 2cm long, white at base and dark grey at tips. Av. barbule length at barb base was 2.4mm, at mid-barb 2.5mm, and barb tip 1.96mm. Barbules at barb base had dark segmented nodes at the base, then trapezoid or hexagonal-shaped nodes along rest of barbule.	Average number of nodes along barbules at barb base was 40, at mid-barb 47, and at barb tip 50. The segmented gumnut-shaped nodes at the barb and barbule base measured on average 0.011mm long x 0.014mm across. Internodal space was 0.046mm, barbule width 0.004mm across (Table 2.2).
Order Cuculiformes Long-tailed cuckoo - *Eudynamys taitensis* OR.021805 Mid-down analysed	White belly feather with brown vertical line down centre. Measured 3.5cm long x 3.5cm across, 1cm was down. Feather down was whitish and light grey.	Long bell-shaped nodes with pigment in basal (thinner) region. Nodes along barbules gradually decreasing in size towards barb tip where nodes were absent.	Downy barbs c.1.5cm long, light grey or white. Long thin barbules at the barb base averaged 2.5mm, at mid-barb 1.85mm, and barb tip 1.5mm. Long bell-shaped nodes along most barbules at barb base and mid-barb, the barb tip lacked nodes. Some barbules twisted/ kinked between nodes.	Barbules at the barb base had 5-8 med-large segmented trapezoid-shaped nodes at base and long bell-shaped nodes after. Pigment in basal area of nodes. The av. no. of nodes along barbules at barb base was 41, mid-barb 37, and barb tip 27. At barb and barbule base, av. node size was 0.008mm long x 0.098mm across, internodal space 0.05mm, barbule width 0.003mm (Table 2.2).
Order Strigiformes Morepork - *Ninox novaeseelandiae* OR.010279 Mid-down analysed	Cream, light brown, and medium brown mottled belly feather. Very downy and soft. Shaft is white, down is grey to dark grey. Feather 2.5cm long x 4cm wide across, 2cm was down.	Pigmented globule-shaped nodes all along barbules. Long whip-like barbules.	Barbs up to 3cm long, grey at base, tips light brown/ cream. Barbules abruptly shorter at barb tip and lacked nodes. At barb base, av. barbule length over 3mm, at mid-barb 2.5mm, at barb tip 2.2mm. At mid-barb, dark nodes along barbules, trapezoid-shaped at barbule base then globular nodes mid-barbule. Pronged nodes at barbule tip.	At mid-barb, 6-8 large dark trapezoid-shaped nodes at barbule base, at mid-barbule dark globular nodes. The av. no. of nodes on barbules at barb base was 44, at mid-barb 41, and barb tip 38. At mid-barb and barbule, pigmented globular nodes were 0.025mm long x 0.006mm wide (Table 2.2), internodal space 0.03mm, barbule width 0.003mm across.
Order Apodiformes White throated needletail - *Hirundapus caudactus* OR.000489 Mid-down analysed	Small light brown back feathers. Dense down light brown/ grey/ white. Barbs short to med in length. Longer towards tip of feather.	Short ribbon-like barbules, pigmented and with minute and indistinguishable nodes with prongs.	Barbs short-med length, longer at tip. Barbules short with indistinct nodes, some with minute prongs at barbule base. At barb base, av. barbule length 0.9mm, at mid-barb and barb tip 0.7mm. Little-med pigment in barbules, reduced at tip.	At barb base the av. no. nodes on barbules was 10, At mid-barb 16, at barb tip 10. At barb and barbule base the av. prong length was 0.005mm. Internodal space was 0.03mm, and barbule width 0.003mm, barbules very thin, short, and spindly towards tip (Table 2.2).
Order Coraciiformes Sacred kingfisher, kōtare - *Todiramphus sanctus vagans* OR.009878 Mid-down analysed	Cream belly feather 4cm long x 2cm wide, 2cm was down. Down grey with a distinct line at pennaceous barbs which were cream.	Pigmented trapezoid-shaped nodes along medium length barbules.	Downy barbs 1.5cm long. Light grey barbules. At barb base av. barbule length 1.5mm, mid-barb 1.4mm, barb tip 1mm. Dark trapezoid-shaped nodes along mostly kinked barbules.	Trapezoid-shaped nodes varied little in size. At barb and barbule base some nodes had small prongs. At barb base av. no. of nodes was 40, at mid-barb 35, barb tip 30. Average node size at barb and barbule base was 0.01mm long x 0.01mm wide; internodal space 0.037mm, and barbule width 0.004mm across (Table 2.2).
Order Passeriformes Tūī - *Prosthemadera novaeseelandiae* OR.011140 Mid-down analysed	Black belly feather measured 5.5cm long x 3cm across, 3.5cm was down. Down dense and dark grey. Tip of feather had brownish grey pennaceous barbs.	Medium length barbules. Pigmented hexagonal-shaped nodes at barb and barbule base, with trapezoid nodes along rest of barbules. Villi (cilia) at base of some barbules.	Barbs c.1.5cm long. Barbules at barb base measured 2.4-2.5mm, at mid-barb 2.3mm, at barb tip 1.4-1.7mm and declined in density. Dark nodes along barbules, except at barb and barbule base. Villi at barb and barbule base with multiple knobs.	At mid-barb nodes heavily pigmented, hexagonal-shaped (Table 2.2) at barbule base, then trapezoid-shaped for rest of barbule. Some with minute transparent prongs. Av. no. of nodes along barbules at barb base 77, at mid-barb 65, at barb tip 52. At mid-barb and barbule, nodes 0.01mm long x 0.01mm across. Internodal space between 0.017-0.02mm, and barbule 0.003mm wide.

Two viable loose moa feathers were studied and temporarily prepared on glass microscope slides, one labelled S.44046/1 was the focus of moa feather analysis in 2015. Presumed to be an upland moa body feather, it had not been positively verified. The box (Te Papa S.44046) label indicated the moa feathers were collected from Waikaia, central Otago. Upland moa fossil remains have been found in late Pleistocene (2.588mya - 11,700ya) and Holocene (11,700ya - present) sites and middens (Worthy, 2010f, p. 13). Natural distribution was South Island only and were common in subalpine zones especially north-west Nelson, Fiordland, and Otago, where fossil sites are available; and rare in eastern and lowland areas (Worthy, 1988, 1989; Worthy, 2010f, 13).

For the feather S.044046/1, damage was noted in the down, and the barbs and barbules were covered in debris, with some broken, missing or bent structures. Identified as a body feather, it was small and measured 3.5cm long x 1cm across (Tables 2.2 & 2.3). The feather was light-medium brown, the down dense and light brown, with similar features to brown kiwi (*Apteryx* spp.) feathers. The shaft was medium-dark brown. The down measured 1.5cm of the feather, and was present from the middle of the shaft. Downy barbs were long, thick, light brown and silky. The barbs were pinetree-shaped, and downy barbules were lacking towards the barb tips. Pennaceous barbs lacked hooks or barbules, and were long, thick and sparse (hair-like), and dark brown at the base and lighter towards the tip.

At the feather base, the downy barbules were short-medium length measuring 1mm-1.3mm. The barbules were straight, light-medium pigment, wide at the barbule base tapering in width at the barbule tips, with barbule width ranging from 0.008-0.004mm across. The barbule tips had single, double, or two pairs of prongs (4 total) at the ends. The base of most barbules were flat and ribbon-like, transforming to round, smooth, straight, and hair-like. The barbules were short at the barb base, dense and longer at mid-barb and abruptly shortened at the barb tip. Barbules at the barb base had small prongs, were scale-like, with brown pigment along barbules in the internodal areas, with little-medium pigment in nodes, and no pigment in prongs.

Most node sites had four (two pairs) prongs, some asymmetrical, with one pair shorter than the adjacent pair. Prong length, which included the entire node site and protruding appendages (prongs) ranged between 0.012-0.025mm long. Prong sites along the barbule were evenly distributed and closely spaced, with internodal space ranging from 0.03-0.04mm. The longer prongs slightly curved outward. Prongs at mid-barb near the barbule tip exhibited increased asymmetry (Table 2.2). The nodes were scale-like at very base of the barb, with prong length increasing towards mid-barbule and barbule tip.

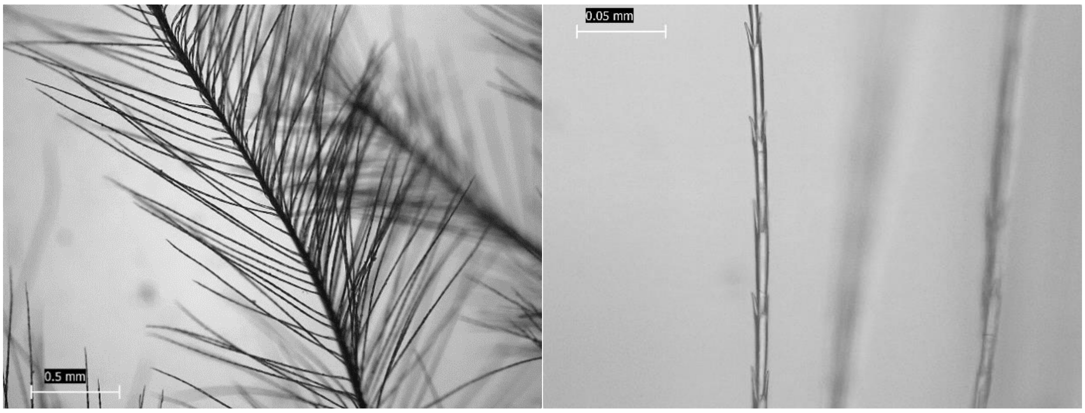


***Figure 2.3*. Photomicrograph of moa feather at mid-down, mid-barb and barbule tip at 400x magnification. Te Papa S.045488/1. Image by Hokimate Harwood, 2016.**

For comparative purposes another viable moa feather sample labelled Te Papa S.045488/1 (from Te Papa fossil vertebrates box S.045488) was analysed in 2016 and showed slight variations from the Te Papa S.044046/1 moa feather in colouration, measurements, and prong distribution (see Fig. 2.3 & Table 2.2). The S.045488/1 feather sample was in better condition than the Te Papa S.044046/1 feather indicating that microscopic studies on a larger feather sample would be required to better gauge microscopic order and species-specific features. At present, several DNA studies from archaeological findings have demonstrated more robust identification techniques (Baker, Huynen, Haddrath, Millar, & Lambert, 2007; Haddrath & Baker, 2001).

2.3.2 Order Casuariiformes - Brown kiwi

The New Zealand order of Casurariifromes include the family Apterygidae, kiwi and sister taxon cassowaries and emus. Kiwi incorporate North Island brown kiwi (*Apteryx mantelli*), Ōkarito brown kiwi (*A. rowi*), South Island brown kiwi (*Apteryx australis australis*), Stewart Island brown kiwi (*A. australis lawryi*), great spotted kiwi (*A. haastii*) and little spotted kiwi (*A. owenii*) (Worthy, 2010d). *Apteryx mantelli* was elevated to species rank due to the marked differences in plumage (Worthy, 2010d, p. 20). Originally recorded throughout the North Island, it is now restricted to Northland, Taranaki, Ruapehu, King Country, Hawke’s Bay, Te Urewera and Coromandel, where mtDNA studies revealed a high degree of genetic variation in remnant populations (Worthy, 2010d). *A. Mantelli* has a greyish head, and back that is dark reddish brown streaked with black, and greyish brown downy feathers on the underside (ventral area) (Marchant & Higgins, 1990a).

For this study a brown back feather was removed from a North Island brown kiwi (*A. mantelli*) specimen in the Te Papa Museum bird collection (Te Papa OR.012851). Records showed it was collected in 1966 in the Minginui Forest, Whirinaki. The feather down was analysed at the feather base in 2015. The back feather measured 4cm long x 1.5cm across, and the down reached 1.5cm up from the feather base. The feather shaft was dark brown, the down medium-dark brown, the pennaceous barbs dark brown and black at tips. The down was dense, and pennaceous barbs lacked defined barbules. The downy barbs were medium-long and dark brown, and downy barbules short and thick at the barb base, longer in the middle and short and lacking at the barb tips. The barbules were pointed, straight and hair-like with prongs visible at low magnification. Four (two pairs) prongs varying in length were present at each node site, and pairs were uneven in length (asymmetric) at times, and barbules appeared scale-like when prong length was reduced (Table 2.2). Prongs were evenly distributed, and size gradually increased at mid-barb. Little or no prongs were recorded at the barb tip, barbule base, with some pigment instead at node sites.

Barbule length was measured at the barb base as 1.41mm, mid-barb 1.5mm, and barb tip 1.28mm (Table 2.3). At the barb base, barbules were thinner at the barbule base, gradually thickening with longer prongs towards the barbule tip. The number of pronged nodes along barbules at the barb base averaged 18, where barbules were short-medium length and wide. At mid-barb the average number of 27 prong sites appeared along thinner and longer barbules. At the barb tip 25 nodes were counted along thin barbules. Comparative analyses of prong length at node sites at the barb base and barbule tip measured 0.019mm long; at mid-barb and barbule tip 0.0018mm, and at the barb and barbule tip 0.027mm (see Table 2.2).

Similar microscopic feather examinations of North Island brown kiwi (*A. mantelli*) also found the barbs were long and filamentous, barbules were medium-long, hair-like with little pigment, and two short-medium pairs of asymmetrical pronged nodes distributed along barbules (Harwood, 2011, p. 136). Chandler (1916) categorised his work on ratites based on the organisation of orders that included the Struthioniformes (ostriches), Rheiformes (rheas), Casuariiformes (cassowaries), and Apterygiformes (kiwi). Kiwi and cassowaries are now classed under the same order Casuariiformes and divided into families. In this study, the kiwi skins had small lateral apteria (bare skin), and plumage showed similar plumules and filoplumes, and functionless wing and tail feathers (Chandler, 1916). Chandler (1916) measured a large body feather of a great spotted kiwi (*A. haastii*) reaching 10cm long x 3cm at the widest point, straightened downy barbs were 14cm long and pennaceous barbs 9-10cm (p. 294). In the well-developed downy section, barbules reached 2-3mm in length, with 25-35 pronged node sites per mm, and measuring 0.008mm across, the barbules were smooth and filamentous in barbs at the feather base, whereas the shorter barbules in barbs moving up the feather had distinct nodes and minute prongs (Chandler, 1916, p. 294).

2.3.3 Order Galliformes - Pheasant

The introduced common pheasant (*Phasianus colchicus*) in the order Galliformes is located in the subclass Neognathae, classified as game birds and allies. In New Zealand the family Phasianidae includes introduced partridges, quails, pheasants and turkeys, and more specifically the subfamily Phasianninae that incorporates chicken (including junglefowl, genus *Gallus*) and peafowl (*Pavo cristatus*) as well as the extinct native New Zealand quail (*Coturnix novaezelandiae*) (Scofield & Worthy, 2010). Originally from Asia, pheasants were introduced to New Zealand from Europe and America repeatedly from 1842 onwards as gamefowl (Long, 1981). Now common in the North Island, the New Zealand stock is derived from several interbreeding subspecies, probably ring-necked pheasant (*Phasianus c. torquatus*) and southern Caucasus (black-necked pheasant: *Phasianus c. colchicus*) (Scofield & Worthy, 2010). Male body feathers are characteristically variable, multi-coloured, iridescent, and patterned (Heather & Robertson, 1996).

A brown belly feather from a male common pheasant in the Te Papa bird skins collection was collected and prepared on a temporary microscope slide and labelled (Te Papa OR.017021/1). The feather measured 6cm long x 3cm across, and 4cm of the feather comprised of down. The feather shaft was white, the down light grey/ brown, with white barbs at the base. The middle section of the downy barbs was analysed in 2015 (see Tables 2.2 & 2.3).

The downy barbules were long to very long, thin and generally straight, gradually decreasing in length towards the barb tip. Barbules at the base of the barb were generally longer than 3mm. The average number of nodes on barbules at the barb base was 76, at mid-barb 40 nodes, and barb tip 47 nodes. The barbules were flat at the very base with nodes all along the barbule, with little to medium pigment observed in barbules. Diagnostic features were present at the barb base, towards the middle of distal barbules (pointing toward the feather tip), and observed as multiple mobile ring-shaped nodes that detached from the node site and moved along the barbule (Table 2.2) (Brom, 1986, 1991; Chandler, 1916; Day, 1966). The barb base and distal barbule base had 6-8 med-large segmented trapezoid nodes, after these towards the mid-barbule, the nodes appeared small and disc-like (rings) or small and trapezoid. At the barb base and middle of the distal barbules, trapezoidal nodes measured on average 0.006mm long x 0.01mm across, and the ringed nodes 0.005mm long x 0.01mm across. At the barb base, mid-distal barbule, the internodal space between stationery nodes measured on average 0.05mm, and the barbule width 0.005mm across.

Similar microscopic studies of a domestic chicken (*Gallus gallus domesticus*) feather and a pheasant belly feather recorded longer barbules, more pigment, and considerably fewer ring-like nodes in the pheasant feather (Harwood, 2011, p. 136). Chandler's (1916) microscopic feather studies of the order Galliformes indicated the barbule length of some types of pheasant and turkey (*Meleagris*) feathers reached over 5mm long, with most Galliformes barbules around 3mm (p. 340). Chandler (1916) found that the ring-like nodes easily detached and bunched together to form multiple-node structures of 5-6 rings (p. 341). These rings were better developed in the middle of distal barbules at the base of barbs, but were still present, yet not as developed in proximal barbules, that pointed towards the feather base (Chandler, 1916).

Day (1966) examined wild and domestic Galliformes including chicken and to a lesser extent common pheasant and turkey in which the unique feature of the order were described as "multiple" ringed nodes located on a small set of closely set distal barbules near the base of the barb (p. 213). These multiple (ringed) nodes were built up by single nodes becoming loose and sliding along the internodes to the next node, where typically two or three, and up to four or five nodes collected at one point (Day, 1966). When identification was difficult, moving the coverslip back and forth loosened the nodes (Day, 1966, p. 213). Nodes outside this particular group were less swollen and non-distinct, and the barbules were 3-4mm long and pigmentation light (Day, 1966, p. 213). The wild species examined had multiple nodes and characteristic node shape, except in neck feathers, and domestic birds had less characteristic features, in that chickens had the node shape only, and turkey barbules lacked the multiple nodes and the characteristic nodal shape (Day, 1966, p. 213).

Brom (1986) examined 13 species in the order Galliformes including pheasant, partridges, quails, and grouse and determined each had very long barbules and pigmented nodes at the barbule base that developed into ring-like nodes (p. 189). The rings detached and moved along the barbules, until the barbule tip where they became underdeveloped again (Brom, 1986, p. 190). The larger birds had longer barbules and fewer numbers of nodes along barbules (Brom, 1986, p. 190). In Brom's (1986) study, common pheasant barbules ranged in length from 2.5-4.1mm and had 15-23 nodes per mm on barbules.

2.3.4 Order Anseriformes - Mallard

Anseriformes incorporate ducks, swans and geese, and includes the mallard (*Anas platyrhynchos*) that falls within the suborder Anseres, family Anatidae, subfamily Anatinae and tribe Anatini (Worthy, 2010b). Introduced to New Zealand for hunting from the United Kingdom (1865-1920s) and North America (1937) and reared extensively for release until the 1960s, mallards are now the most numerous and widespread waterfowl in New Zealand (Long, 1981; Robertson, Hyvönen, Fraser, & Pickard, 2007; Worthy, 2010b, p. 45). Males have an iridescent green head and neck, white collar, chestnut breast, speckled greyish brown body, blue upperwing coverts with black rump and undertail, and whitish tail (Marchant & Higgins, 1990b).

A white and brown speckled belly feather from a male mallard (Te Papa OR.013547) was collected and prepared on a temporary slide and labelled OR.013547/1 for analysis in 2015 (see Tables 2.2 & 2.3). The feather measured 6cm long x 2.5cm wide, 3cm was dense down. The shaft was light brown and white in the upper half. The down at the feather base was light grey/ brown. The mid-down region of the feather was analysed and comprised of white barbs and barbules. The downy barbs were of medium length, with very short barbules all along the barbs. The diagnostic features were the short barbules with large triangular nodes at the barbule tips at the barb base.

Seventeen node or prong sites were counted along barbules at the barb base, with between 2-5 large triangular nodes at the barbule tip, then 1-2 sets of prongs at the very end (tip). At mid-barb there were 17 node or prong sites, and c.3 less distinct triangular nodes followed by pronged nodes at the barbule tip. The barbules at the barb tip had on average 18 node or prong sites, and c.8 prongs in the upper section of the barbule towards the tip.

Measurements of the diagnostic features at the barb base, barbule tips, and large triangle-shaped nodes were made (Table 2.2). At the barb base, barbules measured on average 0.8mm in length. At the barb base and barbule tip the average size of the large triangular nodes measured 0.014mm long x 0.015mm wide. At the barb base and barbule tip, internodal space ranged between 0.02-0.04mm, with an average barbule width of 0.004mm across, both aspects decreased towards the barbule tip.

Previous descriptions of the downy barbules from the base of a mallard belly feather recorded 2-4 large triangular nodes at the barbule tips at the base of barbs, and that the barbules from mid-barb to barb tip typically had prongs along the barbules, with little or no pigment in the nodes and barbules (Harwood, 2011, p. 136). Chandler (1916), noted the downy barbules in this order rarely reached over 1mm, and were generally simple and threadlike with undeveloped nodes, except for the barbule tips at the base of barbs where 3-5 conspicuous expanded nodes were followed by a slender tip (p. 329). On the barb tips, the large nodes were reduced and replaced by pairs of prongs at the barbule tips (Chandler, 1916). Chandler (1916) also observed that the number of nodes differed between species, where *Anas* (e.g. mallards/ ducks) had 2-3 nodes, *Marcea* (e.g. wigeons) 3-5 nodes, and *Mergus* (e.g. merganser) 2-4 nodes. In *Branta* (e.g. geese) the nodes were smaller and numbered 4-6, and *Olor* (e.g. swans) had even smaller widely distributed nodes (Chandler, 1916, p. 329).

Similarly, Day (1966) examined domestic duck, goose, and red-breasted merganser (*Mergus serrator*) and suggested this bird order was the easiest to identify. The order was recognised by the distinct heart-shaped nodes at the barbule tips of basal barbs, and the slight kinking or bending of the internodes that were characteristic of most Anseriformes (Day, 1966, p. 214). The length of the barbules measured 1.5mm-2mm and pigmentation in the nodes varied in density between species (Day, 1966). Brom (1986) detailed 38 species of Anseriformes, including ducks, shelducks, mergansers, swan, geese, wigeon, and teal. The most common species traits were short, threadlike and kinked barbules, and underdeveloped nodes except for large segmented triangular (heart-shaped) nodes at the barbule tip (Brom, 1986, p. 186). The number of nodes and distribution of pigment in the nodes varied between species and feathers on the same bird (Brom, 1986). Mallard barbules ranged between 0.7-2.0mm, and had one of the lowest numbers of diagnostic nodes at the barbule tips, after that the shelducks (*Tadorna*), then geese, and swans had the most amount of nodes on barbules (Brom, 1986, p. 187).

Dove and Agreda (2007) found that Anseriformes had triangle-shaped expanded nodes on most proximal barbules. Quantitative statistical analyses recorded the number of expanded nodes per barbule, maximum node width, distance between nodes and barbule length that highlighted distinctions between dabbling and diving duck down (Dove & Agreda, 2007). Variations in Anseriformes feather morphology were also noted by Harshman (1996), Heacker-Skeans (2002), and Horton (1990).

2.3.5 Order Podicipediformes - New Zealand Dabchick

Podicipediformes incorporate the aquatic grebes, in New Zealand this includes the family Podicipedidae, and endemic New Zealand dabchick (*Poliocephalus rufopectus*). In the North Island they are located along coastal and sand-dune areas, lakes, and dams from North Cape (Otou) to lower Waikato; southern Taranaki to Paraparaumu; the volcanic plateau to Lakes Rotopounamu and Rotoaira; and Gisborne, Hawke's Bay and Wairarapa (Worthy, 2010i, p. 50). The species is considered extinct in the South Island (Worthy, 2010i). New Zealand dabchicks are closely related to the Australian hoary-headed grebe (*Poliocephalus poliocephalus*), but both differ in behaviour and morphology from the "true" dabchicks or little grebes (*Tachybaptus*) (Worthy, 2010i). Head and back feathers are dark grey/ silver, the front is pale, and in breeding birds it is rufous red (Heather & Robertson, 1996).

A black side belly feather from a New Zealand dabchick (Te Papa OR.016431) in the Te Papa bird collection was removed and analysed in 2015 (Tables 2.2 & 2.3). It measured 4cm long x 2.5cm across, 1.5cm was down. The shaft was black with grey down at the feather base, and white barbs near the top of the down. Pennaceous and downy barbs were sparse. The middle section of down was analysed. The downy barbs were grey and the barbules light grey-white. The barbs were med-long, with longer downy barbules at the barb base, and slightly shorter barbules at the barb tip. The diagnostic features were the short barbules, and conspicuous prongs along barbules (Table 2.2). The average barbule length at the barb base was 0.7mm long, at mid-barb 1.26mm, and barb tip 1.3mm.

Thin downy barbules at the feather base and barb base had pigmented nodes along the length. Otherwise little to no pigment in barbules except where small nodes replaced prongs. Barbs towards the middle of the down had more prongs than nodes along barbules, with 2-4 asymmetrical prongs per node site. At the barb base an average of 20 node/ prong sites were counted along barbules. At mid-barb, 25 node/ prongs sites were counted along barbules, in which 22 distinctive nodes appeared at tips. At the barb tip, an average of 22 node/ prong sites were recorded along barbules, c.7 nodes were replaced with prongs that appeared mid-way along barbules towards the tip. The average prong length at node sites at the barb base and barbule tip was 0.033mm; at mid-barb and barbule tip 0.029mm; and barb and barbule tip 0.028mm.

Chandler (1916) studied the feathers of loons and grebes in this order and noted that the down of loons (Gaviidae) resembled that of penguins, having very short barbules (usually under 0.5mm) with well-developed prongs. In grebes, the down was considerably longer, usually over 1mm long, with often slightly developed prongs indicating differentiation within the same order, in that loons showed more similarities with penguins and Procellariiformes (e.g. petrels, allbatrosses) than grebes (Chandler, 1916, p. 301). The breast feathers of the western grebe (*Aechmorphus occidentalis*) were very dense, the barbs set far apart on the shaft (13 per cm), and at a wide angle, and barbules set 20 per mm apart on each side of the barb (Chandler, 1916). The barbules were c.0.75mm long and flattened for half the length, then filamentous when the flattened portion spiralled (Chandler, 1916, p. 301). Brom (1986) studied five species of grebes and found the prongs were always present at the barbule tips (p. 84). The barbule length in grebes varied and ranged between 0.7mm to 1.3mm (Brom, 1986, p. 185).

2.3.6 Order Sphenisciformes - Little penguin

The little penguin or kororā (*Eudyptula minor*) was selected for analysis in the Sphenisciformes order and family Spheniscidae. Little penguins are found in southern Australia, Tasmania, and in the New Zealand region, on North and South Island coasts; Stewart Island (Rakiura) and Chatham Islands (Rēkohu) (Tennyson, 2010e, p. 62). Little penguin feathers are waxy and dark iridescent blue on upperparts of birds, under parts are white.

A small white belly feather was removed from a little penguin museum specimen (Te Papa OR.009144) in 2015. The feather measured 2.5cm long x 2.5cm across, 0.5cm was white down. Barbs were removed from the middle of the down, and labelled OR.009144/2 for analyses (Tables 2.2 & 2.3). The barbs were medium-long, and barbules short. Average barbule length at the barb base and mid-barb measured 0.6m; and at the barb tip 0.5mm. Barbules at the barb base had long prongs towards the base of barbules, the longer prongs faced outward. Typically, two pairs of prongs were present at node sites. Barbules, or prong/ node sites lacked pigment until its appearance at the barb tip. Prongs were evenly distributed.

Barbules at the mid-barb and barb tip had prongs toward the barbule tip, closely spaced and longer towards the tip (Table 2.2). Prongs at the barb and barbule tip were very long and spindly. At the barb base and mid-barb c.9 prong/ node sites were counted along barbules, and 7 at the barb tip. On average, the prong length at the barb and barbule base was 0.038mm; barb base and mid-barbule 0.04mm; barb base and barbule tip 0.035mm long. Average prong lengths at mid-barb and barbule base measured 0.036mm; and mid-barb and barbule tip 0.04mm long. Average prong lengths along barbules at the barb tip measured 0.043mm long.

A relevant historical study of the microscopic feather characteristics in this order described the feather down of a king penguin (*Aptenodytes pennanti*) (Chandler, 1916, p. 297). King penguin feathers were distinct from any other bird in this group in that the shaft was wide and flat, and the downy barbules were dense and very short, usually no longer than 0.8mm long (Chandler, 1916). The barbules were filamentous basally, with comparatively long and conspicuous prongs towards the tip (Chandler, 1916). Chandler (1916) summarised this order had uniformly distributed feathers, and that the broad flattened form of the shaft and general scale-like appearance of the feathers was specific to this group of birds (p. 298).

2.3.7 Order Procellariiformes - Gibson's albatross

The Gibson's albatross (*Diomedea antipodensis gibsoni*), a subspecies of the Antipodean albatross (*D. antipodensis*) in the order Procellariiformes, is one of the largest bird orders in New Zealand. The order is divided into families: Procellariidae of fulmars, petrels, prions and shearwaters; Hydrobatidae of storm petrels; Pelecanoididae of diving petrels; and Diomedeidae the albatrosses (Tennyson, 2010d). Gibson's albatrosses breed on the Auckland Islands, and local movement ranges from the Tasman Sea waters off mainland New Zealand, occasionally south-west Australia and south-west Pacific waters (Tennyson, 2010d, p. 67). Plumage is variable depending on age, sex, and subspecies allocation, and generally they are large seabirds with darker dorsal plumage particularly upperwings.

A white flank feather was removed from a Gibson's albatross Te Papa specimen (OR.012639) and analysed in 2015 (see Tables 2.2 & 2.3). The flank feather was long and curved, mostly white with white down, barbs and barbules. The feather tip had light brown-grey speckling. The feather measured 18.5cm long x 4cm across, 4cm was down. Analysis conducted from the middle of the down revealed short barbules all along the barbs, an average barbule length of 0.8mm at the barb base, and 0.66mm at mid-barb and barb tip. Around 2cm up from the feather base at the very base of the downy barbs, pennaceous barbules with hooklets were imaged (Fig. 2.4). The barbs were long and straight with prongs along most of the barbules, at the base of the barb the prongs appeared longer at the barbule base and gradually decreased in size. Prong pairs were sometimes asymmetrical, and the barbules had no or little pigment.

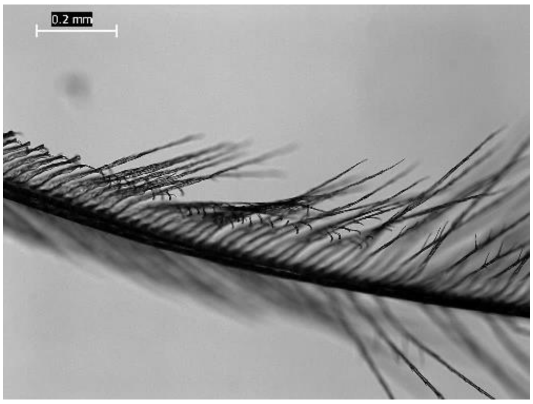


***Figure 2.4*. Photomicrograph of Gibson's albatross (*Diomedea antipodensis gibsoni*) white flank feather, mid-down sampled, at barb base showing pennaceous-like barbules. 100x magnification. Te Papa OR.012639. Image by Hokimate Harwood, 2015.**

Prongs at the base of barbules appeared longer at mid-barb than at the barb base, particularly at the barbule base where prongs were very long and outward curved. Prong length varied considerably, and the longest prongs measured 0.076mm with two pairs of prongs per node site. At the barb base and barbule tip, the average prong length averaged 0.012mm in length. At mid-barb and barbule base, the longer prongs averaged around 0.05mm long. At mid-barb and barbule prong length averaged 0.035mm long, gradually decreasing towards the barbule tip (Table 2.2). At mid-barb and barbule tip 0.017mm long prongs were measured near the barbule tip. At the barb tip and barbule base average prong length was 0.05mm long. At the barb and barbule tip the prong length at the very tip was 0.012mm on average.

Barbules at the barb base had an average of 15 prong sites along barbules. With a more abrupt decrease in prong length at mid-barbule, longer at barbule base, shorter at barbule tip. Barbules at mid-barb had an average of 12 prong sites along barbules. Barbules at the barb tip had an average of 10 prong sites along barbules. Prongs were consistently present and decreased gradually in length along the barbule to the tip.

In a similar study, a Gibson's albatross underwing feather had short barbules that slightly increased from the barb base to the barb tip, with little or no pigment in barbules, and paired prongs that reduced in length towards barbule tips (Harwood, 2011, p. 136). Chandler (1916) studied wandering albatross (*Diomedea exulans*) and sooty shearwater (*Puffinus griseus*) feathers and noted the downy barbules reached 1mm, but were generally less, and both species had long forward-curving prongs, that were slender and cilia-like and at times reached 0.04mm long decreasing in size towards the barbule tip (p. 305). The petrels had shorter, less developed prongs and were more uniform along shorter barbules often reaching 0.8-0.9mm long (Chandler, 1916, p. 306). Pigmentation was also more apparent in petrels, with generally even distribution in the barbules (Chandler, 1916). Brom (1986) examined the feathers of five species (mainly petrels) in this order, and recorded that the barbules were short and the different species displayed varying degrees of well-developed prongs, and generally unpigmented internodes with barbule lengths ranging from 0.5-1.1mm, and averaging 22-29 nodes per barbule (p. 185).

2.3.8 Order Phaethontiformes - Red-tailed tropic bird

A red-tailed tropic bird or amokura (*Phaethon rubricauda*) feather was studied in the Phaethontiformes order, family Phaethontidae. This species is a vagrant, and breeds on islands in the tropical Indian and Pacific Oceans including Lord Howe, Norfolk, and Kermadec Islands (Tennyson, 2010c, p. 136). There are approximately 30 records on the mainland, mainly in the north of the North Island, but also scattered in mainly coastal areas (Tennyson, 2010c). The only other species seen in New Zealand from this order, the white-tailed tropicbird (*Phaethon* *lepturus dorotheae*) is also a vagrant. Amokura are white birds with some black colouring on the back (dorsal) or upperwing regions and distinctive red streamer-like tails.

A white belly feather was removed from a red-tailed tropicbird specimen (Te Papa OR.002732) from the Te Papa bird skin collection and analysed in 2015 (Tables 2.2 & 2.3). The belly feather had a yellow-orange tinge and measured 5.5cm long x 3.5cm across, 1cm was down. At 0.5cm from the base of the feather, the downy barbs had hooklet-like barbules at the base of barbs, like the studied Gibson’s albatross feather (Fig. 2.4). The middle of the down had white short-medium barbs with white, short, and straight barbules. On most barbs, the prongs were located in the lower section of barbules and gradually increased in length towards the barbule tip. The barbs had fewer and shorter barbules towards the barb tip. The prongs were short-medium in length and widely distributed along barbules (Table 2.2). At the barb base, the average barbule length was 0.64mm long, at mid-barb 0.77mm, and barb tip 0.74mm. The barbules had no or little pigment, including in the nodes. The average number of prong/ node sites along barbules at the barb base was 13, at mid-barb 15, at the barb tip 14. Barbules generally had 1-2 small indistinct nodes at the barbule base, with prong/ node sites all along the barbules until the barbule tip.

At the barb and barbule base, the average prong length reached 0.01mm long, at mid-barbule 0.012mm, and barbule tip 0.015mm. At mid-barb, the average prong length at the barbule base was 0.013mm, 0.019mm at mid-barbule, and 0.02mm at the barbule tip. At mid-barb the barbule tips had single pointed or double prongs. At the barb tip and barbule base, prong lengths averaged 0.018mm long, at mid-barbule 0.015mm, and 0.017mm at the barbule tip.

In previous studies, Chandler (1916) documented the feather characteristics of *Phaethon rubricauda*, finding that the downy barbules were smooth and filamentous, and of moderate length, with few measuring over 1mm long (p. 318). Brom (1986) studied the red-billed tropic bird (*Phaethon aethereus*) and noted that the barbules measured 0.6mm-1mm long, that the barbules lacked pigment and had short prongs along the length of barbules, with 21-25 prongs per mm (p. 185).

2.3.9 Order Pelecaniformes - Australasian gannet

The Australasian gannet or tākapu (*Morus serrator*) was selected for study from the order Pelecaniformes and family Sulidae of gannets and boobies. The order also includes the families Pelecanidae (pelicans), Phalacrocoracidae (cormorants and shags), Anhingidae (darters) and Fregatidae (frigatebirds) (Tennyson, 2010b). In New Zealand tākapu breed on outlying islands, and Cape Kidnapper and Muriwai are the only North Island mainland colonies (Tennyson, 2010b, p. 140). Tākapu are described as white birds with off-yellow colouring around the head, and black feather edging around the upperwings and black in amongst the tail feathers.

A white belly feather was collected from an Australasian gannet specimen (Te Papa OR.008451) in 2015 for study, and a barb sample from the base of the feather was analysed and labelled OR.008451/2 (see Tables 2.2 & 2.3). Described as a white belly feather with yellowish tinge at the feather tip, the down formed a V shape at the feather base, with pennaceous barbules (hooklets) at the base of barbs (like Gibson's albatross), with only plumulaceous barbules on the outer edge of barbs towards the end of the barbs only. The downy barbs and barbules were white, the barbs short-medium in length, and barbules very short and present all along barbs. The barbule tips looked tethered. Analysis of the down at the feather base indicated the barbules at the barb base had medium-long prongs along the entire length, and the barbules were very short. The average barbule length at the barb base was 0.38mm, at mid-barb 0.4mm, and at the barb tip 0.32mm. At the barb base and mid-barb the average number of prong sites per barbule was 9, and at the barb tip barbules averaged 7 prong sites.

Barbules at the barb base had long spindly prongs in pairs, not adjacent but close to each other, that wrapped around the barbule. Barbules were wide at the very base of the barb. The prongs towards the barbule base were medium-long, then very long in the middle before decreasing towards the barbule tip. Prongs were generally symmetrical, and not straight, and made imaging and measurements challenging. At the barb base, the very last prong site at the barbule tip was 0.03mm long. At the barb and barbule base, the first prong length varied between 0.04-0.08mm. Prong length generally increased towards mid-barbule 0.08-0.1mm, and then decreased towards the tip, measuring on average 0.03mm long. The tips of barbules typically had a single point or double prong.

Barbules at mid-barb were slightly longer than at the barb base, and had long sparse prongs (Table 2.2). Prongs were long and curved inward. Barbules at the barb tip had prongs from mid-way up the barbule. Prongs were long but shorter than at mid-barb. Barbules resembled hooklets, seen on the proximal side of barbules only. Barbules had little or no pigment.

In previous studies, Chandler (1916) looked at the family Sulidae, and found they differed from other families in this order due to the close distribution of very long pairs of prongs along slender filamentous barbules, where the prongs reached over 0.1mm on barbules that only measured 0.6-0.8mm long (p. 315). In contrast in the family Pelecanidae, a white American pelican (*Pelecanus erythrorhynchos*) feather had minute prongs at the barbule tips (Chandler, 1916, p. 315). An American darter bird (*Anhinga anhinga*) feather in the family Anhingidae had very long filamentous barbules, frequently measuring over 2mm long (Chandler, 1916, p. 315). Chandler (1916) also looked at feathers from a Brandt's cormorant (*Phalacrocorax penicillatus*) in the family Phalacrocoracidae and Ascension frigatebird (*Fregata aquila*) in the family Fregatidae and indicated that in both, the barbules were of moderate length, smooth and filamentous, except with minute prongs at the barbule tips in the cormorant.

Brom (1986) studied feathers of the Northern gannet (*Morus bassana*) where the barbules measured 0.5-1mm long, were unpigmented, and had many well-developed prongs along their entire length (p. 185). The prongs reached over 0.1mm, were slender, filamentous, and longer than the internodal spaces and appeared to overlap, or to lay over the proceeding prongs, except at the barbule tip where the length slightly decreased (Brom, 1986, p. 185). Brom (1986) also studied members of the Phalacrocoracidae family, including the great cormorant (*Phalacrocorax carbo*) which had 0.7-1.2mm long barbules, and European shag (*P. aristotelis*) with 0.6-1.2mm long barbules (p. 185). The barbules were generally not pigmented, with minute nodes usually at the tips of barbules, and sometimes along the entire barbule (Brom, 1986, p. 185). In the Pelecanidae family, the Australian pelican (*Pelecanus consipicillatus*) had barbules measuring 0.7-1.3mm long, and magnificent frigatebird (*Fregata magnificens*) in the Fregatidae family, measured 0.9-1.5mm (Brom, 1986, p. 185). The barbules were also described as lacking pigment with no conspicuous nodes, except minute prongs at the tips of barbules and sometimes along the barbule length (Brom, 1986).

2.3.10 Order Ciconiiformes - White heron

The white heron or kōtuku (*Ardea modesta*) was studied in the Ciconiiformes order and suborder Ardeae, which includes herons and bitterns in the family Ardeidae and subfamily Ardeinae. The other New Zealand family Threkiornithidae includes ibises and spoonbills (Scofield, 2010). In New Zealand, the only known current breeding place for kōtuku is Ōkarito, Westland, historically the species has been found scattered in midden and dune deposits throughout both islands (Scofield, 2010). Described as a tall white majestic bird with long plumes around the torso.

A white flank-side breast feather was removed from a white heron specimen (Te Papa OR.000977) and examined in 2015 (see Tables 2.2 & 2.3). The downy barbs were long, whip-like and dense, and the base of downy barbs had hooklet-like structures. A barb sample was analysed from the mid-down section of the feather. The barbules were long and thin and filamentous, averaging at the barb base 1mm, at mid-barb 1.8mm and barb tip 1.5mm long. Nodes appeared at small sites all along barbules. Pigmentation was absent or reduced in barbules and nodes, with no pigment in prongs. Large even spacing was observed between nodes along barbules at the barb base, mid-barb and barb tips; and at the barbule base and mid-barbule, prong sites were seen at short intervals towards the barbule tip with shorter and fewer prongs. Barbules appeared straight, at the barb tip, barbules had a slight bend and were whip-like at the barbule tip.

At the barb base, tiny prongs at node sites were recorded at the barbule tips. At mid-barb, nodes with prongs appeared at the barbule base and node sites were seen as larger and more distinct. On average at the mid-barb and barbule base, the pronged nodes measured 0.01mm long x 0.007mm across. Prongs were observed in two pairs, and very short (minute) in length (Table 2.2). Along the rest of the barbules, the nodes and prongs were minute and non-descript. At mid-barb and barbule base the average internodal space measured 0.06mm, and barbules were 0.004mm wide. The average number of node/ prongs sites along barbules at the barb base was 18, 24 at mid-barb, and 20 at the barb tip.

In a previous study by Chandler (1916), the great blue heron (*Ardea herodias*) in the suborder Ardeae, family Ardeidae and subfamily Ardeinae, had long downy barbules that were slender and filamentous measuring over 2mm, with slightly enlarged nodes and minute prongs at the barbule tips, and pigment uniformly distributed (p. 324). The American bittern (*Botaurus* *lentiginosus*) also in this family, was described as having dark grey down, and dark pigment along barbules, absent only at the nodes (Chandler, 1916, p. 324). The wood stork (*Mycteria americana*) in the family Ciconiidae had long, slender and filamentous downy barbules reaching over 2.5mm, with minute inconspicuous prongs, or lacking nodes altogether (Chandler, 1916, p. 320). In contrast, the suborder Threskionithes, family Threskiornithidae and subfamily Threskiornithinae, ibis (*Plegadis*) and spoonbill (*Platalea*) had downy barbules that were very stout and coarse, usually measuring under 1mm, and the internodal barbule spaces had ridges and grooves, and the nodes had well developed prongs (Chandler, 1916, p. 320).

Brom (1986) studied 13 species from the three families in this order and determined that microscopic feather differences between families were based on barbule length, pigment distribution, the presence of prongs, and the number of nodes per barbule (p. 185). In the Ciconiidae family, the barbule length for the black stork (*Ciconia nigra*) was 1.2-2.1mm, and white stork (*C. ciconia*) 1.3-2.5mm long (Brom, 1986, p. 186). The barbules were slender, filamentous and unpigmented, with small inconspicuous prongs (11-14 per mm) along the lengths of barbules. Birds in the family Ardeidae had downy barbules that were 1.1-3mm long, slender and filamentous with slightly enlarged nodes (Brom, 1986). Certain Ardeidae family members had unpigmented barbules, with minute prongs, namely the cattle egret (*Bubulucus ibis*) with 1.3-2.4mm long barbules; squacco heron (*Ardeola ralloides*) at 1.1-2.2mm; great white egret (*Egretta* [*Ardea*] *alba*) at 1.2-3mm; little egret (*E. garzetta*) at 1.1-1.9mm; and night heron (*Nycticorax nycticorax*) barbules were 1.2-2.1mm long (Brom, 1986, p. 186). For other members the pigmentation varied, and only minute prongs were apparent distally as in grey heron (*Ardea cinerea*) and purple heron (*A. purpurea*) that had 1.2-2.5mm long barbules; the great or Eurasian bittern (*Botaurus stellaris*) 1.3-2.0mm long; and little bittern (*Ixobrychus minutus*) barbules measured 1.6-2.1mm (Brom, 1986, p. 186). Threskiornithidae barbules were short and stout, coarse and unpigmented, with numerous well-developed prongs, and had 19-23 prong sets per mm in the Eurasian spoonbill (*Platalea leucorodia*), and 21-26 per mm in the glossy ibis (*Plegadis falcinellus*) (Brom, 1986, p. 186).

2.3.11 Order Accipitriformes - Swamp harrier

The swamp harrier or kāhu (*Circus approximans*) was selected for study in the order Accipitriformes. Located in the family Accipitridae it incorporates kites, eagles, hawks and allies. Found throughout most of Australasia, it is widely distributed across New Zealand after colonising the islands post human settlement (Worthy, 2010a, p. 171). The plumage is variable, generally the dorsal areas are brown-dark brown, the ventral side has either brown feathers, or cream feathers with a vertical central brown line. Underwings and tail feathers have pale colouring with brown barring.

For this research, a brown flank feather was removed for examination from a Te Papa swamp harrier specimen (OR.007086) in 2015 (see Tables 2.2 & 2.3). The pennaceous barbs were brown, the down light grey at very base, with white, then cream colouring towards the middle of the feather. The down was dense and downy barbs were very long, measuring 3-4cm at mid-down. Barbs sampled at mid-down were whitish with cream tips, and the downy barbules gradually decreased in length and disappeared towards the barb tips. Downy barbules at the barb base were very long, thin and whip-like, with a maximum length of 2.70mm, and averaged 1.9mm. Barbules were shorter at mid-barb, averaging 2.6mm long. Downy barbules at the very tips of barbs had no visual nodes or prongs and were sparse and measured 2.4mm long on average.

Generally, there were two pairs of prongs per node site. Barbules at the barb base had larger sometimes pronged nodes at the barbule base that abruptly decreased after 3-4 node sites along barbules. At the barb and barbule base, 1-2 larger nodes with short-medium asymmetrical prongs were sometimes attached. Minute prongs, and nodes without prongs, appeared by mid-barbule. At mid-barb, numerous long asymmetric pronged nodes were located at the barbule base (Table 2.2). The thin long filamentous barbules lacked pigment and tapered at the barbule tip to very thin ends. Small bulbous nodes developed at mid-barb and barbule. At mid-barb and barbule tip, pronged nodes re-appeared. Establishing prong/ node sites at the barb base was challenging as the nodes were indistinct and minute at the barbule tip, and numbered c.30. At mid-barb, barbules had on average 33 node/ prong sites, with 28 prongs/ nodes along barbules at the barb tip. At mid-barb, pronged nodes at the base of barbules were significantly larger, and prongs longer than at the barb base, with a gradual decrease in node/ prong size towards the barb tip.

The diagnostic feature of this order was the presence of asymmetrical prongs. In this study, regular asymmetry was observed in med-length node/ prong sites at mid-barb and barbule base, gradually decreasing in size where prongs were minute or not present towards the barbule tip. At the barbule base nodes/ prongs reached 0.02mm long x 0.01mm across. The internodal space measured on average 0.06mm, and the barbule width 0.006mm across. At the barb tip, asymmetric med-length prongs appeared randomly along the barbule. At the barb tip and barbule base the nodes/ prongs reached 0.02mm long x 0.01mm across. Internodal space was 0.06mm, and barbule width 0.006mm across. Where asymmetrical prongs were less common at the barb tip, node/ prong sites measured 0.016mm long x 0.01mm across. Internodal space was 0.06mm, and barbule width 0.006mm across. Prongs/ nodes at the barb and barbule tip measured 0.017mm long x 0.01mm across, the internodal space was 0.06mm, and barbule width 0.006mm across.

A similar microscopic study of a cream belly swamp harrier feather recorded two pairs of prongs at each node site, one pair asymmetrical, more so at the base and tips of barbules where they were closely spaced, and in the middle of barbules small nodes lacking prongs gradually decreased in size towards the tip (Harwood, 2011, p. 136). It was also noted that the barbules lacked pigment, with only slight pigment in the nodes (Harwood, 2011). Chandler (1916) studied a series of hawks, osprey, and vulture feathers, specifically *Accipiter cooperi*, *Pandion haliaetus carolinensis*, *Circus hudsonius*, *Buteo borealis* and *Gyps fulvus* and found that the downy barbules were variable even within the same genus but generally found that they were long, and slender with inconspicuous nodes and short prongs towards the tips (p. 336). Day (1966) examined the feathers of a sparrowhawk (*Accipter nisus*) and golden eagle (*Aquila chrysaetos*) and observed that the nodes were not conspicuously swollen, and appeared asymmetrical with one side of the node more developed than the other, particularly if pairs of prongs were present and one prong was longer than the other (p. 215). Brom (1986) analysed seventeen species in two families namely Acciptridae and Pandionidae, consisting of goshawks, eagles, kites, harriers, buzzards, and osprey feathers. In the harriers, the barbule lengths ranged from 2.3-4mm long (Brom, 1986, p. 188). In general, bird feathers in this order had long slender barbules lacking pigment, and the nodes were only slightly enlarged with 10-20 per mm (Brom, 1986). The nodes had short prongs that were asymmetrical in most cases, and occurred sometimes along most barbules, sometimes at the tips only but more so only at the barbule base (Brom, 1986).

2.3.12 Order Falconiformes - New Zealand Falcon

The native New Zealand falcon, or kārearea (*Falco novaeseelandiae*) was selected for study in the Falconiformes order, it is located in the family Falconidae which includes falcons and kestrels. Restricted to mountainous regions of North and South Islands, it is rare (Worthy, 2010g). Identified by dark brown upperparts and head, the front is cream with a central vertical brown line, and brown flank feathers. Cream and dark brown barring is apparent in underwings and tail.

A belly feather was extracted from a Te Papa falcon specimen OR.004799 and analysed in 2015 (see Tables 2.2 & 2.3). Described as a cream feather with central brown line down the middle, it measured 4.5cm long x 2.5cm across at the widest point, and the down reached 2cm, and made up almost half the feather length. A barb sample was taken from the mid-down for examination. Downy barbs appeared medium-long, measuring 2-3.5cm long, they were similar in appearance to harrier. With pennaceous looking barbules at the very tips, there were longer barbules at the barb base, averaging 2.9mm, shorter at mid-barb at 2.1mm, and barb tip 1.8mm.

The diagnostic features were the pigmented and pronged nodes. At the barb and barbule base nodes could be variable, segmented and trapezoidal, with prongs ranging in size 0.007-0.01mm long x 0.007-0.01mm across. The internodal space varied between 0.04-0.06mm, and barbule width was 0.004mm across. At the barb base, barbules were longer and thinner, and nodes had fewer prongs at node sites, with darker pigment and longer intervals between node sites. Possibly 3 pairs of prongs present at the barbule base. At the barb base, some nodes had pigment in, or just before the node site. The rest of the barbules had little or no pigment. At the barb and barbule base nodes appeared segmented with dark pigmentation, at mid-barbule nodes were globule-like and smaller, and developed into disc-like nodes at the barbule tip.

At mid-barb, pronged nodes were present along barbules, with longer internodal spaces than at the barb tip that had small pronged nodes along barbules. Barbules and small pronged sites lacked pigment at the mid-barb and barbule base (Table 2.2). At mid-barb and barbule base the pronged nodes measured 0.012mm long x 0.009mm across. Internodal space was 0.04-0.06mm, and barbule width 0.005-0.006mm across. At mid-barb and barbule, pronged nodes measured between 0.01-0.015mm long x 0.009-0.01mm across. Internodal space was 0.04-0.06mm, and barbule width 0.006mm across. At mid-barb and barbule tip, prong sizes varied greatly. The average prong/ node length was 0.01mm long x 0.009mm at the widest point.

The last few node sites at the barbule tip were smallest. Decreasing towards the barbule tip, the internodal space ranged between 0.03-0.02mm, and barbule width ranged from 0.005-0.003mm. At the barb tip, the barbule base had large nodes with c.3-4 pairs of minute prongs. There was little to no pigment although microscopic barbules appeared cream in colour. Pronged nodes gradually decreased in size towards the barbule tip, and barbules appeared scale-like. Node/ prong sites along barbules at the barb base averaged 35, 42 at mid-barb, and barb tip 36. In general the internodal space decreased along barbules from the barb base to tip.

In previous studies, Chandler (1916) analysed *Falco peregrinus*, *F. sparverius*, and *F. rusticola* feathers, and found the nodes were generally larger than in the hawks, osprey and vulture in the Accipitriformes order, and not conspicuously larger in *F. rusticola* or *F. peregrinus*, but strikingly larger in *F. sparverius* where the pigment was limited to the nodes and the internodes were slender and wavy, which is rare in downy barbules (p. 336). Day (1966) merged falcons and hawks into the order Falconiformes, however these raptors have now been divided with Accipitriformes encompassing kites, eagles, hawks and allies, and Falconiformes incorporating falcons and allies. For the genus Falco, the nodes in the feather down were not conspicuously swollen except in certain species (Day, 1966, p. 215). Brom (1986) analysed nine of the species of falcons, kestrels and peregrines in the order concluding that the barbules were very long and slender with some waves in internodal spaces, and with some variation between species exhibiting enlarged pigmented nodes along barbules. The barbule lengths ranged from 1.1-3.4mm, and the number of node sites per barbule ranged from 11-24 (Brom, 1986, p. 188). In falcons, the larger birds tended to have longer barbules and fewer node sites per mm than smaller birds (Brom, 1986).

2.3.13 Order Gruiformes - Western weka

The western weka (*Gallirallus australis australis*) is located in the Rallidae family which comprises of rails, gallinules and coots, and includes North Island weka (*G. a. greyi*), buff weka (*G. a. hectori*), and Stewart Island weka (*G. a. scotti*). Also, in the family Rallidae are native banded rail (*Gallirallus philippensis*), pūkeko (*Porphyrio melanotus*) and rare takahē (*Porphyrio mantelli*) (Worthy 2010h). In New Zealand the Gruiformes order consists of two other families Gruidae the cranes, and Aptornithidae the adzebills. Western weka plumage is variable ranging from copper brown in the front to grey, with dorsal and head feathers exhibiting different shades of brown with patterning including barring and central vertical lines.

A black back feather with brown tip was removed from a Te Papa western weka specimen (OR.021889) and analysed in 2015 (Tables 2.2 & 3.3). The tip of the feather, or pennaceous barbs were dark brown. The mid-down barbs were sampled and described as black and downy measuring 2-2.5cm long, and the barbules were short all along the barbs. The barbules had heavy pigment in extended nodes with small prongs at the node tips, so the barbule appeared scale-like (Table 2.2). The prongs typically lacked pigment, as did the area immediately following in the next node site, resulting in reduced internodal spaces. Barbules at the barb base measured 1.8mm, at mid-barb 1.7mm, and barb tip 1.4-1.5mm. Barbules widened towards the barb tip, and were widest at the node sites. Pronged nodes were present all along the barbules. The average number of nodes along barbules at the barb base was 26, at mid-barb 38, and barb tip 32.

At the barb and barbule base the nodes comprised of a heavily pigmented segment just before two pairs (4) of prongs with little-medium pigment. The space just after the prongs had little-med pigment. Pigmented nodes at the barb and barbule base measured 0.04mm long x 0.01mm across at the widest point of the prongs. The area of internodal space that lacked pigment on average measured 0.006mm. Pigmented areas and pronged nodes increased in length towards the barbule tip at the barb base. Prongs sometimes reached 0.01mm at the barbule tip. By mid-barb and barbule base, the nodes were 0.05mm long x 0.01mm across at the widest point. At the barb tip there was little pigment in the barbule. At the barbule base, prongs were minute, and node size measured 0.04-0.05mm long x 0.01mm across at the widest point. At the barb tip and mid-barbule the unpigmented space was more pronounced, the prongs had no pigment and were longer. At the barb and barbule tip, the prongs were longer at 0.015mm, and the space between nodes shorter.

A previous study of pūkeko and western weka (Rallidae) feathers found that the weka flank feather had barbules of medium length, they were wide with dark pigment just before short transparent prongs at the end of nodes (Harwood, 2011, p. 136). A pūkeko back feather was observed as having thinner, and short-medium length barbules, with 4 expanded nodes at the base of distal barbules at the barb base, with medium-heavy pigment around the nodes (Harwood, 2011). Chandler (1916) recorded that in Rallidae feathers, the downy barbules were short, stout and heavily pigmented with short internodes, and the pigment presented chiefly in the distal part of the internodes, with the minute prongs and the proximal part of the internodes were more or less unpigmented (p. 353). In *Rallus obsoletus* the internodes reached 0.035mm in length, in *Gallinula* the nodes were further apart, and in *Cresicus* they were closer (Chandler, 1916, p. 353). Day (1966) described coot (*Fulica atra*), moorhen (*Gallinula chloropus*), and water rail (*Rallus aquaticus*) feathers in the order Ralliformes (p. 214). The downy barbules of this order had two to four swollen heart-shaped nodes confined to the basal region of the pennulum, and further along the barbule and in the tip region the nodes were less swollen (Day, 1966). The reduction in size took place quite abruptly over the distance of one or two internodes, such an arrangement of nodes was strictly confined to barbules found in the proximal half of the barb and most marked in the distal barbules (Day, 1966). Barbules were recorded as short at 1.5-2mm, and the strikingly dark appearance of the nodes was not only limited to pigmented nodes but also to the internodes, which may be heavily pigmented along almost the whole of their length (Day, 1966). Brom (1986) examined 15 species from the order and found the Rallidae barbules to be short (0.4-1.7mm long), with heavy pigmentation in the distal portion of the nodes and short internodes, counting 15-32 per mm (p. 190). Approximately 2-4 large nodes were counted at the base of barbules that became less conspicuous along the barbule and at the tip (Brom, 1986).

2.3.14 Order Charadriiformes - Southern black-backed gull

The southern black-backed gull or karoro (*Larus dominicanus*) from this order are located in the family Laridae: gulls, and was selected for study. Charadriiformes incorporate waders and shore birds and includes the other families Haematopodidae (oystercatchers) and Sternidae (terns and noddies). Karoro can be found in South America, Australia, and New Zealand breeding in coastal areas and on most offshore islands (Tennyson, 2010a). It is one of the larger gulls, and adults typically have a white torso, black back and dark bill and feet.

A southern black-backed gull white belly feather was removed from the Te Papa specimen OR.013100 and analysed in 2015 (see Tables 2.2 & 2.3). The feather generally comprised of white downy barbs and barbules. A barb sample from the feather base was analysed for this study as this area showed more diagnostic characteristics in the large pigmented nodes on short barbules, appearing from the barbule base to the middle of the barbules at mid-barb. The study sample was prepared on a microscope slide and labelled OR.013100/2. The studied downy barbs were light grey-white, and short barbules at the barb base were curved, they shortened and straightened towards the barb tip. Barbule length varied, and looked generally short, but were longer and curved at the base of the barb. Barbules at the barb base reached 1.0mm long, but were generally shorter than that, and then measured 0.5mm at mid-barb and the barb tip. All barbules along the barb had on average 4 conspicuous large pigmented nodes at the base of barbules, that abruptly decreased in size after mid-barbule (Table 2.2). Barbules at the barb tip could have pronged nodes towards the middle and tip of the barbule. The average number of nodes along barbules at the barb base was 12, towards the middle and tip of the barb the average number of nodes reached 10.

A more detailed description of the barb and barbule base indicated there were c.4 large segmented nodes with pigment on the inner section of nodes. After this, very small globule-like nodes abruptly appeared until the tip of the barbule. At the barb and barbule base nodes measured 0.01mm long x 0.01mm across. The internodal space increased at each node site measuring between 0.01-0.06mm after the 4 larger nodes. Barbule width was approximately 0.004mm across. The barbules appeared smooth with a slight kink. At the barb base, mid-barbule, node size abruptly decreased after the 4 large nodes at the base, then gradually decreased in size becoming globule-shaped with no pigment. Nodes measured between 0.01-0.005mm long x 0.007mm across in the first 2-3 nodes after the sudden decrease in colour and size at mid-barbule. Internodal space increased from 0.04-0.08mm, and the barbule width thin ranging 0.002-0.003mm across. At the barb base, the barbule tip had small nodes, some pigmented, most were not. The internodal space decreased towards the very tip, measuring 0.03mm-0.02mm, and the barbule width was thin at 0.003mm across.

At mid-barb, and barbule base med-large segmented nodes had sections described as prong-like. There was no pigment in the nodes or segments. After the four med-large nodes, smaller nodes abruptly appeared, trapezoid-shaped or with small prongs at the node site until the barbule tip. There was a gradual decrease in node size along the barbule at mid-barb. Large nodes at mid-barb and barbule base measured 0.01mm long x 0.01mm across. The internodal space measured 0.04mm and barbule width 0.003-0.004mm across. At mid-barbule, the unpigmented nodes measured 0.007-0.01mm long x 0.005-0.008mm across. Internodal space was 0.03-0.04mm, and barbule width 0.003-0.004mm across. Towards the barbule tip, small unpigmented nodes sometimes had prongs and measured 0.004mm x 0.004mm across. Internodal space ranged from 0.04-0.05mm, and barbule width was 0.002mm across.

At the barb tip, the barbule base had medium sized pronged nodes with no pigment, and there was a gradual decrease in node size and increase in prong length along the barbule towards the tip. At the barb tip, there was one flat wide node then a larger trapezoid or pronged node. There was no pigment in the nodes or barbule, and there were around 2-3 larger nodes then usually pronged nodes all along the barbule gradually decreasing in size. Nodes at the barb tip and barbule base measured 0.01mm x 0.01mm, with an internodal space of 0.03mm, and barbule width 0.003mm across. Some pronged nodes at the barb and barbule tip reached 0.01mm long, but most nodes measured 0.007mm long x 0.005mm across, the internodal space was 0.04mm, and barbule width 0.002mm across.

In other relevant studies, Chandler (1916) also studied Laridae and in contrast observed that the barbules were shorter than in other families in the order, and the nodes were inconspicuous on the base of barbules with well-developed prongs at the barbule tips (p. 358). Day (1966) described a large diverse group that was divided into waders and gulls (Laridae) including the common gull (*Larus canus*), herring gull (*Larus agentatus*), and great black-backed gull (*Larus marinus*) (p. 215). The waders had few positive features that helped with identification, but there were some similarities with Strigiformes and Gruiformes in pigment or node distribution (Day, 1966). The nodes were swollen with heavily pigmented barbules that were identical to passerines, except for the absence of villi on the barbule bases (Day, 1966). The only exception among the waders examined was the woodcock (*Scolopax rusticola*), that was like the gulls in nodal arrangement, and they had short barbules (1.5-2mm) and internodes, and expanded nodes (Day, 1966, p. 215). Brom (1986) described nine families with sixty-eight species in the order including the common gull and great black-backed gull that had barbules ranging from 0.5mm-1.4mm long, and 15-24 nodes per mm on barbules (p. 192). Differences in families were observed in barbule length, pigmentation in nodes, the presence of prongs, and number of nodes on barbules (Brom, 1986). In the Laridae, the barbules were short and the base of barbules typically had 3-8 large and heavily pigmented nodes, and the rest of the barbule had unpigmented and inconspicuous nodes with prongs (Brom, 1986, p. 194).

Previous quantitative and qualitative studies on the microscopic characteristics of this bird order recorded that members of the Charadriidae family had medium-length barbs and barbules, diamond-shaped pigmentation surrounded by a transparent area and expanded nodes at the base of barbules, with pigment usually present in all species (Dove, 1997, p. 52; Dove, 2000). Dove (2000) noted that alcids or Auks (family Alcidae) in this order lacked expanded nodes, where instead prongs were situated at the distal nodes (at barbule tips) much like in ducks (Anseriformes). Dove's (2000) study of interspecific and intraspecific variation in the microscopic features of North American plovers indicated that there are enough differences between species that specific identification was possible (p. 47). Where microcharacters such as the number of pigmented nodes per barbule, subpennaceous length and barb length could differentiate between closely related species (Dove, 1997, p. 55).

2.3.15 Order Columbiformes - Kererū

The New Zealand pigeon or kererū (*Hemiphaga novaeseelandiae*) along with the Chatham Island pigeon (*H. chathamensis*) are the two surviving native pigeons, located in the family Columbidae, consisting of pigeons and doves which includes introduced pigeons and doves from Asia, Europe and Africa (Heather & Robertson, 1996; Worthy, 2010e). Kererū are currently widespread in native bush and urban greenbelts throughout both islands. Adults have distinctive metallic green head and neck feathers, back, uppertail and upperwings of teal and maroon, and front of white feathers.

A white belly feather was removed from a Te Papa New Zealand pigeon specimen (OR.011559) and analysed in 2015 (Tables 2.2 & 2.3). A sample was taken from the upper mid-down and prepared on a temporary slide and labelled OR.011559/2. The white pigeon belly feather was very delicate, and the down long at mid-down. The down was white at the feather base and light grey at mid-down. In the study feather, the downy barbs were light-grey and med-length, the barbules were very long particularly at the barb base and mid-barb measuring over 3mm, and longer than 2mm at barb tips. The barbules were long, wiry, and whip-like at the ends, gradually shortening towards the barb tip. The primary diagnostic feature were the large crocus-shaped nodes at the base of the barbules all along the barb, at the barb tip the large nodes are still present but reduced in size (Table 2.2). The barb base had 49 nodes along barbules, mid-barb had 41, and barb tip 31.

The barb and barbule base had c.11 large nodes that abruptly decreased in size after. The very base of the barb could have 14 large nodes. Nodes gradually decreased in size up the barb. At the barb and barbule base one small node, then the large crocus-shaped nodes around 0.01mm long x 0.02mm wide were observed. The internodal space was 0.05mm, and barbule width

0.004mm across. Internodal space increased when the nodes reduced in size, to around 0.1mm. At the barb base and mid-barbule the nodes were small and globule-shaped, measuring 0.005mm x 0.005mm, the internodal space was 0.1-0.15mm, and barbule width 0.004mm across. The barbules and nodes had little or no pigment. At the barb base and barbule tip, the nodes were minute and non-descript with 3-4 prong sites of varying lengths. The mid-barb barbules had around 8 large nodes from the base of the barbule that abruptly decreased in size after, with similar measurements and node distribution at the barb base. At the barb tip c.6 large nodes at the barbule base abruptly decreased in size after. At the barb tip the barbules were shorter, and some nodes had prongs instead of crocus-shaped segments. At the barb tip and mid-barbule, the nodes were minute. At the barbule tip, pronged nodes varied in lengths.

A previous study of a New Zealand pigeon belly feather counted 4-6 large crocus-shaped nodes at the base of barbules only, these then abruptly decreased in size after, and the barbules and nodes had little pigment (Harwood, 2011, p. 137). Chandler (1916) studied pigeons and doves including rock dove (*Columba livia*) and concluded most had barbules 3-4mm long, and 3-8 large expanded nodes at the base of barbules, then a similar number of smaller nodes gradually decreased in size until inconspicuous near the barbule tip, where the barbule was smooth and filamentous with minute nodes (p. 361). Some species differed in pigment distribution, lacking nodes replaced by prongs and slightly shorter barbules (Chandler, 1916). Day (1966) examined wood pigeon (*Columba palumbus*), that had large flattened plate-like nodes separated by long internodes (p. 214). These characteristic nodes were found on all downy barbules but were more conspicuous and continued along the distal barbules, the pigmentation was confined to the nodes, and the barbules were 3-4mm long (Day, 1966, p. 214).

Another microscopic study of five species in the family Columbidae found the downy barbules ranged from 1.1-5.1mm, that most had at the base of barbules 3-8 large flattened plate-like nodes, then a number of smaller nodes following decreasing in size until they were minute towards the barbule tip, sometimes with minute prongs (Brom, 1986, p. 194). Brom (1986) counted 10-18 nodes per mm on barbules, and that only the barbules at the barb base and mid-barb contained the large quadri-lobed nodes at the base of the barbules, and that at the barb tip they were not as large, or flattened. Gilroy (1987) discussed the variation in downy barbules within the same species of *Columba livia*. While an analysis of the pennaceous barbs of the Oxford University Museum dodo (*Raphus cucllatus*) proved that the barbs had more in common with the barbs on pigeons and doves than with Gruiformes, confirming taxonomic placement in this bird order (Brom & Prins, 1988).

2.3.16 Order Psittaciformes - North Island kākā

North Island kākā (*Nestor meridionalis septentrionalis*) belong in the family Strigopidae, that comprise of kākāpō (*Strigops habroptilus*) and allies, and the subfamily Nestorinae which includes the North and South Island kākā (*Nestor m. meridionalis*) and kea (*Nestor notabilis*) (Chambers, 2010). The other New Zealand families comprise of the Cacatuidae with the Australian cockatoos and galah, and the Psittacidae include typical parrots such as the native parakeets, and Australian lorikeets and rosella (Chambers, 2010). Becoming increasingly more common in native bush and urban areas, North Island kākā plumage varies with shades of brown on the head and back, uppertail and upperwing feathers, and white or grey feathered crown on head. Ventral feathers could be red-tipped, and underwing feathers can be barred orange-red-brown.

A red-tipped belly feather was removed from a Te Papa North Island kākā specimen (OR.028918) and analysed in 2015 (Tables 2.2 & 2.3). The feather had a white shaft, grey down, and pennaceous red barbs with black on the very ends of barbs, at the feather tip. The feather measured 5cm long x 3cm across, and also had a downy after shaft. The feather down reached 2cm, and the downy barbs were 2cm long at mid-down, white at the base and dark grey at very tips of barbs. A barb sample from the mid-down section was analysed. Barbules at the barb base had gumnut-shaped nodes at the base of barbules that transitioned into disc-shaped nodes up to the tips of barbules. Barbules were med-long at 2.4mm at the base, then slightly longer at mid-barb at 2.5mm, then shorter again at the barb tip at 1.9mm. Barbules at the barb tip had bell-shaped nodes all along barbules more closely spaced. The average node count along barbules at the barb base was 40, at mid-barb 47, and barb tip 50.

At the barb base, barbules had light-medium pigmentation, and nodes had medium pigment with four segments at node sites (gumnut-shaped) that were larger at the barbule base (Table 2.2). Nodes at the barb and barbule base measured 0.011mm long x 0.014mm across, the internodal space was 0.046mm, and barbule width 0.004mm. Nodes at the barb base and mid-barbule reached 0.011mm long x 0.014mm across, with internodal space around 0.05mm and barbule width 0.0047mm. Nodes at the barb base and barbule tip were trapezoid or circular-shaped with segments of reduced pigment towards the very tip. Trapezoid nodes were 0.01mm long x 0.008mm across, the internodal space at the barb base and barbule tip 0.03mm, and barbule width 0.003mm across.

At mid-barb, the base of barbules had darker internodal pigment and in trapezoid nodes that decreased along the barbule (see Fig. 2.5). At mid-barb and barbule base the node size was 0.01mm long x 0.011mm across, internodal space 0.046mm and barbule width 0.005mm across. At mid-barb and barbule, the nodes were globule-like and segmented into 4 parts with little-medium pigment, measuring 0.008mm long x 0.016mm across. The internodal space was 0.04mm, and barbule width 0.006mm across.

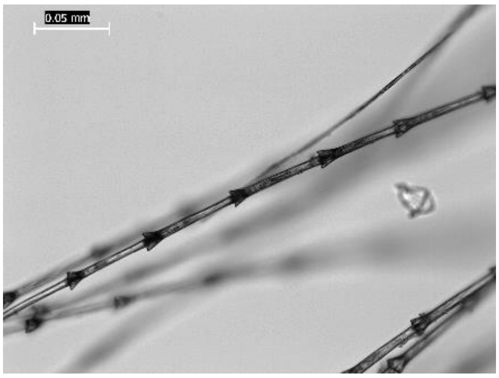


***Figure 2.5*. Long pigmented trapezoid-shaped nodes on a kākā belly feather (Te Papa OR.028918), mid-down, mid-barb, barbule base, 400x magnification. Image by Hokimate Harwood, 2015.**

At the barb tip, the pigment was heavier in the nodes and internodal spaces, and the prongs more prominent on nodes at the barbule base. The nodes were long and trapezoid. Some barbules at the barb tips looked like Gruiforme barbules, they had long trapezoid nodes with small prongs, and short internodal spacing with multiple pronged nodes at the barbule tips.

A similar microscopic study of North Island kākā and kākāriki (red-crowned parakeet: *Cyanoramphus novaezelandiae*) feathers found that red kāka belly feather barbules were long-very long, where larger nodes occurred in barbules at the barb base, with nodes more globular at mid-barb (Harwood, 2011, p. 137). The nodes had heavy pigmentation except in extremities, and were closer and smaller towards barbule tip (Harwood, 2011). In the green kākāriki breast feather, the barbules were med-long, and decreased in length towards the barb tip (Harwood, 2011). Expanded nodes at the barbule base decreased in size along the barbule, and nodes were recorded with pigment in the inner segments, whereas nodes were longer and thinner towards the barbule tip and some prongs were observed (Harwood, 2011).

Chandler (1916) studied parrot down and also noted that it had globular nodes which were rather large at the base of barbules, but very minute at the barbule tips (p. 366). The segmented nodes resembled the eucalyptus tree fruit (gumnuts) and were pigmented, and closely spaced with 15 or more per mm (Chandler, 1916). Brom (1986) studied ten species from three families including parrots, lories, cockatoos and parakeets and noted that the barbules ranged between 0.8-3.5mm, and had pigmented globular or trapezoid nodes (12-24 per mm), enlarged at the barbule base and minute at the barbule tips. The larger birds had less nodes per mm than smaller birds, and some barbules were kinked (Brom, 1986).

2.3.17 Order Cuculiformes - Long-tailed cuckoo

Long-tailed cuckoo or koekoeā (*Eudynamys taitensis*) are located in the family Cuculidae which also includes the shining cuckoo (*Chrysococcyx lucidus lucidus*). Koekoeā are generally vagrants only breeding in New Zealand in spring (Gill, 2010c). They are known for their unique plumage of brown feathers with light coloured vertical lines on the head, barring on the tail or spots on the upperwing, and front white feathers with brown vertical central lines.

A belly feather from a long-tailed cuckoo was removed from a Te Papa specimen (OR.021805), and described as white with a brown vertical line down the middle. The feather was 3.5cm x 3.5cm, 1cm of which was down. The feather was white and downy, and the down white-light grey. A barb sample was taken from the mid-down and analysed in 2015 (Tables 2.2 & 2.3). The downy barbs measured 1.5cm long and were light grey or white. Long barbules at the barb base decreased in length through to the barb tip. The average barbule length at the barb base measured 2.5mm, at mid-barb 1.85mm long, and barb tip 1.5mm. Nodes were all along barbules at the barb base and mid-barb. Average node counts along barbules at the barb base were 41, 37 at mid-barb, 26-29 at barb tip. Nodes were seen all along barbules, and became closer towards the barb and barbule tip.

Barbules at the barb base had 5-8 med-large trapezoid-shaped nodes at the very base that gradually developed into bell-shaped nodes pigmented at the base, along very thin kinked or twisted barbules (Table 2.2). At the barb and barbule base, nodes had 4 segments with little to no pigment except for at the very base along the barbule. The internodal space sometimes had small sections of dark pigment, but generally little or no pigment was recorded in nodes or barbules at the base. Measurements at the barb and barbule base recorded node size at 0.008mm long x 0.098mm across, internodal space of 0.05mm and barbule width 0.003mm across. Measurements at the barb base and mid-barbule recorded node size at 0.02mm long x 0.006mm across, internodal space measured 0.04mm long and barbule width 0.002mm across. Barbules were kinked between nodes. At the barb base and barbule tip the average node size was 0.02mm long x 0.0065mm, and the internodal space and width gradually decreased towards the tip. At mid-barb and barbule base, trapezoid nodes were smaller and less common (3-5 nodes) before transforming into heavily pigmented bell-shaped nodes. At the barb tip, long bell-shaped nodes appeared at the barbule base. Pigmentation varied at the barb tip.

Previous microscopic studies of a long-tailed cuckoo belly feather noted short barbs and medium-long barbules, and at the base of barbules, long bell-shaped nodes with pigmentation in the thinner section of the node (towards the barbule base) (Harwood, 2011, p. 137). At the barbule tips the nodes were thin, long and closely spaced (Harwood, 2011). Chandler (1916) studied the genera Coccyzus, Cuculus and Eudynamis and found that the barbules were long, usually 2mm or longer, very slender, and the nodes formed round droplets, larger near the base of barbules and minute near the barbule tip while still maintaining their unique shape (p. 365). The globular nodes were not present in Geococcyx, and the nodes were only gradually enlarged and pigmented in the distal region of the nodes (Chandler, 1916). In the other cuckoo barbules, the pigment was located to the back of the globular node, in the proximal region (towards the barbule base) (Chandler, 1916). The internodes were very long and slender, in *Eudynamis honorata* sometimes 0.1mm long, and barbules less than 0.002mm across, with 10-12 nodes per mm on barbules (Chandler, 1916). Brom (1986) examined two species from the Cuculidae family, the great spotted cuckoo (*Clamator glandarius*) had 1.4-3.2mm long barbules, and in the common cuckoo (*Cuculus canorus*) the barbules were 1.5-5mm long (p. 196). The barbules had globular nodes, 8-18 per mm that were larger at the base of barbules and minute at the barbule tip, with long slender internodal spaces that sometimes kinked (Brom, 1986).

2.3.18 Order Strigiformes - Morepork

The widely distributed New Zealand morepork or ruru (*Ninox novaeseelandiae*) was studied in the order Strigiformes. Ruru are located in the family Strigidae, which is made up of typical owls, and subfamily Buboninae of hawk-owls and allies, which also included the now extinct native New Zealand laughing owl, whēkau (*Sceloglaux albifacies*) (Worthy, 2010j). The other New Zealand family Tytonidae comprises of the larger introduced barn owls (Worthy, 2010j). Ruru plumage consists of a dark dorsal area of dark brown and cream spotting, the front has mottled brown, light brown and cream feathers. The tail and wings have striking dark brown and cream barring.

A brown, cream and white mottled belly feather was removed from a Te Papa ruru specimen (OR.010279) and analysed in 2015 (Tables 2.2 & 2.3). The belly feather of 2.5cm long x 4cm wide was very downy and soft, the shaft white, and down grey to dark grey. The barbs were long and down made up at least 2cm of the feather. The barb base was grey with long barbules, and barb tips of light brown or cream. The sample was taken from the mid-down. Barbules were abruptly shorter towards the barb tip. At the barb base, the barbule length reached over 3mm. At mid-barb, barbules generally averaged 2.5mm long, at the barb tip 2.2mm. Barbules at the barb tip lacked nodes. Generally dark trapezoid nodes gradually transformed into globule-shaped nodes along barbules (Table 2.2). The average number of nodes along barbules at the barb base was 44, at mid-barb 41, and at the barb tip 38.

Dark nodes at the barb and barbule base were relatively large, elongated and trapezoid-shaped, and numbered 7-12 before they transitioned into dark globular nodes along barbules to the tip. At the barb and barbule base, the pigment that appeared in the barbule terminated in the centre of pronged nodes. The prongs had little or no pigment. The distance between nodes varied from 0.02-0.04mm, and barbule width was 0.004mm across. At the barb base and mid-barbule the pigment was concentrated in long globular nodes that typically lacked prongs. Approximate node size ranged from 0.02-0.03mm long x 0.007mm across. The internodal space measured 0.04mm, and width 0.003mm across. At the barb base and barbule tip the nodes were observed as less globular towards the tip, and more scale-like with minute prongs. Node size was 0.025mm long x 0.0045mm, with the barbule width 0.004mm across. Pigment was located in some barbules before the nodes, but mostly in the nodes.

At mid-barb, 6-8 large dark trapezoidal nodes were recorded before dark globular nodes appeared at the barbule base. The pigment at mid-barb and barbule base was located before and in most nodes, and the 4 small-medium sized prongs lacked pigment. The nodes measured 0.02mm long x 0.01mm wide, the internodal space reached 0.03mm, and barbule width 0.004mm across. At mid-barb and mid-barbule, the pigmented globular nodes measured 0.025mm long x 0.006mm wide, the internodal space was 0.03mm, and barbule width 0.003mm. At mid-barb and barbule tip the heavily pigmented nodes appeared less globular and prongs lacked pigment, and measured 0.03mm long x 0.006mm across, with internodal space and width decreasing towards the barbule tip.

At the barb tip, the trapezoid nodes were smaller and globular nodes longer. The heavily pigmented trapezoidal nodes had four short-med prongs that lacked pigment. At the barb tip and barbule base the nodes and barbules had reduced pigment. The pronged nodes measured 0.02mm long x 0.01mm wide, the internodal space was 0.0.3mm, and barbule width 0.005mm across. Node size decreased towards the barbule tip. At the barb tip and mid-barbule, the nodes and barbules had little pigment, with nodes and prongs appearing scale-like. At the barb and barbule tip, the nodes were pronged and scale-like with little pigment in nodes or barbules. There were long internodal spaces of 0.05mm, and average barbule width of 0.004mm across.

Comparative microscopic analyses of another morepork belly feather indicated that the barbs were long, the barbules med-long with dark expanded trapezoid nodes at the barbule base, with globular nodes at mid-barbule and thin long nodes at the barbule tip (Harwood, 2011, p. 137). Chandler (1916) noted the remarkable softness in owl plumage, and the similarities with Cuculiforme down (p. 375). In the species *Bubo maximus*, at the base of barbules, three large nodes shaped like gumnuts were observed, after which elongated nodes (9-10 per mm) featured pigment at the distal end of nodes, like cuckoo nodes (Chandler, 1916). Barbules of *Aluco patincola* had five enlarged nodes at the barbule base (Chandler, 1916).

Day (1966) examined barn owl (*Tyto alba*) and tawny owl (*Strix aluco*), and found the downy barbules of Strigiformes had an abrupt reduction in node size at the barbule base and that pigmentation varied according to species, in that barn owl had little pigmentation whereas in the tawny owl it was quite heavy (p. 214). The barbules and internodes were recorded as long in Strigiformes (3-4mm) (Day, 1966). Brom (1986) analysed 10 species from Strigidae and Tytonidae, including barn owl measuring 1.5-3.7mm long barbules and 8-15 nodes per mm of barbule; and little owl (*Anthene noctua*) measuring 1.2-2.9mm long barbules and 15-24 nodes per mm (p. 196). Downy barbules varied in pigmentation between species, but most had very long barbules, divided by pigmented nodes along the length, that 2-6 enlarged nodes at the base of barbules were abruptly followed by elongated nodes for the rest of the barbule to the tip (Brom, 1986).

2.3.19 Order Apodiformes - White-throated needletail

The introduced white-throated needletail (*Hirundapus caudacutus*) was selected for study from this order. Located in the suborder Apodi, family Apodidae (swifts), subfamily Apodinae and tribe Chaeturini, that encompasses needletails (Gill, 2010a). This species is a straggler to New Zealand islands, and is more common on the North Island. The other suborder Aegothelae, in the family Aegothelidae (owlet-nightjars) included the extinct New Zealand Owlet-nightjar (*Aegotheles novaezealandiae*) (Worthy, 2010c). The body is divided into a white throat, lower belly and flank; and sometimes back, front, and dark tail mostly of black or brown feathers, and dark blue upperwings. Tail feathers have needle-like projections (Heather & Robertson, 1996).

A light brown back feather was removed from a Te Papa white-throated needletail specimen (OR.000489). The barbs were stuck together so accurate measurements could not be taken. The down was light brown, grey and white. A barb sample was removed from the mid-down and analysed in 2015. The down was dense and the barbs short-med in length, and with several planes of barbules, making imaging and measuring challenging. The longer barbules were orientated towards the feather tip. Barbules were short and lacked distinct node structure, with minimal presence of nodes and minute prongs at some sites at the base of barbules. At the barb base barbules measured 0.9mm long. At mid-barb, barbules were dense and measured on average 0.7mm long, at the barb tip 0.7mm. At the barb base the average number of nodes on barbules was 10, at mid-barb 16, at the barb tip 10. Little-med pigmentation in the length of the barbules was recorded just before node sites.

At the barb and barbule base, blocks of light-brown pigment were recorded just before node sites (Table 2.2). Nodes had minute prongs measuring 0.005mm long. The barbules were short, and the internodal space was 0.03mm, and barbule width 0.003mm appearing thin and spindly towards the barbule tip. At the barb base and mid-barbule, nodes were also 0.005mm long, the internodal space 0.03mm and barbules 0.004mm across decreasing gradually towards the tip. Internodal spaces had medium grainy pigment, limited at the node site. At the barb base and barbule tip, minute nodes lacked prongs, the very tip was thin and whip-like. The nodes measured 0.004mm long x 0.003mm across, and the internodal space 0.04mm, and barbule width 0.004mm. Some pigment observed in internodal spaces except at nodes.

At mid-barb and barbule base, the pigment was med-heavy in internodal space with little pigment at nodes that measured 0.007mm long x 0.005mm across, and the prongs were minute. Inconspicuous nodes were found along barbules. An average measurement of 0.03mm for internodal space, and width 0.004mm across the barbule. At mid-barb and barbule reduced pigment was seen in barbules. The nodes were sometimes non-descript. At mid-barb and barbule tip, the barbule had little pigment and the nodes were more defined.

The barb tip and barbule base featured little-medium blocks of pigment in barbules. The nodes were minute, with few or no prongs recorded. At the barb tip and mid-barbule, the pigment was scattered and minimal. Some minute prongs were observed but not common, and most nodes were indistinct and lacked pigment. At the barb and barbule tip, barbules were very thin and whip-like, and some small prongs noted. Pigment was scattered except at the node sites.

Brom (1986) was one of the few to have studied feathers from this order, namely two species from the family Apodidae, swift (*Apus apus*) and alpine swift (*A. melba*), where the barbules were threadlike and measured as short at 0.7-1.7mm long, and with pigmented nodes and internodes (p. 196). The nodes were difficult to ascertain and count, yet minute prongs were present (Brom, 1986, p. 197).

2.3.20 Order Coraciiformes - New Zealand sacred kingfisher

The New Zealand sacred kingfisher or kōtare (*Todiramphus sanctus vagans*) was selected for study from this order, it belongs in the suborder Acedines, family Halcyonidae of forest kingfishers (Gill, 2010b). This family also includes the introduced Australian laughing kookaburra (*Dacelo novaeguinae*). Kōtare are widespread in New Zealand moving across landscapes throughout seasons (Gill, 2010b). Plumage is described as an off white throat and nape and lower belly; breast of white outlined with brown with off-yellow colouring sometimes in ventral areas such as breast, underwings and belly. The head, upperwings, back and tail are of varying shades of metallic brown, turquoise, green, and blue.

An off-white (cream) belly feather was removed from a Te Papa kingfisher specimen (OR.009878) and studied in 2015. The feather was 4cm long x 2cm wide, the down grey with a distinct line at the pennaceous barbs which were cream. The down made up 2cm of the feather. The mid-down was sampled and analysed (Tables 2.2 & 2.3). The diagnostic nodes appeared parrot-like, the barbules had small pigmented trapezoid-shaped nodes all along barbules (Table 2.2). There was little pigment in 4 small prongs at the barb and barbule base. The rest of the node was heavily pigmented. Average barbule length at the barb base was 1.5mm long, at mid-barb 1.4mm, and at the barb tip it varied considerably down to 1mm long. The average number of nodes along barbules at the barb base was 40, at mid-barb 35, and at the barb tip 30.

Barbules at the barb base had a dent in the internodal spaces, which had no pigment. Nodes were heavily pigmented with small prongs on extremities. Node size at the barb and barbule base was 0.01mm long x 0.01mm across; the internodal space on average measured 0.037mm long, and barbule width 0.004mm across. The node size at the barb base and mid-barbule measured 0.01mm x 0.01mm, with 0.03mm internodal spaces, and average barbule width of 0.003mm across. The nodes were trapezoid and heavily pigmented with small unpigmented prongs on the extremities. Node size at the barb base and barbule tip was 0.01mm x 0.01mm, with longer prongs towards the barbule tip, the internodal space gradually decreased towards the barbule tip, and barbule width measured 0.005mm across on average.

At mid-barb and barbule base, the pigment was observed in the small internodal spaces before the nodes. The average node size was 0.015mm long x 0.01mm across, and the internodal space decreased from the barbule base from 0.03-0.02mm within 1-2 nodes. On average the barbule width was 0.003mm. Nodes were heavily pigmented with small segmented pronged extremities that lacked pigment. At mid-barb and barbule, the node size was 0.014mm long x 0.01mm wide, the internodal space 0.02mm, and average barbule width 0.0035mm across. At mid-barb and barbule tip, the node size was 0.01mm long x 0.008mm across, the internodal space varied with an average of 0.017mm, and barbule width 0.004mm across. The nodes were heavily pigmented with minute prongs.

At the barb tip and barbule base the node size was 0.013mm x 0.01mm, with medium pigment in the barbule before the node and heavy pigmentation in the node, with small prongs at node extremities. Internodal space varied with an average of 0.03mm, and barbule width of 0.004mm. At the barb tip and mid-barbule, the node size varied again with an average of 0.01mm long x 0.008mm across, the internodal space gradually decreased, and barbule width averaged 0.0036mm across. At the barb and barbule tip the node size slowly decreased towards the very tip and the barbule width on average measured 0.007mm across. The prongs were small and not pigmented, with heavy pigment in the main body of the nodes. The internodal space was variable, and barbule width 0.003mm across.

Chandler (1916) studied a diverse range of genera in the order including *Coracias*, *Merops*, and *Momotus*, and overall found the feathers generally had pigmentation in the barbules, the nodes were distinct, and barbules were of moderate length (p. 374). Barbules had heavily pigmented nodes in these genera, the nodes were long and trapezoid-shaped and gradually increased in size on the distal two-thirds of the barbules length, and numbered between 20-28 nodes per mm on a barbule (Chandler, 1916, p. 375). *Halcyon gularis*, in the family Alcedinidae had short, stout nodes with over 30 nodes per mm on a barbule, and nodes at the barbule tips were enlarged and pigmented (Chandler, 1916). Brom (1986) studied feathers of a species from each of the four families Alcedinidae, Meropidae, Coraciidae, Upupidae (p. 197). The common or Eurasian kingfisher (*Alcedo atthis*) feathers had barbule lengths of 0.8-1.6mm long and 21-32 nodes per mm on a barbule (Brom, 1986, p. 199). Across the species, the nodes could be un/ pigmented, but in general the nodes gradually decreased in size towards the barbule tip, with fewer nodes on barbules of the smaller birds (Brom, 1986, p. 198).

2.3.21 Order Passeriformes - Tūī

The tūī (*Prosthemadera novaeseelandiae*) was selected for closer study from the order Passeriformes. Passerines are the largest order of New Zealand birds with two suborders and twenty-four families. Little is known of New Zealand passerines and as such they have been allocated to numerous independent family groups (Gill, 2010d). Tūī is located in the suborder Passeres, which are known as the songbirds, and the family Meliphagidae known as honeyeaters, and includes bellbirds (*Anthornis* spp.) (Gill, 2010d). Tūī are widespread across New Zealand and thrive in urban areas (Bull, Gaze, & Robertson, 1985). The plumage is unique, for in addition to the striking black, iridescent blue and green body feathers, tūī have two distinctive white feather tufts on the throat, white barbed feathers on the nape, and a white band of feathers across the upperwing coverts (Heather & Robertson, 1996).

A black belly feather was removed from a Te Papa tūī specimen (OR.011140) and analysed in 2015 (Tables 2.2 & 2.3). The feather measured 5.5cm long x 3cm across. The barbs were around 1.5cm long, and the barbules roughly the same length all along the barbs. Dark grey dense down measured 3.5cm of the feather. The top of the feather had some pennaceous barbs that were brown/ grey in colour. A sample was taken from the mid-down for analysis. At the barb base, barbules measured at 2.4-2.5mm. The nodes were dark and seen all along barbules from the barb base to the tip (Table 2.2). Barbules at mid-barb measured at 2.3mm long. Barbules were less dense towards the barb tip, the dark nodes still appeared all along the barbules. Barbule length gradually decreased towards the barb tip, ranging between 1.7mm to 1.4mm. The average number of nodes on barbules at the barb base was 77, at mid-barb 65, and at the barb tip 52.

At the barb base, the nodes were long and trapezoid-shaped, the internodal space had little-medium pigment particularly just before the nodes. Barbules appeared scale-like as node sites were less defined, and prongs at the node sites prominent. The nodes measured 0.01mm long x 0.01mm across, the internodal space was 0.02mm, and barbules 0.005mm across. At the mid-barb, nodes appeared triangular and hexagonal-shaped, dark with rudimentary prongs located all along barbules. Nodes gradually decreased in size as did the internodal space towards the barbule tip. The internodal spaces had little to no pigment. Barbules at the barb tip had little pigment but the nodes were heavily pigmented, long and triangular with the base of the node rounded and prongs pronounced. At the barb base and barbule tip, little pigment was observed in internodal spaces and internodal length further reduced.

The diagnostic features for passerines include closely-spaced pigmented nodes along barbules, and the presence of villi (cilia) at the barb and barbule base of some barbules (see Fig. 2.6). The villi in tūī barbules had knobs, and were multiple on some barbules, typically observed on the underside of barbules at the barb base, facing the feather shaft (see Fig. 2.1).

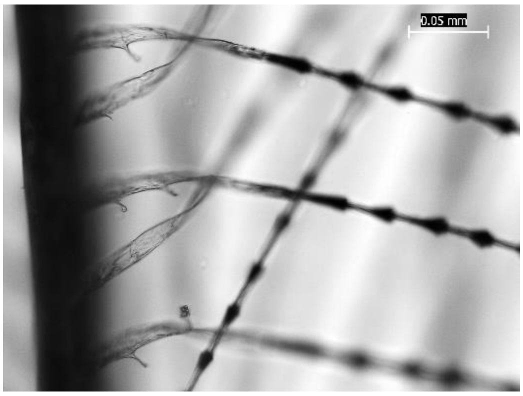


Figure 2.6. **Photomicrograph of knobbed villi (cilia) on tūī belly feather (Te Papa OR.011140), mid-down, barb base, barbule base, 400x magnification. Image by Hokimate Harwood, 2015.**

At the mid-barb and barbule base pigmentation was localised at the very barbule base before node sites. At the very base, nodes were triangular and long 0.017mm, and abruptly decreased in length (pigment) to less than 0.01mm long to form diamond-shaped nodes. At mid-barb and mid-barbule, the diamond-shaped nodes had rudimentary prongs and measured 0.01mm long x 0.01mm across, the internodal space ranged from 0.017-0.02mm, and barbule width 0.003mm across. At mid-barb and barbule tip, heavily pigmented nodes measured 0.01mm long x 0.005mm across, the internodal space was 0.01mm and barbule width 0.003mm across. Prongs were small except at the barbule tip where nodes were closely spaced and prongs prominent.

At the barb tip, barbules were sparse. At the barbule base, nodes were long, heavily pigmented and scale-like. Pigment was med-heavy in internodal spaces just before the nodes. Node measurements varied between 0.017-0.02mm long x width 0.006-0.009mm across. The internodal space was also indistinct, and barbule width measured 0.005mm. At the barb tip and mid-barbule, the dark nodes measured 0.012mm x 0.008mm across. The internodal space lacked pigment and measured 0.017mm long and 0.004mm across. Prongs were small, and nodes triangular. At the barb and barbule tip the nodes were dark, and short internodal spaces had medium pigment. The prongs were distinct, sometimes four were present at the barbule tip.

Another similar study of an iridescent tūī breast feather; a black feather of the extinct huia (*Heteralocha acutirostris*); and yellowhammer (*Emberiza citronella*) flank feather showed adequate commonalities to allocate bird order, and considerable variability in diagnostic features for species identification (Harwood, 2011). The tūī barbules were slightly longer, and villi present at the base of some barbules, and the pigmented nodes present all along barbules

(Harwood, 2011). Variations in feather microstructures were also demonstrated in species of passerine sparrows in China (Lei, Qu, Gan, Gebauer, & Kaiser, 2002). Chandler (1916) found that in the down of over one hundred passerine species, villi was recorded at the base of barbules on the ventral edge (underside) or on the side of the base of the barbules, at the barb base only (p. 382). The barbules were of medium length between 1mm-5mm, and the nodes conspicuous and not much larger at the base of barbules, with node shape and internodal length varying between species (Chandler, 1916).

Day (1966) studied the feather down of passerines including song thrush (*Turdus ericetorum*), blackbird (*Turdus merula*), Starling (*Sturnus vulgaris*), magpie (*Pica pica*), goldfinch (*Carduelis carduelis*), chaffinch (*Fringilla coelebs*), and house sparrow (*Passer domesticus*) (p. 212). Barbule length ranged from 1.5mm-2.5mm, nodes were conspicuous and well-pigmented gradually reducing in size towards the barbule tip, with the characteristic features of villi on the bases of barbules in the proximal half of the barb (barb base) (Day, 1966, p. 213). Brom (1986) analysed feathers from over 100 passerines from 22 families and found the average barbule length was 0.5-3.3mm, with most under 2mm (p. 199). That between 16-55 large pigmented nodes were counted per mm on barbules, with unpigmented internodes, and villi at the base of barbules described as blunt, knobbed or finger-like (Brom, 1986). The only other birds to feature villi were woodpeckers of the Piciformes order, not present in New Zealand (Brom, 1986, p. 199).

2.4 Discussion

In summary, representative species from the 21 New Zealand bird orders can be identified microscopically with a level of accuracy based on the unique diagnostic features outlined. Both moa and kiwi feather down exhibit double prongs, little pigment in internodal spaces, located on medium length hair-like barbules. Pheasant feathers have multiple, moving ring-shaped nodes on long mid-distal barbules at the barb base. Mallard down exhibits diagnostic (3-4) large triangular nodes at the ends of short barbule tips. Grebes have medium length prongs evenly distributed along long barbules. Penguins display short barbules, with medium length prongs appearing from mid-barbule to the tip. Albatrosses have med-long prongs that gradually decrease in length along medium length barbules. Tropic birds have short prongs along the length of short-medium barbules. Gannets have very long slender prongs that only slightly decrease in length at the tips of very short barbules. Heron have long filamentous barbules, with widely spaced minute nodes and short prongs. Hawk feathers have long barbules, little pigment, inconspicuous nodes, and prongs that could appear asymmetrical. They may also have a higher density of pronged nodes at the barbule base and, or at the barbule tip. Falcon have similar looking barbules to hawks, except with less prominent prongs and pigment in nodes. Weka feathers have short, wide barbules with heavy pigment in nodes, only the prongs and short internodal spaces (just after the prongs) lack pigment.

Gull feathers have short wavy barbules, with 3-4 large pigmented nodes at the base of barbules, that abruptly decrease in size after. Pigeon feathers have long wavy thin barbules with large quadri-lobed nodes at the base of barbules followed abruptly by decreasing smaller nodes, present only at the barb base and mid-barb. The barbule base at the barb tip have less expanded nodes. Kākā feathers have large segmented nodes at the base of barbules that gradually decrease in size along barbules, and the nodes are pigmented in the inner segments of structures. Cuckoo feathers have distinctly thin barbules, and at mid-barbule long bell-shaped pigmented nodes in the upper thinner section of the node and the wider section at the base lacking pigment. Ruru feathers have long wispy barbules, pigmented globule-shaped nodes at mid-barbule, with a gradual decrease in node shape along the barbule. Needletail feathers were recorded as having short ribbon-like barbules, pigmented with minute and indistinguishable nodes, that could have minute prongs. Kingfisher feathers have pigmented trapezoid-shaped nodes all along medium length barbules. Tūī have medium length barbules, with pigment around the nodes creating hexagonal shapes at the barb and barbule base that gradually appeared trapezoid along the rest of barbules. Tūī villi are present at the base of some barbules.

Chandler (1916) and Brom (1986) provided quantitative evidence that the microscopic similarities in feather down in birds of the same order and the differences between certain species can be overtly too alike to distinguish. However, Chandler (1916) and Dove (1997, p. 49) also found microscopic variations in different feathers on the same bird, and between ages and sex in the same species. That microscopic differences on the same feather, where even different areas have been sampled can show distinctions, can be further complicated if the origin of the feather sample is unknown, which is often the case for identifications (Dove, 1997). It has been suggested a study of multiple qualitative characters such as barbule morphology, length, node shape and pigment distribution be employed where possible, as well as the utilisation of a comprehensive reference database of different species, feathers, and down samples for comparative research (Dove, 1997, p. 54). Dove (1997, p. 55) also suggested a survey of the microstructures of feather tracts as conducted by Gilroy (1987) on rock doves.

In this study kiwi and moa feathers exhibited limited microscopic variation to demonstrate taxonomic distinction between the orders for positive feather identification using light microscopy. This is in contrast to genetic studies affirming clear historic divergence in and between ratite groups (Cooper et al., 1992; Haddrath & Baker, 2001). Unless the macroscopic features are atypical, and the (moa) feathers are over 5cm long, then microscopic identification as a method is presently limited. Chandler (1916) stated that all ratites have an absence or rudimentary condition of the apteria, the uselessness of the remiges for flight, the absence of differentiated plumules and filoplumes, and a lack of any typical pennaceous structure (i.e. no barbules, hooklets or barbicels on the pennaceous barbs), so feathers appear hair-like. Chandler (1916) classified ratites as having uniform plumage, not separated, and lacking pterylae (feather tracts) (p. 84). The downy barbules on an emu (*Dromaius novaehollandiae*), another Casuariiforme, were also thread-like, with nodes inconspicuously present as minute prongs (Chandler, 1916, p. 291). A study of another ratite body feather from the African ostrich (*Struthio camelus*) (Struthioniformes) highlighted that the feathers were the most distinct in this group in that they lacked an afershaft, and the barbs reached 15-20cm (Chandler, 1916, p. 285). The ostrich barbules were 2.5-3.5mm long, flat, and ribbon-like, and more or less intermediate between a typical downy and pennaceous barbule, but different from either, with no differentiation between the barbule base and main section (pennulum), and no barbicels (hooklets) except rudimentary prongs in the body feather (Chandler, 1916). Feathers of the South American rhea (*Rhea americana*) in the order Rheiformes exhibited similar features to ostriches in the absence of an aftershaft and having 2mm long barbules that appeared to have both plumulaceous and pennaceous characteristics (Chandler, 1916, pp. 288–289).

The similarities in moa and kiwi feathers; harrier and falcon; and most seabirds, suggests that rather than the difference between feathers be based solely on taxonomic positioning, it was also based on bird groups such as ratites, raptors, and ocean-dwelling birds. New Zealand ratites, moa (Dinornithiformes) and kiwi (*Apteryx* spp.) both have hair-like barbules and scale-like pronged nodes along the length of medium sized barbules. Raptors like the harrier (*Circus approximans*) and falcon (*Falco novaeseelandiae*) share similar sized barbules, and small nodes with pigment and prongs, in that the main difference being harrier feathers exhibited longer and asymmetric prongs. Most seabirds and waterbirds across several orders including

Procellariiformes (albatrosses and petrels); Podicipediformes (grebes); Sphenisciformes (penguins); Phaethontiformes (tropic birds) and Pelecaniformes (pelicans, cormorants, shags, frigatebirds, gannets and boobies) have reduced down, short-medium barbules with prongs of varying lengths and consistent distribution along the barbules. The only exception is the seagull, a shorebird that has large segmented and pigmented trapezoid nodes at the base of barbules only. Hooklet-like structures were also recorded on the base of downy barbules on some sea birds and waders such as albatross, gannet, heron and red-tailed tropic bird. Pigment in barbules was not always related to pigmentation or colour in feather down, for example, some white feathers had pigment in the nodes and barbules, as seen in seagull and falcon feathers. The replacement of nodes with prongs in seabird down in particular, is possibly an evolutionary adaptation in that down in seabirds is limited and nodal structures reduced to prongs possibly to streamline long distance flight and water motility. Dove and Agreda (2007) found expanded nodes at the barbule tips only in the feathers of dabbling ducks or shallow diving ducks, but not in diving ducks, as they believed this is due to the insulating nature of down in that the expanded nodes trap air. As seen in penguins (Sphenisciformes), loons (Gaviiformes, not discussed here) and alcids (auks, Charadriiformes) that lacked expanded nodes also, they have prongs on the nodes at the barbule tip much like Anseriforme barbules (Dove & Agreda, 2007, p. 198). It was suggested that the reduction of barbs with expanded nodes in diving birds was advantageous as it reduced buoyancy by trapping less air in with the feathers (Dove & Agreda, 2007). Also, that nodes were more prominent on smaller birds like Passerines possibly further confirms a functional role in regulating body temperatures.

2.5 Conclusions

This first description of microscopic feather down of New Zealand’s 21 bird orders based on differences characteristic of taxonomic position is a valuable tool that can be utilised for feather identification of unknown bird species in New Zealand ethnological, forensic and ecological research. Some microscopic characteristics were also diagnostic for the types of birds as well as taxonomic allocation. Future research in this area requires the detailed microscopic study of the species in each bird order, and sampling of at least one feather from each species from museum collections or wild populations. The similarities in moa and kiwi feathers also warrants further investigation into the microscopic study of verified moa species to determine possible distinctions between groups of Dininorthiformes (moa) and Casuariiformes (kiwi).

Microscopic feather descriptions and comparative studies of other extinct and extant species would also be beneficial, such as the extinct native New Zealand dove (Columbiformes: *Deliaphaps zealandiensis*); North and South Island geese (Anseriformes: *Cnemiornis* spp.), and laughing owl or whēkau (Strigiformes: *Sceloglaux albifacies*) (Checklist Committee (OSNZ), 2010; De Pietri, Scofield, Tennyson, Hand, & Worthy, 2018; Gill & Martinson, 1991; Tennyson & Martinson, 2006; Wood et al., 2016; Worthy & Holdaway, 2002). Where the macro- and microscopic characteristics of moa feathers cannot be distinguished by feather comparisons, and microscopy is not viable, and it is ethically feasible and scientifically warranted, it is suggested that genetic analysis be performed on feathers from paleofaunal sites for positive identification. Species of moa have been positively identified by DNA, through coprolites (Wood, Wilmshurst, Worthy, & Cooper, 2012), bones (Huynen, Gill, Doyle, Millar, & Lambert, 2014), and soft-tissue and feathers (Rawlence et al., 2009; Rawlence, Wood, Scofield, Fraser, & Tennyson, 2013). Genetic studies for New Zealand avifauna has developed into a valuable tool in taxonomic determination and conservation (Bunce et al., 2005; Burbidge, Colbourne, Robertson, & Baker, 2003; Shepherd & Lambert, 2008). DNA analysis has even shown potential in identifying feathers in ethnological collections (Hartnup et al., 2011). Where resources and time is limited, light microscopy has highlighted the importance of accumulating knowledge pertaining to New Zealand bird feather morphology and taxonomic studies.

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CHAPTER THREE: IDENTIFICATION AND DESCRIPTION OF FEATHERS IN TE PAPA'S MĀORI CLOAKS

3.0 Abstract

For the first time, scientific research was undertaken to identify the feathers to species level contained in 110 cloaks (kākahu) held in the Māori collections of the Museum of New Zealand Te Papa Tongarewa (Te Papa). Methods of feather identification involved a visual comparison of cloak feathers with museum bird specimens and analysis of the microscopic structure of the down of feathers to verify bird order. The feathers of more than 30 species of bird were identified in the cloaks and consisted of a wide range of native and introduced bird species. This study provides insight into understanding the knowledge and production surrounding the use of materials in the cloaks; it also documents the species of bird and the use of feathers included in the cloaks in Te Papa's collections from a need to have detailed and accurate museum records.

3.1 Introduction

The Museum of New Zealand Te Papa Tongarewa (Te Papa) houses more than 300 Māori kākahu (cloaks), of which 110 incorporate feathers. Fully feathered cloaks such as kahu kiwi (kiwi-feather cloaks), kahu kura (kākā-feathered or red cloaks) and kahu huruhuru (feather cloaks) are documented. The remaining cloaks have feathers in the borders or in small bunches, such as in korowai (cloaks that may have hukahuka, or two-ply flax-fibre tassels) and korowai kārure (cloaks with unravelling two- or three-ply flax-fibre tassels) (Fig. 3.1). Feathers were also identified in kaitaka (finely woven cloaks with tāniko, or colour geometric patterns, along the borders) and pihepihe (cloaks with cylindrical flax tags) (Pendergrast, 1987). The finer Māori cloaks found in Te Papa's collections are generally produced by scraping the leaves of the harakeke (New Zealand flax, *Phormium* spp.), and then weaving the resulting muka (flax fibre) to create the foundation of the cloak (Pendergrast, 1997, p. 6). The single-pair twining method (whatu aho pātahi) was employed for some coarser rain cloaks or capes, whereas the technique of double-pair twining (whatu aho rua) was used to secure attachments such as feathers, and hence was chosen for more decorative cloaks (Pendergrast, 1987, p. 14). The feathers were typically bunched or butted together and woven into the cloak as it was being made. By using the finger twining technique of whatu, the base of the feather shaft is secured to the vertical backing muka warps (whenu) using two pairs of smaller horizontal weft threads (aho rua), and the feather shaft is then bent back on itself to hold it in place (Te Kanawa, 1992, p. 34). Fragments of a seventeenth-century Māori cloak from a burial site in Strath Taieri in Central Otago were first described by Hamilton (1892, p. 487) and later discussed by Simmons (1968, p. 6), who suggested that, judging from the presence of weka (*Gallirallus australis*), albatross (family Diomedeidae) and moa (order Dinornithiformes) skin and feathers sewn and roughly attached to the fragments, the cloak was a prestige item. The find also exemplifies the change of birds and feathers used in Māori cloaks over time, which is seemingly dependent on the materials available, the preferred bird species, and the knowledge, skills and innovation of the weaver at the time of production.

***Figure 3.1*. Korowai kārure (cloak with unravelling flax-fibre tassels). Muka, dye, kererū feathers; spaced double pair twining, rolling. Te Papa ME014388. All Rights Reserved.**

Literature documenting nineteenth- and early twentieth century Māori feather cloaks mentions primarily the following endemic New Zealand species: brown kiwi (*Apteryx* spp.), New Zealand pigeon (kererū: *Hemiphaga novaeseelandiae*), kākā (New Zealand bush parrot: *Nestor meridionalis*), parakeet (kākāriki: *Cyanoramphus* spp.) and kākāpō (night parrot: *Strigops habroptilus*) (Hīroa, 1911, p. 84). Feathers from weka and the now extinct huia (*Heteralocha acutirostris*) have also been used in kākahu (Te Kanawa, 1992, p. 25). From the latter half of the nineteenth century onwards, striking geometric designs incorporating feathers from newly introduced exotic birds such as peafowl (*Pavo cristatus*), helmeted guinea fowl (*Numida meleagris*) and, later, pheasant (*Phasianus colchicus*) and domestic chicken (*Gallus *domesticus*) were sometimes mixed with feathers from declining native bird species (Pendergrast, 1987, p. 107). Since the foundation of the Colonial Museum in 1865, Te Papa's cloak collection has grown, through gifts, loans, donations, and acquisitions. Much of the information regarding the origins and materials used in these items was either not obtained or has been lost before their inclusion in the collection. In addition, the origin of feathers used in these cloaks has remained scientifically unverified until now. Various publications on Māori cloaks and bird lore indicate that at least 27 native and eight introduced bird species were used in kākahu after 1800. It is currently accepted that the cloaks with feathers studied were produced post-1800. The study and description of microscopic features of feathers from New Zealand birds and a comparison of cloak feathers against identified museum bird skins have facilitated the identification and verification of the bird species used in Te Papa's Māori cloaks for the museum's permanent records. It also enhances our knowledge of the avifauna utilised by Māori, as well as how this has changed with the protection of native bird species, and introduction of American and European game birds.

The identification of feathers from microscopic structures in the down was established by American scientists like Chandler (1916), who studied feather structure and its taxonomic significance among birds. Day (1966) examined feathers and hair microscopically from the gut contents of stoats in the British Isles to identify prey remains. More recently, scientists from the Smithsonian Institution have used downy structures of feathers and comparisons with museum bird skins to identify feather remains resulting from U.S. Air Force birdstrikes (Laybourne & Dove, 1994). Microscopic analysis of feathers has also been used to identify birds in textiles from international anthropological and archaeological studies (Dove, Hare, & Heacker, 2005; Dove & Peurach, 2002; Rogers, Dove, Heacker, & Graves, 2002). It has also been applied successfully in museum collections to infer the possible provenance (or geographic origins) of collection items (Dove, 1998; Pearlstein, 2010). Dove and Koch (2010) have described the key diagnostic features of feathers for the major bird groups occurring in forensic ornithology. Microscopic feather identification in New Zealand is still in its infancy. At the date of publication there is no national microscopic reference database of the features that characterise the feathers of New Zealand bird species. Fast alternative methods requiring less accuracy have been used over microscopic identification - such as studying reference collections of feathers to identify New Zealand falcon (*Falco novaeseelandiae*) prey remains (Seaton, Hyde, Holland, Minot, & Springett, 2008). A national molecular database of some New Zealand birds has assisted in the identification of birds from their DNA for historical and conservation purposes (Seabrook-Davison, Huynen, Lambert, & Brunton, 2009; Shepherd & Lambert, 2008), and the identification of emu (*Dromaius novaehollandiae*) feathers in a rare Māori cloak (Hartnup et al., 2009). Microscopic analyses and DNA profiling have been employed successfully to determine the origin of feathers in ethnological collections in overseas studies. Isotopic analysis of feathers, a science new to New Zealand, has also proven effective, with isotope mapping tools used to geo-locate bird origins in international research (Hobson, Van Wilgenburg, Wassenaar, Moore, & Farrington, 2007). These scientific methods have varying degrees of accuracy and present conservation issues relating to the extraction of materials for analysis.

***Table 3.1*. Native and introduced (*) bird species/ subspecies identified in Te Papa's Māori cloak collection, by numbers of cloaks with at least one feather of the listed species. (Total number of cloaks = 110)**

Number of Bird species cloaks with listed species	
Brown kiwi - *Apteryx* spp.[A]	52
New Zealand pigeon, kererū - *Hemiphaga novaeseelandiae* (Gmelin, 1789)	45
Kākā, bush parrot - *Nestor meridionalis* (Gmelin, 1788)[B]	43
Tūī, parson bird - *Prosthemadera novaeseelandiae* (Gmelin, 1788)	35
Domestic chicken, heihei - *Gallus domesticus* (Linnaeus, 1758)*	25
Common pheasant, peihana - ♂ *Phasianus colchicus* (Linnaeus, 1758)*	15
Peafowl (peacock) - ♂ *Pavo cristatus* (Linnaeus, 1758)*	13
Weka, woodhen - *Gallirallus australis* (Sparrman, 1786)[C]	12
Pūkeko, swamphen - *Porphyrio melanotus* (Temminck, 1820)	11
Parakeet, kākāriki - *Cyanoramphus* spp.[D]	10
Wild turkey - *Meleagris gallopavo* (Linnaeus, 1758)*	5
Albatross, toroa - family Diomedeidae [E]	4
Mallard - *Anas platyrhynchos* (Linnaeus, 1758)*[F]	4
Banded rail - *Gallirallus philippensis* (Linnaeus, 1766)	2
Long-tailed cuckoo, koekoeā - *Eudynamys taitensis* (Sparrman, 1787)	2
California quail - *Callipepla californica* (Shaw, 1798)*	2
Helmeted guineafowl - *Numida meleagris* (Linnaeus, 1758)*	2
Huia - *Heteralocha acutirostris* (Gould, 1837)	2
Australasian bittern, matuku - *Botaurus poiciloptilus* (Wagler, 1827)	1
Kākāpō, night parrot - *Strigops habroptilus* (G.R. Gray, 1845)	1
Morepork, ruru - *Ninox novaeseelandiae* (Gmelin, 1788)	1
Swamp harrier, kāhu - *Circus approximans* (Peale, 1848)	1
Shining bronze-cuckoo, pīpīwharauroa - *Chrysococcyx lucidus* (Gmelin, 1788)	1
Yellowhammer - *Emberiza citrinella* (Linnaeus, 1758)*	1

[A] North Island, Ōkarito, South Island and Stewart Island brown kiwi are included.

[B] North Island kākā and South Island kākā are included.

[C] North Island, western, buff and Stewart Island weka are included.

[D] Red-crowned, yellow-crowned, and orange-fronted parakeets are included.

[E] All albatross species of the genera Diomedea and Thalassarche are included.

[F] All varieties that interbreed with *Anas superciliosa* are included.

3.2 Materials, methods, and conventions

In Te Papa's Māori collections, 110 feathered cloaks were examined using microscopic feather analysis and comparisons with museum bird skins. Feathers from at least 24 native and introduced birds, including species and subspecies, were identified in the cloaks (Table 3.1). Where possible, bird species were identified with accuracy by comparing whole cloak feathers against museum bird skins. For cloak feathers with little or no morphological characters (i.e. white, black, or brown feathers), and feathers that required verification, the bird groups they belong to were identified by comparing diagnostic microscopic structures. Finally, a combination of the two techniques - microscopic characters to determine the bird order and whole-feather identification from museum skins to identify the species/ subspecies - were used. It was estimated that for each cloak the number of bird species from which feathers were obtained ranged between one and eight, with an average of three different bird species per cloak. The number of species, as well as the number of individual birds used, depended on the size of the birds, the types of feathers used, the number of feathers butted or bunched together, and ultimately the size and design of the cloak.

A list of potential bird species was prepared, and a database of feather images was created from museum skins, including species names, sex, age and colour variations (see Fig. 3.2). Owing to the size and fragility of the cloak and bird skin collections, and their location in separate buildings, it was logistically more suitable to use an image database to compare cloak feathers with birdskin images. This is contrary to other methodologies utilised by the Smithsonian Institution, where direct comparison of unknown feathers with the skins themselves is preferred. Detached feathers from bird skins were collected, and the species and feather types recorded to create a reference database of microscopic images of the feather down, and to compare them with fallen cloak feathers. Detached cloak feathers that had been collected and bagged over time (a common museum practice) were used for microscopic identification of some cloaks.

Figure 3.2. **Feather types from bird skins from Te Papa's collection used in comparisons with whole cloak feathers: (a) belly feathers from an albino North Island brown kiwi; (b) rump feathers from a common pheasant; (c) underwing covert feathers from a North Island kākā; (d) back feathers from a kākāpō; (e) vent feathers from a long-tailed cuckoo; (f) throat tufts from a tūī. Images by Hokimate Harwood, 2007.**

These feathers were checked and verified that they had originated from the corresponding cloak based on their size, colour, and pattern, if applicable. Identification methods utilising museum skins and microscopic feather analyses were favoured over other techniques owing to the accuracy required, and the time and monetary restrictions in identifying the number of cloaks. These techniques were also preferred as they did not involve any destruction of the collection items. Downy barbs extracted from contour feathers of a verified museum skin were dry-mounted onto glass slides, and examined using light microscopy (Leica DM500 at 40x, 100x and then 400x magnifications). Images were captured using a fitted microscope camera (Leica ICC50), and the Leica LAS EZ program was employed for processing images and recording measurements. Similarly, detached cloak feathers were dry-mounted for microscopic analysis of their nodes, to place the feather within a bird order and, if possible, to identify the bird family or species/ subspecies.

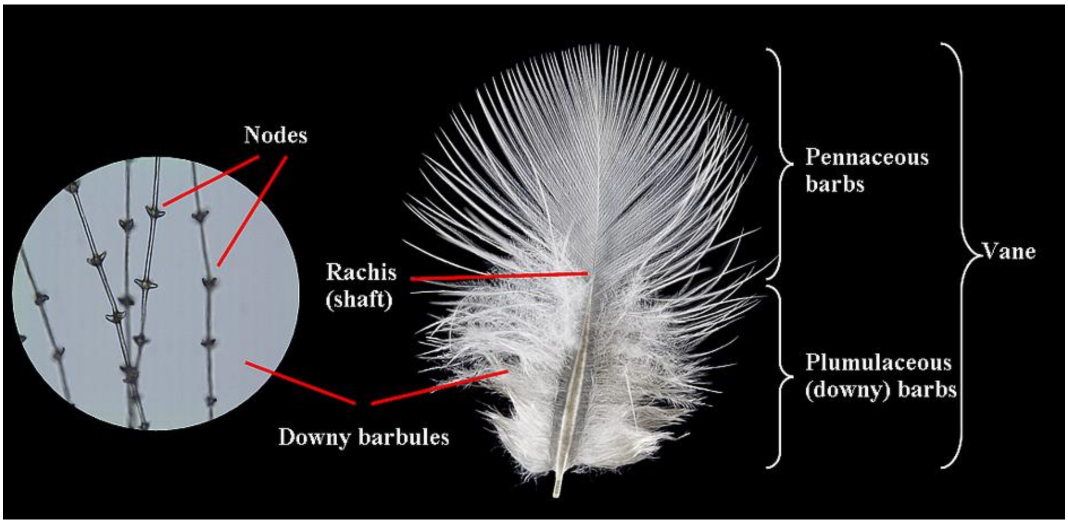

Figure 3.3. **Kererū (New Zealand pigeon) contour feather showing pennaceous barbs, plumulaceous (downy) barbs and nodes on downy barbules. Feather image by Raymond Coory (Te Papa), 2006. Microphotograph and diagram by Hokimate Harwood, 2007.**

Contour feathers from adult skin specimens used for microscopic identification are described as feathers with 'fluffy' down at the base of the feather, a distinct central shaft or rachis, and vanes (barbs) on either side, covering the body of the bird (Dove, 1997, p. 47; Marchant & Higgins, 1990, p. 38) (Figs. 3.3 & 3.4). Contour feathers can also be found in the wings and tail. The barbs at the tip of the feather are known as pennaceous barbs and have small hooklets that link together, providing structure to the feather. The downy structures at the base of the feather, the plumulaceous barbs, have perpendicular barbules attached, which provide insulation for the bird (Dove & Koch, 2010, p. 21).

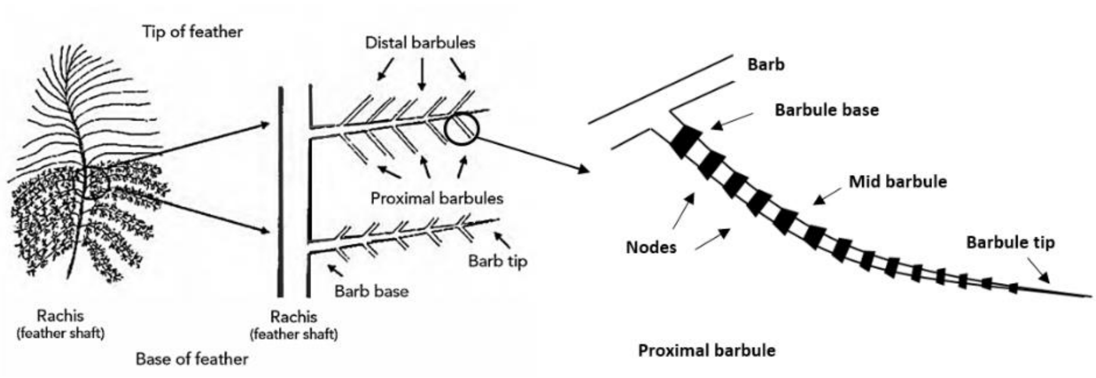

***Figure 3.4*. Diagrammatic structure of a down feather, showing the orientation of nodes and barbules on barbs (modified from Day (1966) and Dove & Koch (2010)).**

Most downy barbules have generally distinctive structures called nodes and, or prongs (see Figs. 3.5–3.8). The length of the space between two nodes was measured as the internodal length (Dove, 1997, p. 51). The average length and width of the downy barbules vary depending on the bird order. Additional parameters useful in systematic studies of feathers are size, shape, and, sometimes, the distribution of nodes along the barbules. Pigmentation within the nodes and along the barbules is also variable among birds. These microscopic features were observed and recorded for each feather that was not identifiable by direct comparisons with museum skins. Each feather sample was studied for nodal morphology, pigmentation patterns, length of barbules, presence of villi (transparent fringe-like projections on the base of barbules; Fig. 3.8e) and other diagnostic characters (e.g. rings, triangle-shaped nodes) that would allow identification of the group of birds to which it belonged (Dove & Koch, 2010, p. 21). As diagnostic features for bird orders may vary among species, feather types, and even between barbs and barbules on a feather, it was important to take several samples, and to use whole feathers for microscopic and museum skin comparisons where possible. Methods and conventions for the identification of feathers in Te Papa's Māori cloaks follow those described by Chandler (1916) and Day (1966), while descriptions of nodes and pigmentation follow Dove & Koch (2010). Descriptions of feather colour follow Svensson (1992), and descriptions of feather type follow diagrams from Marchant & Higgins (1990). Bird nomenclature, vernacular names, and sequence of orders for New Zealand birds follow the Checklist of the Birds of New Zealand (Checklist Committee (OSNZ), 2010).

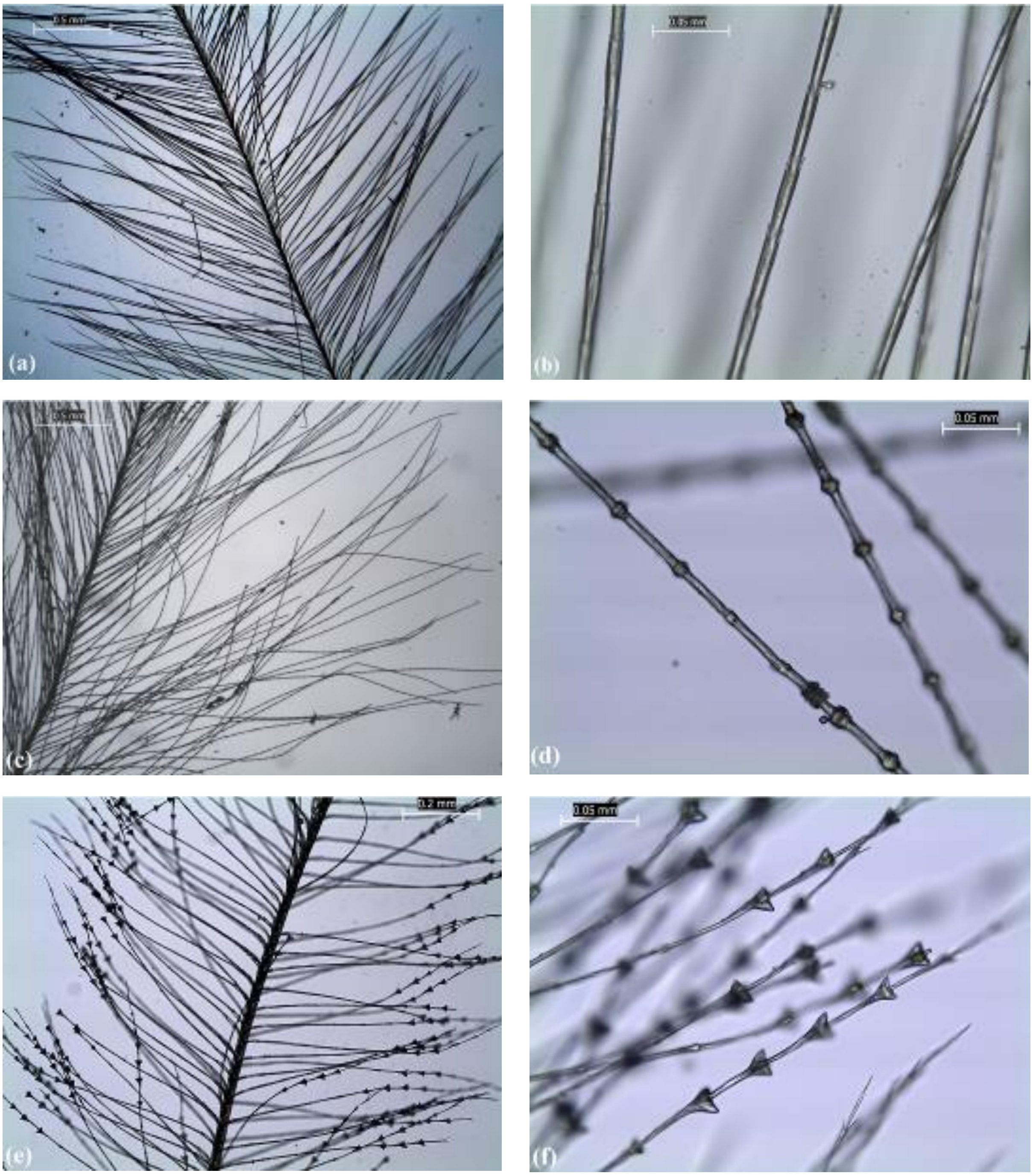

***Figure 3.5*. Photomicrographs of downy barbules from New Zealand birds examined: (a) barbules from a North Island brown kiwi - Casuariiformes; (b) pronged nodes from a North Island brown kiwi - Casuariiformes; (c) barbules from a domestic chicken - Galliformes; (d) multiple ringed nodes from a domestic chicken - Galliformes; (e) barbules from a mallard - Anseriformes; (f) triangular nodes at the barbule tip from a mallard - Anseriformes.**

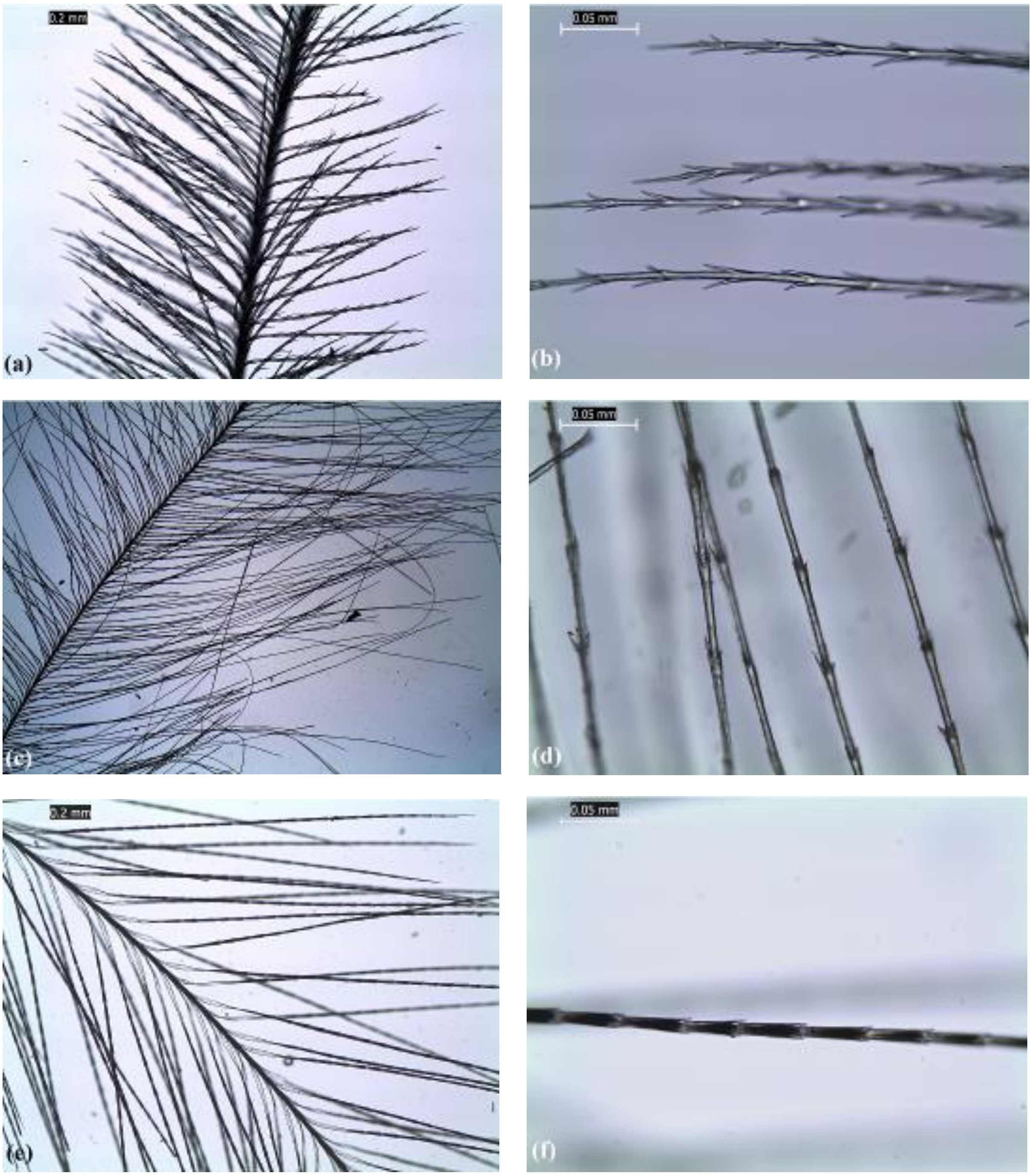

Figure 3.6. **Photomicrographs of downy barbules from New Zealand birds examined: (a) barbules from a Gibson's albatross - Procellariiformes; (b) pronged nodes from a Gibson's albatross - Procellariiformes; (c) barbules from a swamp harrier - Accipitriformes (40x); (d) asymmetric spined nodes from a swamp harrier - Accipitriformes; (e) barbules from a weka - Gruiformes; (f) internodal pigmentation from a weka - Gruiformes.**

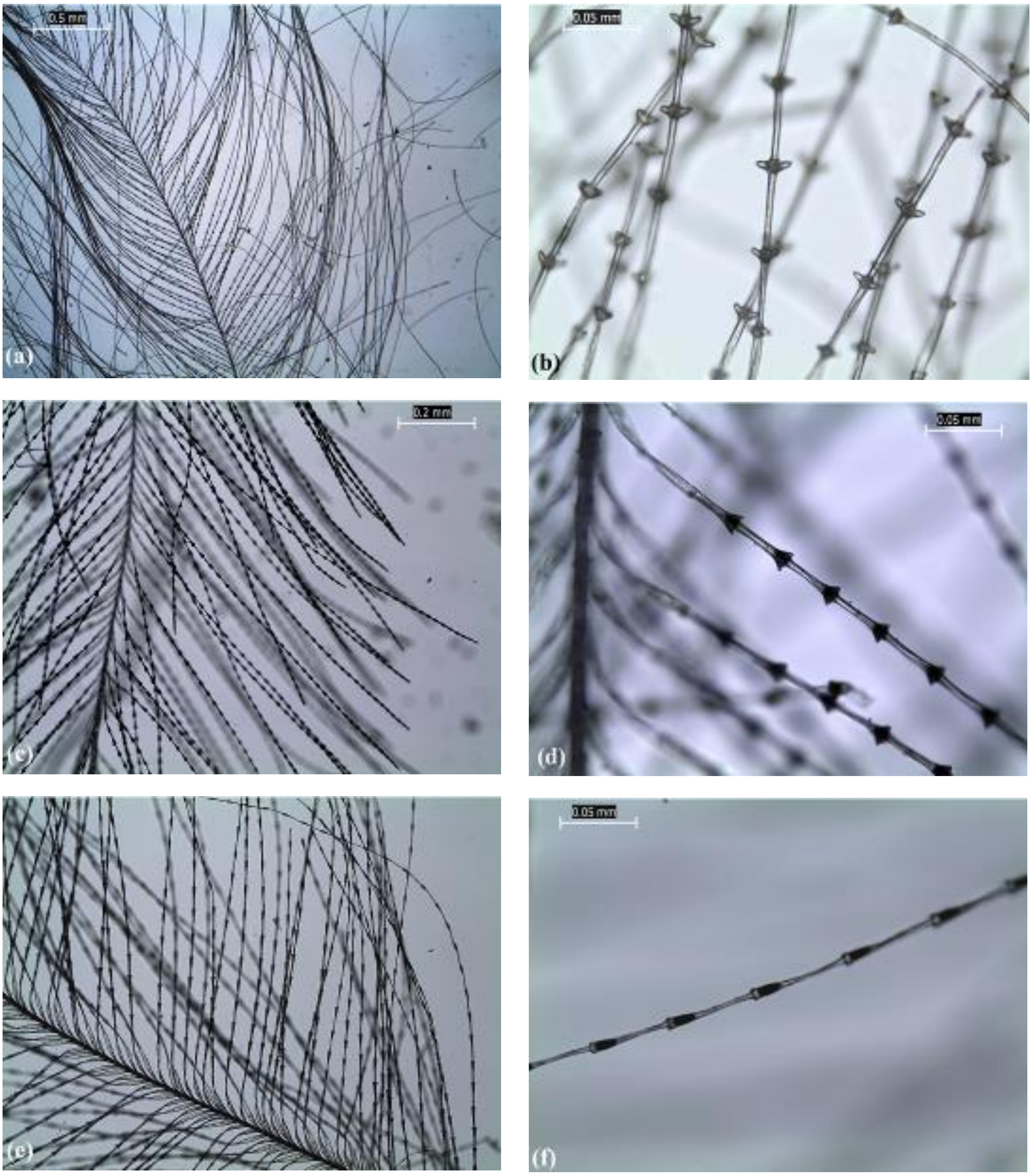

***Figure 3.7*. Photomicrographs of downy barbules from New Zealand birds examined: (a) barbules from a New Zealand pigeon - Columbiformes; (b) crocus-shaped nodes at the barbule base from a New Zealand pigeon - Columbiformes; (c) barbules from a red-crowned parakeet - Psittaciformes; (d) expanded nodes at the barbule base from a red-crowned parakeet - Psittaciformes; (e) barbules from a long-tailed cuckoo - Cuculiformes (100x); (f) pre-nodal pigmented nodes from a long-tailed cuckoo - Cuculiformes.**

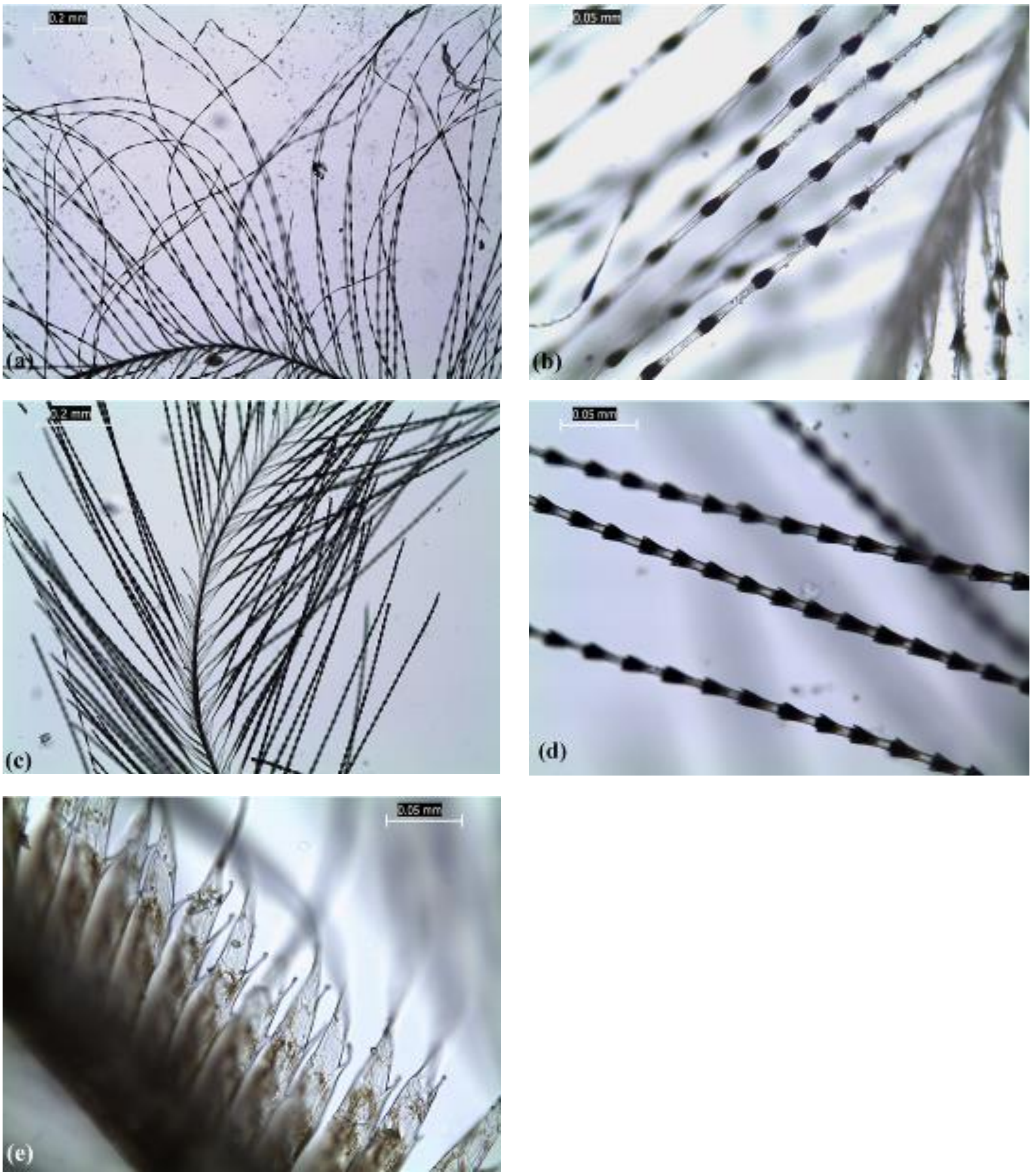

***Figure 3.8*. Photomicrographs of downy barbules from New Zealand birds examined: (a) barbules from a morepork - Strigiformes; (b) large pigmented nodes at the barbule base from a morepork - Strigiformes; (c) barbules from a huia - Passeriformes; (d) closely spaced pigmented nodes from a huia - Passeriformes; (e) villi at the barbule base from a huia - Passeriformes.**

3.3 Microscopic feather descriptions and their use in cloaks

There are 21 bird orders present in New Zealand (Checklist Committee (OSNZ), 2010). Feathers from 12 bird orders were identified in Te Papa’s cloaks, and the use of species from each order is discussed below. Feathers from 11 bird orders were examined and identified microscopically; key diagnostic features of 16 feathers belonging to 16 bird species/ subspecies from those 11 bird orders are summarised in Table 3.2. The use of different feather types is discussed with respect to their presence in Te Papa's Māori cloaks only. Similar feather types from museum skin species and those recorded in the cloaks have been microscopically examined. This is an initial attempt to describe the feathers of New Zealand bird orders at a microscopic level, and to document diagnostic feather characteristics for replication in future identification research.

3.3.1 Order Casuariiformes, family Apterygidae - kiwi

***Figure 3.9*. Close-up of albino brown kiwi feathers in a kahu kiwi (kiwi feather cloak). Te Papa ME002701. Image by Hokimate Harwood, 2009.**

Kiwi are part of a group of birds known as ratites, which includes emus, cassowaries, and moa. Kiwi belong to the family Apterygidae and comprise five species, three species of brown kiwi (including two subspecies) and two species of spotted kiwi (Worthy, 2010c, p. 19). It is inferred that feathers from the North Island brown kiwi (*Apteryx mantelli*) and South Island brown kiwi (*A. australis australis*) were present throughout the cloak collection. However, it was not possible to identify accurately the feathers of brown kiwi to species level using microscopy and comparisons with museum skins alone. A feather from a North Island brown kiwi was microscopically examined to represent this group of birds, and to determine general features of brown kiwi feathers for cloak identifications. Diagnostic characteristics unique to this order are given in Table 3.2.

Table 3.2. **Summary of microscopic examination of bird feathers identified in Te Papa's Māori cloaks.**

Order, Family and Species/ subspecies of bird feather specimens	Feather type and down description	Diagnostic features of feather	Pigment and node distribution on barbules
Order Casuariiformes Family Apterygidae North Island brown kiwi - *Apteryx mantelli* (Bartlett, 1852)	Brown back feathers. Barb sample from middle of down. Barbs are long to very long.	Barbules are medium to long and hair-like (Fig.5a). Minute but distinct nodes with four small symmetrical prongs all along barbules that decrease in size (Fig.5b). Longer prongs at barbule tip.	Little or no pigment in nodes and barbules. Nodes flat with small prongs all along barbules, these becoming thinner and fewer towards barbule tips.
Order Galliformes Family Phasianidae Domestic chicken - *Gallus gallus domesticus* (Linnaeus, 1758)	Black and white barred belly feather. Barbs are long, fine and dense. Barb sample from middle of down.	Barbules are long (Fig.5c). Multiple ring-like structures surround nodes in middle of barbules, in barbules at base of barbs only (Fig.5d).	Little pigment in barbules and little to medium in nodes. Expanded nodes at barb base. In middle of barbules, bases of nodes detach and form multiple ring-like nodes.
Order Galliformes Family Phasianidae Common pheasant - *Phasianus colchicus* (Linnaeus, 1758)	Brown belly feathers. Down is fine and grey, and dense. Barb sample from middle of down.	Barbules are longer and thinner than in Gallus feather specimen. Considerably fewer multiple ring-like nodes compared with Gallus.	Medium pigment in barbules, with little to medium in nodes. Nodes are all along barbules, and are globular, or expanded with few multiple ring-like nodes.
Order Anseriformes Family Anatidae Mallard - *Anas platyrhynchos* (Linnaeus, 1758)	Brown and white speckled belly feather. Barb sample from base of feather.	Barbules are short, thread-like, and thin (Fig.5e). Two to four distinctive large triangular nodes are located at barbule tips only, in barbules at base of barbs (Fig.5f).	Very tips of barbules have large prongs. Barbules from mid-barb to tip have prongs only from middle of barbule. Little or no pigment in barbules, nodes, and prongs.
Order Procellariiformes Family Diomedeidae Gibson's albatross - *Diomedea antipodensis gibsoni* (Robertson & Warham, 1992)	White underwing covert feather. Down is dense. Barb sample from middle of down.	Barbules are very short but slightly increase in length from barb base to tip (Fig.6a). Four symmetrical transparent prongs at each interval along most barbules (Fig.6b).	Little pigment in barbules or prongs. Two to four prongs at each interval, symmetrical in pairs. Prongs slightly curved outwards towards tip, decreasing in size from barbule base to tip.
Order Accipitriformes Family Accipitridae Swamp harrier - *Circus approximans* (Peale, 1848)	Cream belly feather with brown line down shaft. Barb sample from middle of down.	Barbules are long (Fig.6c). Two pairs of asymmetrical pronged nodes at intervals at base and tips of barbule (Fig.6d). Middle of barbules has small prongless nodes.	Barbules have little pigment. Nodes with light to medium pigmentation, small and bulbous, decreasing in size along barbules. Pronged nodes are closely spaced at barbule base and tip.
Order Gruiformes Family Rallidae Western weka - *Gallirallus australis* (Sparrman, 1786)	Dark brown flank feather with medium brown mottling. White barb sample from middle of down.	Barbules are dark brown, straight, and medium length (Fig.6e). Nodes are indistinct. Small transparent prongs at node intervals, pigment is lacking around prongs (Fig.6f).	Barbules are heavily pigmented and wide. Prong length is uniformly short all along barbules. Internodal spaces are uniform except at tips, where nodes are closely spaced.
Order Gruiformes Family Rallidae Pūkeko - *Porphyrio melanotus* (Temminck, 1820)	Iridescent black back feather. Barbs are long and white. Barb sample from middle of down.	Barbules are short, thread-like, and thin (Fig.5e). Two to four distinctive large triangular nodes are located at barbule tips only, in barbules at base of barbs (Fig.5f). Barbules are very short but slightly increase in length from barb base to tip (Fig.6a). Four symmetrical transparent prongs at each interval along most barbules (Fig.6b).	Barbules are thin, with medium to heavy pigmentation except around nodes.

Order, Family and Species/ subspecies of bird feather specimens	Feather type and down description	Diagnostic features of feather	Pigment and node distribution on barbules
Order Columbiformes Family Columbidae New Zealand pigeon - *Hemiphaga novaeseelandiae* (Gmelin, 1789)	White belly feather. Down is white and dense. Barb sample from base of feather.	Barbules are long and 'wispy', tapering to very thin at tips (Fig.7a). Four to six expanded crocus-shaped nodes at base of barbules (Fig.7b).	Barbules and nodes have little pigment. Quadrilobed crocus-shaped nodes at barbule base only, then they abruptly decrease in size towards barbule tips.
Order Psittaciformes Family Strigopidae North Island kākā - *Nestor meridionalis septentrionalis* (Lorenz, 1896)	Red-tipped belly feather. Down is grey and white. Barb sample from middle of down.	Barbules are long to very long, with shorter barbules at barb tip. Expanded nodes occur at medium intervals, larger at barb base, globular at mid-barb, and with small prongs at barb tip.	Barbules have little to medium pigmentation and nodes medium to heavy pigmentation, except in node extremities. Pigmented nodes present along barbules become closer and thinner towards barbule tip.
Order Psittaciformes Family Psittacidae Red-crowned parakeet - *Cyanoramphus novaezelandiae* (Sparrman, 1787)	Light green breast feather. Down is dense. Barb sample from middle of down.	Barbules are medium to long, decreasing in length towards barb tip (Fig.7c). Expanded pigmented nodes at base of barbule (Fig.7d), smaller nodes at medium intervals along remainder. Nodes can have small transparent extremities.	Nodes are pigmented except in lobes. Nodes become longer and thinner towards barbule tip, and some have prongs.
Order Cuculiformes Family Cuculidae Long-tailed cuckoo - *Eudynamys taitensis* (Sparrman, 1787)	White belly feather with a brown line down shaft. Down is dense and grey. Barb sample from middle of down.	Barbs are short and barbules are medium to long in length (Fig.7e). At base of barbules are long, thin, bell-shaped nodes with pre-nodal pigmentation (Fig.7f).	Pigment limited to top of nodes in barbules at middle and base of barb. Nodes decrease in size at base and mid-barb. Nodes at barbule tip are very thin, long, and closely spaced.
Order Strigiformes Family Strigidae Morepork - *Ninox novaeseelandiae* (Gmelin, 1788)	Brown, cream and white mottled belly feather. Down is soft and dense. Barb sample from base of feather.	Barbs are long, and barbules are medium to long (Fig.8a). Dark, expanded nodes occur at medium intervals at barbule base (Fig.8b), globular nodes at mid-barbule, and thin, long nodes at tip.	Large pigmented triangular nodes at barbule base, with a gradual decrease to smaller nodes at middle, and very thin nodes at barbule tips, these with some prongs.
Order Passeriformes Family Meliphagidae Tūī - *Prosthemadera novaeseelandiae* (Gmelin, 1788)	Iridescent black breast feather. Down is grey. Barb sample from middle of down.	Barbules are medium to long. Nodes are heavily pigmented and quadrilobed, with small prongs. Villi are present at base of barb and barbules.	Barbules are wide, pigmented only at nodes. Internodal spaces are short, becoming very short at barbule tip. Nodes are present all along barbules, gradually decreasing in size along barbule.
Order Passeriformes Family Callaeidae Huia - *Heteralocha acutirostris* (Gould, 1837)	Black breast feather. Down is dense. Barb sample from base of feather.	Barbules are short to medium in length (Fig.8c). Nodes are heavily pigmented and quadrilobed, with short internodal spaces (Fig.8d). Villi with distinctive knobbed ends occur at base of proximal barbules (Fig.8e).	Barbules are wide, width gradually decreases along barbule. Heavy pigment in nodes except in prongs, little to medium pigment in internodal spaces. Nodes triangular, gradually decreasing in size at barbule tip.
Order Passeriformes Family Emberizidae Yellowhammer - *Emberiza citrinella* (Linnaeus, 1758)	Canary-yellow flank feather. Down is dense. Barb sample from middle of down.	Barbules are short to medium length. Nodes are pigmented and quadrilobed, with rudimentary prongs at base of barbules. There are few villi at base of barbules.	Little to medium pigmentation in barbules, heavy in nodes. Internodal spaces of medium length, shorter towards barbule tips.

Kiwi feathers were hair-like and the barbs are long and filamentous. Chandler (1916) described the microscopic features of feathers from a great spotted kiwi (*Apteryx haastii*) as having some downy barbs at the base of the feather, with small but distinct nodes and prongs present on barbules (p. 293). Barbules were measured at 2-3mm long in well-developed downy regions (Chandler, 1916, p. 294). The microscopic examination of *A. mantelli* for this research confirmed similar characteristics within the family Apterygidae. The barbules were medium to long, transparent and flat at the base, tapering to thin and spindly (hair-like) at the tip (Fig. 3.5a). Nodes were minute and flat, sometimes with four short, symmetrical prongs that point towards the tip of the barbule (Fig. 3.5b). The tips of some barbules also had large prongs. Brown kiwi feathers were identified in 52 of Te Papa's cloaks, with feathers fully covering the cloak (kahu kiwi) or applied in strips or small bunches. Kiwi feathers from the body of the bird, roughly uniform in size and colour, were recorded, with the larger, strongly coloured back feathers being more prevalent. Hīroa (1911) also noted the preference of back feathers for kākahu (p. 84). Most of Te Papa's kahu kiwi are woven to show the ventral side of the feather facing outwards, referred to as whakaaraara, but five cloaks have feathers placed as on the bird, referred to as tāmoe (Hīroa, 1911, p. 84). The calamus, or quill, at the very base of the feather is generally woven into the cloak using the muka aho (weft threads). In three cloaks, the tip of a single feather was woven into the cloak with the calamus pointing outwards. Natural kiwi feather colours in the cloak collection range from white (albino), faded cream or off-white, to light brown, medium brown, rufous (reddish brown), dark brown and black-brown. Pure white (albino) brown kiwi feathers are defined as lacking any kind of pigmentation in the shaft, barbs, or barbules (Fig. 3.2a). Albino feathers were recorded in seven cloaks, observed in patterns as strips, or as single feathers among other brown feathers (Fig. 3.9). Albino kiwi birds were present but rare in pre-1900 brown kiwi populations, and white kiwi feathers would have been highly coveted by Māori for their inclusion in kākahu. Albinism in kiwi ranged from single feathers to patches of white feathers amongst brown feathers (partial albinism), and to pure or full albinism (Buller, 1873, pp. 310, 322). For Māori, kahu kiwi represent mana (status and prestige). They are the most common type of feathered cloak in Te Papa's collections. At least five different kahu kiwi had hidden feathers from other birds, including huia, kākā, and weka, which could be viewed only when the surrounding feathers are lifted. One kahu kiwi has concealed chicken and pheasant feathers as well a loop of green wool. Brown kiwi feathers were also woven to form a word on one feather cloak.

3.3.2 Order Galliformes, family Phasianidae - introduced game birds

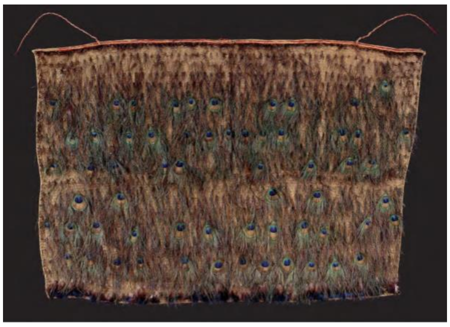

***Figure 3.10*. Kahu huruhuru (feather cloak) with peacock-tail feathers. Te Papa ME003723. All Rights Reserved.**

Feathers from a domestic chicken (*Gallus gallus domesticus*) and a common pheasant (*Phasianus colchicus*) were examined microscopically (Table 3.2) for the identification of cloak feathers. Chandler (1916) observed that down from Galliformes was dense and that barbules were long, potentially reaching 5mm (p. 340). The barbules had characteristic ring-like multi-nodal structures, found on closely situated distal barbules near the base of the barb, sometimes totalling two to three nodes linked together on the barbules (Day, 1966, p. 213). Microscopic examination of Gallus feathers showed the distinctive ring-like nodes in the middle of the barbules at the base of the barb. The barbules were long (Fig. 3.5c). Ringlike nodes are sometimes multiple and appear to move freely along the barbule, having detached from the base of small nodes in the middle of the barbules (Fig. 3.5d). At the middle and tip of the barb, smaller nodes appeared along the barbules. The pheasant barbules in this study were generally longer and thinner than those from Gallus. Node shapes varied from expanded to small nodes with detaching sections, seen as multiple ‘rings’ on barbules. Pheasant barbules had considerably fewer multiple rings than those from chickens, averaging one to two barbules with rings per barb. Multiple ring-like nodes appeared on distal barbules only. Barbules on turkey feathers were described by Day (1966) as having neither characteristic shapes nor multi-nodal structures (p. 213). Chicken feathers of various types, breeds and colours were recorded in 25 Māori cloaks. Many feather colour combinations were present, from single to multiple feather colour combinations in various patterns. Feather colours ranged from white, cream and gold to crimson, scarlet, brown, grey, and iridescent black, as well as dyed feathers. The bi-coloured hackle feathers from the neck and back, as well as the breast and belly feathers of the chicken, were widespread in the cloak collection. Chicken feathers were arranged in strips, bunches and on borders in cloaks. Strikingly coloured and patterned feathers from male pheasants were identified in the cloak collection. Breast and back feathers, as well as those from the belly, flank, nape and rump, were recorded in 15 cloaks from museum skin comparisons (Fig. 3.2b). Pheasant feathers were displayed in the cloaks in small bunches, as strips, or as single feathers mixed with those from other species. Identifications of feathers from peafowl, turkey (*Meleagris gallopavo*), California quail (*Callipepla californica*), and guinea fowl present in Te Papa's cloaks were made from comparisons against birdskin images, and without microscopic analysis. Peacock (male peafowl) feathers were observed in 13 cloaks. Iridescent blue feathers from the neck, green 'peashell' feathers from the back, and black and white mottled feathers from the scapular were recorded. The iridescent 'eyes' and herl (barbs) from the tail were also visually identified in one kahu huruhuru, in which they created a unique and stunning effect (Fig. 3.10). Striking iridescent turkey feathers were identified in five cloaks. The most common turkey feathers in the cloaks were white-tipped, barred brown and black feathers from the upper tail, and iridescent black feathers from the breast. Different turkey feathers were incorporated into cloak patterns, in bunches or strips, or as single feathers mixed with those of other species. Vertically striped brown and white side belly feathers of California quail, together with mottled brown, cream and white belly feathers, are displayed in small bunches as contrasting colours against surrounding feathers of other species. The distinctive white-spotted grey feathers of the guinea fowl are easily identifiable in two of Te Papa's cloaks, attached as small and large bunches within cloak patterns.

3.3.3 Order Anseriformes, family Anatidae - ducks, geese, and swans

While this order includes numerous native and introduced bird species (Worthy, 2010b, p. 30), to date only feathers of the introduced mallard (*Anas platyrhynchos platyrhynchos*) have been identified in Te Papa's cloaks. Mallards were initially introduced from the United Kingdom in 1865 (Long, 1981, p. 55), and have since widely hybridised with native grey duck, or pārera (*A. superciliosa*). A feather specimen from the belly of a mallard was studied microscopically to identify cloak feathers to this order. Key characteristics are summarised in Table 3.2.

Duck barbules were described by Chandler (1916) as generally less than 1mm long and distinctive only at the tip, where he noted between two and eight large, well-developed nodes followed by a slender tip (p. 329). According to Day (1966), anatids have easily recognisable, large triangular shaped nodes, located only at the tips of the barbules and barbules can measure 1.5-2mm long (p. 214). Anas barbules situated at the base of the barb were simple, short, thin, and thread-like, with two to four characteristic large nodes at the tips (Fig. 3.5e). The nodes at the tips were significantly expanded and triangular, and followed by two to four large pronged nodes (0.01mm long) (Fig. 3.5f). The distal tip of a barbule was usually a single thin point. Mallard feathers were identified in four cloaks, originating from the underwing (white feathers), the sides (brown and black feathers) and the belly (black and white speckled or vermiculated feathers) of the bird. A single mallard feather was found concealed alongside a single white (albino) brown kiwi feather in a kahu kiwi. Mallard feathers were also found in strips on borders and in geometric patterns.

3.3.4 Order Procellariiformes, family Diomedeidae - albatrosses

The family Diomedeidae is represented in New Zealand by 17 species of albatross (Tennyson, 2010, p. 64). A feather specimen from the underwing of a Gibson's albatross (*Diomedea antipodensis gibsoni*) was studied and its characteristics are recorded in Table 3.2. Chandler (1916) described barbules from the wandering albatross (*Diomedea exulans*) as short, reaching only 1mm long, and having forward-curved, asymmetrical prongs, either single or double, sometimes measuring up to 0.04mm long (p. 305). Microscopic examination of a feather from a Gibson's albatross confirmed that the barbules were short and wide at the base, and longer and spindly towards the tip of the barb. There were prongs all along most barbules (Fig.6a), these being longer at the base of the barbule. Most barbules had two to four prongs at intervals, with one pair sometimes longer than the other (asymmetrical) (Fig. 3.6b). White albatross body feathers, particularly from the breast and belly, were observed in Te Papa's cloaks arranged in small bunches within patterns, in strips, in borders, and as single feathers alongside those of other species.

3.3.5 Order Ciconiiformes, family Ardeidae - herons and bitterns

***Figure 3.11*. Close-up of swamp harrier and Australasian bittern feathers in a kahu huruhuru (feather cloak). Te Papa ME014385. Image by Hokimate Harwood, 2007.**

Large, mottled cream and dark brown feathers from the rump, flank, breast and upperwing of the Australasian bittern (*Botaurus poiciloptilus*) were identified in one cloak by comparisons with museum skins, without the use of microscope examination. These distinctive body feathers are large and, judging from their placement in the cloak as vertical strips, it is estimated that only one bird would have been used for the cloak (Fig. 3.11).

3.3.6 Order Accipitriformes, family Accipitridae - eagles and hawks

In New Zealand, the family Accipitridae includes only one breeding species, and few occasional visitors and extinct species (Worthy, 2010a, p. 169). A microscopic study of a feather specimen from a swamp harrier (*Circus approximans*) was made, and its diagnostic features are summarised in Table 3.2. Barbule nodes were inconspicuous in the down of hawks, and often had long, asymmetrical prongs and little pigmentation, while barbules were short, 1.5-2mm long (Day, 1966, p. 215). Chandler (1916) observed a more definite distinction, noting that in hawks the barbules are long and slender with small nodes and short prongs at the tips, whereas in falcons they have larger, heavily pigmented nodes, with slight kinks in the barbules (p. 336). Dove and Koch (2010) suggested that the diagnostic features of hawk feathers are long to very long barbules, with little pigment in the barbules and no pigment in the nodes (p. 39). The nodes also had some spines (prongs) that appeared asymmetrical in length. Barbules of the swamp harrier were long, with light to medium stippled pigment (Fig.

3.6c) and lightly pigmented pronged nodes that appeared asymmetrical and closely spaced at intervals on the barbule base and tips (Fig. 3.6d). Multiple bicoloured swamp harrier feathers (white and brown or brown and light brown) were identified in one of Te Papa's cloaks. White, brown, and light brown feathers from the belly, vent and flanks were also identified using comparisons with museum skins. Swamp harrier feathers were woven in small bunches in vertical strips on a kahu huruhuru, alongside Australasian bittern, kākā and New Zealand pigeon feathers, as well as undyed wool in horizontal strips (Fig. 3.11).

3.3.7 Order Gruiformes, family Rallidae - rails, gallinules and coots

Feathers of species of weka and pūkeko (*Porphyrio melanotus melanotus*) were identified in the Te Papa cloaks. Table 3.2 summarises microscopic characteristics observed in a feather of a western weka (*Gallirallus australis australis*), and in one from a pūkeko.

Chandler (1916) measured rallid barbules at 1.5-3.5mm long and described them as having short internodal spaces heavily pigmented along most of the barbule (p. 353). Day (1966) described typical rallid barbules as short and stout, 1.5-2mm long, with two to four swollen, heartshaped nodes at their base, which become less swollen and closer together towards the barbule tip (p. 214). Weka barbules were of medium length, very wide all along but abruptly decreased in width immediately after the prongs, producing a scaling effect (Fig. 3.6e). The nodal structure and internodal spaces were difficult to determine in western weka barbules, which were wide, indistinct, and heavily pigmented along most of their length, with four small prongs at intervals separating the pigmentation (Fig. 3.6f). Small symmetrical prongs appeared all along the barbules with little or medium pigment. Pūkeko barbules shared more of the typical characteristics of other Gruiformes and differed considerably from those of weka in microscopic features. Pūkeko barbules had four large quadrilobed nodes, at the base of distal barbules from the base of the barbs; in proximal barbules these nodes appeared smaller, indicating a characteristic of asymmetry as seen in this order. These barbules appeared thin, with medium to heavy pigmentation except in and just after the nodes and were also shorter than those seen in weka. Pūkeko barbules at mid-barb had small pronged nodes all along their length and at the tip of the barb; short barbules had long prongs at the base and tips.

Weka feathers from the back, breast, belly, and rump were found in 12 of Te Papa's Māori cloaks. The species could not be determined based on microscopic and skin comparisons alone. As with brown kiwi feathers, weka feathers were often turned over on cloaks, with the ventral surface facing outwards. Single or small bunches of weka feathers were dispersed among brown kiwi feathers in two kahu kiwi, and several different body feathers were identified in the main central pattern of a kahu weka (weka-feather cloak).

Pūkeko feathers in Te Papa's cloaks are mainly purple-blue feathers from the breast and belly, but white feathers from the vent under the tail and black feathers from the back are also present. Feather colours from this species range from pastel blue to royal blue, and are used in strips, small bunches, and borders. The distinctive small black and white barred belly feathers from the banded rail (*Gallirallus philippensis*) were confirmed using birdskin comparisons. These feathers adorned two cloaks in the form of strips and small bunches.

3.3.8 Order Columbiformes, family Columbidae - pigeons and doves

The native New Zealand pigeon (*Hemiphaga novaeseelandiae*) is most likely the only species of this order present in Te Papa's cloaks. Microscopic features of feathers from this pigeon are summarised in Table 3.2. Body feathers from columbids have a significant amount of down in the breast and, particularly, in the belly. The rachis is also distinctively flattened at the calamus. Barbules from columbids have been described as having three to eight large, expanded and conspicuous nodes at the base, with another three to eight less conspicuous nodes decreasing in size towards the barbule tip, where there may be minute prongs (Chandler, 1916, p. 361). Most barbules were long and measured up to 3-4mm in length despite some variation among genera (Chandler, 1916, p. 361; Day, 1966, p. 214). Dove and Koch (2010) also noted some asymmetry in node sizes in distal and proximal barbules. New Zealand pigeon feathers have typical columbid barbules, being long with four to six large crocus-shaped (four-lobed) nodes at the base of most barbules (Figs. 3.7a & b). Node size abruptly decreases near the middle of the barbule, until there are minute or no nodes, and there may be three to four pairs of long, transparent prongs at the barbule tip. Internodal spaces are uniformly long, and barbules and nodes have little pigment. Feathers from the New Zealand pigeon were widespread throughout the cloak collection, having been identified in 45 cloaks. The green neck feathers, and white breast and belly feathers are the most common types found. Maroon and ‘teal green’ back and upperwing coverts are also present to a lesser degree. The white and green feathers are used either in strips, borders or contrasting patterns. One kahu huruhuru featured the green neck feathers, which covered most of the cloak.

3.3.9 Order Psittaciformes - parrots and parakeets

The endemic kākāpō and kākā belong to the family Strigopidae, while native parakeets belong to the family Psittacidae (Chambers, 2010, p. 249). Feathers of all three kinds of birds from this order were identified in cloaks. Feathers from a North Island kākā (*Nestor meridionalis septentrionalis*) and a red-crowned parakeet (*Cyanoramphus novaezelandiae novaezelandiae*) were analysed microscopically and their key characteristics summarised in Table 3.2.

Chandler (1916) gives key features for these birds as small heart-shaped or globular pigmented nodes along the length of the barbules, and short, lightly pigmented internodal spaces (p. 365). Also, nodes are large at the base of the barbule and minute at the tip. Dove and Koch (2010) suggest that the diagnostic features for Psittaciformes are the long to very long barbules, widely flared pigmented nodes along barbules, and absence of villi at the base of barbules (p. 50). Kākā barbules were long, straight and pointed towards the barb tip, and vary in width. Nodes are present along the whole length of barbules, gradually decreasing in size. Nodes from barbules at the barb base were short and expanded at the tip. At mid-barb, triangular nodes decreased to form globular nodes in the middle of the barbules, continuing to the tip. At the tip of the barb there were minute prong-like nodes, which became longer towards the tip of the barbules. There was medium to heavy pigmentation in kākā nodes, with little to medium pigment in internodal spaces. Red-crowned parakeet barbules were also long, decreasing in length towards the barb tip. Barbules generally remained the same width along their length (Fig. 3.7c). In the feather examined, from the middle of the downy area, barbules from the base of the barbs had more symmetrical droplet shaped nodes in their middle. At the base of the barb and at the base of the barbules, the nodes were widely spaced, expanded and heavily pigmented except in the tips of the lobes (Fig. 3.7d). Nodes were present all along barbules, with little to medium pigmentation in internodal spaces. At midbarb, nodes were droplet-shaped, heavily pigmented and some had small transparent prongs. At the tip of the barb, barbules had long, thin prongs that were closely spaced.

Figure 3.12**. Kahu huruhuru (feather cloak) with native New Zealand pigeon, kākā, tūī and parakeet feathers. Te Papa ME004275. All Rights Reserved.**

Colour variations of kākā feathers in Te Papa's cloaks indicated that both the North Island kākā and South Island kākā (*Nestor meridionalis meridionalis*) subspecies were present in the collection, based on comparisons with museum bird skins. Kākā feathers were identified in 43 of the cloaks. Weavers primarily used the light orange to crimson-red underwing coverts (Fig. 3.2c) and the red-tipped belly feathers. Four of Te Papa's cloaks contained kākā feathers as their main feature. Two cloaks were catalogued as kahu kura or kākahu kura and primarily utilised the orange kākā feathers; where 'kura' may refer to the colour red or reflect high (chiefly) status. The other two cloaks, catalogued as kahu kākā or kākahu kaka, predominately featured the red or rusty-brown feathers, and may specifically be named after the bird. Kākā feathers were recorded in cloak borders and geometric patterns, while single or small bunches were used to lift the colour of some cloaks, a technique described by Te Kanawa (1992, p. 26). In this, brightly coloured feathers were used as a contrast against darker feathers in the background. Also, where single or small bunches of kākā feathers were hidden underneath the feathers of other species, it is possible they were used as possible weaver 'signatures', a concept that is discussed below. Light green native parakeet feathers appeared in strips, bunches, borders, and geometric patterns. Single feathers were also used to lift the colour from surrounding feathers. Light green feathers from the breast, belly, crown (head) and back were observed. One cloak included blue-green upperwing covert feathers, and other cloaks featured the light green head feathers tipped with red from the crown of the bird (i.e. red-crowned parakeet). Parakeet feathers were often woven into cloak patterns alongside white and green New Zealand pigeon feathers, orange kākā feathers and black tūī feathers (Fig. 3.12). Kākāpō feathers from the belly, breast, back and upperwing were easily identified by comparisons with museum skin images (Fig. 3.2d). Only one cloak in Te Papa's collection, a kahu kiwi, featured kākāpō feathers. In this garment, green, light green and brown mottled feathers were present in the borders, along with feathers of other species; kākāpō feathers were also interspersed throughout brown kiwi feathers in the middle of the cloak, possibly again as a colour lift.

3.3.10 Order Cuculiformes, family Cuculidae - cuckoos

The long-tailed cuckoo (*Eudynamys taitensis*) and the shining bronze-cuckoo (pīpīwharauroa, *Chrysococcyx lucidus*) are migrants, breeding in New Zealand each spring (Gill, 2010a, p. 261). Feathers of both species have been identified in Te Papa's cloaks. Microscopic examination was conducted on a long-tailed cuckoo feather, and data summarised in Table 3.2. Chandler (1916) described feathers from Cuculiformes as having long, slender barbules, at least 2mm in length, with globular nodes in the form of rounded droplets (p. 365). The nodes were large near the barbule base, and smaller towards the tip (Chandler, 1916). He also noted that the internodal spaces were long, slender, and heavily pigmented, particularly just before the nodes. Long-tailed cuckoo barbs are short, with medium to long barbules (Fig. 3.7e). The nodes at the barb base were distinct in that the pigmentation is pre-nodal, being located just before the main node on the barbules and form a bell shape (Fig. 3.7f) (Dove & Koch, 2010, p. 27). These nodes were quadrilobed and gradually decreased in size towards the tip of the barbule, where they had the same width as the barbule. There was heavy pigmentation before the nodes on barbules at the base and middle of the barb. Barbules at the tip of barbs had little to medium pigmentation, with little pigment in the nodes. The nodes were distributed all along the barbule length and were uniform in size. Long-tailed cuckoo feathers were identified in two of Te Papa's cloaks: white breast feathers with a central brown line; white side belly or flank feathers; and vent feathers with a brown 'V' shape across the feather (Fig. 3.2e). Shining bronze-cuckoo feathers were identified by comparisons with images of museum skin feathers, but not with microscopic analysis. Iridescent light green and white horizontal barred feathers from the breast and belly, and iridescent green back feathers were recorded in the borders of a kahu kiwi.

3.3.11 Order Strigiformes, family Strigidae - owls

The morepork (*Ninox novaeseelandiae novaeseelandiae*) is the only extant native New Zealand species belonging to this family (Worthy, 2010d, p. 264), and it is also the only species from this order identified in Te Papa's cloaks. A feather from this species was used to record microscopic characteristics for the order, which are summarised in Table 3.2. Barbules from feathers of Strigiformes generally have three large globular nodes at the base (Chandler, 1916, p. 375). Pigmentation of the nodes was heavy, while the internodal space was slightly transparent. Barbule lengths were 3-4mm long, and the internodal spaces were large (Day, 1966, p. 215).

***Figure 3.13*. Close-up of mottled morepork feathers in a kahu huruhuru (feather cloak). Te Papa ME011987. Image by Hokimate Harwood, 2009.**

Morepork barbs were very soft, long, and wispy. At the base of the barb, barbules are long and spindly, becoming straighter towards the barb tip. They measured 1-2mm in length, with shorter barbules in the middle of the barb (Fig. 3.8a). The barbules at the barb base have five to seven large triangular nodes at their base that gradually decrease in size to very thin, widely spaced pigmented nodes at the tips. At the very tips of the barbules, the nodes often have small transparent prongs. Barbules from the middle and tip of the barb have three to four large triangular nodes at their base (Fig. 3.8b), becoming uniform in size and more closely spaced towards the tip. Generally, internodal spaces are greater in the middle of the barbules. Pigmentation was heavy in nodes, but light to medium in the internodal spaces. Two single mottled brown, cream and white morepork belly feathers were identified in a small kahu huruhuru (Fig. 3.13), with one feather on either side of a vertical pattern of bluish-black tūī feathers and dark blue pūkeko feathers. The two morepork feathers are light against this dark background.

3.3.12 Order Passeriformes - passerines or perching birds

Feathers from at least three species of passerine - two native and one introduced - have been found in Te Papa cloaks: the tūī (*Prosthemadera novaeseelandiae novaeseelandiae*), the extinct huia (*Heteralocha acutirostris*) and the introduced yellowhammer (*Emberiza citrinella*). Summaries for their microscopic feather characteristics are given in Table 3.2.

Down and nodes vary greatly among species of this large group of birds. Nodes are generally well pigmented, triangular, and roughly the same size along the barbule (Chandler, 1916, p. 383). Barbules have flattened transparent growths with knobbed ends or villi (Fig. 3.8e) at the proximal end or from the barbule base (Day, 1966, p. 213). Internodal spaces are transparent and exceptionally short. Passeriformes appears to be the only order of New Zealand birds with these distinctive characteristics. Passerine barbules are variable in length, ranging from 1.5mm to 2.5mm in Day (1966, p. 213), or from 1mm to 5mm in Chandler (1916, p. 382). The shape of the barbules and length of internodal spaces also vary among family groups. In tūī, the barbules were of medium length. Villi with distinctive knobbed ends were identified on the base of barbules from the base of the barb. Barbules were slightly wider in the middle, and nodes were present all along the barbules. At the barbule base, nodes were large and quadri-lobed, with rudimentary transparent prongs that developed in the top quarter of the barbule. Nodes at mid-barbule were uniform in size and generally heavily pigmented, but with little pigment in the internodal spaces except at the tips of barbules, where nodes were wider, darker and closer together. Internodal spaces were short. Huia barbules were very short, 0.4-1mm long, and wide (Fig. 3.8c). Nodes were small and slightly triangular in shape, and present all along barbules, spaced closely with a slight decrease in size towards the tip (Fig. 3.8d). Villi were also present at the base of proximal barbules (Fig. 3.8e). Barbule widths gradually decreased along their length. Nodes in huia feathers are heavily pigmented, but pigment in internodal spaces is light to medium. Internodal space is very short. There were some rudimentary transparent prongs on pigmented nodes at the base of some barbules, with transparent pronged nodes at the tips. Yellowhammer feathers had few villi at the base of barbules. Nodes are trapezoidal at the base of barbules at the barb base, and globular at the middle of barbules, with minute prongs only at the very tip of the barbule. Barbule lengths in the yellowhammer were short, ranging from 0.8mm to 1.4mm. There is little to medium pigmentation in the barbules. Basal quadrilobed nodes were heavily pigmented, with rudimentary prongs that were lightly or not pigmented. Internodal spaces were medium to long at the base and mid barbule, becoming abruptly shorter at the tip. Iridescent black tūī feathers from the neck, back, breast and upperwing coverts were identified in 35 Te Papa cloaks.

***Figure 3.14*. Close-up of a small bunch of hidden huia feathers in a kahu kiwi (kiwi-feather cloak). Te Papa ME003714. Image by Hokimate Harwood, 2009.**

These feathers were incorporated into borders, strips, geometric shapes and small bunches. Each of the two white throat-tuft feathers from a tūī (Fig. 3.2f), identified from museum skins, adorned each side border of a cloak. The black belly feathers from a huia were identified in two kahu kiwi, hidden among kiwi feathers. In one cloak, small bunches of huia feathers were hidden among those from a brown kiwi across the garment (Fig. 3.14). The other kahu kiwi featured single huia, kākā and New Zealand pigeon feathers hidden among the brown kiwi feathers. The last confirmed sighting of a live huia was in 1907 (Heather & Robertson, 1996, p. 419). Feathers from a yellowhammer, an introduced Eurasian passerine (Gill, 2010b, p. 322), were identified in a single kahu huruhuru. Their distinctive canary-yellow breast and belly feathers, with central vertical brown lines, were identified in two small bunches in the middle of a cloak, surrounded by feathers of other species.

3.4 Conclusions and future research

Previously, the bird species from which feathers were used in Te Papa's Māori cloaks had not been identified with precision using scientific methods or analysis, but made visually or somewhat anecdotally, with little scrutiny of the methodology or accuracy required. Using a complete and well-curated collection of bird skins, such as those at Te Papa, and an accurate microscopic examination of down proved to be a cost- and time-effective method of identifying cloak feathers. Microscopic analysis has already proven effective in identifying feather and hair fragments in archaeological material in Alaska (Dove & Peurach, 2002), and in identifying Pacific and historical museum collection items in international studies (Dove, 1998; Pearlstein, 2010). There is potential for successfully replicating the methods used in this study to identify feathers in other significant ethnological collections, including other taonga Māori (treasures) in collections held in museums both in New Zealand and overseas.

DNA analysis has proven useful in identifying the species and sex of kiwi (Hartnup et al., 2009; Shepherd & Lambert, 2008), but it is not always possible to extract DNA from degraded or contaminated samples, or from fragile Māori textiles in a museum collection. Studies of brown kiwi are particularly relevant to research on the history of Māori cloaks, owing to the prevalence of kiwi feathers throughout the cloak collection. Analysing the DNA of brown kiwi feathers in conjunction with the muka fibres from a cloak could possibly retrieve the geographic origin of the materials used, and therefore iwi (Māori tribe) provenance could possibly be inferred.

Isotopic analyses of feathers have proven to be an effective tool in tracing the geographical origins of birds (Hobson et al., 2007). The stable isotope composition of bird feathers determined by diet and ingested water is a unique geographical marker of the bird's origin. Provenance could therefore be determined by comparing isotope landscape maps of New Zealand against feathers of known provenance, and then with feathers from cloaks. However, both this method and DNA analysis require destruction of some of the feather material, and results can also be dependent on the degradation and viability of the samples used. There is also the issue of trade and gifting of cloaks, feathers and birds between iwi and Europeans that can mislead or confuse evidence of origin and ownership of items. It is therefore important that several feather and fibre samples are taken from the cloak, as this increases the likelihood that similar samples have originated from the same location, thereby revealing possible geographic origins. This is new information about the materials used not previously known.

The most frequently identified bird species whose feathers feature in Te Papa's cloaks were once abundant, widespread, and ground-dwelling or low-flying. These birds featured in the Māori diet, and their feathers used for kākahu, and other clothing and weaving, personal adornment or for inclusion on weapons and carvings (Best, 1942; Orbell, 2003). Weavers preferred certain feather types and species, for example the green neck and white breast feathers of the New Zealand pigeon, and the orange underwing and red belly feathers of the kākā. Introduced birds also played an important role in changing Māori weaving in recent history. As native bird numbers declined and their use was restricted by law in the second half of the nineteenth century, the inclusion of feathers from introduced birds into Māori cloak designs not only became essential, but also introduced a whole new range of colours and designs.

The identification of feathers in Māori cloaks in other national and international collections warrants further research as it will undoubtedly lead to additional important findings and, possibly, associations in the location of origins. One of the most interesting discoveries resulting from feather identification of Te Papa's Māori cloaks has been the uncovering of hidden feathers incorporated into some cloaks. At least 30 of the 110 cloaks examined had hidden feathers or a subtle use of feathers, as well as the inclusion of other materials (e.g. wool). Presumably, these were inserted by the maker as an individual mark or memory of an event or person and, in some cases, could indicate the identity of the weaver. They may also provide an indication of the status of the wearer, and the time and environment in which he or she was living. Documentation about the use of all feathers (particularly the location of hidden ones) in other national and overseas cloak collections could test this hypothesis and, through the comparison and matching of these unique feather insertions or 'signatures', potentially provide provenance for some cloaks.

The use of bird feathers to create striking coloured patterns in Māori cloaks dating from the last two centuries is testimony to the enormous skill, ingenuity, and creativity of their weavers. This research highlights the relevance of scientific identification and verification of materials held in museum collections. In addition to studying bird skins and the cloaks themselves, a better understanding of the Māori cloaks in Te Papa's collection could also be gained through the documentation of the techniques and materials employed by modern weaving practitioners. Kākahu embody the ever-changing knowledge and resources available to Māori weavers, and the information contained within the materials the weavers used will be a key to the rediscovery of their origins.

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CHAPTER FOUR: NGĀ TOHU O NGĀ KAIRARANGA: THE SIGNS OF THE WEAVERS

Rarangahia te kōrari ka kitea te whānau	*Weave the flax and find the family*
Whakairotia te rākau ka kitea te tūpuna	*Carve the wood and find the ancestor*
Tāmokohia te kiri ka kitea te tangata	*Incise the skin and find the person.*

(Haupuru Harwood, Ngāpuhi 2001)

4.0 Abstract

The whakapapa (genealogy) and histories of iwi Māori (tribe/ peoples) are continued within oral histories, and they are represented in our taonga (Māori treasures) such as toi whakairo (carving), tā moko (tattoo), and whatu raranga (weaving). This article explores findings from the feather identification of Māori kākahu (cloaks) in the Museum of New Zealand Te Papa Tongarewa. By examining the techniques and materials used in the making of selected cloaks, I reflect on how this information can potentially tell us about the weaver, the intended wearer, events, and the time and environment in which they were living. I argue that the discovery of possible feather "signatures" in kākahu means that cloaks are a tangible form of retaining histories and memories. Finally, I propose that museums play an important role in unlocking and interpreting the knowledge needed to reconnect these taonga to their origins.

4.1 Introduction

4.1.1 Whatu raranga: he taonga tuku iho

Māori weaving is a taonga handed down the generations. Taonga can be described as having ancestral connections in that they contain histories and knowledge relationships to people and places. As Ngāi Tahu historian, Rawiri Te Maire Tau, observes, "Every 'thing' was related and all 'things' were held together by genealogical connections that eventually referenced back to the self" (Tau, 2001, p. 137). Taonga are treasured because they were made, used, worn, and revered by our tūpuna (Māori ancestors); they therefore connect the living to those passed. Weaving links Māori directly to our ancestors in the retained practices inherited from our origins in eastern Polynesia. The plaiting and finger twining methods of basketry were successfully adapted to produce protective clothing for the harsh temperate New Zealand climate, where the basis for most Māori clothing was created from scraped harakeke (New Zealand flax, *Phormium* spp.) (Fig. 4.1) (Pendergrast, 1987, p. 6). The single-pair finger twining method (whatu aho pātahi) was employed for the coarser, roughly scraped, harakeke rain capes. The resulting softer fibre from intense scraping and pounding, referred to as muka, formed the foundation (kaupapa) of the finer warmer Māori cloaks. Double pair finger twining (whatu aho rua) in which two pairs of horizontal wefts (aho) held together the thicker vertical warps (whenu) to form the kaupapa (Fig. 4.1). This latter weaving method is preferred in decorated cloaks to better secure attachments such as feathers and hukahuka (dyed muka tassels) (Pendergrast, 1987, p. 14). Decorated cloaks usually begin from the bottom left-hand corner and the attachments are added as each row progresses. The cloak finishes in the top right-hand corner and is then turned upright to wear. Dedication, skill, and time go into preparing the materials to create each kākahu.

Figure 4.1. **Left: Harakeke flax leaves. Right: Horizontal aho and vertical whenu (warp) threads. Images by Hokimate Harwood, 2010.**

4.1.2 The mana and prestige of Māori feather cloaks

Māori anthropologist and museum ethnologist Te Rangi Hīroa (Sir Peter Buck) wrote in *The Coming of the Māori* that, “woven garments were … a form of wealth necessary for social exchange and to provide appropriate gifts at marriages and funerals” (Hīroa, 1966, p. 177). The relationship between cloaks and whakapapa and whānau (family) indicates they also played an important role in birth and death rituals (Henare, 2005, p. 128). Fragments of two South Island burial cloaks found in Otago (Strath Taieri) and Southland (Lake Hauroko), dated around the sixteenth and seventeenth centuries, seem to point towards a transitional period in the evolution of Māori feather cloak production. They both employ single-pair twining, but also feature a passive weft (aho) that is wrapped around a running weft (Hīroa, 1926, p. 96). The Strath Taieri cloak integrates the feathers and skins of weka (woodhen, *Gallirallus australis*), albatross (family Diomedeidae), and presumably moa (order Dinornithiforme) (Hamilton, 1892, p. 487; Simmons, 1968, p. 6). The Lake Hauroko fragments also comprise feathers and skin from kākā (South Island bush parrot, *Nestor meridionalis meridionalis*), kākāpō (night parrot, *Strigops habroptilus*) as well as kurī (Polynesian dog, *Canis lupis domesticus*) skin (Simmons, 1968, p. 4). It can be assumed that the incorporation of dog and bird skin and feathers provided warmth and insulation, but it is also theorised that these cloaks were highly regarded prestige items based on the cultural value and rarity of the species. Moa became extinct around the period the Taieri cloak was produced. Cloaks symbolise prestige, status, and authority (mana) with certain cloaks worn only on special occasions. At European contact, mainly men or women of high rank wore kaitaka, a large finely-made cloak decorated with tāniko borders (coloured geometric bands of tightly twined muka strands). Kahu kurī (dog skin cloak) helped to identify Rangatira (chiefs) or fighting men of rank. Kurī were highly prized and valued for their hunting abilities, and their skin and hair were desired for cloaks and adornment of taiaha (carved fighting weapons).

***Figure 4.2*. Left: North Island kākā orange underwing covert feathers. Right: South Island brown kiwi back feathers. Images by Hokimate Harwood, 2007.**

Kahu/ kākahu kura (red feather or chiefly cloaks) Feather cloaks were rarely recorded at first European contact. A few red feathered cloaks worn by Rangatira (chiefs) were recorded by English naturalist and botanist, Joseph Banks, in 1770 on James Cook's first voyage to New Zealand. Presumably the red feathers were from the underwing or belly of the kākā (bush parrot, *Nestor meridionalis*); they were highly prized and incorporated into Māori cloaks to indicate the status of the wearer (Fig. 4.2) (Mead, 1969, p. 56). Red feathers are commonly employed in cloak production throughout many Polynesian cultures. The colour red is symbolic in its connection to high chiefs and in having an association to the gods (atua) in New Zealand, Hawaiʻi and Tahiti (Hīroa, 1957, p. 216).

4.1.3 Kahu kiwi (kiwi feather cloaks)

Kahu kiwi are one of the most prestigious feather cloaks and exhibit the lustrous brown feathers of the native brown kiwi (*Apteryx* spp.). These birds were treasured and widely sought after for cloak production. The strong, large, brown back feathers were preferred, and when woven in with the ventral side of the feather facing out (whakaaraara) it made the cloak wearer appear larger (Fig. 4.2) (Hīroa, 1911, p. 84). Pure albino (white) kiwi were extremely rare and, therefore, coveted. Before the general decline of brown kiwi populations, Māori hunted entirely white birds for their inclusion in cloak designs. Other rare and culturally significant New Zealand birds- such as the now extinct huia (*Heteralocha acutirostris*), albatross, and kākāpō were also acquired for personal adornments and Māori clothing until their decline towards the middle of the nineteenth century. Around this time new geometric designs appeared fashioned from feathers of the kererū (New Zealand pigeon, *Hemiphaga novaeseelandiae*), tūī (parson bird: *Prosthemadera novaeseelandiae*), weka, and kākāriki (parakeet: *Cyanoramphus* spp.). Time intensive cloaks, such as the kaitaka and kahu kurī, were also gradually replaced by the more expressive feather cloaks that took less time and effort to create (Pendergrast, 1987, pp. 106–107). The introduction of numerous European and North American game birds and fowl throughout the 1800s resulted in wild populations distributed across New Zealand (Long, 1981). The decline and protection of native species saw the introduced common pheasant (*Phasianus colchicus*) (Fig. 4.3), peafowl (*Pavo cristatus*), and chicken (*Gallus gallus domesticus*) being mixed with native species, adding new varieties of colours to feather cloak-making (Pendergrast, 1987, p. 107). Numerous kākahu were gifted and exchanged between iwi (peoples) for other taonga to initiate or maintain important tribal relationships (Tapsell, 1997, p. 338). There are instances of kākahu being buried with people or gifted to bereaved families at tangihanga (funerals) (Mead, 1969, p. 175). Information about the cloaks (such as the owner, name of the weaver, and origin or date it was produced) was often lost or forgotten. Museums throughout the world hold numerous Māori collections of no known provenance. It is argued it is the role of museums to lead research in the recovery of information regarding taonga Māori by documenting the knowledge of modern practitioners and researching the materials, designs, and techniques used to produce them.

Figure 4.3. **Left: Mottled green kākāpō back feathers. Right: Male common pheasant back feathers. Images by Hokimate Harwood, 2007.**

4.1.4 Feather identification of Te Papa's Māori cloaks

When chronicling the evolution of Māori cloaks in *The Coming of the Māori*, Hīroa (1966) states that, "the garments themselves tell us what did occur but to understand them, we must learn their language through the minute details of technique" (p. 177). The Museum of New Zealand Te Papa Tongarewa holds over 300 Māori cloaks. In 2007, approximately 110 cloaks containing feathers were identified to species level, where possible, and it is currently accepted that all of them were produced after 1800 (Harwood, 2011). Comparative microscopic feather and bird skin image databases assisted in the identification of more than 20 native and 10 introduced bird species, where some species had not previously been recorded in the literature as being used in Māori cloaks (Harwood, 2011). Microscopic feather identification of a museum ethnological collection was a first for Te Papa and New Zealand. Methodologies were replicated from the microscopic feather identification of a native feather blanket in North America, leading to its provenance (Pearlstein, 2010). Less than one-third of Te Papa's cloaks have a known iwi affiliation or geographic association. The most common birds recorded in Te Papa's cloaks are the native brown kiwi (52 cloaks), kererū (45), kākā (43), and tūī (35) (Harwood, 2011). These birds are ground dwelling or low flying and are easily caught. Before the 1800s they were all common and relatively widespread in their distribution (Robertson, Hyvönen, Fraser, & Pickard, 2007). Other native species identified include albatross, huia, weka, kākāpō (Fig. 4.3), pūkeko (*Porphyrio melanotus*), kākāriki, Australasian bittern (*Botaurus poiciloptilus*), and swamp harrier (kāhu: *Circus approximans*).

Introduced birds were also well represented in Te Papa's Māori cloaks. Feathers from the domestic chicken were identified in 25 cloaks, also common was the pheasant (15) (Fig. 4.3) and peacock (13) (Harwood, 2011). To a lesser degree, helmeted guineafowl (*Numida meleagris*), wild turkey (*Meleagris gallopavo*), California quail (*Callipepla californica*), and mallard (*Anas platyrhynchos platyrhynchos*) were also identified (Harwood, 2011). Findings and an interpretation of the knowledge gained from the feather identification of Te Papa's nineteenth and twentieth-century Māori cloaks are outlined below. Theories discussed intend to demonstrate that through the design, selection of birds, or placement of feathers that weavers communicated information about the prestige of the cloak, the status of the wearer, and potentially their identity.

4.2 Ngā tohu o ngā kairaranga

4.2.1 Culturally significant bird species in Māori cloaks

Certain birds symbolise important aspects of Māori culture. Brown kiwi are the hidden birds of the atua, Tāne Mahuta (deity of man and the forest). The regal, black and white-tipped tail feathers of the huia are associated to Rangatiratanga (chieftainship), while the kōtuku (white heron, *Ardea modesta*) in its flight is connected to Ranginui (the sky father). Soaring albatrosses (toroa) represent strength and grace, while the kāhu and kārearea (New Zealand falcon, *Falco novaeseelandiae*) were respected for their strength and fearlessness (Orbell, 2003). A relatively small kahu huruhuru (feather cloak) in Te Papa's collection (Te Papa ME011987) is intriguing in its design and use of feathers (Fig. 4.4); estimated to have been produced pre-1900, it is single-pair twined which is unusual for a feather cloak. The orange kākā feathers from under the wing, and white kererū belly feathers in the side borders, form a canvas for the black tūī and blue pūkeko feathers that produce a large dark π pattern across the cloak. Small bunches and single feathers from the kākāriki (lime green), peacock, pheasant (a single feather), and reddish brown kākā feathers are scattered throughout.

 

***Figure 4.4*. Kahu huruhuru with feathers from kākā, kererū, tūī, pūkeko, peacock, pheasant, kākāriki, and ruru. Te Papa ME011987. All Rights Reserved. Right: Close-up of a mottled ruru belly feather in a kahu huruhuru. Image by Hokimate Harwood, 2009.**

The most significant finds were two single feathers from the ruru (morepork, *Ninox novaeseelandiae*). There is one ruru feather within each of the vertical columns of the π design. The feathers originating from the belly are distinctively mottled white, cream, and brown (Fig. 4.4). The cloak's right-hand side border (facing the garment) has an additional orange band of kākā feathers hidden under the white kererū feathers. Above this hidden band is a single iridescent black peacock feather. Despite its small size, this cloak communicates an interesting story in terms of the feathers and birds used by the weaver. For different iwi, the ruru represents the spirits or an atua, for others it is an omen for death, alternatively the feathers could have been inserted as a kaitiaki (guardian) (Orbell, 2003, p. 99). This is the only occurrence of ruru in the cloak collection, and there is no literature suggesting ruru were used in Māori cloaks.

 

***Figure 4.5*. Kahu kiwi (kiwi feather cloak) with brown kiwi and huia feathers. Te Papa ME003714. All Rights Reserved. Right: Close-up of hidden huia feathers amongst dark brown kiwi feathers. Image by Hokimate Harwood, 2009.**

4.2.2 The placement and design of feathers in Māori cloaks

Feathers of contrasting colours were added for effect in several cloaks, apparently to lift the colour away from the darker background of the cloak (Te Kanawa, 1992, p. 26). This technique is said to have "added interest and variety" (Pendergrast, 1997, p. 25). It was also observed that in at least 30 museum cloaks that feathers were hidden and woven in amongst surrounding feathers, visible when surrounding feathers were lifted. Single feathers or small bunches of various species such as huia, chicken, pheasant, albino brown kiwi, and kākā feathers were placed under the feathers of different species (Harwood, 2011). Strands of coloured wool have also been recorded hidden amongst feathers. The deliberate selection of certain birds, and the placement and use of feathers for the purpose of concealment from onlookers, has previously been unrecorded in the literature. One example is of a kahu kiwi in the museum collection (Te Papa ME003714) that has hidden bunches of black huia feathers across the kaupapa of the cloak of brown kiwi feathers (Fig. 4.5). Brown kiwi is the most frequently recorded species in the cloak collection and are seen in at least 52 of the 110 cloaks surveyed (Harwood, 2011). Both the brown kiwi and huia feathers in this cloak were woven in with the ventral side of the feather facing out. The huia was quite possibly the most valuable bird to Māori, unique to New Zealand before deforestation, predation, and hunting for their feathers led to their extinction by 1907 (Heather & Robertson, 1996, p. 419). The tail feathers were coveted by Māori for hair ornamentation (Orbell, 2003, p. 57). Huia feathers were also remembered for being inserted into kākahu as well (Te Kanawa, 1992, p. 25).

It is likely that hidden feather "signatures" were very personal information that was not discussed freely amongst weavers. The feathers can be seen only when the surrounding kiwi feathers are lifted. As cloak feathers are plucked and painstakingly sorted and bunched or butted according to size and colour; it is therefore unlikely that feathers of another species and colour could be woven in accidentally. It is argued here that there is knowledge and personal information contained in the species or feather placement. Some single feather patterns across a cloak could represent landscapes, constellations, or relate to events or people that are known to the weaver. Patterning in cloaks often communicates information. Geometric tāniko designs have associations to whakapapa and landscapes in the form of tribal motifs (Mead, 1968). It is unlikely that these odd feathers are mistakes or a lapse in concentration for such skilled practitioners, particularly as it can take up to nine months to produce a modern cloak (Pendergrast, 1998, p. 129). Discussions with modern weavers have given further insight and support to this theory. There are contemporary examples of weavers inserting different coloured feathers into cloaks to honour people that have passed away. One weaver was known to use red thread in her cloaks as an individual sign that she had created it. Another used a specific species of bird in their piece in memory of a relative who had passed away. This hypothesis can be further tested with ongoing feather cloak research in private and museum collections by recording possible comparable "signatures" between collections.

4.2.3 Writing, initials, and symbolism in Māori cloaks

***Figure 4.6*. Kahu huruhuru with kererū, kākā, tūī, and brown kiwi (Te Papa ME010762). All Rights Reserved.**

There are examples of cloaks in the collection that communicate more evident forms of information by weaving in writing. A Te Papa kahu huruhuru (feather cloak) (Te Papa ME010762) contains a Māori word using brown kiwi feathers (Fig. 4.6). Production time for the cloak is estimated to be 1850-1900. Materials comprise of muka (flax) as the kaupapa, feathers, and wool. There are alternating rectangular patterns of green and white kererū, and reddish brown kākā feathers. Each of the white rectangles have small bunches of alternating orange kākā and black tūī feathers located roughly in the centre, and the bottom and two side borders comprise bluish-black tūī feathers.

At the top of the cloak tāmoe, brown kiwi feathers form a word. Tāmoe is described as a technique in which the feathers are woven in flat, with the ventral (under) side of the feather facing down as they are on the bird (Hīroa, 1911, p. 84). The letters are facing upright when the cloak is worn, requiring them to be woven in upside down. Certain letters may be identified (possibly an *A* and *R* on the far right). Unfortunately, due to a loss of feathers the word has not been deciphered to date. Incorporating writing into cloak weaving certainly moved away from what was considered traditional design. Yet, Mead (1968) keenly observed that: … weavers loved to decorate their cloaks, especially those worn by chiefs … [and] … the desire of chiefs to look resplendent and their wish to outdo others, combined with the technical and artistic skill of their weavers, meant there was always room for improvement and innovation (p. 24). This ongoing change in techniques, designs, and materials from 1800 to the present is unmistakably reflected in the Māori cloaks stored in Te Papa's collections. Cloaks that contain initials are certainly noteworthy in that they most likely refer to the weaver or the wearer.

***Figure 4.7*. Korowai with brown kiwi feathers and initials in the tāniko border. Te Papa ME014386. All Rights Reserved. Right: Close-up of the initial H in bottom corner of tāniko border of cloak. Image by Hokimate Harwood, 2010.**

A korowai (cloak with hukahuka, tassels) in the Te Papa collection (ME014386) features unusual elements and design (Fig. 4.7). It contains distinctive features associated with a korowai, and feathers throughout the kaupapa, but it also has a woollen tāniko bottom border, which is typically seen in kaitaka. First, there are the initials '*H*' and '*A*' woven in red wool into the corners of the coloured tāniko border at the bottom of the cloak (Fig. 4.7). The letters are upside down when the cloak is facing the correct way up. When constructing the cloak and attaching the tāniko border to the rest of it, however, these letters would have been the correct way up from the perspective of the weaver, weaving from the garment's bottom left-hand corner to the right.

Numerous hukahuka are missing, having either disintegrated or been removed. Brown kiwi feathers are sparsely woven in small bunches throughout the cloak, and in some bunches there are also orange and brown kākā feathers. Numerous vertical whenu (warps) have been carefully removed in six bands across the cloak, leaving remnants of the horizontal aho holding the rest of the tightly twined whenu together. It is difficult to ascertain whether this removal was performed by the weaver during production or later. This fragile cloak is unique, with many facets to its design and construction. It is an example of changing techniques and innovative design, underscoring how traditional cloak-making continually changes where new techniques, materials, and designs are often combined. Most importantly from the perspective of researching the origins of this cloak, it is significant because of the addition of initials that again (if observed in other private or museum collections) could assist with its provenance.

4.3 Discussion and Conclusions

Feathered cloaks are no longer needed for warmth but they still retain mana and prestige for the wearer at social occasions such as weddings and graduations today. The birds were likely chosen based on several factors: essentially whether the bird was culturally or personally significant, its rarity, or the colour of the feathers. The feathers and the birds themselves are therefore a pivotal factor in rediscovering the origins of museum cloaks.

Scientific tools can offer an insight into an environment and time in which the weavers were living and creating kākahu by telling us more about the materials used. These tools give us a further glimpse into the information held within Māori cloaks, essentially conveyed to us by the weavers through nonverbal communication.

Isotopic analyses of feathers have proven to be an effective tool in tracing the geographical origins of birds, and it proposes to assist in helping to provenance cloaks, or at least the birds used in cloaks. The stable isotope composition of bird feathers determined by diet and ingested water signals is a unique geographical marker of the bird's origin (Hobson, Van Wilgenburg, Wassenaar, Moore, & Farrington, 2007). Provenance can therefore potentially be determined by comparing isotopic landscapes along New Zealand against feathers of known geographic origins to the cloak feathers, thus providing the provenance of the birds used. Similarly, the DNA of cloak feathers and muka can be compared to a database of New Zealand birds and flax cultivars, which could determine species, sex, the number of birds in a cloak, and potentially estimate the origin of the birds and muka (Hartnup et al., 2008).

Modern-day weavers play an important role in understanding concepts and their techniques should be documented. The admission of some contemporary weavers that they insert personal information into their cloaks should encourage ongoing research into older museum cloaks, particularly if the same “signature” or anomaly is seen in two or more different garments. It could be an effective tool in locating cloak origins and re-connecting museum weaving to iwi Māori.

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CHAPTER FIVE: POSSIBLE POLYNESIAN INFLUENCES ON MĀORI FEATHER CLOAKS

E hara i te mea poka hou mai, nō Hawaiki mai anō.
It is not something of recent origin but a tradition of Hawaiki
(Mead & Grove, 2001, p. 23)

5.0 Abstract

From the Pacific, Māori inherited the principles of taonga (treasures) which encapsulate whakapapa (genealogies), mana (authority and status) and tapu (sacredness) over other everyday objects. It is widely acknowledged that Māori feather cloaks exhibit various Polynesian influences, in that feather cloaks are taonga associated with rank and prestige that represent Mātauranga, knowledge and stories surrounding it, and tikanga dictating the customs and traditions in how to make and use it. In a large body of work spanning 40 years, Te Rangi Hīroa, the foremost scholar on Māori and Polynesian clothing documented relevant feather attire and twining in Aotearoa (New Zealand), Hawai‘i, French Polynesia, the Cook Islands, Sāmoa, Tonga and the Chatham Islands (Rēkohu/ Wharekauri). Cloak production and in turn feather use depended on several factors namely the time, climate, functional use and the social (iwi Māori) or cultural (tāngata Māori) importance. A re-examination of Hīroa's Polynesian feather attire from an ethno-ornithological perspective interpreted past assumptions affirming that Māori arrived with the necessary weaving knowledge and applied known skills to adapt to the colder New Zealand climate to produce twined and feather clothing. This research focussed on the major research themes of language, materials, techniques, the processes, and protocols around how Polynesian feather attire is made and used and later employed by Māori. Aspects of Polynesian and Māori cloaks such the veneration of red feathers, incorporation of significant bird species, and techniques of twining and tāniko designs in kākahu (clothing) were adopted and adapted here while others were not. By highlighting these features it was possible to interpret many ancestral connections in kākahu that are still present today.

5.1 Introduction

Contemporary New Zealand Māori feather cloaks are produced from scutching (scraping) the leaves of the harakeke (flax: *Phormium tenax*) plant to produce a soft warm inner fibre, referred to as muka (see Chapter One, Fig. 1.6). These muka fibres form the elements of cloak weaving. Hīroa (1926) defined the distinctive technical feature of (post-European) New Zealand Māori feather cloaks by the incorporation of feathers using interlocking finger-twining, or spaced double pair twining. The technique secures the base of bent feathers against the vertical warp (whenu) strands with two strands of horizontal weft (aho) threads in spaced rows to form the backing foundation or kaupapa (Fig. 5.1).

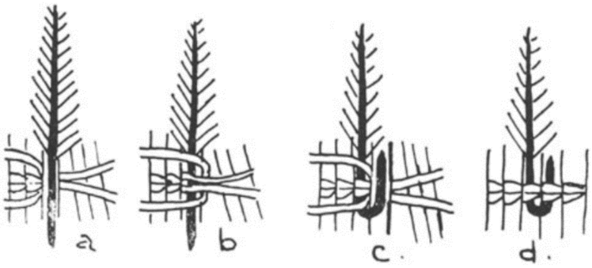


***Figure 5.1*. Orthodox Māori feather attachment, using two pair-interlocking weft twining. From Hīroa (1925); [Fig. 78.].**

Adapted from basketry and traps, twining is an ancient technique employed by most Polynesian cultures (Fig. 5.2) (Blackman, 2011; Hīroa, 1926). However, it is not common in Pacific clothing, with a few known examples in French Polynesia, the Cook Islands and limited feathered pieces in Tonga, whereas elaborate featherwork is essentially present on all Polynesian islands where there are birds (Lander, 2011, p. 77; Stokes, 1925). Twined feather cloaks in which the feathers are bent and twined into the backing was understood to be unique to New Zealand.

***Figure 5.2*. Hīnaki (New Zealand Māori eel/ fish trap). Mānuka (Family Myrtaceae), muka; single pair twining, basketry. Made 1850-1900; New Zealand. Te Papa ME011844. Right: Detail of twining. All Rights Reserved.**

Substantive records on feather adornment and twined clothing practices have been created for nations within the Polynesian triangle (Fig. 5.3) (Hīroa, 1926). Within this group of interest are New Zealand Māori, Cook Island Māori, Moriori and Ngāti Mutunga of Rēkohu/ Wharekauri (Chatham Islands), islands within French Polynesia, Sāmoa, Tonga, and Hawaiʻi. French Polynesia lies to the Central North East of the triangle and consists of The Society Islands (Tahiti and Raʻiātea), Tuāmotu archipelago (including Gambier Islands), Marquesas Islands and Tuhaʻa pae or the Austral Islands (Rapa). The Hawaiʻian Islands are at the very northern point, with Aotearoa and the Chatham Islands to the South West, and Rapa Nui (Easter Island) governed by Chile is located east of the triangle.

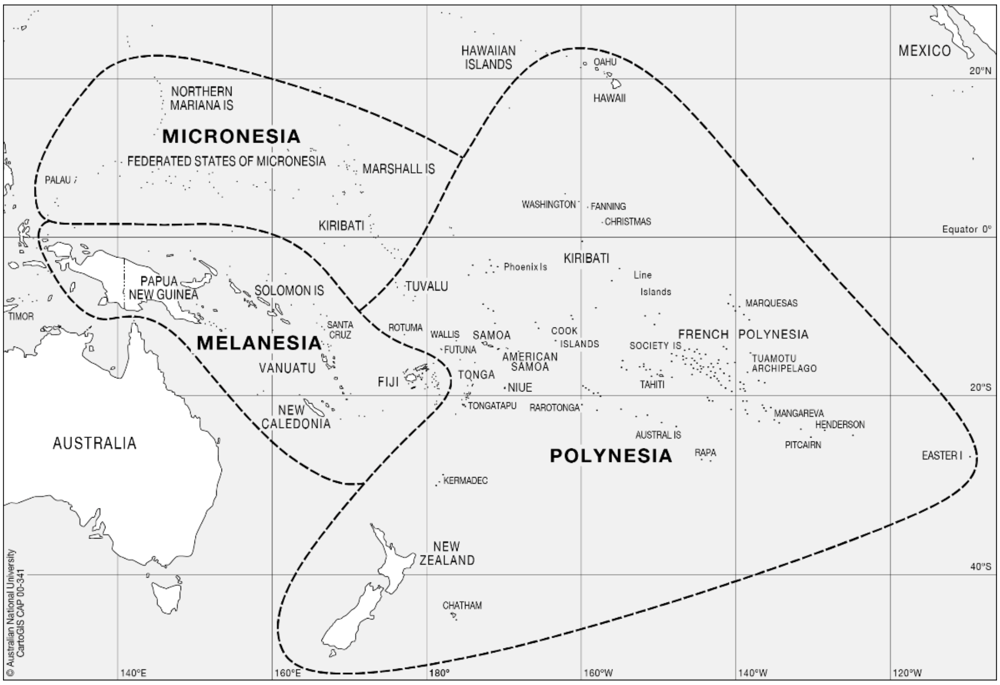


***Figure 5.3*. Map of Polynesia. Courtesy CartoGIS, College of Asia and the Pacific. The Australian National University, Canberra, ACT, Australia, c.2008.**

Oral traditions state that New Zealand Māori sailed from the ancestral homelands of Hawaiki, variants of which are Havaiki, Hawaiʻi, Avaiki, and Savaiki (Anderson, 1928, p. 35; Harlow, 2007, p. 15). Today the American state of Hawaiʻi is a group of volcanic islands at the northern point of the Polynesian triangle. Māori also recognise Rangiātea as an alternate place name for Hawaiki, like Raʻiātea in the Society Islands (Harlow, 2007). Hawaiʻians apparently believed they came from Kahiki (Tahiti) (Stokes, 1925, p. 31). It is from this ancestral place (or places) that Māori learning originated from tribal knowledge, traditions, and memories. The strong affiliations in language, physical attributes, and artforms, are especially apparent when comparing New Zealand and Cook Island Māori, Tahitian and Hawaiʻian cultural materials.

Pacific feather cloaks have cultural significance as they denote status and wealth. Hawai‘ian feather cloaks, ‘ahu ‘ula (Māori, kahu kura), have numerous elements in common with Māori clothing including feather colour and bird use. Both Māori and Hawai‘ian feather cloaks collected by Captain James Cook have been found in hundreds of international museums (Kaeppler, 1978a). Early European explorers and missionaries observed that impressive Hawai‘ian royal feather cloaks were amongst the most esteemed of the garments worn by highly ranked chiefs and warriors (Ellis, 1853).

A major contributor to this area of research has been Te Rangi Hīroa (Sir Peter Buck). Both William Brigham and Hīroa studied the Māori and Pacific collections in the Bernice Pauahi Bishop Museum in Honolulu, Hawai‘i in the late 19th and early 20th centuries. For over 20 years, Hīroa investigated the relevant material culture of Pacific nations, specifically the Hawai‘ian feather cloaks and capes (Hīroa, 1944b), twined clothing of Cook Island Māori (Hīroa, 1944a), and fine Sāmoan feathered mats (Hīroa, 1930). He also examined feather cloaks in Tahiti (Hīroa, 1943), and discussed twining and feather use in the Tuāmotu (ancient name Pa‘umotu) and Rapa (Iti) islands in French Polynesia (Hīroa, 1926). Both Hīroa (1926) and Skinner (1923) documented aspects of clothing of the Moriori and Ngāti Mutunga of Rēkohu (Chatham Islands) and noted similarities in techniques and terminology with Māori and Polynesian clothing.

Hīroa (1944b) also connected the importance of red feathers in the Pacific, namely from Hawai‘ian through to Māori clothing. Stokes (1925) acknowledged the similarities in Polynesian featherwork including the importance of red coloured feathers and associated symbolism. Concepts throughout the literature discussed Polynesian and Māori artforms, that supported the significance of the colour red, particularly feathers (Colenso, 1881; Houston, 2010; Stack, 1879). The veneration of red earth (ochre, kōkōwai) has been observed throughout many indigenous and ancient cultures (McKenzie, 1922; Petru, 2006; Ritzenthaler & Quimby, 1962). Māori apply kōkōwai to the face and body, carvings, weapons, and cloaks that are soaked or painted red (Hīroa, 1926, p. 211; Mead, 1969, p. 179). It represents the blood spilled on the earth from the separation of the ancestral parents Rangi-nui (the sky father) and Papatūānuku (the earth mother). In Māori society, kahu kura, treasured red (feather) cloaks are the epitome of prestige and rank and represent Rangatiratanga (chieftainship). These taonga incorporate concepts such as mātauranga (knowledge), kōrero (stories and traditions), mauri (life force), tapu (sacredness) and tikanga (customs) (Tapsell, 1997). For the colour red, these concepts create the most compelling evidence that Polynesian influences have and continue to feature in various Māori artforms particularly clothing and adornment. Rangatiratanga requires clear distinctions in social hierarchy that determine roles and positions in Māori society. Schwimmer (1963) simplified the dichotomies of Māori philosophies and social structure as shown in Table 5.1 (p. 409). These interpretations clearly do not accurately reflect the complexities of Māori society but serve as an example of perceived assumptions from observing outsiders (Shore, 1989, p. 179). For instance, high ranked girls (puhi) and women (Ariki Tapairu) were tapu, as was red kōkōwai (ochre) of the earth (Williams, 1957).

***Table 5.1*. Perceived dichotomies of Māori philosophies thought to correspond to social and religious practices.**

Ora (life)	Aitua (fate)
Sky	Earth
Spirit	Body
Day	Night
Tapu (sacred, restricted)	Noa (ordinary, common)
Man	Woman
Right	Left
Even	Odd
Propitious (favourable)	Unpropitious

Brigham (1892, 1903, 1899, 1918) produced substantial catalogues of Hawaiʻian featherwork at the Bishop Museum in Honolulu Hawaiʻi, developed further by Hīroa (1944b, 1957) and Kaeppler (1978a & b). They listed Hawaiʻian feather cloaks and capes in public and some private collections and recorded materials, techniques, provenance, images, and locations when known. Hīroa's (1994a, 1957) substantial contributions to the local evolution of Hawaiʻian clothing credits fish netting techniques as the foundational stage to create the more refined feather cloaks. Recent studies by Cummins (1984) addressed aspects of symbolism in Hawaiʻian cape and cloak design, and Linnekin (1988) and Cordy (2003) questioned who made these cloaks. Very few published authors in this field were of native Hawaiʻian descent.

Hīroa (1944b, 1957) and Brigham (1899) produced initial identifications of bird and feather use in Hawaiʻian cloaks, and Brigham specifically described the morphology and ecology of relevant Hawaiʻian species. Essentially a form of ethno-ornithology, it showed transmitted Polynesian knowledge and traditions pertaining to the significance of certain birds, colours, and feathers (McGovern-Wilson, 2005). The origin and history of bird species throughout Polynesia confirmed that factors such as historic presence, flight, and human trade can determine bird distribution, and in turn bird use (Mayr, 1976). This is apparent in the movement of parrots and parakeets exchanged and relocated between Fiji, Sāmoa, and Tonga for use in adornment and clothing (Watling, 2001). Pacific bird distributions have been portrayed based on scientific field studies, in Tahiti (Thibault & Rives, 1975, 1988); the endangered passerines of the central Pacific and Hawai'i (Munro, 1960; Perlo, 2011; Pratt, Bruner, & Berrett, 1987; Pyle, 2002); and in the Cook Islands (Holyoak, 1980). To a certain extent, Malo (1903) and Barrow (1999) also confirmed the intrinsic relationships Hawai'ians have with birds.

The first major literary work on New Zealand ornithology published by Sir Walter Buller illustrated a natural history and anecdotal accounts of native birds (Buller, 1888). Orbell (2003) and Riley (2001) attempted to encapsulate the depth of understanding regarding Māori and birds, however the sources of information were often not recorded. Elsdon Best was in one of the most advantageous positions to interpret the significance of feathers in cloaks for iwi Māori (peoples) having recorded the knowledge of Ngāi Tūhoe of Te Urewera (Bay of Plenty) in the *Art of Te Whare Pora* (cloak weaving) (Best, 1898) and *Forest Lore Of the Māori* (Best, 1977), but only published exclusively on these topics. The intrinsic relationships Polynesians have with birds and feathers unfortunately appear in limited accounts, scattered throughout the literature in which numerous assumptions are made and large gaps remain.

The positive material identification of ethnological pieces is imperative in drawing valid conclusions of environmental influences, or societal and possible individual weaver preferences. While some authors summarised bird species in attire in the literature, specific identifications from personal observations were required for certain pieces. The feather identification of 110 Māori cloaks in the Te Papa Tongarewa Museum (Te Papa) collection enabled a further acknowledgement of weaving and collecting behaviours in conjunction with avifaunal distribution (Harwood, 2011a; Robertson, Hyvönen, Fraser, & Pickard, 2007). In Māori cloaks made after the nineteenth century, commonly identified species such as brown kiwi (*Apteryx* spp.) and kākā (*Nestor meridionalis*) and kererū (*Hemiphaga novaeseelandiae*) were still widely distributed in New Zealand until the mid-1800s and featured in the Māori diet (Harwood, 2011a; Robertson et al., 2007). To a lesser extent, culturally significant species as the ruru (morepork: *Ninox novaeseelandiae*) and extinct huia (*Heteralocha acutirostris*) were incorporated to reflect a specific relationship with the weaver and the status of the wearer (Harwood, 2011b). Other findings acknowledged the significance of red feathers and the incorporation of stylistic traits that could identify individual weavers (Harwood, 2011b).

Methods for the Te Papa Māori cloak feather identifications compared microscopic images of feather down that allocated the bird order, and comparisons to museum bird skins determined bird species and feather types (Harwood, 2011a). Gill (2014) emphasised the useful applications of studying museum bird skins to identify species and feather types. Chandler (1916) published a comprehensive list of the microscopic characteristics of feather down, demonstrating how they could be explicit to bird orders and some species. This method was useful for plain (unpatterned) brown, black or white feathers. Similar studies relying on microscopic feather identification specifically in early ethnological items and textiles included Dove, Hare, and Heacker (2005); Dove & Peurach (2002); and Rogers, Dove, Heacker, and Graves (2002). It has also seen success in museum collection items in determining geographical origins from species distribution (Dove, 1998; Pearlstein, 2010). Dove (1998) conducted macroscopic and microscopic feather identification of red Hawai'ian creeper feathers in Polynesian featherwork and determined the provenance from species distributions.

5.2 Methods and Methodologies

This research explored the range of bird species, and weaving techniques identified in relevant Polynesian feather attire. It was assessed as to whether similar elements were also present in Māori feather cloaks based on the research themes of language, what information is communicated by the weaver in the form of the cloak; the classification (type) or title of the cloak; the materials, namely plants and birds; and the techniques, what weaving methods were employed. Additionally, the spiritual concepts surrounding the cloak that determined how it was made and used; who made and wore it; and the cultural (tāngata Māori), social (iwi Māori), or personal significance of the birds and feathers used. These themes were then analysed in relation to the temporal (time period) and environmental factors (location, climate) in which the cloak was made to determine how, if at all, these components may have appeared in Polynesian and then Māori clothing over time. As Mead (1969) explained, clothing portrayed the status or position of the wearer in society, and this is particularly true for early Polynesian clothing.

This chapter re-examined the large body work of Te Rangi Hīroa on Māori and Polynesian material cultures pertaining to feather use and twining. It is understood that certain aspects of Polynesian culture, language, historical and social customs, and traditions have influenced how Māori feather cloaks were made through to today. Methods were employed to showcase a multidisciplinary approach that incorporated indigenous knowledge, and Polynesian customs and traditions in a respectful and accurate manner in conjunction with the material evidence outlined by Hīroa. In order to measure how and why certain birds have been used in Māori clothing, it was intended to achieve an understanding of the materials and techniques in feather attire throughout Polynesia that may have influenced Māori relationships to birds, feathers and clothing, and hence how feather cloaks have been made and worn through to present day.

The methods of obtaining knowledge pertaining to phases of Māori-Polynesian heritage that have been adopted or adapted over time combined scientific and Māori frameworks. Comparative matrix models have showed capabilities in comparing data in mathematical and sociological studies (Vallier, 1973). A matrix framework (Table 5.2) helped form an understanding of the material and technical composition of cloaks and acknowledged the tangible knowledge, from the physical world, and the intangible, from the spiritual realm. These aspects of feather cloaks were inherently interwoven and produced layers of knowledge using multiple disciplines in the fields of te pūtaiao (the natural world) and Mātauranga Māori (Māori knowledge) that when combined unlocked information regarding taonga Māori (treasured items). For each cloak or reference the following matrix was tabulated to record important aspects of knowledge associated with the production and use of each kākahu (Table 5.2).

***Table 5.2*. Matrix method of data collection for each cloak relating to the main research themes and where they are placed in the temporal space, and physical and social environment.**

	Time period the cloak was made	*Where the cloak was made, climate*	*Birds & Plants available*	*Social & religious factors*
Who made/ wore the cloak				
The birds & plants used				
How were the feathers attached				
Why were the materials & techniques used				
What was the cloak called				
What did the cloak communicate				

The matrix model was the ideal method for conducting thematic analyses in qualitative research in that it allowed for simple visual comparisons and contrasts in data, particularly interview data and interdisciplinary projects such as this (Gale, Heath, Cameron, Rashid, & Redwood, 2013). The themes identified in Table 5.2 were cross-referenced against the temporal, environmental and social influences for each kākahu using the following methods for data collection:

1. A search of major literature covering ethnological studies of Polynesian clothing and feather use, Cook voyage accounts and collections, Māori bird lore, Polynesian bird use and featherwork, and Pacific Island climates and bird distributions.
2. Conducting oral history interviews with well-known National and northern iwi (peoples/ tribe) weavers, and experts in Māori bird and resource management.
3. The creation of an International Register of Māori feather cloaks in world museums.
4. Recording the materials and techniques of each cloak from personal observations and images from museums and the literature. Identifications were made based on comparisons of reference image databases of the microscopic feather down, and from macroscopic verification of species and feather types using museum bird skins, or both.

Major primary sources of literature included archival manuscripts and documents that incorporated observations and diagrams by authors such as Hīroa, Brigham, Stokes (n.d.), Emory (1975), and Kaeppler (1978a, 1978b), in their prominent studies of Polynesian and Māori clothing in museum collections and archaeological sites. Indigenous knowledge in the form of customs and traditions recorded in the literature by indigenous scholars such as Malo (1903) and Hīroa were limited yet significant. Contemporary, oral, and indigenous narratives substantiated evidence or triangulated forms of data (information) in conjunction with other historical accounts to answer the research questions. The sketchings, paintings and records of artists and crews from early Polynesian-European encounters such as Captain James Cook, the Forsters, Reverend Daniel Tyerman and George Bennet, and William Ellis also constituted primary sources. Secondary sources from Kaeppler (1978a, 1978b), Cummins (1984), and Roth (1923) consisted of additional writings and records that interpreted, discussed, or reviewed some of the primary sources consisting of historic observations and analyses.

Oral history interviews were conducted in 2017 as semi-structured conversations with eight prominent national and northern iwi, weavers, artists, and conservationists. The interviews supplemented gaps in knowledge in the literature and research and have been cited in the text (e.g. Prime (2017)) to recognise the knowledge of each participant and the importance of the information imparted for this research (See Appendix One for ethics approval and Appendix Two for an example of an interview schedule). The questions addressed the themes of traditional and contemporary Polynesian and Māori bird and feather use, Māori feather cloak production and use, and iwi Māori relationships with taonga. After each interview, statements were analysed according to the corresponding theme, time, and location to which it belonged.

An important method involved contacting national and international museums to create the first published inventory of Māori feather cloaks held in museums around the world between 2015-2019. To build this International Register, participating museums were asked to provide production and provenance histories for feather cloaks in the collection. Relevant Polynesian cloaks located in New Zealand, the United Kingdom, and European museums that required additional information or permissions regarding image use, were contacted for further examination of materials, techniques, production history, and locations. The International Register was built on preliminary research of Māori collections in British, European, and North American museums (Simmons, 1996-1997, 1982; Gathercole & Clarke, 1979).

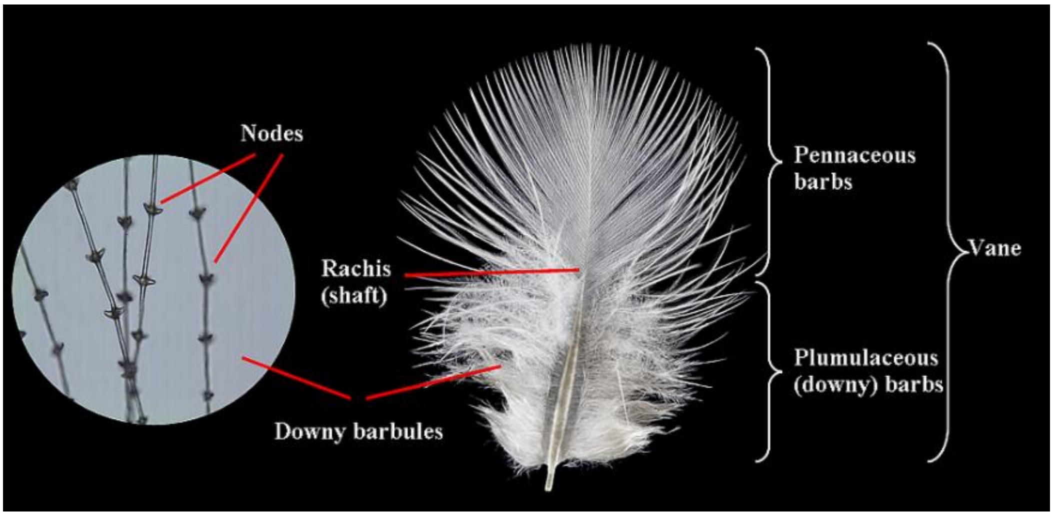


Figure 5.4. **Kererū (New Zealand pigeon) contour feather showing pennaceous barbs, plumulaceous (downy) barbs and nodes on downy barbules. Feather image by Raymond Coory (Te Papa), 2006. Photomicrograph and diagram by Hokimate Harwood, 2007.**

Feather identifications conducted in person in 2016-2018 used macro- and microscopic comparisons of museum feathers and bird skins, by matching feather colour, size, shape, and patterned feathers in cloaks. Identifications of species and feather types involved imaging, measuring, and comparisons of cloak feathers and reference images of feathers and bird skins.

For the period 2016-2017, detailed microscopic analyses were conducted to identify the red feathers in a Hawai‘ian feather cloak (‘ahu ‘ula) in the Te Papa collection (FE000327). Microscopic analysis involved comparing feather down characteristics of detached (fallen) red feathers from the garment, and red feathers from Hawai‘ian passerines obtained from the Bird Recovery Project in Maui, Hawai‘i, for the Te Papa collection in 2017. As diagnostic features vary between orders and species this research involved studies of the downy barbs at the feather base. The downy barbules along these barbs have minute structures (nodes or prongs) that are distinctive to the type of bird (e.g. pigeon, duck, parrot) (Fig. 5.4). Analyses of the downy barbules involved measuring the barbules, recording pigmentation in the barbule and nodes, as well as the average node size, shape, number of nodes and their distribution along the barbules (Chandler, 1916; Day, 1966) (Fig. 5.5). Other aspects included the space between the nodes, or internodal space, the barbule width, and the presence of villi (cilia-like projections) at the base of barbules, a feature often observed in passerines (Brom, 1991; Day, 1966; Dove, 1997). Macroscopic feather analysis involved detailed comparisons of feather size, colour and patterning between the cloak feathers, the loose Maui feathers, and museum bird skins.

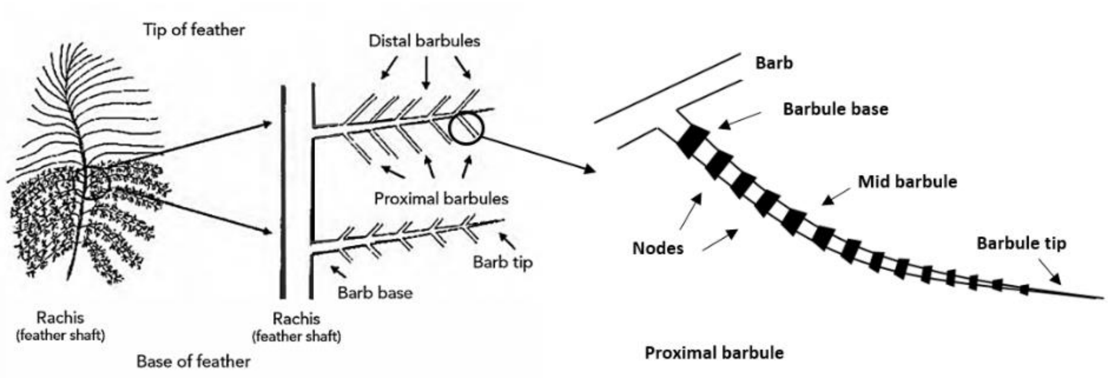


***Figure 5.5*. Down feather diagram showing positioning of diagnostic structures, modified from Day (1966), Dove & Koch (2010).**

The feathers were dry-mounted onto glass slides and examined using light microscopy (Leica DM500 at 40x, 100x and then 400x magnifications). Photomicrographs were captured using a fitted microscope camera (Leica ICC50W), and the Leica LAS EZ program employed for processing images and recording measurements. Limitations were acknowledged in that the detached Hawai‘ian feather cloak (FE000327) samples were fragmented and damaged creating challenges in comparing the cloak feathers to a known species. Also, using only detached (fallen) cloak feathers created some doubt as to whether the feathers originated from the

Hawai‘ian cloak (FE000327), and not another garment. Additionally, the Hawai‘ian feather samples from Maui were collected from unknown locations (feather types) on the bird.

Methods were replicated from the feather identification of Te Papa’s Māori cloaks (Harwood, 2011a); and Hawai‘ian passerines (Dove, 1998). Microscopic methods and conventions also followed Chandler (1916), Day (1966), and Dove and Koch (2010) for descriptions of nodes and pigmentation. Descriptions of feather colours and types observed Svensson (1992); and field identifications and behaviours sourced from Marchant and Higgins (1990), and Heather and Robertson (1996). Bird nomenclature, vernacular names, and sequence of orders for New Zealand birds complied with the *Checklist of the Birds of New Zealand* (Checklist Committee (OSNZ), 2010).

The Waka Mātauranga framework engaged in the various aspects of the research in that it fostered the essence of ‘te reo o te kākahu’, and the relationship between the language and knowledge communicated in cloak making that transferred from Polynesian cloaks through to present day Māori feather cloaks (Black, 2014). There was an assertion that Māori and Polynesian cultures were independent and autonomous, having maintained a unique identity, authority, and language for centuries, however certain aspects pertaining to terminologies, bird and feather use, and feather cloak production and use, highlighted specific commonalities. Further to this, the research regenerated and strengthened these Māori-Polynesian ties facilitating new understandings of how we could better understand Māori feather cloaks today by recognising their ancestral origins, and in looking forward with this continued connection.

5.3 Possible Polynesian influences on the evolution of Māori feather cloaks

5.3.1 Polynesian climate and geology

Polynesian islands have temperate, tropical, and sub-tropical climates. Table 5.3 provides estimates of the average yearly rainfall and temperatures in the studied Pacific islands and emphasises the need for warmer, dryer clothing in some islands. The islands in this study comprised primarily of volcanic or limestone islands, atolls, or a combination (Finucane, Marra, Keener, & Smith, 2012, p. 2).

***Table 5.3*. Approximate annual mean rainfall and temperature ranges in Polynesia.**

	Mean annual precipitation (Range: Min-Max)	**Mean annual temperature (Range: Min-Max)**
Wellington, New Zealand *	70mm-140mm	9-17˚C
Rēkohu/ Wharekauri/ Chatham Islands*	55mm-108mm	9-14˚C (8-15˚C)
Honolulu, Hawai‘i **	12mm-98mm	17-28˚C
Papeete, Tahiti, French Polynesia**	50mm-310mm	20-30˚C
Apia, Samoa **	125mm-400mm	23-30˚C
Rarotonga, Cook Islands **	90mm-250mm	19-29˚C

Sources: * http://www.newzealand.com ** https://weather-and-climate.com

New Zealand, Hawai‘i, and some of the atolls in French Polynesia have high terrains consisting of mountains, cliffs, and valleys, and incur sudden climatic changes including rainfall (Finucane et al., 2012, p. 2). New Zealand and Rēkohu/ Wharekauri are closest to Antarctica and temperatures can fall below 0˚C in extreme conditions. New Zealand's climate varies considerably between the North and South Islands, and alpine and coastal areas, with temperatures reaching above the mean high of 20˚C in summer in the far north of the North Island, and as low as -10 ˚C in areas of the South Island, where the average annual rainfall across the islands can measure between 600-1600mm.[2] In contrast, Hawai‘i is the closest island group to the equator and is warm and dry in comparison, experiencing small seasonal variation in temperatures (Finucane et al., 2012, p. 12).

5.3.2 Language

The Māori language is derived from numerous East Polynesian islands. However most Pacific island nations have linguistic synergies that reveal close genealogical relationships. Where languages and behavioural traits developed separately, but not exclusively in temporary geographical locations. As expert navigators, sea-faring Polynesians constantly moved, traded, lived with, fought with, and inter-married with different Pacific cultures, essentially exchanging and expanding languages, resources, and knowledge as they did so.

Te reo Māori (Māori language) revolves around whakapapa, genealogical memories, and religious and social constructs, where retaining oral language was paramount for its survival. Certain aspects of Polynesian histories have endured, where in Māori traditions the atua (deities or gods for lack of a better term) stemmed from the ancestral parents Ranginui (heaven, sky

[2] https://www.niwa.co.nz

father) and Papatūānuku (earth mother). Creating a world of light, the forced separation of the parents by their children Tāne (of man, forests and associated creatures), Tangaroa (the sea and its creatures), Rongo (agriculture), Tūmatauenga (war), Tāwhiri-mātea (winds), and Ruāumoko (volcanoes and earthquakes) fulfilled different sustaining or levelling roles on man and woman. Variations in Hawai‘i have the names of the gods as Kāne (the ultimate god), Kanaloa (the sea and creatures), Lono (agriculture), and Kū (war) (Kaeppler, 1982).

Written Polynesian languages integrate the vowels *a e i o u* and the variations of consonants form cognates with shared (alike) definitions between the languages. For example, for the Māori word whare (house, pronounced fare), in other Polynesian languages the *wh* uses the *f*, or it was silent, and the *r* has instead a *l*. So, in Sāmoa it is *fale*, Hawai‘i *hale*, Tahiti *fare*, Tonga *fale*, Rarotonga *are*, Marquesas *hae*, and Mangareva *hare* (Tregear, 1891). As Polynesian languages were expressed in written form starting from the late 18th-19th century, it is possible that te reo Māori was based on the onomatopoeic verbalisation of the original Polynesian terms and the letters and words written how they were pronounced, in that *r* was heard by Europeans as a rolled *l*, and *wh* as *f*. The glottal stops (‘) represent macron accents (extended vowel sounds), where Ha‘amoa became Sāmoa, or it signified the replacement of a consonant as in *‘upega* a net in Sāmoa, and *kupenga* (net in Māori) (Tregear, 1891).

The relationships also corresponded to cloaks and adornment. Table 5.4 lists Polynesian clothing terminologies that are undeniably akin. New Zealand Māori, Cook Island Māori, Hawai‘ian, Sāmoan, Tongan and French Polynesian languages contributed variations of the term kahu signifying and communicating clothing, and cloaks or capes specifically (Buse & Taringa, 1995; Kent, 1993; Pratt, 1862; Pukui & Elbert, 1986; Tregear 1891). The generic term for feathers huru also applied to hair, and fur, so manu huru described bird feathers.

***Table 5.4*. Language comparisons of relevant related Māori and Polynesian clothing terms.**

Language	**Clothing/Cloak or Cape**	**Red/ Treasured**	**Weave/ Plait or Braid**	**Skirt or Girdle**	**Feather/ Feathers**
New Zealand Māori	Kākahu/ Kahu	Kura/Whero/ Ngangana/ Ura	Whatu/ Raranga	Maro	Huru/ Huruhuru
Cook Island Māori	Kāka‘u	Kura, Mura	Raranga	Maro	‘Uru/ ‘Uru‘uru
Hawai‘i	‘a‘ahu/‘ahu	‘ula	Haku	Malo	Hulu
Sāmoa	‘afu	‘ula	Fatu/Lalaga	Malo	Fulu
Tonga	Kafu, Kofu	Kula	Fatu/Lalaga	Manoo	Fulufulu
French Polynesia:					
Tahiti (Society Is.)	Ahu	Ura	Fatu/Raraa	Maro	Huru
Mangareva	Kahu	Kura (& Yellow)	Raraga	Maro	Huru
Tuāmotu Islands	Kahu	Kura	Raraga	Maro	Huru, Uru/ Huruhuru

The languages are thus connate when naming cloaks, as in kahu tōī or mountain cabbage tree (tōī: *Cordyline indivisa*) leaf cloak, and kahu kiwi (kiwi feather cloak). A Māori red (feathered) cloak is a kahu kura, where *kahu* refers to the cloak, and *kura*, is red or precious (treasured) (Fig. 5.6). Kahu also describes the protective embryonic sac in the womb (Williams, 1957). Colenso (1881) tabulated more than 30 different terms to differentiate the various red shades and hues, emphasising its importance. In cloaks, kura denoted the kōkōwai (red ochre) dyed fibres or the reddish feathers from the New Zealand kākā (bush parrot: *Nestor meridionalis*). A royal Hawai‘ian feather cloak is classed as a ‘a‘ahu ‘ ula or ‘ahu ‘ula (kahu kura), where the ‘k’ is silent, and the ‘r’ replaced the ‘l’ (Kent, 1993, p. 48). Historically this Hawai‘ian name possibly described a red, or red feathered cloak as the earlier cloaks had predominantly red feathers, today it encompasses all Hawai‘ian feather cloaks and capes (Hīroa, 1944b, p. 10; Hīroa, 1957, pp. 216, 222). Over time, it likely had several interpretations where kura was both red and a treasure, and anything red was treasured. One Māori tradition tells of Kahukura, an ancestor, who had learnt the art of net-making from patupaiarehe (mythical mountain people), Kahukura was an atua of rainbows and sometimes present in a sacred red garment (Anderson, 1928, p. 131; Grey, 1885; Tregear, 1891; Williams, 1957). Other Polynesian traditions of kahu kura were found in the Tuāmotu islands (French Polynesia) chiefly chants, one that belonged to Tangihiariki was named a kahu kura from its decorative polished red pearl shells (uhi kura) (Emory, 1975, p. 84).

***Figure 5.6*. Kahu kura (N.Z. Māori red feather cloak). Muka, dye, kākā feathers; spaced double pair twining, plaiting. Made 1900-1940. Purchased 1996. Te Papa ME015838. Right: Detail of kākā underwing feathers in the side border and middle of cloak. All Rights Reserved.**

In general, historical indigenous clothing embodied environmental and social knowledge where feather preference was measured against what resources were available. Various forms of featherwork were widespread throughout Polynesian cultures, yet the function of how and why it was incorporated differed. Articles of feather attire often performed a higher level of communication subsequently procuring and preserving a person’s power and wealth.

5.3.3 Rēkohu/ Wharekauri/ Chatham Island Clothing

New Zealand Māori, and the peoples of Hawai‘i, Rapa Nui (Easter Island), Cook Islands, Tahiti, and Rēkohu/ Wharekauri (Chatham Islands) have similarities based on language, physical attributes, and artforms (Fig. 5.3). Isolation of these island groups caused the local development of some material clothing. Like New Zealand Māori, the Moriori/ Ngāti Mutunga of Rēkohu/ Wharekauri could not rely on bark clothing as it grew insufficiently and lacked the necessary warmth or protection. Instead, it was likely that several varieties of flax (*Phormium* spp.) became the main plant fibre source for Moriori textiles, alongside animal (seal) skin for warmth (Hīroa, 1926; Smissen & Heenan, 2010).

Moriori arrival slightly pre-dates Māori in Aotearoa. Less than 1,000km apart there was potential for pre-European contact, in fact Skinner (1923) believed that Moriori and South Island twined flax clothing shared similarities. Although, Hīroa (1926) doubted these post-European observations were ‘traditional clothing’. Lt. Commander William Broughton’s Chatham’s logbook listed two types of plaited flax clothing, one a finer plaited mat of thin scraped flax leaves worn as a warm, dry cloak or cape (weruweru) (Hīroa, 1926, pp. 199, 202; Shand, 1911, p. 8). The second, a rougher plaited mat of broad scraped flax leaves and worn as a rain cape (tukou) (Hunt, 1866; Shand, 1911). A Māori weru or weruweru, is a finely woven flax mat with ornamental border (Williams, 1957). A pūweru was a common (Worn daily) Tūhoe garment (Best, 1898, p. 656). In Rapa (French Polynesia), raincapes were named ‘taveru’, in that ‘veru’ or ‘weru’ were ancient Polynesian names for capes or clothing (Hīroa, 1926, p. 204). Based on Shand’s (1911) observations, Skinner (1923, pp. 109–110) believed Moriori made cloaks of scutched flax and netted twine, named kupenga (Māori, net). Skinner (1923) associated these garments with the netted feather cloaks of Hawai‘i (p. 110). Hīroa (1926) believed these cloaks were an anomaly or later adaptation of a fishing net worn around the shoulders and filled in with scutched fibre and feathers sewn onto it, and that Moriori were simply seeking clothing materials, whereas Hawai‘ians adapted netting as a foundation for developing featherwork (pp. 202–203). There appeared to be no surviving feather cloaks, but Hīroa (1966) found a Moriori rain cape in the Canterbury Museum in the South Island (p. 161).

5.3.4 Tongan feather attire

***Figure 5.7*. Sisi fale (Tongan overskirt). Kafa (Coconut fibre), shell, teeth, feathers; single pair twining, stitching. Made before 1773. J. R. & G. Forster collection. Pitt Rivers Museum, University of Oxford, Oxford, England 1886.1.1332. Right: detail of feather attachment.**

In Tonga, fine feathered ‘mats’ worn by men and women as formal attire were made from Pandanus leaf or Hibiscus and decorated with dye, patterns, and sometimes red feathers as seen in a Ta‘ovala (mat or apron) in the National Museum of Australia in Canberra (Inv. Oz 147). A Sisi fale (apron) from the Friendly Isles (Tonga) in the Pitt Rivers Museum, University of Oxford (1886.1.1332) in England resembled stiff twined fibres in basketry, with straight twined red feathers (Fig. 5.7). Collection records indicated the feathers were Fijian red-breasted shining parrot (*Prosopeia tabuensis taviunesis*), it is congenerous to *P. t. atrogularis,* which has similar red, green, and blue feathers (Fig. 5.8). Live shining parrots or kakā (a variation of the N.Z. parrot, kākā) were introduced from the Fijian islands to Tonga in the 18th century for their red feathers, today reduced Tongan populations habituate forests and the outskirts of occupied areas (Fig. 5.3) (Watling, 2001). The coconut (*Cocos nucifera*) fibre was woven in a basket-work pattern and ornamented with red and green parrot feathers. One historic description called it a ‘Kafolalanga worn by the Tamahā and the Tu‘i Tonga on feast days’ (Kaeppler, 1971). It was also probably worn by other high ranking members of the family, although the Tu‘i Tonga, his sister and Tamahā (his sister’s daughter) are the highest ranking male and female in the groups, and the designs correspond to the Tamahā (Kaeppler, 1971, p. 213; Kaeppler, 2008, p. 87). Collection records at the Pitt Rivers Museum and National Museum Australia in Canberra (Inv. Oz 142) stated that only women wore the garment. Also, apparently the title should read ‘Kofulalanga’ a woven dress, or ‘Kafalalanga’ a garment constructed of woven coconut fibres (Kaeppler, 1971, p. 213). Alternately, ‘Kafulalaga’, (in Māori, kahu raranga) in Tongan is a woven garment.

Figure 5.8. **Kakā (Red Shining Parrot: *Prosopeia tabuensis atrogularis*). Fiji. Gift of the Wellington City Council, 1929. Te Papa OR.014328. CC BY 4.0.**

With no existing eighteenth century examples in Tonga, and less than 20 pieces spread between the Göttingen, Florence, and Berne museums, these early records are key to interpreting how they were made and worn (Kaeppler 1978a, p. 213f; Kaeppler 1978b, pp. 92–94). Apart from Māori feather cloaks, this attire is a rare Polynesian example of twined feather attachments. Modern Māori feather cloaks bend the feathers to secure them in the twining process. Several early Māori cloaks collected on Cook's voyages employed feather binding then twining them into the backing (see Chapter Six). An apron-style twined feather piece from the Admiralty Islands, to the North of Papua New Guinea in Melanesia, showed at the waist close single pair twining to hold red and green parrot feathers (Hīroa, 1926, p. 149). Hīroa (1926) possibly described the same apron in Auckland War Memorial Museum (X37, 15865), as composed of fibres, shells, and feathers for adornment. The feathers were not bent back, as seen in Māori cloaks, but attached in an insecure fashion that resulted in feather loss (Hīroa, 1926).

5.3.5 Sāmoan feather attire

Figure 5.9. **'Ie tōga (Sāmoan cloth for tōga). Le ageagea o Tumua. Pandanus leaves, Fijian collared lory feathers, cotton, bast (stem) fibre; weaving, knotting, threading. Made 1800s; Sāmoa. Gift of the New Zealand Government, 2002. Te Papa FE011716. CC BY-NC-ND 4.0. Right: collared lory feather detail. Image by Hokimate Harwood, 2018.**

Sāmoan fine mats or ‘ie toga are considered significant pieces of cultural material and the highest form of weaving, functioning as garments when wrapped around the torso (Fig. 5.9). ‘Ie tōga are gifted and exchanged at ceremonies, marriages, births, and deaths, and inter-relational exchanges attended by high positioned families of social or ancestral standing. Skilled women take months to complete the intricate woven mats (Brigham, 1906, p. 40). The pandanus (*Pandanus tectorius*) or lau‘ie (Māori, rau ‘ie, or ‘ie leaf) resembled kiekie (*Freycinetia*), a New Zealand climbing plant. Stripped pandanus leaves were finely plaited from minute even whenu or warps, and red feathers added to a border elevating its value. The feathers were sewn into the matting, or knotted laterally along a thread (Hīroa, 1930, p. 281). The red feathers originated from parrots in Sāmoa, Tonga and Fiji. The Fijian collared lory (*Phigys solitarius*) with scarlet red throat, breast and upperback, were introduced to Sāmoa specifically for their valuable red feathers in clothe and hair adornment (Hīroa, 1930, p. 281; Pratt et al., 1987). In 2018, the red breast and belly feathers, and red and green upperback feathers from the blue collared lory were personally observed, identified, and described in a Sāmoan ‘ie toga in the Te Papa collection (FE011716) (Fig. 5.9). Direct feather comparisons of the piece to a Te Papa museum birdskin of a collared lory (OR.019935) aided in the identification (Fig. 5.10). The Fijian collared lory known as kula (Māori, kura) in Fiji, is still widespread on the islands of Fiji (Mayr, 1945; Mercer, 1967, p. 9; Steadman, 2006; Watling, 2001, p. 126). Previously the Sāmoan sega‘ula or blue-crowned lory (*Vini australis*) was favoured, and while not as common in Fiji, it is still widespread on most Sāmoan and Tongan islands (Akuhata-Brown, 1966, p. 12; Steadman, 2006).

***Figure 5.10*. Kula, blue collared lory (*Phigys solitarius*). Collected by Fred Kinsky 30 July 1973, Nausori Highlands, Viti Levu, Fiji. Te Papa OR.019935. Right: detail of upperback feathers. Images by Hokimate Harwood, 2018.**

Sāmoa and Tonga place such value on red feathers for fine mats and headdresses that they traded in red parrots from Fiji, in exchange for mats, ornaments, bark cloth and prized whales’ teeth (Hīroa, 1944b, p. 9; Kirch, 1989, p. 240). Fiji potentially still has six endemic birds, mainly from the parrot family, that have variations of red feathers (Perlo, 2011). Live kula translocated for their red feathers failed to become established in Sāmoa but are still present and widespread on some Fijian islands (Watling, 2001).

The Sāmoan red feather kilts, titi ‘ula (titi kura) were not well documented in the literature (Hīroa, 1930). Titi is a variation of the Tongan term sisi (aprons), and ‘ula referred to the red feathers. In the studied titi ‘ula, bunched feathers were attached to fine two-ply twisted cords via an open overhand knot, and the base of the feather shafts plaited into the hanging braids (Hīroa, 1930, p. 257). According to Hīroa (1930), the titi ‘ula, like the Tongan sisi fale, were worn over other garments for dances and festive activities. A contemporary piece in the Te Papa collections combined dyed red and white chicken (*Gallus*) feathers (Te Papa FE010353).

A late nineteenth century Sāmoan women’s waist garment, ‘ie sina (white shaggy garment) in the Te Papa collection (FE001185) was made from splitting and scraping the fine fibres from the bast of the fau pata (*Cypholophus heterophyllus*) into wefts with a shell (Hīroa, 1930, p. 272). The fibrous plant tags attached in the weaving process produce a shaggy appearance, resembling some Māori rain capes (Te Papa ME000307). This process of scraping plant fibres to extract an inner softer, warmer fibre, is known as hāro in manufacturing Māori clothing.

5.3.6 Cook Island twining

***Figure 5.11*. Pāreu kiri‘au (Cook Island Māori hula/ dancing skirt). Plant fibre; scutching, spaced single pair twining. Purchased 1993. Te Papa FE010306. Right: detail of single pair twining along waistline. All Rights Reserved.**

Single pair twining appeared as one or two rows beneath the bast (plant fibre) waistline of some Cook Island dancing skirts (Hīroa, 1966, p. 164). Hīroa (1966) detailed a kilt in his possession with vertical strips of pūrau or hau (Hibiscus) fibres that looped over the top weft (horizontal strand) to hang down, and the double strands twined using a single pair of wefts (p. 36). A similar skirt in Te Papa (FE010306) had a single pair twined row under the waistband for structure (Fig. 5.11). It was difficult to ascertain whether twining was prominent in Pre-European times or whether feathers were attached to the garments using this technique with limited examples to study. Cook Island culture regularly integrated feathers into vibrant objects, along with shells, flowers, and seeds adorning twined skirts (Hīroa, 1927, p. 90). Headwear of flowers, leaves, shells, feathers, and human hair formed part of the festive attire for men and women, implying it was the functionality of Polynesian featherwork specifically that elevated clothing from common everyday wear to ceremonial attire (Hīroa, 1944a, p. 79).

5.3.7 Rapa Nui/ Easter Island

The peoples of Rapa Nui (Easter Island) were thought to have descended from Rapa Iti in French Polynesia. Governed by Chile in South America, Rapa Nui sits in the far east of the Polynesian triangle (Fig. 5.3). While feather headdresses were common, feather clothing was less so, with no examples located for this study. Limited suitable plant and bird life restricted this type of personal adornment and attire. However, one notable piece, a Hami Nua, or Chief's quilted cloak made from barkcloth was located in the Pitt Rivers Museum, University of Oxford, England (1886.1.1250) as part of the Johann Reinhold Forster and George Forster collection from Cook's second voyage. The barkcloth cloak resembled the stitched rows of New Zealand Māori sewn animal skins and weaving.

5.3.8 French Polynesian twining and feather attire

<u>*Tuāmotu archipelago*</u>

***Figure 5.12*. Tuāmotu twined kilt. Plant fibre; spaced single pair twining, twisting, plaiting. Egmont Island, Vaira'atea, Tuāmotu archipelago. 18th/ 19th century. ©Trustees of the British Museum Oc,EP.12. Right: detail of twining technique.**

Finger twined clothing in Tuāmotu (ancient name Pa‘umotu) was recorded in the 18th and 19th centuries. The employment of single and double pair twining in some Tuāmotu garments have been likened to Māori capes, cloaks, and rāpaki (waist garments) (Emory, 1975). An historic piece from the Tuāmotu islands in the British Museum (Oc,EP.12) was recorded as a shoulder garment, and strongly resembled an unadorned Māori cloak with plaited side borders (Fig. 5.12). It was labelled a kilt, as it appeared too small to be a cloak, measuring 85.5cm wide x 45cm in height (Emory, 1975, p. 79; Hīroa, 1926, p. 42; Roth, 1923, p. 118). It differed slightly in that it had a single pair of wefts wrapped (twined) around the two vertical warps creating a textured foundation (Fig. 5.13) (Hīroa, 1926, p. 42; Roth, 1923, pp. 118–119). Made of vegetable or palm fibre, the plaited edges and twisted fibres extended out at the corners. This double warp weaving is ubiquitous in Polynesian and Māori netting and basketry (Fig. 5.2).

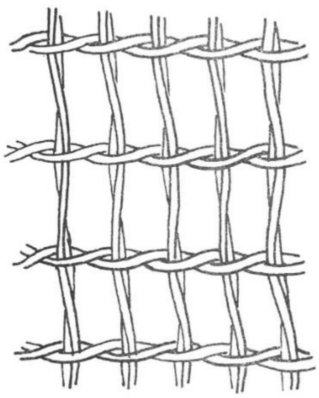


***Figure 5.13*. Diagram of twining in Tuāmotu kilt, based on kilt in the British Museum Oc,EP.12. Taken from Hīroa (1924b), Evolution of Maori clothing, Part III - after Ling Roth (1923).**

Descriptions of the Tuāmotu rain capes have been based on their rudimentary construction of stripped overlapping pandanus leaves, interlocked with lateral running cords sewn across the leaves using a bone needle (Emory, 1975, p. 84). Stokes (n. d.) referred to these garments as *veve*, which in pre-contact times varied in manufacture and functioned as sleeping mats in some islands. The aerial roots of the pandanus leaf were pounded and scraped to loosen the fibres to form the warps and wefts, and the twining produced from two strand dextral (hand) weaving, with sinistral twists, rather than sewing (Emory, 1975). The British Museum houses three French Polynesian cape-like garments, with other examples in Honolulu, London, Edinburgh, and Stockholm museums (Pendergrast, 2005).

The British Museum (Oc,+.8486) also holds a cape from Tuāmotu with entirely different weaving. Hīroa (1966) fleetingly mentioned the sporadic occurrence of twined cloaks in the

Tuāmotu atolls, providing minimal detail in the manufacture or potential tie to Māori cloaks, concluding that it was not a common or established technique (p. 164). Clearly environmental and social circumstances influenced production. Hīroa (1926) proclaimed throughout his work that twining in Māori cloaks was independent of the French Polynesian twining as practices were mutually exclusive, and that Māori adapted this type of clothing over hundreds of years.

Tahiti, Society Islands

Tahitian Kings and noble men wore finely made and sometimes decorated tapa (bark cloth) and later tiputa (ponchos) with red, black and yellow feathers, or they were of plain white tapa with fringes of ‘ura (red) feathers (Henry, 1928, p. 285). Fine plaited garments decorated with feathers added more value to the attire (Oliver, 1974, p. 151). Only the highest-ranking Tahitian sovereigns, Ari‘i nui (in Māori, Ariki nui, sovereign leader), were entitled to dress in the prodigious red girdles or maro ‘ura (Māori, maro kura) (Henry, 1911, p. 5). The suffix ‘ura indicated that the maro was red, precious, invaluable, or chiefly as were maro tea (yellow or light coloured feather girdles). Both were highly prestigious and sacred. Common maro (girdles) of bark cloth or plaited plant fibres were wrapped between the legs and around the lower waist in French Polynesia (Emory, 1975). The royal Tahitian feather maro decorated with sacred red feathers served as insignia of royal investiture elevating the wearer with divine ancestry (Stokes, 1925). Where god and King shared authority over humankind as ancient royalty descended from the gods (Ellis, 1853, p. 94). No examples were located in museums, but historical accounts existed of red feather girdles in Ra‘iātea (Tyerman & Bennet, 1831, p. 527) and Tahiti in the Society Group (Cook & King, 1785, pp. 345–346). It was understood the sacred girdles had a groundwork of netting with added red, yellow, and black feathers (Stokes, 1925, p. 26). Other accounts have it composed of cloth with yellow and red feathers sewn or glued on with gum (Henry, 1911, p. 6; Hīroa, 1926, p. 45). The maro ura cloth was of beaten sacred aoa or banyan (*Ficus*) tree fibres to which red feathers or ‘uru’ (feathers) taken from revered god idols were interwoven into the garment, transferring the sanctity from one object to the other (Ellis, 1853, p. 108). A red woven Tuāmotu maro ura in the British Museum (Oc,EP.36) is made from dyed pandanus leaf and plaiting. Cook witnessed a funeral of a dignitary in which red feathers, maro kura and a carved god image or idol, *Eatooa* (E Atua), were incorporated into the rites (Cook & King, 1785). Europeans described the idol as an uncarved piece of wood with red feathers attached (Stokes, 1925, p. 26). Due to its large size, one maro ʻura was referred to as a robe, measuring at least fifteen feet long, it had eight patches where additions were made for each new ruler (Cook & King, 1785, p. 346; Tyerman & Bennet, 1831, p. 526). Only men attended the ceremony, and animal and human sacrifices added to its omnipotence (Stokes, 1925, pp. 26–27). Human sacrifices were supposedly conducted for each new commencement of the maro ura, known as fatu raa (whatu rā), or sacred weaving (Ellis, 1853, p. 108; Tregear, 1891). Henry (1911) clarified that sacrifices implored the deities at war time, not just the inauguration of new rulers. Extending the maro for each sovereign made it a sanctified historical record, hence few if any were collected by early Europeans. This is likely the case for Māori maro kura (red feathered aprons) and kahu kura (treasured/ red feather cloaks), for while they were recorded (albeit rarely) by early European explorers, it appears few were traded or gifted before 1800 (Mead, 1969, pp. 56, 64).

***Figure 5.14*. Ahu rupe (Tahitian pigeon feather (mourning) cloak). Coconut fibres, ʻieʻie, Tahitian pigeon feathers; weaving, tying, knotting, braiding. 18th century, Forster Collection. Pitt Rivers Museum, University of Oxford, Oxford, England 1886.1.1637.4. Centre and Right: reverse and detail of feather attachment.**

Fortunately, other feather garments exist in museums and further understanding can be drawn from the material evidence. A Society Island mourning costume, possibly from Tahiti, formed part of the Forster collection acquired on Cook's second voyage in the Pitt Rivers Museum, University of Oxford in England (1886.1.1637.6) and consisted of an impressive barkcloth cape and headdress of dark split pigeon feathers bound to a kind of head piece of coconut fibre and twined bark cloth (Fig. 5.14). A useful account of an elaborate Tahitian Maohi (Māori) feather cloak in the British Museum (Oc1987,Q.22) was also provided by Hīroa (1943). It was part of the mourning attire worn during public funeral proceedings known as heva or more accurately as *taihaa* [tyehaa] (Māori, tangihanga) (Davies, 1851; Oliver, 1974, p. 502; Tregear, 1891, p. 466). The mourning costume consisted of a compound headdress, a faʻaupoʻo (in

Māori whaka upoko), a mask (parae) to cover the face, and some form of tapa clothing and feather cloak that tied around the neck and draped down the sides and back (Fig. 5.15) (Hīroa, 1943). The garment was worn by the chief mourner (heva tupapa‘u), usually a priest or a male relation of the recently deceased of high rank (Hooper, 2006, p. 43). A Māori priest equivalent would be a type of tohunga or higher expert in these customs, and the tupapa‘u (tūpāpaku) referred to the deceased person. Fully dressed, the relative fearfully portrayed the aggrieved dead, parading in public, and brandishing a shark-toothed weapon as if in a state of grief striking those in their path. Whole and parts of these costumes are scattered in museums around the world, one of which dates to the 1760s (Hīroa, 1943, p. 12).

***Figure 5.15*. A man of Otaheitee (Tahiti) in a mourning dress. Print made by J. Collyer, after W. Ellis. c.1785. ©Trustees of the British Museum 1933,0713.7.**

The Pitt Rivers Museum (1886.1.1637) costume had a backing cloak and two feather streamers projecting from each shoulder (Fig. 5.14) (Hīroa, 1943). The museum labelled it an ‘ahow roopé’, a misnomer that should read ‘ahu rupe’ or pigeon cloak, named for the rupe or Pacific pigeon. The split feathers were connected to coconut (*Coco nucifera*) cord fibres creating a ladder or latticework (Fig. 5.14). The quills were bent back on themselves or wrapped around cord to form rung-like structures across the cloak (Hīroa, 1943). The 18th century cloak in the British Museum (Oc1987,Q.22) had dark iridescent feathers from the Tahitian rupe (Polynesian Imperial pigeon: *Ducula aurorae*) (Fig. 5.16) (Hīroa, 1943). The vertically split feathers were bunched, then bent back on themselves forming a loop securing the feathers along a two-ply fibre cord with overhand knots (Hīroa, 1943, p. 13). The cord was tied to the larger backing of passive wefts of ‘ie‘ie (*Freycinetia*) vine (Hīroa, 1957, p. 216). Splitting feathers down the middle shaft forces the feather vane to curl back generating volume and movement. The feathers on waka Māori (canoes) and sails (rā or mamari) gauge the presence and direction of the wind. On weaponry the movement of feathers distracts an opponent in combat, and in clothing curled feathers allow the wearer to appear larger and more important.

***Figure 5.16*. Rupe (Polynesian Imperial pigeon: *Ducula aurorae*). Image by Frédéric Jacq, Makatea atoll, Tuāmotu Islands, 2007.**

The rupe has a back and tail of dark iridescent green, and underparts and head and neck of silver-grey (Fig. 5.16) (Pratt et al., 1987; Watling, 2001). The Tahitian rupe was uncommon and are now vulnerable, in the Tuāmotu archipelago they are still endangered but more common, restricted to remote mountainous forested areas (Pratt et al., 1987; Thibault & Rives, 1975). Other Tahitian mourning garments were ornamented with a network of mother of pearl shells fringed with ʻōtaha or man-of-war bird (great frigate bird: *Fregata minor*) feathers, with two oro-oro or long decorative feather tassels hanging off the piece (Ellis, 1831a, p. 413; Oliver, 1974, p. 503). The large ʻōtaha (Māori, kotaha) have a wingspan over 2m across and display aggressive behavior towards other birds (Marchant & Higgins, 1990). In Tahiti ʻōtaha also represent the war god ʻOro (Turnbull, 2009). In Rapa Nui (Easter Island) it was a symbol for the warrior class (Lee, 2000). The plumage is dark iridescent black, purple, and green, and breeding males have conspicuous deep red inflatable throat pouches (Pratt et al., 1987; Thibault & Rives, 1988). The birds are widespread throughout East Polynesia, nesting on lightly populated islands throughout the year (Thibault & Rives, 1988). In Hawaiʻi, the long metallic-tinted feathers of man-of-war birds, or ʻiwa, dressed cloaks and kahili (feather staffs) (Brigham, 1899, p. 11; Hīroa, 1944b). ʻIwa in Hawaiʻi were thought to carry souls to heaven (Moreman, 2014). As New Zealand vagrants (non-resident), it is not known how available these bird feathers were for Māori attire (Heather & Robertson, 1996). Kāhu (swamp harrier: *Circus approximans*) personified courage and ferocity, and their appearance before war was a propitious sign, the wing and tail feathers were split down the shaft and attached to weapons like tewhatewha (a long fighting staff) (Te Papa ME011210), and when brandished distracted the opponent (Maihi, 2011, p. 35; Orbell, 2003; Riley, 2001).

Rapa, Austral Islands

Despite the limited sources of material evidence, the few recorded cloaks, and capes of Rapa Island (in the Austral Islands) merited some attention (Fig. 5.3). In his unpublished Bernice Pauahi Bishop Museum manuscripts in Honolulu, Stokes (n.d.) recorded the pre-European twined cloaks from Rapa as kaʻureʻe (Māori, kahu rehe), a cloak made by an expert weaver. It was also known as kaurae, kaurei, takaravae or takavavae, and thought to be an ancient dress (Stokes, n.d.; Stokes, 1955, p. 333). Stokes (n.d.) described decayed fragments of an original garment, from Plates 8550 and 8551 that had both wefts of one strand (single pair twining) and two strands (double pair twine), as per Māori rain capes and cloaks. The warps were of twined rush, raupo (*Scirpus* spp.) with 2-strand wefts of spun mōrē (*Hibiscus tiliaceus*) (Stokes, n.d.). The wefts and pile were of raupo pith, with the outer green epidermis likely scraped away traditionally with a shell (Stokes, n.d.). Māori weavers scrape the outer harakeke (flax) leaf with a kuku or mussel (*Perna canaliculus*) shell to extract the inner fibre, muka. Like Māori clothing, the purpose of Rapa garments was warmth. A soft pile covered the surface of a larger rectangular work that served as blankets, and smaller pieces worn as cloaks (Stokes, n.d.). They are no longer produced, with the last known pieces made in the mid to late 1800s. The women helped prepare the materials with one woman weaving the piece (Stokes, n.d.). As in Māori cloaks, the weaving started in the lower border so that the piling lay over the previous filling. The descriptions alluded to finger twining as the primary technique, and the rain capes (taveru) all showed similar twining and attachments (Hīroa, 1926, p. 44). One Rapa rain cape was located in the Bishop Museum (No. B.05110) in Honolulu. Stokes' (n.d.) unpublished manuscript also catalogued twined Rapa island cloaks in French Polynesia and described several cloaks with warps consisting of braids (plaits) held together with wrapped twining, in spaced rows (Plates 8552 and 8553) (Hīroa, 1926, p. 97).

When English missionary William Ellis (1794-1872) journeyed to Rapa in 1817, he became aware that a King was the supreme ruler with subordinate chiefs below him, and one of the chiefs was a Tereau (Ellis, 1831b, p. 364). Possibly the same chief, Teraau (possibly misspelt), became an informant for Ellis, and claimed that Rapa royalty wore blue feather cloaks derived from the kotokoto (Cameron, 2012, p. 102). This bird was possibly the rare Tuāmotu kingfisher (*Halcyon gambieri*), imported after European contact, the feathers have a turquoise or bluish-green tinge on the wing and back (Cameron, 2012, p. 102). In Tahiti, the kingfisher is a sacred bird that fed on the remains of sacrifices whereby embodying the gods in the ceremony (Ellis, 1833, p. 258). According to other sources the kotokoto is a rail, possibly a spotless crake (*Zapornia tabuensis*) which has dark bluish-grey feathers and are rare on Rapa (Anderson, 2012, p. 43; Stokes, 1955, p. 334). In contrast, the ignoble feather cloaks were decorated with more common black and white petrel (Hydrobatidae) feathers (Cameron, 2012, p. 102). It is understood that none of the fine twined or feathered attire are made today in French Polynesia, and so without additional primary sources, makes any assumptions about feather and bird use dubious.

5.3.9 Hawai‘ian feather attire

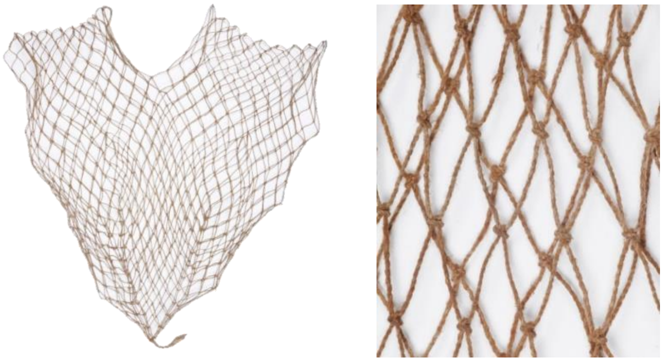


***Figure 5.17*. Kupenga (Cook Islands net). Plant fibre; knotting. Cook Islands. Gift of Masonic Lodge Tawera o Kapiti, 1950. Te Papa FE012003. Right: Detail of knotted weaving. All Rights Reserved.**

Kanaka Maoli (tāngata Māori), the indigenous peoples of Hawai‘i, arrived on the islands at least 1000 years ago. The advancement of Māori and Hawai‘ian feather cloaks corresponded with the adaptation of basket and net weaving into clothing, where Māori cloaks incorporated twining from basketry, the Hawai‘ian cloaks developed from knotted netting (Hīroa, 1926, 1944b). They both incorporated bird skins and feathers in cloaks, having refined the artistry that have few equals in terms of featherwork. Hawai‘ian clothing enhanced a material culture that is vibrant with rich social structures and religious beliefs. The techniques in Hawai‘ian feather cloaks and capes appeared to evolve from the ‘olonā (*Touchardia latifolia*) fibre mesh netting seen in fishing apparati, but more closely spaced (Fig. 5.17) (Hīroa, 1944b). Where the knotting in fish-nets progressed into Hawai‘ian kui la‘i or ‘ahu la‘i, the tī (*Cordyline fruticosa*) leaf rain capes (Hīroa, 1944b). The netting of ‘olonā or hau (*Hibiscus tiliaceus*) cordage of fresh tī leaves achieved a degree of water proofing when placed over each other (Hīroa, 1944b).

There are at least two existing Hawaiʻian feathered textiles that predate the feather capes and cloaks known today (Stokes, 1925). One is a fifteenth century feathered waist cord or sash, Kāʻei Kapu O Liloa (Māori, Tāhei tapu o Liloa) or the ʻsacred band of Liloa' and is housed in the Bishop Museum in Honolulu, Hawaiʻi (1910.018.001) (Stokes, 1925). It is 3m long and adhered to the olonā netting are skin and feathers of the red ʻiʻiwi (*Drepanis coccinea*) bird, and skins and feathers of yellow ʻoʻo (*Moho* spp.) on the borders (Hellmich, 2015, p. 58). The band is embellished with human molars and possibly fish teeth (Brigham, 1918, pp. 33–35; Hellmich, 2015, p. 58). The early date limits our understanding of how and when it was used, just that it is of extreme importance to have survived so long. It is possibly an equivalent of the Tahitian maro ʻura, a signifier of the genealogy, power and authority of aliʻi nui (ariki nui, supreme leaders) (Hellmich, 2015, p. 58). The second cordon is slightly longer but in remnants in the Bishop Museum (No. 6921) and lacks the distinguishing features of the feathers previously attached (Brigham, 1918, p. 39; Stokes, 1925).

***Figure 5.18*. ʻAhu ʻula (Hawaiʻian feather cape). ʻOlonā netting and fibre, bark cloth, tropic bird and Hawaiʻian fowl feathers, ʻiʻiwi and ʻōʻō or mamo feathers and bird skin; Plaiting, sewing, tying, knotting. Late 18th century. ©Trustees of the British Museum Oc1982,Q.747.**

Collected in the late eighteenth century, rare early Hawaiʻian trapezoid shaped feather capes with bird feathers and skin still survive in museums in Europe (Vienna Museum) and the United Kingdom. The British Museum houses a number including Oc1988.Q1, and VAN234, and one in particular (BM Oc1982,Q.747) from Cook's third voyage has white-tailed tropic bird (*Phaethon lepturus*) feathers, and brown and black Hawaiʻian fowl (moa: *Gallus gallus*) feathers (Fig. 5.18). Feathered skins from small passerines like red ʻiʻiwi and yellow and black ʻōʻō (*Moho nobilis*) or mamo (*Drepanis pacifica*) along the top enhance the waist. Over time, the netting was refined, decreasing in size to accommodate the smaller yellow and red feathers adorning most feather capes and cloaks (Hīroa, 1944b, p. 11).

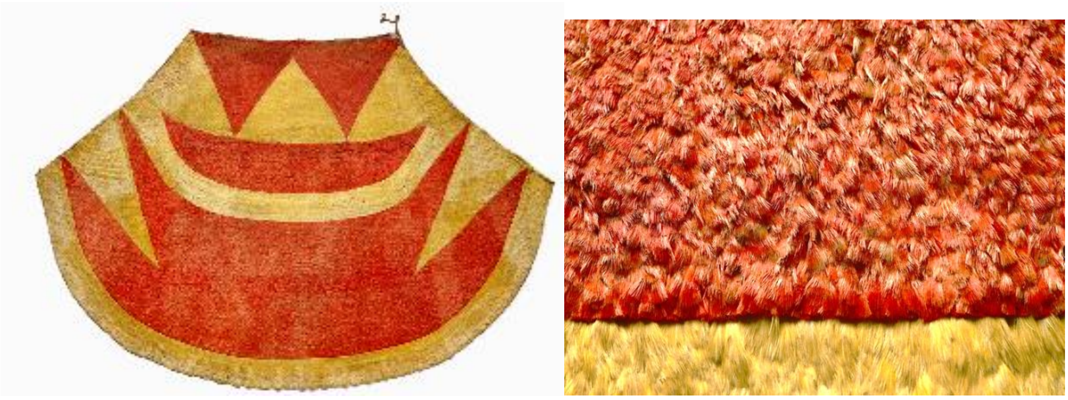


***Figure 5.19.* ‘Ahu ‘ula (Hawai‘ian feather cape) belonging to King Kalani‘ōpu‘u. Plant fibres, red i’iwi and yellow feathers; plaiting, tying, and knotting. Made in Hawai‘i, 18th century. Gift of Lord St Oswald, 1912. Te Papa FE000327. Right: detail of red i’iwi and yellow feathers.**

In Hawai‘ian capes and cloaks the paramount feather colours were initially red and yellow, harvested from endemic honeycreepers to make ‘ahu ‘ula (red feather cloaks) and aahu mamo (yellow robes) (Tregear, 1891). A ‘alaneo is a robe entirely of yellow mamo feathers or of only one kind of feather (Kent, 1993, p. 48). King Kamehameha I had an infamous large yellow mamo feather cloak (Hīroa, 1957, p. 230; Kaeppler, 1985). These prestigious feather capes had red, yellow, and sometimes black, and crescent-shaped designs (Cummins, 1984, p. 3). Permanently loaned to the Bishop Museum in 2016, a Te Papa ‘ahu ‘ula (FE000327) that once belonged to King Kalani‘ōpu‘u, had red feathers derived from the i‘iwi, identified from macro- and microscopic comparisons of cloak feathers to Hawai‘ian feathers and birdskins (Figs. 5.19, 5.20 & 5.22). No yellow feathers with down had detached from the ‘ahu ‘ula (FE000327) and no yellow feathers could be obtained from the museum birdskins, or Hawai‘i for comparative studies, however the yellow cloak feathers were assumed to originate from a species of ‘ō‘ō (*Moho*) or from the mamo (Figs. 5.20 & 5.24).

***Figure 5.20.* ‘Ahu ‘ula (Hawai‘ian feather cape) belonging to King Kalani‘ōpu‘u. Detail of orange-red i‘iwi and yellow feathers, and knotted backing (right). Made in Hawai‘i, 18th century. Gift of Lord St Oswald, 1912. Te Papa FE000327.**

The fine two-ply olonā fibre created a diamond-shaped netting and the central joins of the overhand knots had small feathers attached creating straight rows of feathers (Fig. 5.20) (Hīroa, 1944b). Single feathers or bunches tied over the knots overlapped on each row whereby filling the gaps in netting much like the Tī leaves in the rain capes. Such intricacy in an artform speaks to the prominence of these garments. The cloak commenced in the lower border with the feather tips (free ends) facing the lower edge, and the artist worked along and then up the cloak until the feathers were layered like feathers on a bird. There were possibly supplementary layers or extensions, which could be a similar practice of adding additional ownership to the garment much like the Tahitian feather girdle, maro ʻura (Hīroa, 1944b).

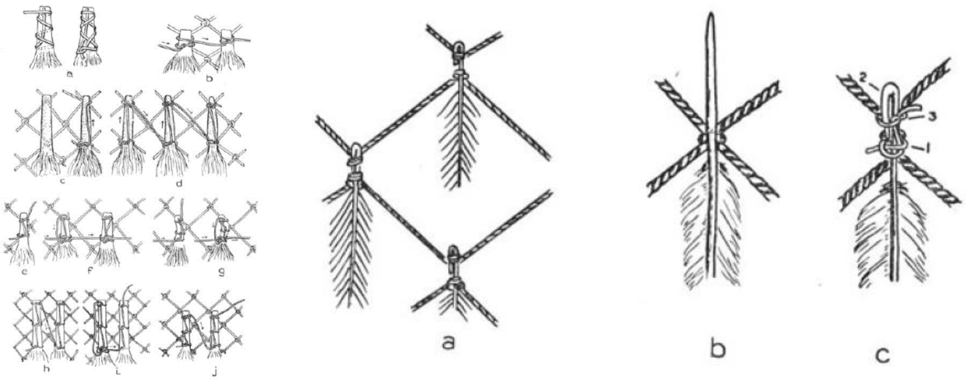


Figure 5.21. **Feather attachment in Hawaiʻian feather cloaks from Hīroa (1944b) [Figs. 1 & 2.]**

The feathers were traditionally plucked, sorted according to size, and tied or bound together in bunches at the feathers base, employing numerous tying combinations in which a detailed cord network linked the feather bundles together (Hīroa, 1944b). Brigham (1899) remarked that when fastening the feathers to the net, a "much finer thread … was used and the feather was bound by two or three turns of the thread… The shaft of the feather was bound by one turn, then bent, and the end bound by another turn of the thread, to the same or the next lower mesh. This was a very secure method, and the feather could be broken but not pulled out whole" (p. 51). The feather bunches were either spiral tied or bound using successive overhand knots along the shaft then continued along the netting rows to the next lateral mesh knot or knots (Fig. 5.21) (Hīroa, 1944b). If single feathers were attached, a pair of olonā fibres were twisted together and the feathers knotted with the shaft bent back on itself as it is tied to the netting (Fig. 5.21) (Hīroa, 1944b, p. 2; Roth, 1923). This cloak technique suited the warm climate and allowed for some mobility. The passerine feathers were also too small to be twined.

Figure 5.22**. ‘I‘iwi ♂ (*****Drepanis coccinea*****). Collected by G. Munro, 9 September 1893. Kauai Is., Hawai‘i. Te Papa OR.009995. Right: detail of breast feathers. Images by Jean-Claude Stahl (Te Papa), 2017.**

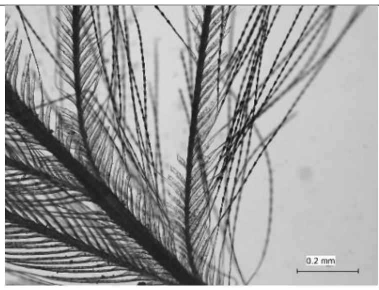
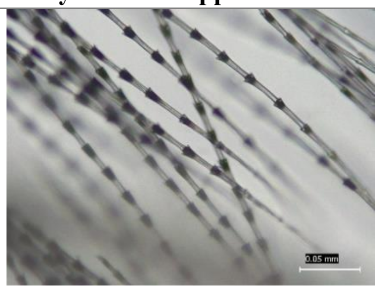
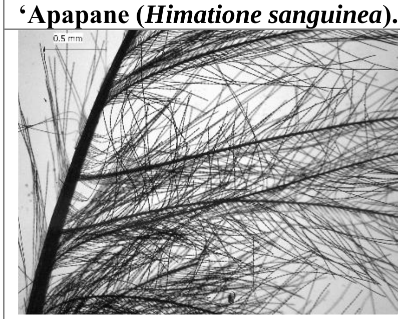
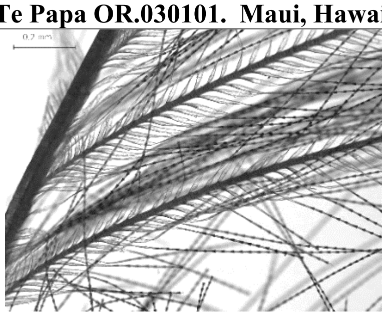
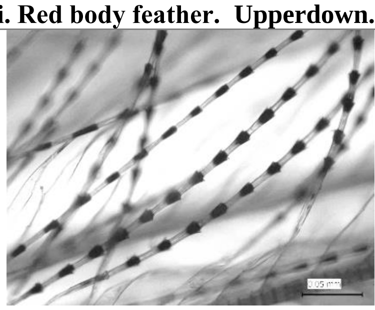
Figure 5.23**. ‘Apapane ♂ (*****Himatione sanguinea sanguinea*****). Collected by G. Munro, April 1907. Molokai Is., Hawai‘i. Te Papa OR.009996. Right: detail of breast feathers. Images by Jean-Claude Stahl (Te Papa), 2017.**

Figure 5.24**. ‘Ō‘ō ♂ (*****Moho braccatus*****). Collected by G. Munro, 10 September 1898. Kauai Island, Hawai‘i. Te Papa OR.009994. Right: detail of yellow flank feathers. Images by Jean-Claude Stahl (Te Papa), 2017.**

Typically the vermillion red ‘i‘iwi and crimson red ‘apapane (*Himatione sanguinea*) supplied the red feathers that were coveted trade items between hunters and collectors (Figs. 5.22 & 5.23). The bright yellow ‘ō‘ō feather tufts near the wing and tail numbering 15-20 individual feathers were highly valued (Fig. 5.24), and to a lesser extent the golden yellow mamo feather tufts (c.20 feathers each), on the thighs and tail were plucked from birds (Brigham, 1899, p. 9). The black feathers were also worked into garments (Brigham, 1899). The now extinct ‘ō‘ō were sought after for food and feathers and were once common and widely distributed on the islands (Brigham, 1899, p. 10; Hīroa, 1944b). Small green ‘o‘u (*Psithacirostra psittacea*) feathers were also used in circular capes, while longer bird feathers from moa (fowl), man-of-war bird (*Fregata* spp.) and tropic birds (*Phaethon* spp.) decorated the larger coarse netted capes (Brigham, 1899; Hīroa, 1944b). The finer circular netted cloaks required more labour and time and comprised of the rare and valuable red and yellow feathers (Brigham, 1918, p. 9).

For microscopic feather identifications, red feathers detached from the ‘ahu ‘ula (Te Papa FE000327) were labelled (Te Papa FE000327/1) and compared to red reference feathers of ‘i‘iwi and ‘apapane gifted by the Maui Forest Bird Recovery, Hawai‘i in 2017 (Table 5.5 & Fig. 5.19). Additional macroscopic comparisons of cloak feathers to Te Papa museum Hawai‘ian bird skins (Figs. 5.22-5.24) confirmed that some red feathers in the ‘ahu ‘ula (Te Papa FE000327) were possibly neck or upperbreast feathers from i‘iwi.

***Table 5.5*. Photomicrographic comparisons of detached cloak feather (Te Papa FE000327/1) with i‘iwi (*Drepanis coccinea*) and ‘apapane (*Himatione sanguinea*) body feathers, 2016-2017.**

Detached red feather (i‘iwi) cloak sample. Te Papa FE000327/1. Upperdown.		
40x magnification	**100x magnification**	**400x magnification**
 **Upperdown, barb base.**	 **Upperdown, barb base.**	 **Upperdown, barb & barbule base.**
I‘iwi (*Drepanis coccinea*). ♀. Te Papa OR.030100. Maui, Hawai‘i. Red body feather. Upperdown.		
 **Upperdown, barb base.**	 **Upperdown, barb base.**	 **Upperdown, barb & barbule base.**
‘Apapane (*Himatione sanguinea*). Te Papa OR.030101. Maui, Hawai‘i. Red body feather. Upperdown.		
 **Upperdown, barb base.**	 **Upperdown, barb base.**	 **Upperdown, barb & barbule base.**

The few feather samples detached from the Hawai'ian feather cloak (Te Papa FE000327/1) had little or no down remaining on the feathers, either intentionally removed before or during the attachment process, or from wear. Some down had been retained within the netting when the feather had detached from the cloak, and several feather samples were missing the calamus (the shaft section at the feather base attached to the skin). The remaining upper down on the detached feathers was insufficient to positively identify the bird to species level, just that it originated from a passerine in that extant med-long downy barbules at the base of the barbs had dark triangular nodes all along the barbules, and villi was present at the base of some barbules (Fig. 5.25) (Harwood, 2011a). The upperdown region of the feather was situated just below the pennaceous barbs, and still exhibited plumulaceous (downy) barbs (see Fig. 5.5).

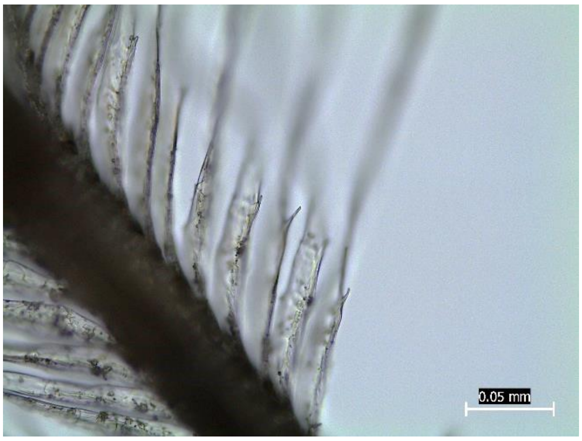


***Figure 5.25*.** **Photomicrograph of villi (cilia) at the base of some barbules in the remaining upperdown region of the red feather (i'iwi) cloak sample (Te Papa FE000327/1). 400x magnification. Image by Hokimate Harwood, 2016.**

Most of the detached cloak feather fragments (Te Papa FE000327/1) were less than 1cm long and had substantial damage to the downy barbs and barbules. The feathers had white shafts and orange-red pennaceous barbs, and most of the lower down (near the feather base) was missing. One sample (FE000327/1) had knobbed villi that were shorter and reduced in number at the base of barbules in the upperdown region (Fig. 5.25). The average barbule length at the barb base was 0.76mm. The average node size at the barb and barbule base was 0.01mm long x 0.01mm wide, with an average internodal space of 0.016mm, and barbule width of 0.005mm. The nodes along the barbules were dark with unpigmented short prongs (Table 5.5).

Feather measurements and descriptions were made of a male i'iwi (*Drepanis coccinea*) birdskin (Te Papa OR.009995) for macroscopic comparisons. The upperbreast feathers were a vibrant vermillion red and measured approximately 1cm long x 0.5cm wide (Fig. 5.22). The shaft was white, with white barbs and grey downy barbules at the feather base. Half the feather length was grey down, and the barbs formed a white V pointing towards the feather tip, transitioning into orange and bright vermillion red pennaceous barbs at the feather tips in a fan shape.

A red body feather from a female i'iwi (*Drepanis coccinea*) (Te Papa OR.030100) collected from Maui Forest Bird Recovery in Hawai'i was examined in 2017 for microscopic comparisons to the cloak feather (Te Papa FE000327/1) (Table 5.5). The Bird Recovery feather (Te Papa OR.030100) was similar (but not the same) in size and colouring to the cloak feather in that it measured 1.2cm long x 1cm wide, it was a contour body feather with a white shaft, white barbs, dark grey downy barbules, forming a point towards the tip. At the feather base and barb base the down was dark grey then lighter white along the barb, and orange-red colouring at the barb tip. The diagnostic (triangular, pigmented) passerine nodes were only visible on down a quarter of the way up the feather. The rest of the down had stippled pigment throughout nodes and internodal spaces. Appearance of knobbed villi at the base of the barbs was also reduced. Analysis of the upperdown region found that the average barbule length at the barb base was 0.95mm, and the average number of nodes along barbules at the barb base was 62. At the top of the downy region, at the barb and barbule base the internodal space was 0.022mm. The nodes had pigment, but less than in down at the feather base. Prongs were small and lacked pigment and the nodes were short at the very barbule base and gradually increased in size ranging from 0.007-0.1mm long x 0.008mm wide. The barbule width measured 0.004mm and the pigment was light and stippled in some places.

Dove (1998) analysed i'iwi feathers in museum specimens noting the contour feathers had a medium dark grey downy region, including a white stripe below an orange-red pennaceous tip. The average barbule length was 1.3-1.5mm; and average number of nodes per barbule was 56, with nodes uniformly swollen and distributed all along barbules, and pigment at nodes round, defined and teardrop shaped (Dove, 1998). Little internodal stippling was noted at the barbule base, where internodal space appeared thinner and nodes appeared wider, compared to distal nodes (at barbule tip), which were well confined and with prominent prongs (Dove, 1998).

Macroscopic comparative analysis was conducted in 2017 on the red cloak feathers (Te Papa FE000327/1) to the red feathers of a male 'apapane (*Himatione sanguinea*) museum birdskin (Te Papa OR.009996) (Fig. 5.23). The crimson red feathers from the breast and upperbelly measured around 1cm long x 0.5cm wide, they had a white shaft and barbs, and grey barbules, with less contrast than i‘iwi between the grey down and red pennaceous barbs. The grey down measured 0.5cm, and it was darker than in the i‘iwi feathers. The V shaping was also less prominent than in i‘iwi. The head consisted of more vibrant red feathers (Fig. 5.23).

In 2017 microscopic feather descriptions were recorded for a red feather from a male ‘apapane (*Himatione sanguinea*) (Te Papa OR.030101) collected from the Maui Bird Recovery in Hawai‘i (Table 5.5). The body feather measured 1.5cm long x 1cm wide, and the down measured 0.5cm. The shaft was white and the down greyish black with darker pigment near the shaft. The pennaceous barbs were crimson red towards the barb tips and black at the base. The downy barbules at the feather base and barb tip lacked short nodes. In the upper down region, the downy barbs had downy barbules up to the mid-barb, where short pennaceous barbules appeared towards the barb tip. Knobbed villi at the base of barbs and barbules were also uncommon. Long barbules had pigmented nodes at the barbule base. At the barb base the average length of barbules was 1.4mm long and had on average 55 nodes per barbule. At the barb and barbule base, dark pigmented well-developed nodes with small clear prongs were measured on average at 0.011mm long x 0.01mm wide, the internodal space was on average 0.011mm long, and the barbule width 0.005mm across in between nodes. Little or no pigment was present in the internodal spaces.

Previous analyses of red ‘apapane feathers indicated they had a medium dark grey plumulaceous region with a dusky (dark) red stripe below a dark red pennaceous region, compared to *Himatione sanguinea freethi*, the Laysan race, which was more orange in colour (Dove, 1998). The average barbule length ranged from 0.7mm-0.9mm, and average number of nodes per barbule was 37 (Dove, 1998). Nodes were uniformly swollen and distributed all along the barbules, and the barbule base was moderately stippled with pigment on distal barbules (Dove, 1998). Nodal pigment at the barbule tip was somewhat confined but some internodal spaces had stippling of pigment and appeared shorter than other species, and the prongs were more apparent on nodes at the barbule tip (Dove, 1998).

5.4 Discussion

An analysis of Polynesian feather attire indicated several key tangible and intangible factors to trace aspects of the history of Māori feather cloaks. The physical elements on a cloak such as colour, the design and use of certain plant or animal materials function alongside the technical aspects in how it was made. The spiritual significance of the birds and feathers can answer why it was made, and potentially constitute customs such as who made it, for whom and what occasion. The relationship the cloak has to the genealogy (whakapapa) of the weaver and wearer, and to the spiritual world (deities, ancestors) create the protocols (tikanga) and knowledge (mātauranga) surrounding a cloak. Collectively these factors dictate the role or status of the cloak and wearer on a cultural (tāngata Māori) and social (iwi Māori) level.

5.4.1 The significance of colour and design

In Chinese culture the significance of colour symbolism is evident in the theory of the five elements of fire (red), metal (white), water (black), wood (green) and earth (yellow) (Lee, 2012). Red is associated with good fortune, wealth, health and the female sex; white represents peace, success, purity, and death; black is nobility, darkness, and holiness; green denotes youth, vigour, and safety; and yellow means good luck, Imperial power, holiness and dignity (Li, 2014).

***Figure 5.26*. Tevau (Feather currency roll). From Santa Cruz. Feather, fibre, nylon, shells. Made 20th century. Te Papa FE012737. All Rights Reserved.**

Literary perceptions of Polynesian and Māori artforms relate to the significance of the colour red, in that in many indigenous cultures it is synonymous with esteem (Colenso, 1881; Stack, 1879). The treasured red feathers of the pileated woodpecker (*Dryocopus pileatus*) was accepted as currency in North America (Campbell & Lack, 2013, p. 414). On the island of Santa Cruz in the Solomon Islands, in Melanesia, a red feather currency formed in which coiled textile cords with thousands of valued red cardinal honeyeater (*Myzomela cardinalis*) feathers were traded with nearby islands (Fig. 5.26) (Houston, 2010). In Brasil (Brazil), the Tupi capes of scarlet ibis feathers were readily acquired for European courts, as shown in Chapter One (Buono, 2012, p. 240; Campbell & Lack, 2013, p. 414). The colour of fire, red often represents danger, sacredness, power, and the relationship to the atua (gods). In Polynesia, it reflects status and chieftainship observed in religious and ceremonial red adornments and clothing of high officials.

In the 1300s, Taininihi, a voyager from Hawaiki landed in Whangaparāoa in the Bay of Plenty in the summer and upon seeing the scarlet red *Metrosideros* flowers he discarded his treasured red feather headdress, declaring 'the chiefly colour of Hawaiki is cast aside for the chiefly red of the new land that welcomes us' (Hīroa, 1964, p. 278). Another interpretation of this statement is recalled in Arawa (Bay of Plenty) tradition where Taininihi said 'E, kua nui ake te kura o tēnei kāinga i te kura o Hawaiki, ka panga hoki ahau i aku kura ki te wai' (Mead & Grove, 2001, p. 37). Roughly translated as 'the red plume is more plentiful in this country than in Hawaiki, I will throw mine into the sea' (Brougham & Reed, 1975; Grey, 1971; Williams, 1957).

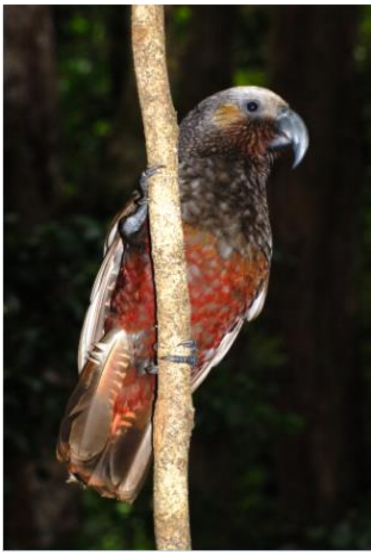


***Figure 5.27*. Kākā (N.Z. bush Parrot: *Nestor meridionalis*). ©Peter Reese, Kāpiti Island, 2007.**

Very few New Zealand birds have vibrant red feathers. Red-crowned parakeets (kākāriki: *Cyanoramphus novaezelandiae*) have limited small red crown (head) feathers. In contrast, the underwing and belly feathers from the larger kākā (*Nestor meridionalis*) and kea (*Nestor notabilis*) supplied most red feathers that ranged in colour from light orange, to crimson red, and rusty reddish brown (Fig. 5.27). Variations of the name kākā also denotes other parrots in

Polynesia, as in Fiji, where the parrots are called kakā (*Prosopeia* spp.) (Watling, 2001). In Māori, kā refers to fire, and a screeching sound, so the naming of kākā has both taxonomic, genealogical, linguistic, onomatopoeic, and descriptive origins and functions (Williams, 1957). The International Register of Māori feather cloaks compiled from museums around the world listed at least seven cloaks that can be categorised as kahu kura, predominantly incorporating red or orange kākā feathers, and around 150 cloaks fashioned with kākā feathers to varying degrees (see International Register). For Māori, rau kura (red or treasured feathers) were highly prized and described treasured feathers notably kākā, huia (*Heteralocha acutirostris*), kōtuku (heron: *Ardea modesta*), toroa (albatrosses: family Diomedeidae), and gannets (tākapu: *Morus serrator*). The precious red tail feather streamers from the sacred amokura or red-tailed tropic bird (*Phaethon rubricauda*) were also desired. Vagrant amokura that had washed ashore were in demand and the feathers traded for other valued taonga.

In Polynesia, red feathers invoked the (atua) gods, particularly those pertaining to war (Stokes, 1925, p. 25). The Hawaiʻian god of war Kū (in Māori Tū, or Tūmatauenga) is represented by the colour red in which there is a reciprocal divine exchange between the feathers and deity (Wilkins, 2008). In the Society Islands red feathers are believed to be symbols of a deity rendering them unearthly (Hīroa, 1944b, p. 9). Kura was understood to be a sacred crimson bird of the gods in the Tuāmotu islands (Emory, 1947). In Tuāmotu Fangatau chants, 'vivivini [vivini] te tangi o te kura', refers to the fearful (wiwini) cry of the kura, and is likely a parakeet (Emory, 1947, p. 192; Williams, 1957). In Tahiti, vini refer to parakeets (Emory, 1947).

Ngāpuhi weaver and artist Maureen Lander (2017) discussed the importance of red and yellow for New Zealand Māori:

> The red and yellow feathers in Polynesia "were about mana… yellow didn't come through to New Zealand. Even though we have got pīngao [*Ficinia spiralis*], and we have got raurēkau [*Coprosma* spp. bark for yellow dye]. We can have yellow if we want it. So, my thought about that is, it is the combination of the colour, and the feather that is important… With the kākā and the kea, some of them are almost orangey-yellow and some are more a deep scarlet. I think it's the scarlet ones that are referred to as 'kura' and that they have more mana status that the orangey paler ones".

The colour yellow is also associated with prestige, royalty, and divinity in Tahitian and Hawaiʻian feather attire. Yellow is affiliated with the Hawaiʻian god Kāne (in Māori Tāne,

Tāne-nui-a-rangi), the creator of life (Beckwith, 1970). He is credited with providing bounty and success in one's endeavours. The birds with yellow feathers were so rare the labour to obtain the birds and few yellow feathers only increased their value, rather than any mythological, religious, or social associations pertaining to the colour yellow (Cummins, 1984, p. 6). It seems that the rarity of Hawaiʻian passerines, ʻōʻō and moho, and their limited yellow feathers resulted in yellow superseding red as the colour of prestige as only wealthy leaders could afford the rare precious yellow feathers (Hīroa, 1944b, p. 10; Pyle, 2002). Stokes (1925) disputed this, stating that rarity had no impact on importance, that although yellow feathers supplanted red feathers in terms of importance, and that red feathers (and birds) were more abundant had no bearing (p. 25). Coincidentally, in French Polynesia, the royal yellow feathers in Tuāmotu originated from the ʻoʻo (Atoll fruit dove: *Ptilinopus coralensis*) (Emory, 1947). This distinctive fruit dove had yellow belly feathers, and was common on uninhabited islands (Pratt et al., 1987).

***Figure 5.28*. Hīhī (N.Z. stitchbird: *Notiomystis cincta*). ♂. Collected Kāpiti Island, Gifted Department of Conservation, 1987. Te Papa OR.025017. CC BY 4.0.**

In Buller's (1888) New Zealand bird manuscripts, a Whānganui Rangatira (chief), Topine Te Mamaku in the 1800s recalled the existence of an eighteenth century kahu hīhī, a Māori feather cloak of yellow feathers from hīhī (stitchbird: *Notiomystis cincta*) (pp. 104–105). Yellow hihi feathers are limited to the male's upperwing making this type of cloak exceptionally rare and treasured, and while there is anecdotal evidence that hīhī cloaks did exist in Māori society, no known physical examples survived in museum collections (Fig. 5.28) (Brigham, 1892, p. 9).

***Figure 5.29*. Kahu huruhuru (Māori feather cloak). Muka, pheasant, pūkeko, kākā, tūī, koekoeā (long-tailed cuckoo) and yellowhammer feathers; spaced double pair twining; plaiting. Previous owner Thomas Donne. Purchased 1974. Te Papa ME013124. All Rights Reserved. Right: detail of yellowhammer feathers in cloak centre. Image by Hokimate Harwood, 2010.**

Yellow did not feature extensively in Māori cloaks as it did in Tahitian and Hawaiʻian culture and feather attire. The only entirely yellow native New Zealand passerine is the mohua (yellowhead: *Mohoua ochrocephala*). After European settlement, yellow or golden chicken feathers were typically used in cloaks (Harwood, 2011a). One Te Papa kākahu (ME013124), listed in the International Register, has two bunches of bright yellow breast and belly feathers from the introduced yellowhammer (*Emberiza citrinella*) in the centre, identified in 2007 (Figs. 5.29 & 5.30) (Harwood, 2011a).

***Figure 5.30*. Yellowhammer (*Emberiza citrinella caliginosa*). ♀. Te Papa OR.011666. CC BY 4.0.**

Red, white, and black appear to be significant in Māori society (Clarke, 2012; Colenso, 1881; Petrie, 2011). King Pōtatau Te Wherowhero of Tainui (Waikato), spoke at his coronation as the first Māori King in 1858: "Kotahi te kōhao o te ngira e kuhuna ai te miro mā, te miro pango, te miro whero, i muri, kia mau ki te aroha, ki te ture, me te whakapono", in which he instilled that ‘there is but a single eye of the needle through which white, black, and red threads must pass, and that after he was gone his people were to hold fast to the love, to the law, and to the faith (Christianity)’ (Mead & Grove, 2001). The pepeha (saying) also iterates the importance of people working together towards a common goal. White is a signifier of purity, peace, rarity, and rank in certain iwi, and white birds, the toroa, tākapu and kōtuku were deemed sacred and only men wore the feathers as adornment. Maureen Lander (2017) revealed that the influential nature of the colour white in Māori society likely stemmed from Polynesian religious rituals:

> “White seems to be important…if you think back to the use of amokura feathers in the Pacific, worn to create a radiant circle of light around the head of the priest in Tahiti, you know that something was going on, more than just adornment. So, in New Zealand where amokura feathers were not so available it would more likely be the tail feathers of the gannet that were used, often worn in a semicircle around the head, as seen in early drawings [Augustus Earle]…. I understand from my research that white feathers may have been used to protect personal tapu.”

For bird feathers of mana (pride, authority, status), Lander (2017) refers to the white tipped tail feathers of the huia (*Heteralocha acutirostris*) and their status in Māori society: “I don’t think the huia tail feathers would have been used if they didn’t have the combination of black and white, and because the bird became rare (and eventually extinct), it’s feathers became even more of a status symbol”. In Hawai‘ian culture, black, white, and brown feathers were reportedly taken from birds that were eaten and used in ornamentation, with little value held in the feathers outside this use (Hīroa, 1944b, p. 9). Black or dark colours have associations with death for Māori, which is likely from the transition from life to death, light to darkness, to the realm of Hine-nui-te-pō (Best, 1905, p. 150). In January 1770, in the Cooks Strait, Captain James Cook and naturalist Joseph Banks observed Māori wearing mourning caps or headdresses adorned with dark feathers, that were possibly associated with people of high rank (Beaglehole, 1962a, p. 454; Hīroa, 1966, p. 284; Salmond, 1991, p. 243). On the same voyage, artist Sydney Parkinson illustrated women wearing these dark feather hats (British Library Board, London, Add. MS 23920,f.65(a-b)). From the 19th century, pōtae tauā (mourning caps) were adorned with dark feathers (Otago Museum D10.103), brown kiwi feathers (Te Papa ME002454), huia, kererū (pigeon: *Hemiphaga novaeseelandiae*), and tūī (*Prosthemadera novaeseelandiae*) feathers (Best, 1905, p. 179; Hamilton, 1972, p. 297; Hīroa, 1966, p. 284). Nevertheless, any inclusion of feathers in a culturally protected object or piece of clothing worn around the body or head, of someone of rank, creates an inherent value, especially if the bird is distinctive or rare.

***Figure 5.31*. Hiapo (Niuean tapa cloth). Paper mulberry (*Broussonetia papyrifera*) bark cloth, dye; beating. Made 1800s, Niue. Augustus Hamilton Collection. Purchased 1914. Te Papa FE000278. Right: detail of diamond and triangle motifs on right hand side.**

***Figure 5.32*. Kaitaka paepaeroa (fine Māori cloak). Muka, wool; spaced double pair twining, tāniko. Gift of Mrs Thomas Purvis Russell, 1921. Te Papa ME003812. Right: detail of triangle and diamond motifs in tāniko patterns in the side and bottom borders. All Rights Reserved.**

Compared to the smaller Pacific islands, New Zealand's greater land mass and range and number of avifauna available to Māori weavers afforded a more extensive selection of birds and feathers for adornment (Atkinson & Millener, 1991; Holdaway, 1989; Holdaway, Worthy, & Tennyson, 2001; McGlone, 1989). More bird species, feathers, colours, and patterns adorned New Zealand Māori feather cloaks over the last 500 years than any other Polynesian nation. In the late 18th and early 19th centuries, certain elements in kaitaka Māori, the fine cloaks with borders of coloured geometric designs, resembled Polynesian tapa (bark cloth) patterns (Figs. 5.31 & 5.32). Whakairo Māori such as wood carving, kōwhaiwhai and tā moko (tattoo) generally comprised of curvilinear patterns, or spirals, whereas kaitaka borders, and more recently feather cloak designs, were largely rectilinear consisting of straight-lined triangles, diamonds and rectangles (see Table 5.6). Weaver Dante Bonica (2017) addressed the designs and origins of tāniko, recalling that very similar patterns appeared in Indonesia. There are also specific examples of diamond designs in bark cloth in the British Museum (BM Oc1952,01.16). Variations of triangular designs, diamond, poutama (staircase); rau kūmara (kūmara leaf) design (horizontal lines); and chevron designs appeared in Tongan, and eighteenth century Hawaiʻian bark cloth (Kaeppler, 1978a; Thomas, Adams, Lythberg, Nuku, & Salmond, 2016, pp. 284–285). These designs likely evolved from or were inspired by patterns in woven mats, traps, and netting (see Figs. 1.1, 1.7, 5.2, 5.17).

***Table 5.6*. Similarities in Polynesian Bark cloth and Māori feather cloak designs.**

 **Masi bolabola (Fijian tapa/ bark cloth). Fiji. Gift of Alexander Turnbull, 1913. Te Papa FE000823.**	 **Kahu huruhuru (Māori feather cloak). Te Papa ME010763. All Rights Reserved.**
 **Tapa (Sāmoan bark cloth). bark cloth, dye. Made in Sāmoa. Te Papa FE005131. All Rights Reserved.**	 **Kahu huruhuru (Māori feather cloak). Belonged to Hinekatorangi Apatu. Gift of Mr S.I. Dixon, 1955. Te Papa ME007739. All Rights Reserved.**
 **Siapo mamanu (Sāmoan tapa cloth). Bark cloth, dye. Made in 1896, Sāmoa. Collected by Z. Schwimmer, 1966. Gift of Michael Powels, 2001. Te Papa FE011611.**	 **Kahu huruhuru (Māori feather cloak). Muka, kererū, kākāriki, kākā feathers; twining, braiding. Te Papa ME015756. All Rights Reserved.**

Pacific tapa cloth is decorated with a variety of patterns, some geometric, and others abstract that reflect the weavers' surroundings of plants, animals, and landscapes (Neich & Pendergrast, 1997, 2001). A decline in labour-intensive Māori cloaks such as kahu kurī (dogskin cloaks) and kaitaka occurred in the 1800s after European arrival, as discussed in Chapter Seven, this created a market for bold geometric designs in the kaitaka borders that potentially transferred to Māori feather cloaks that exponentially increased their appeal mid-19th century. Cook's first voyage 1768-1771 on the Endeavour navigated around the southern tip of the South American continent to Tahiti then New Zealand before heading north around the northern tip of Australia and South Africa (Forster, 2000). It is therefore plausible that patterned bark cloth designs were collected and traded along Cook's routes through Polynesia. When in the Poverty Bay area, Cook's men traded Tahitian cloth (assumed to be bark cloth) for Māori clothing in late October 1769 (Cook, 1842, p. 135). Māori would have coveted bark cloth, a reminder of the ancestral connections to Hawaiki, particularly as there was limited success in growing trees for bark cloth in Aotearoa.

In Hawaiʻi, red feathers in the ʻahu ʻula (kahu kura) symbolised a connection to royalty and the gods determined by one's genealogical position (Cummins, 1984, p. 3). The size and colour of the garment marked the wearer's power and wealth and the crescent design marked the wearer as a member of a family group based on sacred descent (Cummins, 1984, p. 13). The crescent denotes the piʻo (Māori, piko, bend) and signifies a bend or arch, as in a rainbow; and also refers to the 'marriage' of a brother and sister, as well as distinguishing a superior or the highest grade of chief (Tregear, 1891). The crescent could be a physical manifestation of the sacredness and rarity of the rainbow, like the royal family, as both correlated with the gods and the heavens (Cummins, 1984). The cohabitation of close high-born family members was designed to retain the purity of genes and carry ancestral lines of sacred ranks, and so the bend of the arch possibly represented the connectivity and folding in (joining) of one's family genes (Cummins, 1984). The atua of the rainbow, Kahukura, could also be represented in this design.

5.4.2 The significance of materials, birds, and feathers in Māori and Polynesian cultures

The evolution of clothing materials transpired from understanding Polynesian and Māori clothing where culturally significant plants such a paper mulberry for bark cloth; and pandanus for weaving in the Pacific were replaced with New Zealand Māori harakeke which was incorporated into most forms of apparel and functional items such as mats, ropes and cloaks etc. Throughout Polynesia, variations of the Māori word *hara*, from harakeke, and hara

(Mangarevan), ara (Mangaian), fara (Tahitian), and hala (Hawaiʻian) collectively refer to the pandanus plant, and keke is the process of softening (Maihi, 2011, p. 35; Tregear, 1891, pp. 611–612).

Flying birds have a proximity to the heavens that humans are unable to attain, delivering messages between the different realms. In Sāmoa and the Society Islands group, war gods such as ʻOro, took the form of birds (Kooijman, 1964). Omens pertaining to success in war were founded on the presence or behavior of certain birds (Stokes, 1925). In Tahiti, birds are the shadows of the gods, known as guardians or messengers (Henry, 1928). Bird totemism is also not necessarily limited to the Pacific, with records in various forms from Africa, Asia, and North and South America. In north-central California, cloaks of raven (*Corvus* spp.) and condor (*Gymnogyps californianus*) feathers were worn in rituals in the eighteenth century to embody the spiritual aspects of these birds in religious contexts (Okladnikova, Kostruba, Hudson, & Bates, 1983).

***Figure 5.33*. Kanak (New Caledonian) mourner's mask (dagak) and costume, feather cloak. Plant fibre, notu pigeon feathers; netting, tying, binding. New Caledonia, Melanesia, 1850-1900. Turnbull Collection. Te Papa FE000834. CC BY-NC-ND 4.0. Right: detail of knotted netting and feather binding. Image by Hokimate Harwood, 2016.**

Additional evidence to support the function of Pacific pigeon feather cloaks as being associated with mourning or death customs lies in a piece in Te Papa (FE000834) from New Caledonia (see Figs. 5.3 & 5.33). It was part of a mourning costume that consisted of a mask with human hair and a cloak of feathers from the notu pigeon (Goliath imperial pigeon: *Ducula goliath*). The Kanak of Grand Terre Island in New Caledonia were recorded wearing a mourner's mask, *dagak*, which translates as 'birdman' (Kjellgren, 2007, p. 190). Examined in 2016 for this research, the Te Papa cloak (FE000834) had a backing of loose-knotted plant fibre cords consistent with knotted fish netting, which is commonplace in New Caledonia as in most island nations (Leenhardt, 1980). The pigeon feathers were bunched, bent, then bound together at the feather base, and a cord running around the feather bunches tied on to the netting. Kanak customs varied between regions, in some areas high ranking chiefs wore the costumes to ceremonies wielding weapons, as seen in French Polynesia, in others, they were worn for mourning rites for departed chiefs where the masked performers behaved as substitutes for the deceased (Kjellgren, 2007, p. 191).

***Figure 5.34*. Pākē (Māori rain cape). Muka (and harakeke), kererū feathers, coloured wool, dye; scutching, feather splitting, spaced double pair twining, plaiting. Purchased 1905. Te Papa ME001170. All Rights Reserved. Right: detail of split kererū tail feathers along neckline. Image by Hokimate Harwood, 2007.**

Pigeon feather mourning cloaks have been discussed in Tahiti in the Society Islands and New Caledonia. These islands are 4,500km apart, yet there are indications these were not isolated or arbitrary practices in the Pacific. Archaeological evidence has traced the origins of Polynesians to Melanesia based on the unusual Lapita pottery (named after a locality in New Caledonia) (Trotter & McCulloch, 1989, p. 24). Lapita ware has been found in the Melanesian Admiralty Islands (above Papua New Guinea), and Tonga, and Sāmoa (Trotter & McCulloch, 1989). The people who made the pottery were around from about 3500-2500 years ago, when it disappeared in Sāmoa and Tonga approximately 2000 years ago (Trotter & McCulloch, 1989). Cloaks with New Zealand pigeon (kererū) that incorporate the tail feathers are rare in museum collections, a Te Papa cape (ME001170) listed in the International Register, has split tail feathers along the neckline (Fig. 5.34). Kererū feathers from the neck (green) and front (white) adorned many of Te Papa's Māori cloaks produced from the nineteenth century on (Fig. 5.35) (Harwood, 2011a).

***Figure 5.35*. Kererū (New Zealand pigeon: *Hemiphaga novaeseelandiae*), ventral and dorsal views. Collected by Mord, 1974; Normandale, Lower Hutt. Te Papa OR.018676. CC BY 4.0.**

The New Zealand pigeon (also known as kuku, kukupā or kererū) was a requested food by kaumātua (Māori elders) in the north (Ngāpuhi iwi) who were declining in health. Kererū were delicacies taken in their prime in autumn, and their meat and fat a rich source of nutrients. Ngāti Hine kererū expert, Kevin Prime (2017) understood they were possibly requested at this time because the pigeon "knew the way to the other [under] world and would assist in the journey", and that this was possibly a "carry over from the legend of Māui changing himself into a pigeon to fly to the underworld to find his mother Taranga". According to Māori tradition, Māui (Māui-tikitiki-a-Taranga) the trickster demi-god, disguised himself as a pigeon in order to follow his mother Taranga to the underworld, where the dead presided (Best, 1977, p. 228). This could be a manifestation from the story and perhaps the bird and the feathers have a link to death in certain Polynesian and Māori customs. Rupe was the 'honorific' term for New Zealand pigeons by some Māori, but it is also the generic name for pigeons in the Pacific, and the name of a brother to Hina, Māui-mua, who could transform into a pigeon (Best, 1977, p. 228; Williams, 1904). Polynesian pigeons also appear to have cultural restrictions in their use, in Sāmoa, lupe and lube in Tonga (variations of rupe, pigeon) were a delicacy for the high ranked and hunted with ritual in managed events (Forster, 2000, p. 458; Oliver, 2002; Williamson, 2013). For Tūhoe, historically only women or Rangatira ate this sacred bird (Lyver, Jones, & Doherty, 2009). Pacific pigeons are bush dwelling, so are uncommon on islands surrounded by coastlines and with limited forested areas, elevating their worth.

Despite belonging to different genera, many of the Pacific pigeons and doves have a dark neck, wings and back, and a lighter breast and belly. Kūkupa and kukupā, the northern Māori names for the kererū, is the name for the fruit dove in the Cook Islands (*Ptilinopus rarotongensis*), Tuāmotu (*Ptilinopus coralensis*) and Tahiti (ʻuʻupa: *Ptilinopus purpuratus*) (Holyoak, 1980; Thibault & Rives, 1975). Pigeon feathers were valued in Tahitian mourning costumes, and prestigious fau headgear and gorgets, and in New Zealand Māori carvings, canoe sails and Māori cloaks from the nineteenth century on (Best, 1976b; Firth, 1931; Harwood, 2011a; Hetherington, 2001, p. 65; Stevenson & Hooper, 2007, p. 192). A Te Papa feather cloak (ME000738), listed in the International Register, is canvassed in green kererū feathers, and exhibits kiwi feathers, kurī (dog) skin and hair, and red thread along the neckline, all insignia of a high-ranking individual. Unfortunately, the weavers or previous owners are no longer able to convey the purpose of the birds or cloaks. What is known is that pigeons appeared to have special significance throughout Polynesian culture and aspects have filtered into Māori society.

***Figure 5.36*. Rooster (tame heihei, male domestic chicken: *Gallus domesticus*). Image by Hokimate Harwood, Staglands Wildlife Reserve and Café, Akatarawa, Upper Hutt, 2018.**

New Zealand Māori often designated variations of Polynesian bird names already known to them for birds that looked or sounded similar. Many bird names had numerous variations depending on dialects, locations, and age and gender of the bird (Williams, 1906). For instance, the Māori and Polynesian word for bird is manu, also meaning to fly. Moa became collectively known as the species in the New Zealand bird order Dinornithiformes, although it is likely that different species had localised names, particularly given the dimorphism and geographic separation of species (Worthy & Holdaway, 2002). Moa also denotes the chicken or its ancestor the wildfowl (Southeast Asian jungle fowl: *Gallus gallus*) in Sāmoa (moaʻaivao), Tahiti (moʻa ʻoviri), Hawaiʻi, Tonga (moakaivao), Mangaia, Marqueses, and Mangareva (Finney, 1973; Thibault & Rives, 1988; Tregear, 1891; Watling, 2001). One theory for the reoccurrence of the name moa in Aotearoa was that the structure of chicken (hackle) feathers resembled kiwi and moa plumage (Fig. 5.36) (see Chapter Seven). It has been suggested that Polynesian bird names originated in Asia, and diverged out through the Pacific (Christian, 1916). It is understood that red jungle fowl (*Gallus gallus*) originated from South East Asia and is the maternal ancestor of the feral chicken (*Gallus gallus*) differing from contemporary domestic chicken (*Gallus domesticus*), with domestication occurring at least 5,400 years ago (Gongora et al., 2008; Scofield & Worthy, 2010, p. 27; Storey et al., 2012). The spread of fowl was associated with the Lapita cultural complex Polynesian island discovery and settlement 3,500 years ago that continued to 800 years ago spreading east from Asia into the Pacific (Dancause, Vilar, Steffy, & Lum, 2011; Storey et al., 2012).

***Figure 5.37*. ‘Ahu ‘ula (Hawai‘ian feather cape). ‘Olonā fibre, dark chicken feathers, red and yellow feathers; knotting, tying. 18th century. Te Papa FE006380. CC BY-NC-ND 4.0.**

Moa (fowl) were dispersed via human movement in the Pacific Islands and accompanied our ancestors along with the kurī (Māori dog: *Canis lupis familiaris*) and kiore (Māori rat: *Rattus exulans*). Dogs and kiore were rare and valuable and had a strong association with historical movement throughout the Pacific. Some of their traits and cultural importance, particularly for dogs, were personified in attire and personal adornment throughout Polynesia and New Zealand (see Chapter Six). Fowl feathers appear in various eighteenth century Hawai‘ian capes and cloaks (Fig. 5.37). Its distribution across the Pacific reflects its historical importance as a food source and for feather adornment, in that the Hawai‘ians brought it with the pig and dog to the islands generations earlier and continued use in striking featherwork (Oliver, 2002). Chicken feathers were apparently common enough to adorn various forms of attire, the tails feathers adorned Tahitian feather skirts and headdresses as seen in British Museum examples (Oc1981,Q.1702 and Oc1899,-.170).

***Figure 5.38*. Kahu huruhuru (Māori Feather cloak). Muka, cotton, multi-coloured chicken feathers; spaced double pair twining, plaiting. Gift of Constance Morice, 1967. Te Papa ME011816. All Rights Reserved.**

It is not known if Māori brought fowl (*Gallus*) to Aotearoa, as none were thought to have survived. If they did, they failed at establishing populations, so when Pākehā (Europeans) introduced chickens to New Zealand, Māori later applied the name heihei to the bird (Fig. 5.36) (Long, 1981; Orbell, 2003; Scofield & Worthy, 2010, p. 27; Thomson, 1922). Domestic chicken feathers were liberally added to Māori cloaks from the 19th century through to today, and as different breeds have multiple coloured feathers, weavers were free to experiment with traditional and creative feather designs (Fig. 5.38) (Harwood, 20011a; Pendergrast, 1987).

Similar looking birds with corresponding nomenclature (naming) ensured language continuity for generations of Pacific seafarers. A case in point is the kiwi (*Apteryx* spp.), which were named for their call (onomatopoeia), yet the bristle-thighed curlew (*Numenius tahitiensis*), is recorded as kivi in the Cook Islands (Colbourne, 1981), Tahiti (Thibault & Rives, 1975) and the Tuāmotu islands (Emory, 1947). The curlew is a brown and cream wading Pacific shorebird with a long slightly curved beak, and not generally found in New Zealand (Heather & Robertson, 1996; Medway, 2010, p. 202). In Hawai'ian, the term kikiwi describes a curved or bent beak as in the Hawai'ian 'i'iwi (Pukui & Elbert, 1986, p. 150).

Other Pacific name variations apply to the New Zealand kōtuku (heron) and matuku (Australasian bittern: *Botaurus poiciloptilus*). Both birds are situated in the Ardeidae family and Ciconiiformes order and have morphological and genetic similarities. The similar Pacific reef heron (*Egretta sacra*) in Sāmoa is matu‘u, in Tonga and Niue motuku, in Tahiti ‘otu‘u, and in the Tuāmotu islands it is kotuhu (Emory, 1947; Thibault & Rives, 1988). The New Zealand kingfisher (*Todiramphus sanctus vagans*) is known as kōtare, and the Cook Island chattering kingfisher (*Todiramphus tutus*), and Society (Tahitian) kingfisher (*Todiramphus veneratus*) are known as ōtātare (Thibault & Rives, 1975). The retention of names is a measure of their importance for Māori, as a memory device, in having spiritual or cultural significance.

***Figure 5.39*. Ruru (N.Z. morepork: *Ninox novaeseelandiae*). ©Peter Reese, Tūhua/ Mayor Island, Bay of Plenty, 2007.**

Ruru (morepork: *Ninox novaeseelandiae*), are known as lulu (barn owl: *Tyto alba*) in Fiji, Sāmoa and Niue (Fig. 5.39) (Watling, 2001). A striking 18th or 19th century Hawai‘ian owl cloak is apparently housed at the Honolulu Museum of Art in Hawai‘i. Mottled owl feathers were reserved for the kāhili (feather staffs), and like the Hawai‘ian cloaks, are sacred as they were associated with royalty (Malo, 1903). In Hawai‘i, the native owl, pueo (*Asio flammeus sandwichensis*) is a deity and regarded as a ‘aumākua, or guardian ancestor that guides and protects families (Barrow, 1999; Malo, 1903, p. 62). In Māori, kaumātua refer to the elders, the keepers of ancestral traditions and knowledge that is handed down. Māori thought of the ruru as one of the first winged inhabitants of New Zealand, and therefore of historical importance (Buller, 1888, p. 196). Ruru can also be kaitiaki (guardians), aitua (omens), or messengers of news of a visitor, death, or disaster for iwi Māori (Phillips, 1963). Hineruru, a female ruru spirit protects, warns, advises, and helps, and as a messenger of the underworld heralds the approach of death or visitors (Schwimmer, 1963, p. 401). For Ngāi Tūhoe, it is the guardian spirit of a person, or the land belonging to a family (Phillips, 1963, p. 412). Kopa, resembling a morepork, was thought of as an atua (god) for Ngāti Toa Rangatira (Phillips, 1963). As mana guardians for northern Ngāti Wai, these spirits are the source from which human beings derive power, if tapu is broken then a person loses their mana (Phillips, 1963).


***Figure 5.40*. Kahu huruhuru (Māori feather cloak). Muka, kākā, kererū, tūī (parson bird), pūkeko (swamphen), kākāriki, peacock, pheasant, and ruru feathers; spaced single pair twining, plaiting, dyeing. 1860-1900. Te Papa ME011987. All Rights Reserved. Right: Detail of ruru feather in cloak. Image by Hokimate Harwood, 2009.**

A Māori feather cloak in Te Papa (ME011987), listed in the International Register, has two single ruru feathers (Fig. 5.40) (Harwood, 2011a). The inclusion of two single owl feathers in a Māori cloak would unquestionably be a symbol relating to the relationship of the bird to the weaver, wearer, or event (Harwood, 2011b). The occurrence of rare or culturally significant species or feathers in attire certainly elevates its importance in Polynesian and Māori cultures.

5.4.3 The significance of techniques of feather attachment


***Figure 5.41*. Kākahu (tūī tail feather cape). Bark cloth, commercial cloth, tūī tail feathers, muka, cotton thread; spaced single pair twining, sewing, beating. Presented to the citizens of Auckland by Sir George Grey. Auckland Art Gallery Toi o Tāmaki care of Auckland War Memorial Museum Tāmaki Paenga Hira AM1491, Grey 304. Right: detail of feather attachment.**

The eminent attire of Polynesian tail feather cloaks exemplifies their historical and social status when also applied to kākahu Māori. A rare 19th century example of a bark cloth garment listed in the International Register described as a tūī tail feather cape, in the Auckland War Memorial Museum (AM1491), compares to the striking tail feather cloaks of Tahiti (Figs. 5.41 & 5.42) (Pendergrast, 1987, p. 113). The feather cape resembles a Māori rain cape and combines components of traditional and contemporary materials and techniques in that the backing is of cloth, and incorporates iridescent black tūī tail feathers in which the base of the pairs of feather shafts are bent on themselves and attached using spaced single pair twining with muka threads and then secured to the bark cloth backing (Mead, 1969, p. 134; Pendergrast, 1987, p. 113). Wing and tail feathers are larger and more rigid than body feathers, and offer limited warmth or insulation, so have a more aesthetic (or cultural) rather than functional (practical) role.

***Figure 5.42*. Tūī (*Prosthemadera novaeseelandiae*). Collected in Nelson New Zealand, Gifted by the Department of Conservation, 1987. Te Papa OR.025218. CC BY 4.0.**

Tahitian fau (headdresses) have a backing of whickerwork or basketry and the feather bunches are bound and tied together using overhand knots and a running cord that is knotted to each feather bunch securing the feathers together, as seen in the Sāmoan fine mats (Fig. 5.43). This type of horizontal knotting of the cord moving across the foundation is referred to as a 'running hitch knot', both types of knotting are used in a similar fashion in Tahitian taumi (gorgets or ornamented breast plates) (Rose, 1971). An example of a fau of twined wickerwork in the Pitt Rivers Museum in Oxford, England (1886.1.1683) is over 1m tall. According to museum records, the feathers are black, white, and yellow, and are likely from the Atoll fruit dove ('o'o:

Ptilinopus coralensis), with a trim of tropicbird feathers lining the outer edge. Frigate birds (makohe, kotaha makohe) and the bluish green feathers of a pigeon (*Ducula*) were also incorporated into Tuāmotu headdresses (Emory, 1975; Stevenson & Hooper, 2007). A similar Tahitian fau in the British Museum is also constructed of twined wickerwork and dark feathers (Oc,TAH.9). Another version of an elaborate feather headdress attributed to the Cook Islands in the British Museum incorporates a frame with bark cloth and dark fowl feathers attached (Oc,LMS.88).

***Figure 5.43.* In Heiva, or kind of priest of Yoolee-Etea [Ra'iātea], & the Neighbouring Islands. Plate 11. From the book: A journal of a voyage to the South Seas, in his Majesty's ship the Endeavour. Made by Sydney Parkinson; after; 1784; London, T Chambers; engraver (printmaker); 1784; London. Gift of Charles Rooking Carter. Te Papa RB000268/071a.**

Early European depictions of Tahitian men implied that their attire encapsulated the finery and workmanship of the time, and hierarchy of the wearer. Suited with the finest bark cloth, a type of cloak, and impressive feather headdress (fau) and taumi (gorget or breastplate) (Figs. 5.43 & 5.44). The taumi is constructed of wood, plaited plant fibre cords, bound feathers, dog hair, and shark's teeth and shells. A fully covered taumi was an impressive piece of armoury providing protection and prestige for the wearer. The hierarchical authority it inspires is based on its composition of rare (exclusive), valuable materials and creative architecture such as the intact taumi in Te Papa (FE000335) and the British Museum (Oc,TAH.57). A Cook-collected taumi in the Banks Collection at the Pitt Rivers Museum in Oxford England (1886.1.392) is missing some of the adornment, so offers a unique opportunity to compare Polynesian and Māori hair and feather adornment (see Fig. 5.44). The feathers are bound by twine and secured to the backing either by a horizontal thread that knots, or loose ties hold the feathers in place. Similar overhand knotting and feather binding have been observed in adornment of taiaha kura (adorned Māori fighting staffs) (Te Papa ME023600).

***Figure 5.44*. Taumi (Society Islands gorget/ breast ornament). Cane, coconut fibre, bark cloth, feathers (centre), dog hair (right), human hair (?), and shark teeth, shell; plaiting, binding, knotting, drilling. Part of Banks' collection acquired 1769 on Cook's 1st voyage. Pitt Rivers Museum, University of Oxford, Oxford, England 1887.1.392.**

When questioned on the significance of feather attachment in taonga, weaver, and artist Maureen Lander (2017), responded with:

> "I know that function is important, so how you bind the feathers… it's often about whether you want them to move or not". If it is a "large feather with a stiff shaft you're going to have to split that shaft to get the movement. Throughout the Pacific it's known that binding and feathers add symbolic meaning to items, such as the god sticks which are dormant until the binding is put on as a pathway for the atua. The feathers on a waka are not just decorative. They engage with Tāwhiri-mātea [god of the wind] and are important navigational aids."

Another renowned Māori weaver, Toi Te Rito Maihi, reiterated this sentiment in that the artist would add the 'feathers to make the carvings come alive' (Maihi, 2011, p. 34). Many of the bound, knotted, and tied feathers in Polynesian and Māori cultures can be found in taonga that require movement and durability such as carvings, and weapons and attire worn in battle. The significance of technique is apparent in articles that were worn by high ranking men at events such as war or religious ceremonies. Feather knotting or tying for instance is commonplace in weaponry and cloaks that require tightly bound feathers that would not fall out with use or wear, as seen in taiaha adornment (Fig. 5.45). These items were likely bound for battle, in which case a spiritual and religious protection in its manufacture was embedded in the piece to ensure the safety of the owner, and demise of their foes. The techniques and materials in sacred objects can instruct how it is used and by whom, serving a functional (practical) as well as spiritual role. Knotted netting and twining are widespread across Polynesia and observed in sacred objects. It could therefore be the ritual of prayer (karakia) that re-enforces the binding of feathers to objects correlating with death and war. It is this treatment of the feathers before, as they are attached, and use of the item that sanctions the sacred nature of the piece.

***Figure 5.45*. Taiaha (Māori long fighting staff). Wood, muka, wool red dye, feathers, dog hair; plaiting, binding, close overhand knotting. Made 1800-1850. Oldman Collection. Gift of the New Zealand Government, 1992. Te Papa OL000057. All Rights Reserved. Right: detail of tight close overhand knotting as feather attachment. Image by Hokimate Harwood, 2009.**

Not surprisingly, most Pacific cultures share similar weaving techniques for various applications depending on the materials and functionality. Māori had access to the same or similar weaving knowledge and skills as other Pacific peoples and retained the knowledge of twining and knotting for traps, baskets and nets and applied these techniques where required in Aotearoa. This Māori knowledge includes knotted netting in the form of fish nets, the foundation for which Hawai‘ians made feather cloaks and helmets and god images. Hawai‘ian mahiole (helmets), sometimes worn with the fine ‘ahu ‘ula, have a foundation of solid twined basketry for structural support as observed in a featherless mahiole in the British Museum (Oc1878,1101.584). The twined helmet framework is then covered in the flexible feathered knotted netting, as seen in a Te Papa mahiole (FE000376). The red passerine feathers were too small for twining in Hawai‘ian ‘ahu ‘ula and mahiole, so attachment through binding was employed.

There are assertions that upon arrival in Aotearoa, Māori initially did not exercise their skills in twining for clothing, that it was later adapted from twined fish traps (Hīroa, 1926). However, this study of Polynesian attire and even archaeological clothing refutes this theory in that many indigenous cultures in Polynesia, the Americas, Europe, and Asia have known and used this technique for clothing for thousands of years (Bonica, 2017; Blackman, 2011; Hall, 2007, 2011; Harris, 2014). Single pair twined bark capes from the 18th and 19th centuries produced by the native Canadian Clyoquot peoples of Vancouver Island incorporated a neck border reinforced by sewing in a broad, thin fillet of rawhide (Holmes, 1884, p. 413). David Samwell, a surgeon on Cook's third voyage, saw similarities in the twined cloaks from New Zealand Māori and Nootka (Nuu-chah-nulth) Sounds in North America, with thickness and coarseness the only contrast (Beaglehole, 1967, p. 1099). Native Californian feather cloaks also comprised of twining (Hīroa, 1926; Willoughby, 1922, p. 434). A cloak in the Kunstkamera Museum (МАЭ №. 736-135) in St. Petersburg Russia has red and blue feathers twined against foundational warp threads and appears to be from the American continent. Joseph Banks likened the twining of Māori clothing to the hammocks of Brasil in South America (Beaglehole, 1962b, p. 25). The Tupinambá of Rio de Janeiro also used a simple double pair twine pulled tightly to resemble cloth (Métraux, 1948, p. 109).

5.4.4 The significance of language, function, social, and environmental influences

That cloaks have a direct relationship to whakapapa or genealogies is paramount as weaving practices are handed down with each generation. The plants and birds represent the re-emergence of new life and a continuance of the physical form. Many of the language correlations, and materials and practices are mnemonic tools to retain genealogical relationships and etymological origins. The inherent knowledge contained within the language of kākahu cannot be underestimated as it validates the genealogy of the people it belongs to, the mana of the wearer, the skills of the weaver, and the importance of the materials and techniques used to create it. The naming of specific Māori clothing in pre-European times is potentially lost, however most of the continuation of naming particular woven Polynesian cloaks as having variations on the prefix kahu in Māori, where it is used in ʻahu ʻula in Hawaiʻi, ahu rupe in Tahiti, and kaʻureʻe (kahurehe) in Rapa, allocates this single noun as a crucial denomination in the whakapapa and language of kākahu. These connections are forever retained in the tangible materials and techniques and designs, and intangible language, kōrero, and spiritual symbolism.

Ethnologists believed that the rank and roles of men and women in Hawaiʻi were clearly defined and separate. In pre-European times, records indicate Hawaiʻian feather capes and cloaks were worn by the paramount chiefs, or high born men, and the construction restricted to men, with women helping only to prepare the materials, as items and people touching royalty were restricted (Hīroa, 1944b, p. 2; Hīroa, 1957, p. 217). An indication that Hawaiʻian cloaks were made under kapu (Māori, tapu, restriction) is that men of rank had the most prestigious (long yellow) feather cloaks, and this restriction resulted in anyone other than the rightful owner donning a royal feather maro (girdle) or robe, being put to death (Malo, 1903, p. 83). It was thought women were exempt because the feather capes and cloaks were also worn in battle, a male and dangerous endeavour (Brigham, 1899, p. 52). This can be disputed as there were few recorded eye-witness accounts, and as women were known for making valuable textile wrappings in Polynesia, it should be considered they were also more involved in this process (Cordy, 2003; Hooper, 2006, p. 84; Linnekin, 1988). There is also a stunning ʻahu ʻula once owned by Princess Kēkauluohi Kaʻahumanu III in the Pitt Rivers Museum, University of Oxford (1951.10.61). The same assumptions were made for Māori kahu kurī, in that ethnologists reported that dogs, and in particular dogskin cloaks, were associated with men, rank, and battle, and in making dogskin cloaks, the women constructed the muka backing and men tended to drying and sewing the skins to the garment (Colenso, 1877, p. 151; Tregear, 1904).

Polynesian pastimes not retained in Māori society are just as relevant in understanding cultural history as those that were. For example, Māori did not appear to strictly adhere to gender roles for some things, such as weaving and wearing feather cloaks. European ethnologists have perpetuated some of these gender roles in the nineteenth century, asserting that men were dedicated to artforms such as carving; and pursuits pertaining to war and religion such as dog skin cloaks, ceremonial objects, and weapons; whereas women were expected to excel at the decorative arts such as weaving (Best, 1898). Bonica (2017) stated “you’ve got to be living in that community at that time of that writing, and it can be put in concrete by those writers [ethnologists], and there are always exceptions”. That if anyone showed a kind of proficiency, whether male or female, they would continue to enhance their skills and knowledge in their chosen area (Bonica, 2017). While women may have typically woven baskets and clothing, most society members needed a basic knowledge of weaving. Out of necessity and survival, men needed to process harakeke for fishing, ropes, and rain capes and already practised twining techniques for fish and eel traps.

Ngāti Wai and Te Waiariki kaumātua Hori Parata (2017) spent time as a young boy helping to collect materials for kākahu:

> “Sometimes it was the men that were sent to get the harakeke or whatever it was, .. it certainly was like that even when we were young boys we were taught to do it. How to go out and cut

> that harakeke …and make sure that you are looking after the plant. Same as the feathers. It was generally us [boys/ men] that went out to get those."

Likewise, renowned northern weaver Te Hemo Ata Henare (2017), knew that men could be just as competent and involved in weaving as women:

> "My dad was a bushman, so my dad knew a lot about wood, plaiting, bark,.. [and] they were brought up by the sea so dad knew how to make fishing nets so I learnt that from my father and plaiting up too. I had an Uncle from Ngāti Wai so he would have these … big ropes, like 26 plait… because he worked on the boats, so he knew how to do that. He learnt the ability. He had that basic traditional …[knowledge] and then he just developed whatever he needed to survive".

Māori academic and artist, Maureen Lander (2017) agreed sharing that:

> "I think Māori men had more involvement in weaving than we give them credit for now, especially in the tāniko [woven geometric designs] and the tukutuku [woven house panels]. When it comes to the significance of patterns there is probably some input from both men and women. They all worked together."

European encounters recorded Māori wearing twined feather cloaks but did not differentiate between who wore the cloaks although most encounters were with men of rank, and women specifically were recorded wearing what assumed to be twined feather maro (skirts) (Mead, 1969). It was understood that Māori women of rank wore feather cloaks, whereas the kahu kura (red/ feather cloaks) were specifically the insignia of male chieftainship (Hīroa, 1926, p. 305). There are certainly historical (pre-European) examples of Māori women wearing feather cloaks in burial situations, as discussed in Chapter Six (Blackman, 2007; Hamilton, 1892; Simmons, 1967, 1968; Trotter, 1972). As the Māori feather cloaks are now known to have been made by women, and initially worn by women of rank, some of the practices of Polynesia, specifically in Hawai‘i and Tahiti regarding predominantly men (of rank) associated with the prestigious and symbolic feather cloaks have largely dissipated.

Twined cloaks in Tuāmotu were likely made and worn for warmth and protection in the cooler months, and in contrast Tahitian pigeon cloaks and Hawai‘ian feather cloaks seemingly fulfilled social and religious functions. Their purpose was dictated by the birds and coloured feathers used, who made it, why it was made, and who wore it and when. Stately clothing and personal adornment were imbued with an inviolability, for instance the royal feather girdles or maro ‘ura, and sashes of French Polynesia and Hawai‘i are not found anywhere else with the same degree of social value and sacred connotations (Stokes, 1925, p. 28). As there were less than five twined Tuāmotu cloaks acquired in the eighteenth century with little information for museum collections, it is difficult to measure their value in society. It is evident that twined Māori clothing was worn daily in the colder seasons, and these warmer practical cloaks were undoubtedly repeatedly worn and replaced, unlike the more valued feather cloaks. Similarly, personal bark cloth attire in Polynesian would have been worn out and replaced, whereas performance wear and personal ornaments decorated with feathers and dog hair like the British Museum Tahitian feather girdles (Oc,LMS.85 and Oc,VAN.348), and Tuāmotu attire with bound dog hair (Oc,LMS.210), were likely of higher worth and therefore preserved.

Cloaks from a direct royal or chiefly line of descent authorised position and prestige for the descendants. Eastern Polynesia was governed by strict hierarchical constructs in which the rank or status of families were carried through ancestral blood lines. Political unrest existed for many Pacific islands and without social structure, societies would have struggled to uphold traditions and kin relationships (Howard & Borofsky, 1989). One’s rank or importance was akin to wealth and power, which equated to the quality and quantity of goods and valuables at their disposal. The finest of material goods measured personal wealth and power in that the most unique, rare, or beautiful articles were the most treasured. Items difficult to obtain were prized and as such traded with other valuables, serving as currency. Feathers, hair, pearls, shells, bones, teeth, and flowers served as Polynesian ornamentation, and the scarcity of certain resources made them more valuable. Hawai‘ians paid a tax in feathers yearly to the akua (atua, gods) during the festival Makahiki which was spread across October-January (the autumn and winter months) which included Makali‘i (Māori, Matariki), where feathers were gifted (pālala) to chiefs for adornment in cloaks and god images (Brigham, 1892, p. 10; Malo, 1903). Chiefs killed in battle also lost their valuables including cloaks to rivals (Brigham, 1899, p. 53). ‘Ahu ‘ula were worn on the most important occasions as symbols of wealth and power and were valuable assets for exchange and gifting. In the late eighteenth century, Hawai‘ian leaders gifted numerous stunning feathered garments to European explorers (Brigham, 1892, 1903, 1918; Hīroa, 1944b, 1957; Kaeppler, 1978a, 1978b). In his journal, Captain King witnessed a feather cloak traded for a musket, and others exchanged for large nails (Brigham, 1899, p. 5). By the 1830s this featherwork had largely ceased due to the introduction of European clothing, customs, and economies (Brigham, 1899, p. 4). This was similarly the case for Māori cloaks made from the 19th century, in which the functional role of cloaks transitioned from practical (warmth) and ceremonial (status), to social (costume) and economic currency (exchanged for European goods and moneys) (see Chapter Seven) (Mead, 1969).

5.5 Conclusions

This body of work presented what possible determinants may have contributed to the development of feather clothing from Polynesian to Aotearoa. Most Polynesian islands had a knowledge of twined basketry for making twined feather cloaks. New Zealand Māori had a surplus of birds and harakeke, and a colder climate, which accelerated the specific aspects of this artform here. The methods evolved based on what was needed, wanted, and available at the time. Polynesians share similar languages, ingenuity, skills, and knowledge, yet each group adapted known skills to generate higher artforms that met their social and physical needs. Hīroa (1926) maintained the evolution of Polynesian and Māori clothing was mutually exclusive, that all Polynesians had basic skills in making nets, mats and basketry and drew from different influences to build on these in a local context. Hīroa (1926) highlighted the diverging techniques in Hawaiʻian and New Zealand Māori cloak production, but that the evolution of both are mirrored in terms of development from established weaving techniques into refined artforms. The consistent use of variations of the term kahu throughout the Pacific and over generations, also undermines this projected disconnect in cultural materials. New Zealand twining was an important technique because of the need for warm clothing, with comparable examples of twined cloaks in North America (Roth, 1923, p. 54). Roth (1923) was one of the first writers to catalogue (describe) and illustrate Māori (feather) cloaks in British Museums. Hīroa (1924a) acknowledged the importance of this study, but stated that several errors marred this work, namely that Roth had no practical experience in Māori weaving, and his lack of knowledge in Māori customs and language hindered his ideas. The other assertion was that Māori progressed twining over generations and that it was an independent advancement (Hīroa, 1926).

Unfortunately, ethnologists tended to exhibit personal bias, and generalise personal observations of indigenous peoples and apply it to the general population. Iwi Māori, like all Indigenous cultures have a strong sense of autonomy, and differences within a single iwi (peoples) and hapū (subgroups) can vary greatly. When outsiders study Polynesian cultures, objectivity and attention must be employed. Interpretations of Elsdon Best who was credited with living amongst Ngāi Tūhoe in the late eighteenth century, is now questioned in his record of the language and behavior tainted by his personal agenda toward Māori (Smith, 2012).

Polynesian feather attachment is dependent on the materials, feather size, and purpose of the work. Feather binding is still the most effective technique in securing feathers to an object and appeared to be associated with men, war, death, and religious ceremonies. It was suspected that through the binding of objects, karakia (incantations) created a sacred form of protection in which the wishes of the people could be met when the god received the prayers (Best, 1976a). Likewise, in conjunction with performing incantations, the binding (or rebinding) of sacred objects in Polynesia initiated a form of divinity in the object (Adams, 2016; Hooper, 2006; Kaeppler, 2007). It was possibly the process of wrapping an object and the resulting product that enabled the creation of a sacred and divine connection (Kaeppler, 2007, p. 97).

Tahitian and Hawaiʻian feather cloaks were not worn daily or for warmth so they served a social function for the wearer. Examples of feathers attached to knotted net foundations were recorded in Hawaiʻian and Moriori feather cloaks and a mourner's cloak from New Caledonia. Polynesians modified plant fibres for clothing to suit the environment, and prior weaving knowledge for netting, traps and basketry has been the conductor of this change. Contemporary Māori cloaks are distinguished by the harakeke foundation and finger twining to fasten feathers into the backing as it is made. Although, twined clothing has been recorded in the Tuāmotu capes, Rapan cloaks, Moriori capes, and Cook Island skirts, the Tongan aprons (sisi fale) are one of the rare Polynesian examples of twining with feathers. Twining is present in some Hawaiʻian mahiole (helmets), where the method provided structural support for the helmet to sit and stay on the head, and the outer layers exhibited the feathers tied to knotted backing nets. Hawaiʻian feather images ʻaumakua hulu manu (bird feathered guardian ancestors) utilised wicker-work of single-pair twining and two-pair interlocking weft techniques, akin to Māori cloaks (Hīroa, 1957, p. 505). The ʻaumakua hulu manu Kūkaʻilimoku or Hawaiʻian feather image in the Te Papa collection (FE000325) features iʻiwi, and fowl feathers and incorporates this combination of techniques. In clothing, twining reduces the gaps in the weaving, and provides warmth, insulation, protection, and structure that other techniques do not. Twining in Māori feather cloaks also has artistic outputs in coloured adornment and patterning such as bird and feather use and tāniko. Despite similar techniques used in New Zealand and Tuāmotu, Hīroa (1926) argued that Māori twined cloaks evolved locally in Aotearoa from twined basketry rather than Māori carrying these skills for twined clothing throughout Polynesia. The determining factor that refutes this, was that twining was adapted by Māori and Polynesian (particularly in Rapa, French Polynesia) to respond to the climatic conditions of the islands, and was made for higher altitudes and colder weather (Stokes, n.d.). No surviving New Zealand archaeological evidence features twined clothing at the time of Māori arrival (Davidson, 1984). However, examinations of historical Māori clothing demonstrated aspects of twining spanning the last 500 years, discussed in Chapter Six. It has only been the last 250-300 years where refinement and conformity in feather attachment appeared in conjunction with this method. It is therefore not a recent adaptation, nor is it specific to New Zealand or Polynesia, as several examples in the Bishop Museum, Honolulu Hawaiʻi show Melanesian twining in a Fijian belt (No. 07502) collected in 1840, and in Jabin dance tassels (No. 01776B) from New Guinea collected in 1890 (Stokes, n.d.).

Feather cloaks and twined clothing in French Polynesia have numerous factors in common with Māori garments, yet there are limited detailed accounts and examples of pre-contact influences in cloak making and feather use (Cook & King, 1785; Ellis, 1853). Hīroa (1943) catalogued the birds and feather attachment techniques in a small number of Tahitian mourning costumes comprising of pigeon feather cloaks worn by men for funerals of dignitaries. While the kinds of materials and techniques found in Māori feather cloaks are ancient and widespread, it is the combination of the social and cultural significance of these techniques, feather colours, birds and designs that have influenced Māori cloak production. In the inventories of Hawaiʻian ʻahu ʻula, no two cloaks are the same. Similarly, for this research the International Register of around 600 Māori feather cloaks demonstrates that while similar species, feather types and patterns may be identified across numerous museum collections, no two cloaks are the same even when manufactured by the same weaver. Also, unlike other Polynesian cloaks that were governed by a strict adherence to colour, species, and design requirements resulting in cultural, religious, and social limitations, Māori cloaks allowed for more flexible practices in construction, design, and function.

The feather identification of ethnological items is integral when interpreting bird and feather use in a cultural context. Accurate microscopic feather identification is reliant on viable cloak feathers and comparable reference feathers of known species and feather types. The microscopic similarities in the feathers of the two red Hawaiʻian passerines of iʻiwi and ‘apapane required a combination of detailed reference comparisons to the feather down of known species; museum skins, and feather samples for macroscopic analyses.

Rare birds, or birds with unique feathers were in general desired for prestigious personal attire and clothing in Polynesian and Māori cultures. Red feathers are semi-permanent receptacles between the spiritual and physical realms. The sacred colour red is aligned with chieftainship and the gods, and has persisted as being paramount in determining the ‘greatness’ of an object or person and has unquestionably been a significant element of Polynesian origin to influence kākahu and te ao Māori (the Māori world). Birds throughout Polynesia play an important role in understanding the physical and spiritual plains. The appearance and behaviour of birds established beliefs in their other worldly powers. The funerary cloaks of Tahiti indicate that the pigeon or rupe has a link to death and, or high rank. Hawai‘ians believe in the connection of some birds like the owl to the ancestral spirits (‘aumākua) in that they act as kaitiaki or guardians for families, so single owl feathers affixed to a Māori feather cloak implies persistence with ancient bird beliefs for personal expression. Bird names and weaving terms that have Polynesian origins and that continue today function as memory devices, implying they are of ancestral importance. While they have been adapted for use in Aotearoa, the original concept has been carried through in oral and practical knowledge for generations.

Many of the observations of Polynesian cultures were conceived by ethnologists and external outsiders, who observed events with little understanding of the historical or cultural context. With so few published works on this subject conducted by indigenous researchers, ornithologists or traditional and contemporary practitioners, this reinforces the importance of supporting native speakers and practitioners in material culture studies, particularly in the interpretation of results and critique of assumptions. Specialised skills and knowledge like weaving and bird lore is traditionally transferred orally and in practical application. Since European colonisation of the Pacific, traditional Māori and Polynesian practices have barely survived. Māori scholars, Hīroa and Mead thoroughly investigated this artform, and could speak with some authority on the subject. Hīroa had access to the largest collections of Māori and Polynesian artefacts in the world and his work on Māori clothing published in the 1920s set the groundwork for connecting the intricate details and relationships between Māori and Hawai‘ian cloaks. Finally, this research confirms that museum collections are necessary in preserving material evidence for research and understanding cultural practices, but supporting and sharing traditional knowledge is required to interpret context and depth.

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CHAPTER SIX: EARLY MĀORI FEATHER AND BIRD SKIN CLOAKS 1500-1800 A.D.

Me ka uhi rānei koe ki te huruhuru kākāpō pū mai o te tonga

Wouldn't you rather be covered in the feathers of the kākāpō that have come from the South.

From Grey (1853, p. 329), translated by Haupuru Harwood (Ngāpuhi) (2017)

6.0 Abstract

Analysis of thirteen Māori textiles dating from 1500-1800 A.D. offered a glimpse into a dynamic stage in the history of Māori feather cloaks. Previous research focussed on basic feather cloak descriptions and where they placed in the evolution of Māori clothing, with limited interpretation of how and why certain birds and feathers were used. From 2017-2019, an ethno-ornithological study re-examined six historical South Island feather cloaks made 1500-1700 A.D., and seven cloaks collected on the New Zealand voyages of Captain James Cook (1769-1777), revealing material and technical information previously unrecorded. The importance of species identification to ascertain Māori-bird relationships from 19th century cloaks has been recognised (Harwood, 2011a). This research aimed to interpret earlier feather and hair adornment using scientific techniques to compare cloak materials to reference image databases of microscopic hair, feather down, and museum bird skins. The findings showed that treasured kurī (Māori dog: *Canis lupis familiaris*) adorned most of the cloaks in conjunction with nine bird species including extinct moa (Dinornithiformes). Variations in twining, plaiting, sewing, binding, and knotting facilitated skin, hair, and feather adornment. Historical cloak production pointed to possible Polynesian and later European influences juxtaposed with social factors such as preferences for certain birds and feather colours, European collecting behaviour, and environmental factors such as climate and bird distribution determining weaver choice.

6.1 Introduction

The literature created a picture of the New Zealand environment in which Māori arrived and subsequent behavioural adaptations to it. Unlike other Pacific Islands, New Zealand has a relatively large land mass of over 260,000km². Around 3,000 years ago, it is estimated 85-90% of the land was dominated by conifer-broadleaved and podocarp forests (Holdaway, 1989; McGlone, 1989, p. 116). Protein in the Māori diet consisted of fish, seafood, sea mammals, introduced mammals like kiore (Māori rat: *Rattus exulans*) and kurī (Māori dog: *Canis lupis familiaris*) on occasion, and an array of sea and land birds representing at least 245 breeding species (Fig. 6.1) (Atkinson & Millener, 1991, p. 129; Bell, 1990; Colenso, 1877, p. 143; Holdaway, Worthy, & Tennyson, 2001, p. 119). Of the breeding forest birds, 33% were flightless and 21% nocturnal or semi-nocturnal (Atkinson & Millener, 1991, p. 129). The closest continent, Australia is over 1,000km away, and this geographic isolation led to the evolution of endemic bird species including giant eagles (*Aquila moorei*) and flightless moa both now extinct, and kiwi (*Apteryx* spp.) and kākāpō (night parrot: *Strigops habroptilus*) (Tennyson & Martinson, 2006).

***Figure 6.1*. Kurī (Māori dog: *Canis lupus familiaris*). ♀. Location between 'Waikava' (Waikawa) & Mataura plains, Catlins. Collected by Anderson, 1876. Te Papa LM000828. CC BY 4.0.**

New Zealand also has one of the most diverse landmasses in Polynesia with a climatic range, geology, landforms, and freshwater environments (Trotter & McCulloch, 1989). The mean annual temperature at sea level ranges from 15-9˚C, from North to South, and is colder with greater seasonal changes, unlike smaller Polynesian islands. Mean annual South Island rainfall varies from 300mm in Central Otago to over 8000mm in the Southern Alps (Trotter &

McCulloch, 1989, p. 34). Māori arrived in Aotearoa accustomed to wearing tapa or bark cloth, ideal for tropical regions, it is easier and quicker to produce than woven clothing and found throughout Polynesia as far east as Easter Island, and in Micronesia and Melanesia (Hīroa, 1926). There were unsuccessful attempts to grow the paper mulberry (aute: *Broussonetia papyrifera*) for tapa in New Zealand ("Gift of huia feather box", 1933; Rowley & Simmons, 1966, p. 108). The plants and bark clothing did not suit the colder climate of New Zealand and so only small pieces could be manufactured and incorporated into ceremonial objects or adornment as opposed to body attire. In response to this, Māori customised flax (harakeke: *Phormium tenax*), traditional weaving techniques, and animal skin clothing to produce warm, protective, as well as finely made garments (Figs. 6.2 & 6.3) (Hīroa, 1926, p. 2).

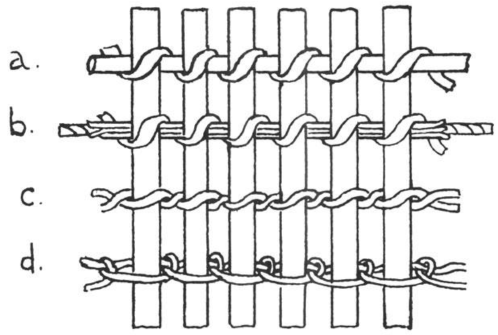


***Figure 6.2*. Weft techniques showing (a) wrapped twining, (b) tāniko, (c) single pair twining, (d) half-hitch weft technique. From Hīroa (1925, p. 87); [Fig. 35].**

There is no surviving New Zealand archaeological evidence featuring twined clothing at the time of Māori arrival (Davidson, 1984). However, Hīroa (1926) determined that ancient Polynesian twined basket and net weaving strongly influenced the local evolution of Māori clothing, where simple to complex weaving techniques developed over time (Fig. 6.2). That in isolation, Māori weaving adapted from bark clothing to plaited garments, single pair twining in rain capes, through to double pair twining in warm dress cloaks (Hīroa, 1926; Hīroa, 1966, p. 176). Simmons (1968) proposed a different clothing timeline for the South Island's Murihiku region where most of the earlier cloaks were located or collected after Māori arrived, in that the unsuitable bark cloth was replaced with large bird (moa) skin, and whole dog skin and seal skin garments (p. 14). Between 1400-1700 A.D. when moa were scarce, Māori used smaller sewn bird and dog skins, seal and plaited garments, and from 1700-1800 A.D. single and double pair twining was adapted, including tāniko (decorative geometric designs) described as wrapped weft twining (Hīroa, 1926; Simmons, 1968).

6.1.1 Historical Māori feather cloaks produced 1500-1700 A.D.

A study of six early Māori feather cloaks dating from 1500-1700 A.D. created valuable links and patterns between materials, techniques, collection locations and dates, and social and individual weaving skills and practices. These rare pieces created an opportunity to understand some of the variables in Māori feather cloak production before European settlement, namely what bird species were used in cloaks against what was possibly available at the time.

***Figure 6.3*. Flax (harakeke: *Phormium tenax*). Image by Hokimate Harwood, Whakatāne, Bay of Plenty, 2019.**

The six historical Māori feather cloaks identified from the literature and New Zealand museum records were described by Hamilton (1892); Simmons (1967a, 1968); Trotter (1972); Anderson, Goulding, and White (1991); Wallace (2002); and Blackman (2007). Hīroa (1926) based his valuable material and technical descriptions and illustrations on Hamilton (1892) and Roth (1923). The authors contributed extensive knowledge with analyses that drew on expertise in ethnology, archaeology, and to a lesser extent weaving. Most of the historical pieces had a foundation of harakeke, with one confirmed of tōī (Cabbage tree: *Cordyline* spp.), with varying amounts of scraping, scutching or processing (Fig. 6.3). Historically Māori populations settled near flax plantations as it was a vital plant harvested for clothing, rope, baskets and mats (Hīroa, 1966). While basic bird identifications were recorded for some cloaks, they were provided with limited knowledge in the field of ornithology. An exception, *Beech Forest Hunters: The Archaeology of Maori Rockshelter Sites On Lee Island, Lake Te Anau, In Southern New Zealand*, edited by Anderson and McGovern-Wilson (1991) catalogued the site of one of the oldest cloak fragments, found on Lee Island, Lake Te Anau in Fiordland in the 1970s. This study noted general construction methods of the burnt remains of a twined flax cloak with brown kiwi strips and dog skin along the neck (Anderson & McGovern-Wilson, 1991). It provided a short comparative analysis of other historical cloaks, and documented the site including utensils found in shelters, floral and faunal remains, and a census of local bird species (Anderson & McGovern-Wilson, 1991). The Lee Island cloak pieces were located in Southland Museum and Art Gallery Niho o te Taniwha in Invercargill for study in 2017.

Simmons (1967a, 1968) and Trotter (1972) observed and described a burial cloak and shelter on an island on Lake Hauroko, Fiordland. They did comprehensive site and cloak descriptions with only some discrepancies in plant identifications and measurements. Simmons (1968) positioned the cloak within a timeline of Māori clothing and made some generalisations despite drawing from such a small number of historical cloaks. The cloak was replicated by weavers in 1967 for study at Otago Museum, Dunedin, and the burial, including the cloak remain on the island.

Hamilton (1892) first described a Central Otago (Ōtākou) twined cloak with kākāriki (*Cyanoramphus*) bird skin strips and dogskin decorations in the Otago Museum, Dunedin. Anderson, Goulding, and White (1991); Wallace (2002); and Blackman (2007) contributed additional valuable material and technical descriptions and interpretations.

***Figure 6.4*. Theo Schoon Māori Rock Drawing, Craigmore, Pareora, July 1946. Oil on board. Commissioned by the Canterbury Museum, Christchurch E150.319. All Rights Reserved.**

Two burial garments wrapped around a woman found in a shelter in Strath Taieri, Central Otago were first described by Hamilton (1892), then Roth (1923), Hīroa (1926), and Simmons

(1968). The fragments in Otago Museum, Dunedin, consisting of an outer garment of roughly scraped and plaited flax warps have been held together by half-hitch wefts with albatross (Procellariiformes) and weka (*Gallirallus australis* spp.) feathers intertwined for centuries (Hamilton, 1892; Hīroa, 1926). The inner garment consisted of several pieces of weka skin sewn together with a moa (Dinornithiforme) skin seam attached to one of the pieces (Hamilton, 1892). This important garment is the only known surviving museum artefact that contributes to the limited recorded knowledge on the relationship between iwi Māori and the now extinct moa. Recent traditions pertaining to moa had stronger associations with the South Island where this garment was located, as have numerous archaeological sites and rock shelters in South Canterbury and North Otago that have preserved moa feathers, skin, bones, and rock art depicting moa, and moa hunting (Fig. 6.4) (Teviotdale, 1932).

A bird skin garment found in 1993 in association with a burial was located at Lake Wanaka (Oanaka) in the Otago district. The cloak consisting of knotting and the skins of various bird species, went to Otago University for examination before being returned to the associated iwi (peoples) for reburial (Ngarimu-Cameron, 2008; Wilson, 2014).

6.1.2 Cook-collected Māori feather cloaks produced 1750-1777

There are more than 40 cloaks in museums in the United Kingdom and continental Europe collected during the New Zealand voyages of British navigator Captain James Cook (1728-1779) dating from 1769-1777 (Blackman, 2011, p. 91). The few records of fully feathered cloaks described cloaks adorned with red feathers, however to date no full-feathered Māori cloaks have survived in any collections (Beaglehole, 1962a, p. 415). The seven known Cook-collected cloaks with feathers collated for this research were located based on relevant literature, archival manuscripts and international museum records. They were made between 1750-1777 and lacked detailed records on the material and technical aspects of production. All seven were located in United Kingdom and European museums, and had connections to Cook voyage collectors Joseph Banks (1743-1820), a naturalist on the first voyage; and Reinhold Forster (naturalist) and son Georg (George) Forster (naturalist, illustrator) on the second voyage. Previously, provenance was established from museum records and correlating crew manifests, as well as stylistic similarities (Henare, 2005; Simmons, 1996, 1997, 1981). The museums holding important Cook collections comprised of the British Museum in London, England; The Trinity College in Dublin, Ireland and collegiate organisations the Museum of Archaeology and Anthropology, University of Cambridge in Cambridge, England and Pitt Rivers Museum, University of Oxford in Oxford, England. Smaller collections were found in the Hunterian Museum, University of Glasgow, Glasgow, Scotland; Weltmuseum Wien (World Museum Vienna), Vienna, Austria; and the Museum of Ethnography (National Museums of World Culture), Stockholm, Sweden. Preliminary records research was conducted by museum staff collating archival cloak documentation, images, and material and technical information where known. Most of the published research centred on provenance and museum collection records from Cook's catalogue of artefacts derived from Shawcross (1970), Coote (2004, 2015), Rydén (1963), Kaeppler (1978), and Thomas, Adams, Lythberg, Nuku, and Salmond (2016).

***Figure 6.5*. Parkinson, Sydney, 1745-1771: A war canoe of New Zealand / R. B. Godfrey, engraver. London, 1784. Ref: A-111-001-2-a. Alexander Turnbull Library, Wellington, New Zealand. /records/22908674**

One cloak located in the Ethnographic Museum in Berlin Germany (VI 490) had been attributed to the 18th century and north of the South Island (Simmons, 1981, p. 31; Simmons, 1996c, 1997a). Simmons (1981) noted that the kaitaka had a single pair twined canvas, tāniko, and white gull feathers dyed pink that had been added later using half-hitching (p. 31). The cloak along with other taonga Māori had been collected by American Captain Samuel Hadlock Jr. who had left North America for Europe in 1821 and while travelling through Britain likely acquired the cloak and artefacts and placed them in the Berlin Museum before 1824 (Schindlbeck, 1991, 2018; Simmons, 1997a). As the provenance for this cloak could not be confirmed for this research timeline it was excluded from the study.

Scholars acknowledged the significance, yet scarcity of feather cloaks recorded by Europeans in pre-1820 Māori society (Hīroa, 1926; Mead, 1969; Pendergrast, 1987; Roth, 1923). The times 1642-1800 A.D. have been referred to as the 'Classical period' that represented the pinnacle of 'traditional' Māori clothing, before European settlement in the 19th century (Mead, 1969). Māori cloaks were collected by Cook in the North Island along the east coast, and the South Island at Queen Charlotte Sound and Dusky Sound, however the total number and variety of feather cloaks collected is unknown (Orchiston, 1974; Simmons, 1981; Thomas et al., 2016). Hīroa (1926) and Roth (1923) offered technical information of some of the known collected feather cloaks, however Hīroa did not personally observe the cloaks, and Roth's knowledge of Māori weaving was limited. Mead (1969) contributed classifications and social context for some kākahu. Journals from major collectors such as Captain James Cook, Joseph Banks and the Forsters, supplemented museum records. Most observations probably referred to kākā feather cloaks, but descriptions were restricted and obscure omitting species detail, as do the artists' depictions that lacked information to distinguish between feathered, dog, or dyed patterned flax cloaks (see Fig. 6.5).

The first verified European contact with New Zealand Māori occurred during Dutch explorer Abel Tasman's voyage to New Zealand (1642-1643 A.D.) (Collins, 1991). Little about the islands and its peoples were recorded, including the attire at the time. Just that on 19th December 1642 near Golden Bay, in the north of the South Island, Māori were observed wearing clothing of mats and 'cottons' (Sharp, 1968, p. 122). The Dutch avoided further engagement with iwi Māori (peoples) as the interactions were considered hostile.

Cook's voyages offered slightly more insight. In the Hawke's Bay on the 15th October 1769, Sydney Parkinson, a naturalist, and illustrator described one old Māori man, a chief painted red, in a red garment (Parkinson, 1984, p. 93). The next day, near Cape Kidnappers and Hawke's Bay, a man wearing 'some beasts skin with long hair dark brown and white border' would not part with this garment when invited to trade it (Parkinson, 1984, p. 94). Banks implied that dogskin cloaks were valuable, and that the skins were used sparingly in corners or along borders or cut into strips and sewed some distance apart across the cloak (Beaglehole, 1962b, p. 15). That Māori also had feather dresses, one had an entire dress of red parrot (kākā) feathers, but these were not common (Beaglehole, 1962b). On a cold night on 20th October 1769 near Anaura Bay and Tolaga Bay on the north east coast of the North Island, Banks wrote of two chiefs invited on board the Endeavour who received gifts from the English seamen

(Beaglehole, 1962a, p. 415). Dressed in ‘jackets’, one was adorned with dogskin, the other covered almost entirely with small tufts of red feathers (Beaglehole, 1962a, p. 415; Morrell, 1958, p. 57). It was indicated that the feather cloak was a ‘kakukura’ (kahu kura), the distinguished garment in which the crimson kākā feathers from under the wing is woven into the *Phormium* (flax) base (Beaglehole, 1962a).

On the second Cook voyage in April 1773 at Dusky Bay (Sound) in the South Island, Georg Forster saw and exchanged items for woven parrot feather cloaks (Forster, 2000). In February 1777, surgeon William Anderson journaled how in Queen Charlotte Sound, the silky flax material created complex clothing of which dog skin patches adorned entire cloaks or the corners, and that they resembled the cloaks covered entirely in large bird feathers that seemed worked in as the cloak progressed (Beaglehole, 1967, p. 810). Anderson then most certainly had witnessed the production of twined feather cloaks.

6.1.3 Current cloak materials and techniques

The identification and description of feathers in the Māori cloaks in the Museum of New Zealand Te Papa Tongarewa (Te Papa) cloak collection in 2007 facilitated further understanding of weaving and collecting behaviours alongside avifaunal preferences (Harwood, 2011a). Te Papa’s cloaks were produced predominantly in the late 19th century, to which the most frequently identified birds were brown kiwi (*Apteryx* spp.), kākā (*Nestor meridionalis*), and kererū (pigeon: *Hemiphaga novaeseelandiae*), species that still featured in the Māori diet, and were common and widely distributed in New Zealand forests until the mid-1800s (Harwood, 2011a). To a lesser extent, socially significant species such as ruru (morepork: *Ninox novaeseelandiae*) and the extinct huia (*Heteralocha acutirostris*) were incorporated to communicate a specific relationship to the weaver and status of the wearer (Harwood, 2011b). Other findings acknowledged the significance of red feathers and the incorporation of stylistic traits that could identify individual weavers (Harwood, 2011b).

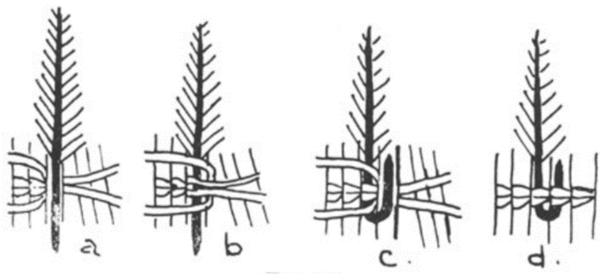


***Figure 6.6*. Orthodox Māori feather attachment, using two pair-interlocking weft twining. From Hīroa (1925); [Fig. 78.].**

Māori feather cloaks dating from the 19th century often referred to as 'traditional Māori clothing' have become the standard in cloak manufacture. Construction is based on a backing of muka, or scutched (scraped) harakeke in which the plants' inner fibres form two pairs of horizontal wefts (aho), that are finger twined around vertical warps (whenu) and the feathers secured to the backing warps via the 'two-pair interlocking' wefts (Fig. 6.6) (Hīroa, 1925; Mead, 1969). The feathers point upwards and the shafts then bent and held against the adjacent warps along the weft rows. Feather cloak production typically commences in the bottom right hand corner and continues across, and feathers are added to each weft row, where the layered feathers cover the previous row. Upon completion in the top left-hand corner, the spaced double pair twined cloak is hence inverted so the feathers face down.

6.2 Methods and Methodologies

This Chapter explored the range of bird species and weaving techniques identified in kākahu Māori made before European settlement in New Zealand. Māori bird and feather use was analysed based on the research themes of language, what information was communicated in the cloak; the classification (type) or title of the cloak; the materials, namely plants and birds; and techniques, such as what weaving methods were employed; and the spiritual concepts surrounding the cloak determining how it was made and used. Finally, the cultural (tāngata Māori), social (iwi Māori), or personal significance of the birds and feathers to the weaver was discussed. These themes were analysed in relation to the temporal and environmental factors in which it was made to determine how these aspects have changed over time.

Comparative matrix models have been adapted to analyse data across mathematical and sociological studies (Vallier, 1973). The matrix model was the preferred method for conducting thematic analysis in qualitative research allowing for simple visual comparisons and contrasts in data, particularly interview data, and interdisciplinary projects such as this (Gale, Heath, Cameron, Rashid, & Redwood, 2013). For this research, a matrix framework incorporated the material and technical composition of cloaks and acknowledged the tangible, in the physical world, and the intangible, the intellectual and spiritual realms. These aspects were inherently interwoven and produced layers of knowledge using multiple disciplines in the fields of te pūtaiao (the natural world) and Mātauranga Māori (Māori knowledge) that when combined unlocked information regarding taonga Māori (treasured items). For each cloak or reference the following matrix was tabulated to record important aspects of knowledge associated with the production and use of each kākahu (Table 6.1).

***Table 6.1*. Matrix method of data collection for each cloak relating to the main research themes and where they are placed in the temporal space, and physical and social environment.**

	Time period the cloak was made	*Where the cloak was made, climate*	*Birds & Plants available*	*Social & religious factors*
Who made/ wore the cloak				
The birds & plants used				
How were the feathers attached				
Why were the materials & techniques used				
What was the cloak called				
What did the cloak communicate				

The research interpreted the possible influences contributing to the changing concepts of Māori clothing, namely ancient, Polynesian, environmental and early European elements in Māori clothing. Where societal and individual characteristics of cloaks, including weaver experimentation and creativity contrasted with the practical needs of protection and warmth. Determining what elements of the early Māori feather cloaks were unique or common, required a combined multidisciplinary approach that incorporated Māori and European knowledge frameworks. The premise of the research was the collation, analyses, and categorisation of relevant Māori feather clothing dating from 1500-1800 A.D. Conclusions were made based on the inherent value of each cloak such as the significance of feather attachment techniques; weaver knowledge and skills; and wearer influences such as who made it, who wore it, and what this conveyed to society. The matrix research themes were purposefully measured against when the cloak was made, where it was made, the climate at the location, and what birds and plants were available to the weaver. With the different kinds of religious and social factors that may have influenced the production or use of each cloak also discussed. As Mead (1969) explained, clothing portrayed the status or position of the wearer in society, and so appreciating why a feather cloak is worn reflects on the symbolism for the wearer.

The primary methods of investigating bird use in early Māori feather cloaks involved:

1. A search and review of major literature covering archaeological and ethnological studies of historical Māori cloaks, Cook voyage accounts and collections, Māori bird lore, New Zealand climate and historical bird distributions.
2. Conducting oral history interviews with well-known national and northern iwi (peoples/ tribe) weavers, and experts in Māori bird and resource management.
3. Creation of an International Register of Māori feather cloaks held in museums around the world, that recorded materials, techniques, images, museum numbers, cloak descriptions, provenance, and collection histories.
4. Additional feather identifications were conducted from personal observations and analysis, and from images provided by participating museums. Identifications were made from comparisons of reference image databases of microscopic feather down and museum bird skins initiated in 2007 (Harwood, 2011a). Additional microscopic and macroscopic hair and feather images were created for this research 2015-2019.

A study of literary works from the last 120 years encapsulated the main themes of the research. Major publications that incorporated material, technical, and contextual analyses of cloaks made from the dates 1500-1800 A.D. were primarily derived from 19th and 20th century ethnologists. Historical cloaks recorded and analysed from primary and secondary sources, included excerpts from journals of Cook's crew (Beaglehole, 1961, 1962a, 1962b, 1967; Cook & Smith 1842a, 1842b; Forster, 1977, 1996; Forster, 2000); classifications and catalogues of Cook's voyages and trading sites (Kaeppler, 1978; Mead, 1969; Orchiston, 1974; Simmons, 1978); and artwork on the voyages (Joppien & Smith, 1985, 1987a, 1987b).

Oral history interviews of weavers, artists, and northern iwi conservationists conducted in 2017 supplemented gaps in the literature and research. Semi-structured conversational questions pertaining to traditional and modern cloak materials and techniques; as well as bird use and management; historical and contemporary cloaks; and the cloaks collected on Cook's voyages, were included in the interview process. The interviews have been cited in the text (e.g. Prime (2017)) to recognise the knowledge of each participant and the importance of the information imparted for this research (see Appendix One for ethics approval and Appendix Two for an example of an interview schedule). After each interview, the responses were analysed according to the corresponding theme, location, and time-period it was associated with.

The creation of an International Register of Māori feather cloaks was formulated between 2015-2019 from the substantial work undertaken by Auckland War Memorial Museum ethnologist David Simmons from his largely unpublished 1978 research, catalogues, and indexes of Māori artefacts in Australian, United Kingdom, European, American, and Canadian museums (Simmons, 1978, 1981, 1982, 1996, 1997). Crucially, Simmons recorded museum names, museum numbers, material, technical, images and provenance information. Kaeppler and Stillman (1985) also catalogued American museums. Gathercole and Clarke (1979) supplied a list of taonga Māori in United Kingdom and Irish museums. Ethnologist Mick Pendergrast catalogued in detail the materials and techniques, and provenance and collection history of Māori feather cloaks at Auckland War Memorial Museum and the British Museum in London (Pendergrast, 1987; Starzecka, Neich, & Pendergrast, 2010). Bolton and Specht (1984) also catalogued Australian museum numbers and material and collection information. Museums were contacted in New Zealand and overseas for their inclusion in this study. Participating museums were asked to provide images, production information and provenance histories for permanent collection items, cleared of iwi and stakeholder permissions, and copyright and reproduction costs. The museum cloaks for this study have been roughly dated from the 16th century through to 1777 (Cook's last New Zealand voyage) and were also included in the International Register.

Cook's first voyage on the Endeavour stopped along the East Coast (North Island), Coromandel, Thames and then Queen Charlotte Sound (Tōtaranui in the South Island) in January 1770 (Simmons, 1978). Collections from this voyage are held at the Museum of Ethnography in Stockholm, Sweden (The Banks collection), British Museum, and the Museum of Archaeology and Anthropology, University of Cambridge, Cambridge in England, Te Papa Museum in Wellington, and probably the Five Continents Museum in Munich, Germany (Simmons, 1978). On the second voyage from 1772-1775 on the Resolution, Cook stayed at Dusky Sound (South Island) March-May and Queen Charlotte Sound in June 1773 (Forster, 2000; Simmons, 1981). Collections from this voyage are held at Pitt Rivers Museum, Oxford (Georg and Reinhold Forster collection); Göttingen University (Forster collection) in Germany; the Museum of Ethnography in Stockholm, Sweden (Sparrman collection), and

Museum of Archaeology and Anthropology, University of Cambridge (Simmons, 1981; Soderstrom, 1939). Cook on his third voyage in 1777 on the Discovery stayed briefly in Queen Charlotte Sound, where crew artist John Webber acquired a collection in February 1777 that went to Bern Historical Museum in Switzerland (Simmons, 1981, p. 1). Other second and third voyage pieces went to Trinity College (Dublin, Ireland) (Simmons, 1981). According to Simmons (1978), items collected on the first voyage originated from the East Coast North Island, and on the second and third voyages most artefacts traded were specifically from the Whānganui and Taranaki areas (West Coast North Island). Simmons based some of these attributions on trading relationships at Queen Charlotte Sound and on stylistic aspects such as tāniko designs in cloaks, not on museum collections, crew, or voyage records.

For this study, seven Māori cloaks with feathers were recorded as collected on the Cook voyages 1769-1777. One from Banks' collection was in the Ethnology Museum in Stockholm Sweden was studied from images in 2018. Two cloaks in the Pitt Rivers Museum, in Oxford, England were from the Forster's and Banks collections, one of which was possibly from Cook's second voyage to Dusky Sound, the other, a dogskin cloak was studied in person in 2019. Two cloaks were listed as Cook collection items in the Hunterian Museum, University of Glasgow, Glasgow, Scotland, one fine cloak with unique feather attachment was studied in detail from images provided in 2017. One dogskin cloak was studied in person at the Museum of Archaeology and Anthropology, University of Cambridge in Cambridge, England in 2019. Few detailed studies have concentrated on these individual 18th century kākahu.

Positive material identification of ethnological pieces is imperative in drawing valid conclusions of societal and individual weaver preferences. Most of the birds in the historical cloaks dating 1500-1800 A.D. had been identified to species level, however feather types and subspecies were not recorded. The thirteen historical cloaks were examined between 2017-2019 that incorporated imaging, measurements, and macro- and microscopic analyses of feather and hair materials by comparing cloak samples with reference images.

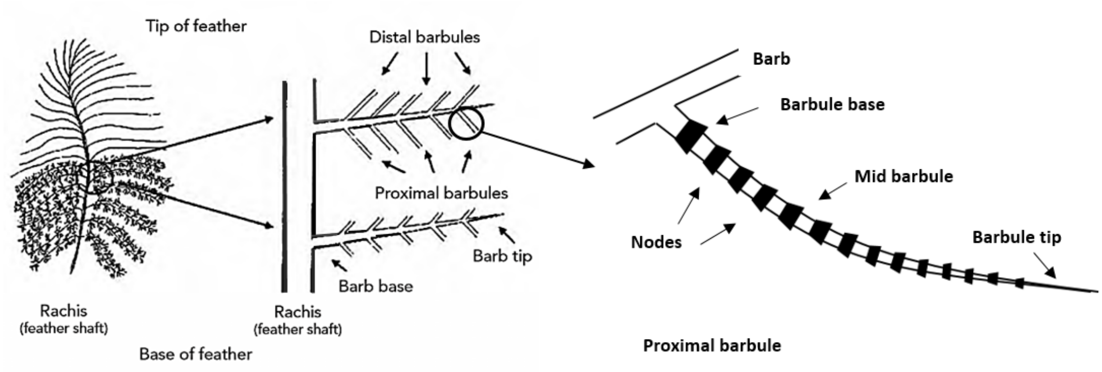


***Figure 6.7*. Down feather diagram showing positioning of diagnostic structures, adapted from Day (1966), Dove & Koch (2010).**

Methods for the feather identification of Te Papa's Māori cloaks in 2007 employed reference image databases of museum birds skins and feathers and comparing the microscopic characteristics of the feather down such as barbule length, node/ prong shape and size to determine bird order to cloak feathers (Figs. 6.7 & 6.8) (Harwood, 2011a). Other variants included the space between the nodes (internodal space), barbule width, and the presence of villi (cilia-like projections) at the base of barbules (Brom, 1991; Dove, 1997). Microscopic analysis was typically conducted in conjunction with the macroscopic study of museum bird skins. Where comparisons of feather colour, patterning, size, and shape between cloak feathers and museum skins determined species and feather types (Harwood, 2011a). Reference museum bird skins have useful applications for species and feather identification (Gill, 2014). Chandler (1916) and Brom (1986, 1991) compiled lists of the microscopic characteristics of feather down, demonstrating how they were specific to certain bird orders and sometimes species. This method can assist in establishing the bird order for plain (unpatterned) brown, black, or white feathers where macroscopic determination is challenging. International studies that have employed microscopic feather identifications in paleontological and ethnological items and textiles included Dove and Peurach (2002); Rogers, Dove, Heacker, and Graves (2002); Dove, Hare, and Heacker (2005); and Pedergnana and Blasco (2016). This method has also been used successfully in international ethnological museum collections to determine provenance based on species distribution (Dove, 1998; Pearlstein, 2010).

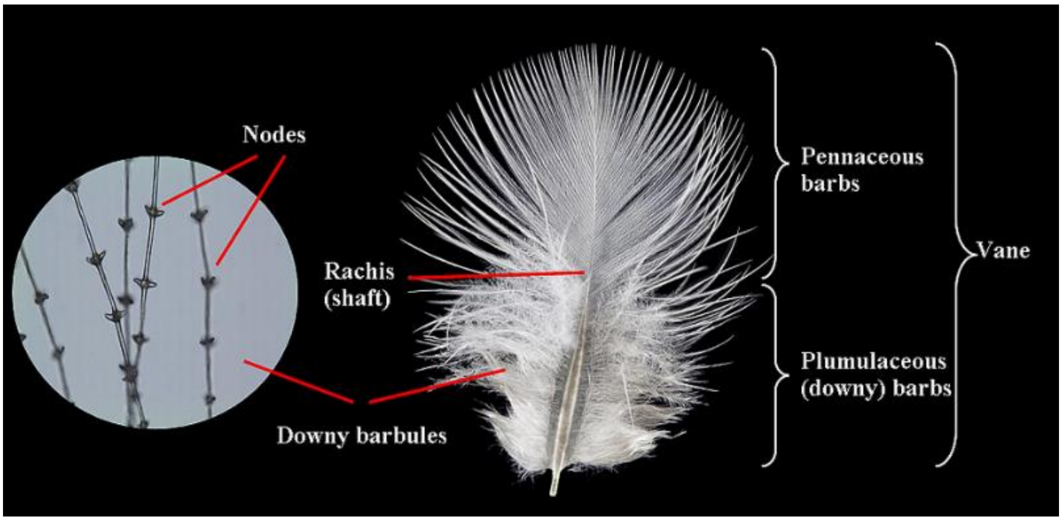


Figure 6.8. **Kererū (New Zealand pigeon) contour feather showing pennaceous barbs, plumulaceous (downy) barbs and nodes on downy barbules. Feather image by Raymond Coory (Te Papa), 2006. Photomicrograph and diagram by Hokimate Harwood, 2007.**

Methods and conventions for the identification of feathers followed those described by Harwood (2011a), Chandler (1916), and Day (1966), while descriptions of nodes and pigmentation observed Dove and Koch (2010). Descriptions of feather colours and types observed Svensson (1992); and field identifications and behaviours sourced from the *Handbook of Australian, New Zealand and Antarctic Birds* (1990-2007), Harwood (2011a), and Heather and Robertson (1996). New Zealand bird nomenclature, vernacular names, and taxonomic classifications complied with the *Checklist of the Birds of New Zealand* (Checklist Committee (OSNZ), 2010).

Historic bird distributions and abundance deduced from fossils and midden sites from the late Pleistocene (50,000-10,000 years ago) and Holocene (10,000 years to present), and current population status and distributions were attained from the Checklist Committee ((OSNZ), 2010); Atkinson and Millener (1991); and Holdaway et al. (2001). Anecdotal ornithological evidence from 19th century scholars was based on ornithologist Walter Buller's (1838-1906) volumes on *A History Of The Birds Of New Zealand* (Buller, 1888a, 1888b); and ethnologist Elsdon Best (1856-1931) who was in one of the most advantageous positions to interpret the significance of feathers in cloaks having recorded the knowledge of Ngāi Tūhoe of Te Urewera (Bay of Plenty) in the Art of Te Whare Pora (cloak weaving) (Best, 1898) and Forest Lore Of the Māori (Best, 1977), but only published exclusively on these topics. There was limited modern literature that focussed specifically on Māori and birds, particularly published by Māori. Riley (2001) and Orbell (2003) have formally published on aspects of Māori customs and traditions pertaining to birds and served as supporting knowledge, although some of the original sources of information could not be traced.

Light microscopy for hair identification in textiles is a new area of research in New Zealand. Hair identified in Te Papa's Māori cloak collection incorporated predominantly kurī, and contemporary dog breeds, merino wool (*Ovis aries*), domestic goat (*Capra hircus*) and angora goat (Tamarapa, 2011). Microscopic mammalian hair identification has been an effective tool in forensics, in the conservation of materials and textiles (Goodway, 1987; Petraco & Kubic, 2004; Tridico, 2005), and in ecological studies and wildlife management (Day, 1966; Kennedy, 1982).

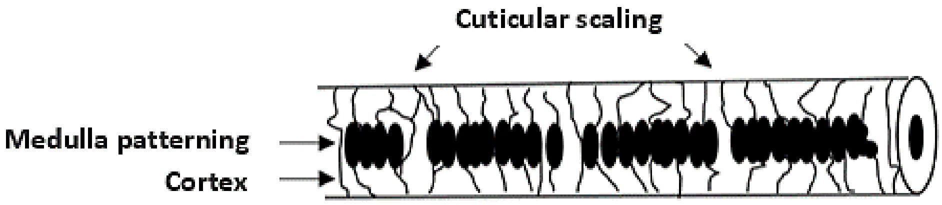


***Figure 6.9*. Diagram of a typical guard hair shaft showing cuticular (outer) scaling and medulla (inner) patterning. Diagram by Hokimate Harwood, 2017.**

Most mammalian hair resides close to the skin and is classified as short fine 'underfur'; slightly longer, coarse 'guard hairs' that exhibit more diagnostic features for identification; and the 'overhairs' that are longer still and relatively sparse (Hausman, 1920, p. 507; Tridico, 2009). The hair shaft is predominantly comprised of keratin, consisting of the cortex within the shaft made of closely packed fusiform cells; the medulla made of loosely packed cuboidal cells varying in pigment content and patterning when present; and an outermost layer or cuticle of unpigmented cells that form differing scaling patterns (Fig. 6.9) (Hausman, 1920, p. 497; Mayer, 1952, p. 481). Hair identification using light microscopy involves analyses from the hair root to the tip along the shaft identifying the patterning in cuticular scaling and medulla type, as they vary along the shaft (Hausman, 1920, p. 509). The patterning and depth of the scaling and changing pigment in the medulla are the primary diagnostic features. Other useful features can include the measurement of the ratio of the diameter of the medulla in relation to the diameter of the hair shaft, known as the Medulla Index (MI), as well as the pigmentation and its distribution along the shaft.

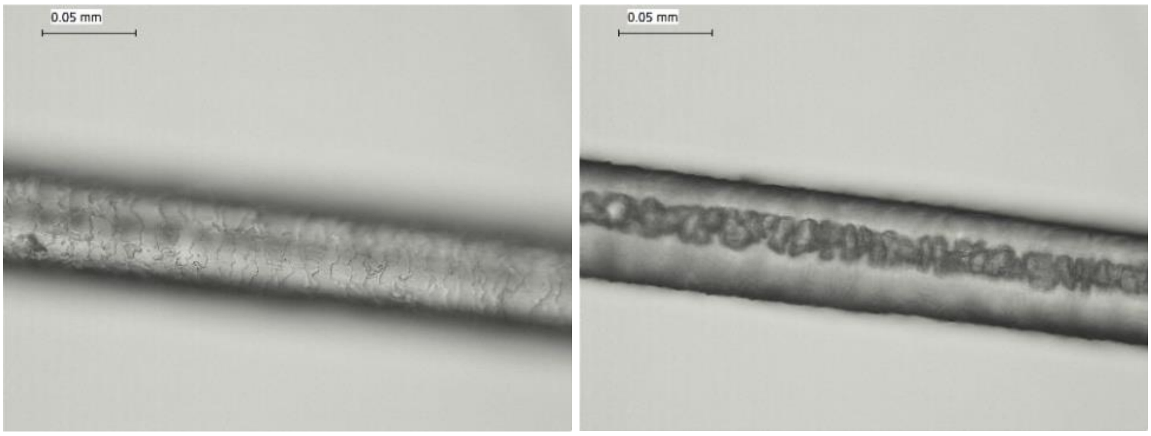


Figure 6.10. **Photomicrographs of kūri (dog) hair (Te Papa LM000828). White guard hair near the shaft tip. Left: close imbricate cuticular scaling, 400x magnification. Right: continuous ovoid medulla patterning, 400x magnification. Images by Hokimate Harwood, 2018.**

Microscopic hair identification for this study involved comparing the cuticular scaling (outer shaft) and medulla patterning (inner shaft) in cloak hairs to reference images of animal hairs (Figs. 6.9 & 6.10). Macroscopic detail of hair length, colour, and shape was analysed. The study in 2017-2019 compared reference images to a database of New Zealand mammalian hairs from kurī, fur seal (*Arctocephalus forsteri*) and sea lion (*Phocarctos hookeri*). Dog hairs were collected from a museum kurī (Te Papa LM000828) and the location, colour, and hair type recorded, including overhairs, underfur, and guard hairs as references for comparison (see Figs. 6.1 & 6.10).

Mammal hairs show considerable variation in diagnostic features between species, between hairs on a single animal, and along the hair shaft, as is the case for dog hairs that exhibit a high degree of variability between breeds, in hair colour, length, and texture (Kennedy, 1982; Petraco & Kubic, 2004). Dog hair shafts have a continuous amorphous medulla (lacking shape) that can be vacuous (empty), with differing cuticular scaling along the shaft categorised as diamond, petal, and imbricate patterns, and a cross section that is usually round (Petraco & Kubic, 2004, p. 244). Replicable hair identification keys and guides compiled by Hausman (1920), Mayer (1952), and Teerink (2003) can be useful in the field of ethnology.

Detached cloak and reference feathers and mammalian hairs were temporarily dry-mounted onto glass slides, and examined using light microscopy (Leica DM500 at 40x, 100x and then 400x magnifications). Photomicrographs were captured using a fitted microscope camera (Leica ICC50W), and the Leica LAS EZ program employed for processing images and recording measurements. Preparation and analyses were temporary, non-destructive, and replicable (Harwood, 2011a). Light microscopy is generally simple, quick, and cost-effective.

Microscopic analyses of cloak materials were conducted on site at the respective museum using detached cloak feather and hair samples. Detached (fallen) materials can create doubt as to the origins of the samples. Ideally, feather and hair identification is conducted using reference databases from different species/ subspecies (in a bird order), taken from different sample areas from the body and different positions along the hair or feather shaft for direct reference comparisons (Chandler, 1916; Hausman, 1920; Kennedy, 1982; Moore, 1988).

The premise of previous research asserted that early Māori cloaks were rudimentary, and that Māori twined clothing was a local adaptation to the New Zealand climate that developed over generations to reach a pinnacle of weaving in the 19th century (Hamilton, 1892; Hīroa, 1926; Simmons, 1968). The Waka Mātauranga framework introduced by Black (2014) encompassed the various aspects of the research in that it fostered the essence of 'Te Reo o Te Kākahu', and the relationship between the language and knowledge or kōrero (history) communicated in each cloak. The essence of understanding the language of a cloak, is interpreting what it conveyed through the skills and knowledge expressed by the weaver. It supported the questioning of these assertions of Māori clothing, with the promotion of Māori knowledge from scientific analyses and thorough multi-disciplined research. There was confirmation that early Māori weavers retained the memory and practice of twining and bird use over hundreds of years from Polynesia, and that weavers inherently inserted cultural and personal elements into each cloak that is practiced to this day, strengthening Māori ancestral ties.

6.3 Historical Examples of Early Māori Feather Cloaks Dating from 1500-1700 A.D.

For this study, six historical Māori feather cloaks dating from 1500-1700 A.D. had probable affiliations in the South Island, and at least three were originally located at remote burial sites. They filled critical gaps in knowledge of pre-European clothing, in the identification and interpretation of materials and techniques in the timeline of Māori feather cloak production and pointed to a crucial transitional period in cloak evolution.

6.3.1 Lee Island, Lake Te Anau, Fiordland cloak

***Figure 6.11*. Kākahu, fragments of a burnt cloak. Muka, brown kiwi skin and feathers, dog skin and hair; spaced single pair twining; sewing, knotting. Estimated age 16th-17th century, South Island. Found on Lee Island Lake Te Anau Fiordland, Collected 1983. Southland Museum and Art Gallery Niho o te Taniwha, Invercargill 88.258.57(a) & (b) (on right). Images by Hokimate Harwood, 2017.**

One of the oldest surviving Māori feather cloaks dating to 16th-17th century was located in the 1970s in a rock shelter on Lee Island, Lake Te Anau in Fiordland, South Island (Fig. 6.11) (Anderson, 1991a, 1991b; Hamel, 2001, p. 90). A comprehensive environmental and site examination as part of an archaeological survey in 1979 was published in *Beech Forest Hunters, The Archaeology Of Māori Rockshelter Sites On Lee Island, Lake Te Anau, In Southern New Zealand* (Anderson & McGovern-Wilson, 1991). The burnt remains of the cloak 88.258.57(a), and other related carbonised cloak fragments 88.258.57(b) as well as additional feathers, hair, and fibre fragments from the site were examined for this research in 2017 in Southland Museum and Art Gallery Niho o te Taniwha in Invercargill (Fig. 6.11). The original site material, notes, and layout were deposited in the museum with the agreement of the Waihōpai Māori committee, the Fiordland National Park Board, and the museum (Anderson, 1991a, p. 1). Iwi representatives from Kāi Tahu, Waihōpai, Ōraka Aparima, Awarua, and Hokonui were contacted and informed of the research visit to the museum to view the Lee Island cloak in 2017.

The cloak was made of scutched flax or whītau (the southern vernacular for muka), spaced single pair twining (whatu aho pātahi) and vertical strips of brown kiwi (*Apteryx* sp.) skin, and kurī (dog) skin along the neckline (Anderson, Goulding, & White, 1991, pp. 43–55; Beattie, 1920; Blackman, 2007, p. 30; Wallace, 2002, pp. 154–155). The cloak fragments were consolidated by a ‘shellac-like’ substance resulting in black, brittle, and fragile fibres (Blackman, 2007, p. 30). This carbonisation converts the material to carbon during the process of heating, burning and, or fossilisation. Most of the cloak was destroyed so it was difficult to estimate the original size; on average modern cloaks can measure over 1m in width and height.

In 2017, the larger fragment 88.258.57(a) measured 12cm long (down), and 16cm wide (across), and additional dogskin measured 4.5cm along one side (Fig. 6.11). The weft wrapped around one warp at a time and twisted in a single twine, then wrapped round the next warp. There were three warp threads per 10mm, and brown kiwi birdskin strips, measuring 3mm wide by 10mm long were fixed with the twining on every second warp (Anderson, Goulding, & White, 1991, p. 46). Along the neckline, a ball of whitish-grey coloured dog hair was recorded in the top left corner in 2017, and a dogskin strip measuring 1.5cm wide was folded over to cover both sides of the neckline attached by half-hitches to the backing (Blackman, 2007, p. 30). In 2017, the dog hair measured 4cm long x 3.5cm wide and 2cm deep (Fig. 6.11).

***Figure 6.12*. Detail of black hair-like pennaceous barbs of kiwi feathers in spaced single pair twined cloak with kiwi skin strips and dogskin neckline. Found on Lee Island Lake Te Anau Fiordland, Collected 1983. Southland Museum and Art Gallery Niho o te Taniwha, Invercargill 88.258.57(a). Images by Hokimate Harwood, 2017.**

In 2017, limited remnants of the 5cm long kiwi feathers remained except for partial brown down on some cream coloured feather shafts. Up to 10 brown kiwi feathers had been added with the skins in the twining process. There were single short shiny black hair-like fibres on the larger fragment (88.258.57(a)) (Fig. 6.12). Comparisons with Te Papa museum brown kiwi skins in 2017 confirmed these as the hair-like pennaceous barbs at the tip of back feathers from a brown kiwi (Fig. 6.13). On a skin, these back feathers measured between 5cm-5.5cm and had cream-light brown feather shafts. Brown kiwi pennaceous barbs are distinctive in that they lack the connecting hooklets or barbicels present in other contour bird feathers (see Fig. 6.8).

***Figure 6.13*. South Island Brown kiwi (*Apteryx australis australis*). No data, acquisition history unknown. Te Papa OR.001160. Right: detail of brown kiwi back feathers with cream coloured shafts and black hair-like pennaceous barbs at tips. CC BY 4.0.**

Brown kiwi are flightless endemic nocturnal ratites and were found exclusively in isolated populations due to their sedentary behaviour. Currently they are organised into four separate species and subspecies. The North Island brown kiwi (*Apteryx mantelli*) are more common, whereas the Ōkarito brown kiwi (*Apteryx rowi*) presently have a limited distribution in the Ōkarito area, up the west coast of the South Island and south of the North Island, and unknown previous distribution (Worthy, 2010a). Southern brown kiwi consists of two subspecies, Stewart Island brown kiwi (*Apteryx australis lawryi*) and South Island brown kiwi (*Apteryx australis australis*) (Fig. 6.13). It is assumed the cloak materials were acquired from the surrounding area. In which case, South Island brown kiwi was likely the source of feathers, because this taxon has a wider distribution including Fiordland and was counted in a 1983 Lee Island bird census of the area (Worthy, 2010a; Morrison & Anderson, 1991, p. 7).

Lee Island was a transition area for fowlers who abandoned prepared flax, feather bundles and skins, food preservation containers, fire residue including floral and faunal remains, and drying racks (Anderson & McGovern-Wilson, 1991, p. 79; Anderson, McGovern-Wilson, & Holdaway, 1991; Holdaway, 1991, p. 67). The lack of green kererū head and neck feathers, and orange-red kākā underwing covert feathers, suggested a particular preference for these feathers in clothing and personal articles (Holdaway, 1991, p. 65). Researchers also collected large wing and tail feather bundles of South Island kākā (*Nestor meridionalis meridionalis*), kākāpō, paradise duck (*Tadorna variegata*), and skins of kākāriki and possibly kea (*Nestor notabilis*) (Holdaway, 1991). This reflects the species richness within the area (Duff, 1952). Flax (*Phormium*) and cabbage tree (*Cordyline*) plant fibres were prominent in knotting, for binding feathers and skins, and in plaited lengths and loops (Anderson, Goulding, & White, 1991, p. 45). Both *Phormium tenax* and *P. cookianum* (wharariki) were both scarce on Lee Island, but both were likely formerly common (Anderson, Goulding, & White, 1991, p. 46).

6.3.2 Lake Hauroko, Fiordland cloak

***Figure 6.14*. Lake Hauroko cloak, detail of weaving front, showing two-ply cords and diamond hitching to secure bird skin strips. From Simmons (1968); [Pl. 13].**

An important historical feather cloak made in the 17th century was located in 1967 wrapped around a woman at a burial site in an island cave on Lake Hauroko, in the south of the Fiordland National Park just over 100km west of Invercargill, South Island (Fig. 6.14) (Simmons, 1967a, p. 367). Roger Duff and Michael Trotter of Canterbury Museum visited the cave in April 1967, and in May a team from Otago and Southland Museums including David Simmons viewed the site (Blackman, 2007, p. 29; Duff, 1967). Otago Museum staff studied and catalogued the findings with the permission of the Murihiku tribal executive (Simmons, 1967a, p. 367). Simmons (1967a, 1968) and Trotter (1972) gave comprehensive descriptions of the site and cloak (Figs. 6.14 & 6.15). The cloak was well preserved, likely due to the cool and dry sheltered environment (Hall-Jones, 1968, p. 33). The burial and cloak are still in situ, and were not personally examined for this study.

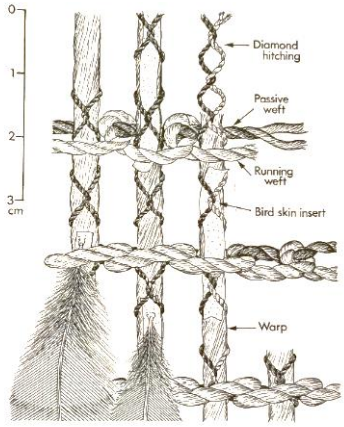


***Figure 6.15*. Lake Hauroko cloak, diagrammatic detail of cloak construction, showing spaced half-hitch horizontal weft and vertical diamond hitching down warps to secure bird skin strips. From Trotter (1972); [Fig. 9].**

The woman was covered in a flax cloak of bird and dog skin, turned inside out, with vines tied around the cloak and body (Simmons, 1967a, p. 367). Prodigious dogskin cloaks were also turned inside out to protect the wearer from the cold (Salmond, 1991, p. 409; Trotter & McCulloch, 1989, p. 68). The area it was found in was noted for its high rainfall (Blackman, 2011, p. 90). The whītau cloak measured 84cm long x 96.5cm wide, and horizontal wefts reached 117cm (Simmons, 1968, p. 4; Trotter, 1972, p. 121). The warp (whenu) threads were of rolled 2-ply muka cords 5mm thick with diamond hitching along the lengths (Fig. 6.15) (Simmons, 1967a, p. 367). Each vertical warp was diamond hitched with a 1mm thick cord along its length, and warps spaced at 10mm intervals with half-hitches wrapped around the passive weft on either side of the warp, with the rows spaced at least 1cm apart (Fig. 6.15) (Simmons, 1968, p. 4; Trotter, 1972, p. 121).


***Figure 6.16*. South Island kākā (*Nestor meridionalis meridionalis*). Dry Skin ♂. Collected by Andreas Reischek, April 1884, Dusky Sound. Te Papa OR.016682. Right: detail of belly feathers. Images by Hokimate Harwood, 2019.**

Skin strips of kākā (*Nestor meridionalis*) with red tipped feathers were fixed into the diamond hitching forming a 23-25cm band at the top and base of the cloak (Fig. 6.16) (Simmons, 1967a,

p. 367; Simmons, 1968, p. 4). Bands of green feathered kākāpō (*Strigops habroptilus*) skin were seen on both sides, and skin strips of kurī (dog) with yellow, white, and gold hairs were sewn along the neckband with needle stitching half-hitches or blanket stitch (Fig. 6.17) (Blackman, 2007, p. 30; Blackman, 2011, p. 87; Simmons, 1967a, p. 367; Simmons, 1968, p. 4). Roger Duff also observed an unconfirmed thick band of weka (*Gallirallus*) feathers on the inner collar (Hall-Jones, 1968, p. 34). The dogskin was possibly part of another garment attached to this cloak (Simmons, 1968, p. 6). Simmons (1967a) thought the middle appeared plain except for the decorative diamond hitching surrounded by feathers, not unlike modern korowai (see Fig. 6.18 & Chapter Seven) (p. 367). In contrast, Trotter (1972) believed it was originally fully covered in bird skins, like a modern kahu huruhuru (p. 125).

***Figure 6.17*. Kākāpō (*Strigops habroptilus*). New Zealand, no data. Te Papa OR.014347. Right: detail of side and upperback feathers. CC BY 4.0.**

Radiocarbon dating on a mānuka (Myrtaceae family) stake at the burial site calculated the age at 289 ± 58 years before 1950 (A.D. 1661 ± 58) (R 2025), so the garment was estimated to have been produced around the 17th century (Simmons, 1967a, p. 368; Simmons, 1968, p. 14; Trotter, 1972, p. 126). Despite its age, it was considered in good condition, as the feather colours were still vibrant (Simmons, 1967a, p. 68).

***Figure 6.18*.** **Lake Hauroko cloak replica. Baling twine, dyed chicken feathers and skin, sheep skin; cutting, dyeing, vertical diamond hitch twining, horizontal half-hitch weft twining. Made by Otago Museum staff and Dunedin Māori women's welfare league. Produced 1967, Dunedin. Otago Museum, Dunedin D96.106. Image by Hokimate Harwood, 2017.**

A replica of the Lake Hauroko cloak based on Simmons' observations was examined and imaged for this study in 2017 at Otago Museum, Dunedin (D96.106) (Fig. 6.18). It is a useful resource for studying historical Māori feather cloaks. The replica cloak measured 95cm across (wide) x 90 cm long (down). Baling twine probably formed the foundation (R. Wesley, personal communication, July 25, 2017). Brown and dyed red domestic chicken (*Gallus domesticus*) feathers and skin decorated the front and back and across the top and bottom. Dyed green chicken feathers and skin covered the sides, with sheepskin along the neck.

Māori weaving that involves 'crossing-over' techniques occur in basketry, and tukutuku panel weaving in which two smaller elements pass and cross over a larger backing element. In modern (post 1900) Māori clothing, the crossing over of the warp elements appear when two of the outer vertical warp threads carry and cross over in front of a central warp thread then returns to the original position on the side of the central warp. Instead of two active elements crossing over and then around the warp, as in the Lake Hauroko cloak, they are stopped and held in place on the side of the warp by the whatu (twine) and then crossed in front of the warp again in the next row down, known as māwhitiwhiti.

6.3.3 Central Otago twined cloak with kākāriki and dogskin strips

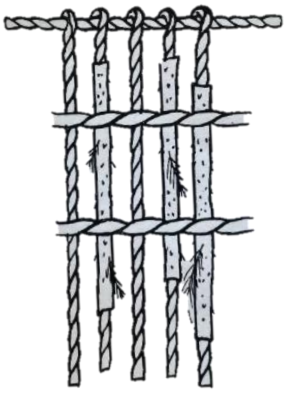


***Figure 6.19.* Representation of the construction of a spaced single pair twined cloak with kākāriki skin strips. Locality Central Otago. Otago Museum, Dunedin, registration number unknown. Modified from Simmons (1968); [Fig. 8], after Hamilton (1892); [Pl. LII, Fig. 2].**

An historical feather garment found in the South Island, Central Otago (Ōtākou) district, was constructed of spaced single pair twining (whatu aho pātahi) that secured green kākāriki (parakeet: *Cyanoramphus* sp.) skin on one side of the cloak, and adorned with dog skin around the fringes (Figs. 6.19 & 6.20) (Hamilton, 1892, Plate LII [Fig. 2]; Simmons, 1968, p. 9). Measuring 1.2m x 1.8m, it was stored in the Otago Museum when examined by Hamilton (1892), then Simmons (1968), and Mason (Anderson, Goulding, & White, 1991). It could not be located at Otago Museum for study in 2017. Previously the warps (whenu) measured 3mm across and were compact (nearly three whenu per cm), with weft rows spaced 1cm apart (Hamilton, 1892, p. 488; Simmons, 1968, p. 9). It lacked shaping, and was catalogued with an additional plain, thick, and warm flax mat sewn into the neckline, possibly for added warmth at the shoulders (Hamilton, 1892, p. 488). Simmons (1968) presumably saw this piece with a separate fragment of a dogskin garment (20cm x 24cm) stitched on one side (p. 9).

***Figure 6.20*. Kākāriki (red-crowned parakeet: *Cyanoramphus novaezelandiae*). ©Peter Reese, Matiu/ Somes Island, Wellington Harbour, 2008.**

The cloak had thin carefully cut kākāriki skin strips, most 10-15cm long running vertically down the garment (Hamilton, 1892, p. 488). The kākāriki was identified using microscopy by Dr Parker, the Otago Museum curator at the time (Hamilton, 1892). Hamilton (1892) counted nine parallel bird skin strips in 65mm, stating they were expertly placed, running continuously from the top to the bottom of the cloak and twined, deducing the cloak would have been striking, and as the thickness of the bird skin strips varied, it may have included other bird species (p. 488).

***Figure 6.21*. Kahu kurī (Māori dogskin cloak). Muka, dog skin/ hair; close single pair twining, hand sewing. Made 1750-1840, New Zealand. Bequest of Kenneth Athol Webster, 1971. Te Papa WE001591. Right: detail of twined foundation and sewn dog skin strips. All Rights Reserved.**

The cloak's upper and lower edges had dog skin strips with black, reddish brown, and white hairs twisted in, and the strips twined around the warps with the wefts (Hamilton, 1892, p. 488). Hamilton (1892) and Hīroa (1926) likened it to 19th century dogskin cloaks except that typically in these later cloaks the vertical dog skin strips were horizontally sewn (not twined) in place as observed in the missing Central Otago piece (Fig. 6.21).

Kākāriki skins located in the rock shelter on Lee Island Fiordland suggested the site was used to process selected feathers and skins for clothing and adornment (Holdaway, 1991). Te Papa's Māori cloaks produced from the late 19th century included light green kākāriki body and wing feathers in 10 out of 110 cloaks (Fig. 6.20) (Harwood, 2011a). A preliminary count of Māori cloaks made after 1800 in the International Register recorded at least 36 cloaks (of c.600) with kākāriki feathers. Red-crowned parakeets (*Cyanoramphus novaezelandiae*) were formerly widespread on the main islands and are now reduced to offshore islands, and in small scattered populations in the North and South Islands (Chambers, 2010, p. 256; Higgins, 1999).

6.3.4 Central Otago Strath Taieri cloaks

Garments preserved as burial attire for a woman were found in 1881 in a rock shelter on Cottesbrook station in Strath Taieri (Taiari), Middlemarch, Central Otago in the South Island (Hamilton, 1892, p. 487; Simmons, 1968, p. 6). The stable shelter environment had protected a woman and child from the elements for centuries (Harrowfield & Trotter, 1966; Thompson, 1949). The cloaks were first described in detail by Hamilton (1892) and Simmons (1968) at Otago Museum, as an outer garment of plaited warps with attached albatross and weka feathers (Otago Museum D10.172) (Fig. 6.22); and an inner garment of surviving sewn weka skins now in two separate segments (D10.172A & D10.172B), one of the weka skins had a seam of moa skin and feathers (D10.173). The pieces were registered at Otago Museum, Dunedin in 1910 as part of the Hocken collection (Blackman, 2007, p. 28). The pieces had not been radiocarbon dated but based on similar techniques found in the Lake Hauroko cloak, it was estimated the production date was around the 17th century (Blackman, 2007). The outer garment (D10.172), inner weka skins (D10.172A & D10.172B) and moa feathers (D10.173) were personally examined for this study at Otago Museum in 2017.

Strath Taieri outer garment of plaited warps, half-hitch weft and toroa feathers D10.172

***Figure 6.22*. Strath Taieri outer garment. Harakeke, albatross and weka feathers; plaiting, binding, horizontal half-hitch weft twining. Found 1881, Cottesbrook Station, Central Otago. Estimated age 17th century. Hocken Collection. Otago Museum, Dunedin D10.172. Image by Hokimate Harwood, 2017.**

Hamilton (1892), Hīroa (1926), Simmons (1967a, 1968), and Blackman (2007) referred to the first outer woven piece in Otago Museum (D10.172) as incomparable to any other Māori cloak recorded (Fig. 6.22). The small section of remaining outer wrapping of 'partly dressed' (roughly scutched) flax warps have maintained a golden hue on some strands due to the residual dried plant cuticle (Hamilton, 1892, p. 487; Simmons, 1968, p. 6). The vertical warps (whenu) were recorded as 9-10mm thick across and plaited three-ply to which white toroa (albatross: Diomedeidae) feathers were intertwined, inserted or wrapped around the warps (Figs. 6.22 & 6.23) (Hamilton, 1892, p. 487; Hīroa, 1926, p. 95; Simmons, 1968, p. 6).

***Figure 6.23*. Sketch of Strath Taieri kākahu (outer garment) of plaited warps, half-hitch weave with interspersed albatross feathers. From Hīroa (1925); [Fig. 34], after Hamilton (1892); [Pl. LII, Fig. 1].**

Cloaks made after the 19th century typically have 2-ply warps around 5-6mm wide (Hīroa, 1926, p. 64). The horizontal weft threads of tightly twisted whītau (muka) have held the warps together with half-hitch twining across this unique cloak (Simmons, 1968, p. 7). Observations at Otago Museum in 2017 recorded one side of the cloak, however it was evident that albatross feathers were intertwined around the warps on both sides. Simmons (1968) figured the feathers were added during and after construction (p. 7). He also observed a separate piece of plaited textile in Otago Museum with a row of half-hitches along its edge that may have originally been attached to this piece (Simmons, 1968, p. 9).

***Figure 6.24*. Detail of weaving in Strath Taieri kākahu (outer garment). Found 1881, Central Otago, Cottesbrook Station. Estimated age 17th century. Hocken Collection. Otago Museum, Dunedin D10.172. Images by H. Harwood, 2017.**

The horizontal passive straight weft (aho) ran across the vertical plaited warps and were bound together by an active running weft that was wrapped around the passive weft then the vertical warp, taking a half-hitch round the passive weft in the warp interspaces (Figs. 6.23 & 6.24) (Hīroa, 1926, p. 96). The distance of spacing between the warp threads was 6mm, in which two warps could fit into 2.4cm (Simmons, 1968, p. 6). Hīroa (1926) defined the technique as ‘spaced half-hitch weft’ weaving, although several closely woven sections were evident in 2017 (Fig. 6.24) (p. 144). As the knotting technique can be tightened (and loosened), the cloak was likely originally more robust in structure, and the degradation of fibres resulted in a loss in tension. Double half-hitching was also recorded in the piece, known as cow hitching in rope work (Blackman, 2007, p. 29). In 2017, the garment was thick, and the longest warp fragment measured 37cm down the cloak, with 17 warps and 9 weft rows remaining. The longest passive weft reached 35cm across, made of whītau (muka) that was 2-ply thick, tightly rolled (miro) and ranged from 2.5-3mm in diameter (Blackman, 2007, p. 29; Hamilton, 1892, p. 487; Simmons, 1968, p. 7). The correct orientation of the cloak was not recorded. In the original diagram, the feathers pointed up (Fig. 6.23) (Hamilton, 1892, Plate LII [Fig. 1]). Simmons (1968) suggested the fragment positioning as seen in Figure 6.22 was the passive side (Plate 15).

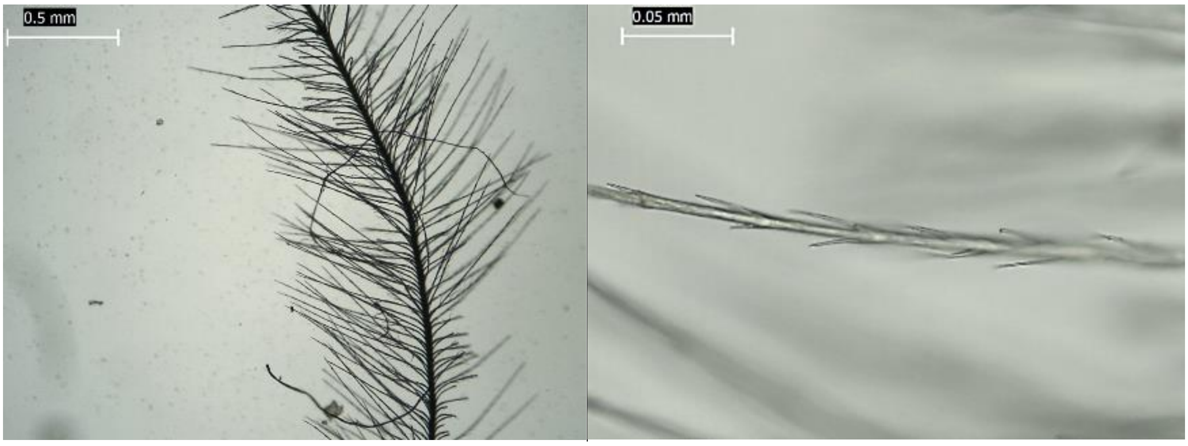


Figure 6.25. **Photomicrographs of a white albatross downy feather barb detached from the Strath Taieri kākahu (outer garment). Otago Museum, Dunedin D10.172. Left: white toroa (albatross) feather barb, mid barb, 40x magnification. Right: detail of prongs at mid barb, barbule base, 400x magnification. Images by Hokimate Harwood, 2017.**

In 2017, a detached section of white downy feather barb was collected and prepared on a temporary glass slide, then imaged and analysed with a light microscope. The barb measured 1cm long, with white short downy barbules and long prongs distributed along the barbules shortening towards the barbule tip (Fig. 6.25). Feather measurements and diagnostic features corresponded to a sea bird from the Procellariiformes order (albatrosses and petrels) (see Chapter Two). The lack of a full feather made the identification of species and feather type challenging. In depth microscopic descriptions of a Gibson's albatross (toroa: *Diomedea antipodensis gibsoni*) flank and underwing feather can be found in Chapter Two, and Harwood (2011a). In 2017, the white barbs lacked pigment in the barbules and prongs. The feather barb base had small hooklet-like barbules, and longer downy barbules with med-long prongs at mid barb. The barbule length ranged from 0.7mm-0.8mm long. At mid barb, the barbule width ranged from 0.006mm-0.003mm from the barbule base to the tip. Barbules had 3-6 sets of medium-long prongs at the base and mid barbule, then abruptly 6-8 sets of small-medium length prongs towards the barbule tip. At mid barb, longer prong pairs at the barbule base ranged from 0.03mm-0.07mm, at mid barbule 0.015mm-0.02mm, and at the barbule tip 0.009mm-0.017mm. Sometimes two asymmetric pairs of prongs were present at node sites.

***Figure 6.26*. Southern royal albatross (toroa: *Diomedea epomophora*) ventral (left) and dorsal view. Collected by Eric Prattley 1994, south of Snares Is. Gift of Ministry of Fisheries. Te Papa OR.024955. CC BY 4.0. Right: detail of upperwing coverts. Image by Hokimate Harwood, 2017.**

Toroa, southern royal albatross (*Diomedea epomophora*) and northern royal albatross (*Diomedea sanfordi*) both breed at Taiaroa Head, Otago (Fig. 6.26) (Croxall & Gales, 1998; Marchant & Higgins, 1990; Tennyson, 2010, p. 67). Measurements of an adult male northern royal albatross specimen in the Te Papa collection (OR.023474) in 2017 found that the neck feathers reached 5cm, breast 8cm, belly 10cm, and lower belly or flank 11cm. Salvin's mollymawk (*Thalassarche salvini*) and Buller's mollymawk (*Thalassarche bulleri*) both occur frequently off the Otago coast and are slightly smaller than the royals. An adult male Buller's mollymawk (Te Papa OR.029787) had white feathers 4cm long on the neck, 5cm long breast feathers, and 6cm long on the belly. The white albatross feathers on the cloak fragment ranged from between 5cm-7cm long, with white shafts wider at the feather base and 2cm of down. As one of the largest sea birds, an adult southern royal albatross covered in hundreds of pure white body feathers can weigh 9kg, and have a wingspan of 3m (Moore, 2017). The white cloak feathers appeared to have originated from the neck, breast and, or wing of an albatross.

***Figure 6.27*. Feather details in Strath Taieri kākahu (outer garment). Left: grey-brown albatross feather. Right: barred brown & cream weka feather. Estimated age 17th century. Hocken collection. Otago Museum, Dunedin D10.172. Images by Hokimate Harwood, 2017.**

A greyish-brown feather was located amongst the white albatross feathers on the D10.172 cloak in 2017 (Fig. 6.27). The feather measured around 5cm long, had light down and grey-brown pennaceous barbs, and appeared to be an albatross feather from the back or upperwing. The upperwing lesser coverts with light down on an adult southern royal albatross measured 5cm x 3cm (Fig. 6.26).

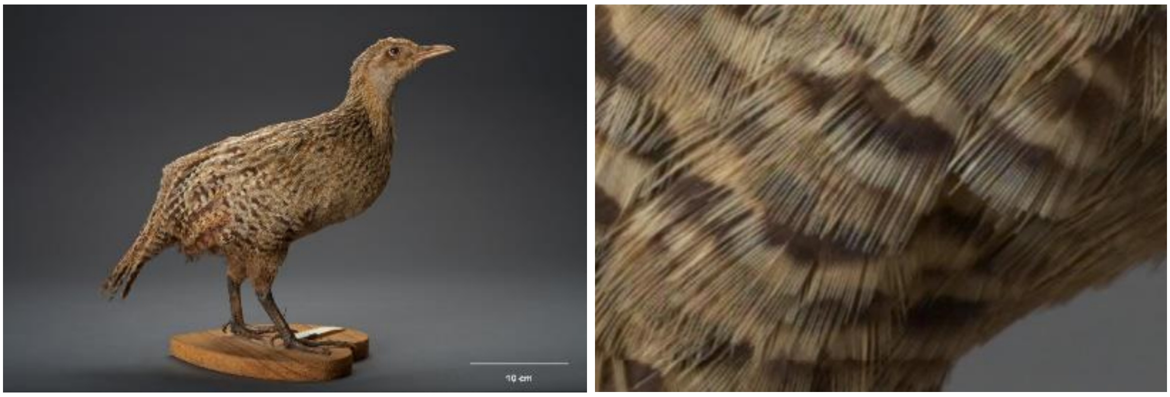


***Figure 6.28*. Buff weka (*Gallirallus australis hectori*). Collected South Island. Te Papa OR.010914. Right: detail of barred side belly feathers. CC BY 4.0.**

Weka feathers were also inserted or intertwined in some warps, most had degraded over time or were destroyed by insects; leaving a fine grey down at the feather base (Hamilton, 1892, p. 487; Hamilton, 1972, p. 281). A weka cloak feather recorded in 2017 had remnants of cream and brown barred pennaceous barbs that appeared to resemble belly feathers on the buff weka (*Gallirallus australis hectori*), and may have been accidentally transferred from the inner weka skin garment (D10.172A & D10.172B) (Figs. 6.27 & 6.28).

Feathers were possibly added to both sides for warmth and to enhance the aesthetic value, but heat would have escaped from the gaps in weaving without the skin garments (D10.172A & D10.172B) worn underneath. Simmons (1968) noted the cloak was well worn, with signs of repair indicating its importance (p. 7). Strands of dark human hair were also observed on and in the garment in 2017.

Strath Taieri inner garment of sewn weka skins

***Figure 6.29*. Central Otago inner sewn weka skin garment. Weka skin, dog skin, flax; cutting, tying, sewing. Found Cottesbrook Station, Strath Taieri, South Island, 1881. Estimated age 17th century. Hocken collection. Otago Museum, Dunedin D10.172A. Image by Hokimate Harwood, 2017.**

***Figure 6.30*. Central Otago inner sewn weka skin garment. Weka skin, flax; cutting, tying, sewing. Found Cottesbrook Station, Strath Taieri, South Island, 1881. Estimated age 17th century. Hocken collection. Otago Museum, Dunedin D.10.172B. Image by Hokimate Harwood, 2017.**

The Otago Museum inner garment consisting of two detached segments of sewn weka skins were both examined in 2017 for this study (D10.172A & D10.172B) (Figs. 6.29 & 6.30). In the late 19th century, Hamilton described this garment as consisting of five bird skins that were well prepared and dressed, and as such were still partly covered with dark weka feathers

(Hamilton, 1892, p. 487). The weka skins were folded around the edges and oversewn from the back using partially dressed whītau (flax), and a strip of degraded moa skin with pale feathers that covered one join (Hamilton, 1972, p. 282; Wallace, 2002, p. 58; Wallace, 2011, p. 56). The moa feathers have since detached from the skin and were registered separately at Otago Museum as D10.173, discussed later. In 2017, only four weka skins had survived, and feather tracts (pterolysis) were apparent on some skins, as were the wing holes.

D10.172A The smaller dark coloured weka skins


***Figure 6.31*. Central Otago inner sewn weka skin garment. Detail of weka feathers. Found Cottesbrook Station, Strath Taieri, 1881. Estimated age 17th century. Hocken collection. Otago Museum, Dunedin D10.172A. Images by Hokimate Harwood, 2017.**

The smaller of the weka skin pieces (Otago Museum D10.172A) studied in 2017 consisted of two skins sewn together measuring 30cm wide (across) and 21cm long (down) (Figs. 6.29 & 6.31). The left skin measured 12.5cm long (down) and 7cm wide (across) with a seam on the right, with limited feathers remaining. The large weka skin on the right consisted of a whole bird that measured 22cm wide (across) and 21cm long (down) (Fig. 6.31). As the feathers were facing down, the garment was oriented so the top of skin aligned with the top (head) of the bird, with the tail of the bird towards the base of the skin (garment).

***Figure 6.32*. Buff weka (*Gallirallus australis hectori*). No data. Te Papa OR.004749. Detail of throat (centre) & upperbelly (right) feathers. Images by Hokimate Harwood, 2017.**

Measurements of adult buff weka skins in the Te Papa collection (OR.004749) in 2017 ranged between 19-25cm long, from the neck to the rump (excluding the head and tail), and between 20-22cm circumference (around) the bird, measured just under the wing. Feather colour on the weka skin garment (D10.172A) ranged from tan, to light, and dark brown. Large weka feathers near the middle garment seam measured 5cm-6cm long x 1.5cm-2cm wide (Fig. 6.31). The shafts were cream, pennaceous barbs light brown, downy barbs creamy white, the downy barbules light brown, and the down towards the feather base measured 4.5cm. Weka belly feathers on a museum skin (Te Papa OR.004749) reached 5-6cm long, they had cream shafts, brown down, and lighter coloured pennaceous barbs (Fig. 6.32). On the garment (D10.172A), the wing holes were spaced 11cm apart, as on an average adult weka skin.

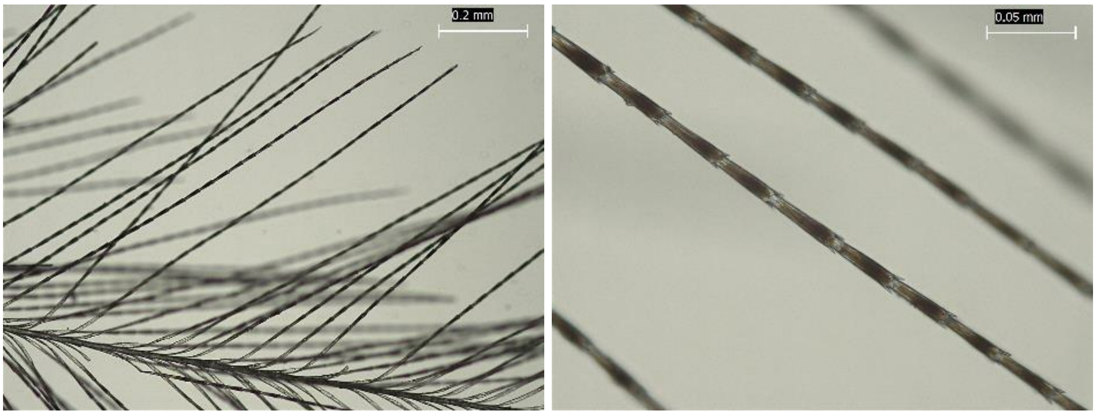


***Figure 6.33*. Photomicrographs of detached brown weka feather from Central Otago inner weka skin garment. Otago Museum, Dunedin D10.172A. Left: pigmented barbules at the feather base, barb tip, 100x magnification. Right: detail of pigmented barbules and transparent pronged node sites at the feather base, barb tip, and mid barbule, 400x magnification. Images by Hokimate Harwood, 2017.**

In 2017, a fragment of a detached brown weka feather (presumably) from the weka skin garment D10.172A was collected and placed on a temporary glass slide for microscopic analysis (Fig. 6.33). The fragment had a brown shaft, white downy barbs 1cm long, and medium length brown barbules. The barbule length at the barb base ranged between 1.6mm-

1.9mm and at mid barb, and the barb tip ranged from 1.1mm-1.2mm. The number of nodes along the barbules counted at the barb base, mid barb, and barb tip averaged 29-30 nodes per barbule. The nodes towards the barbule tip had distinct transparent prongs reaching 0.005mm. The barbule width ranged from 0.004mm-0.007mm. The brown pigmentation in the barbules extended to the nodes and pre-nodal space (before the nodes), with pigment lacking in the prongs and just after the node. This characteristic barbule pigmentation is present throughout the Gruiformes or rails. Microscopic barbule and node measurements, and pigment distribution were consistent with weka down. A detailed microscopic description of a Western weka (*Gallirallus australis australis*) feather is provided in Chapter Two and Harwood (2011a). Macroscopic features such as colouring and feather size were also consistent with weka, however the lack of a full feather made species identification challenging.

***Figure 6.34*. Dog skin seam in right corner of weka skin on Central Otago inner weka skin garment. Found Cottesbrook Station, Strath Taieri, 1881. Estimated age 17th century. Hocken collection. Otago Museum, Dunedin D10.172A. Images by Hokimate Harwood, 2017.**

In 2017, a previously unrecorded strip of mammalian skin was located on the far right of the weka skin (D10.172A) (Fig. 6.34). The mammalian skin strip measured 5.5cm long x 1cm wide and was sewn into the seam using whītau thread and had thin light yellow-brown hair measuring on average 1.5cm long. A detached hair presumably from D10.172A collected near the seam was mounted on a temporary slide in 2017 for physical and microscopic analyses. The hair sample reached 7mm long and had a dark brown shaft and yellow-brown follicle, that matched some of the hair on the garment. Microscopic analysis indicated the hair originated from a dog, based on the cuticular (outer shaft) scaling, presence of continuous ovoid bodies, and medulla (inner shaft) patterning mid shaft (Figs. 6.35 & 6.36) (Petraco & Kubic, 2004; Teerink, 2003).

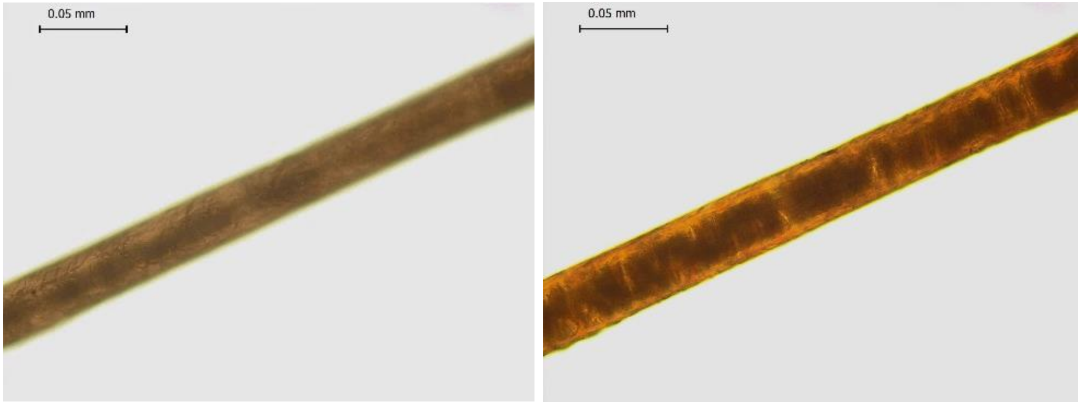


***Figure 6.35*. Photomicrographs of the cuticular scaling (left) and medulla patterning (right) in a brown kurī (dog) hair towards the tip, detached from Central Otago inner weka skin garment. Otago Museum, Dunedin D10.172A. 400x magnification. Found Cottesbrook Station, Strath Taieri, 1881. Estimated age 17th century. Hocken collection. Images by Hokimate Harwood, 2017.**

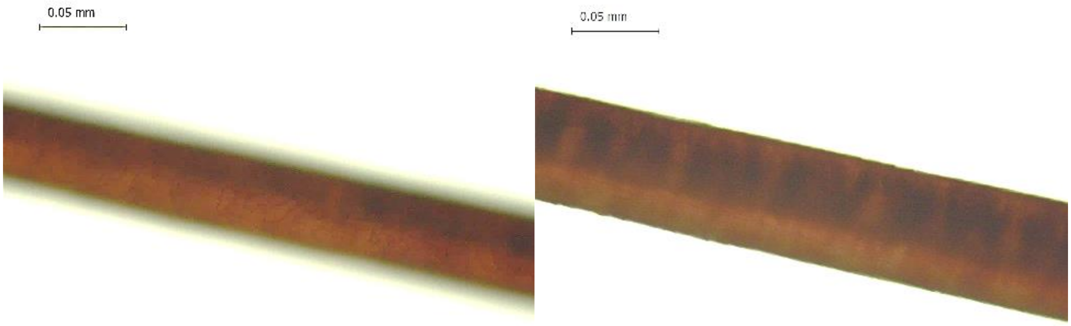


***Figure 6.36*. Photomicrographs of a brown back guard hair from a kurī (Māori dog: *Canis lupis familiaris*) hair towards the tip, with cuticular scaling (left) and medulla patterning (right). Te Papa LM000828. 400x magnification. Images by Hokimate Harwood, 2018.**

Characteristics of the mammalian hair were consistent with a kurī (dog) guard hair, the thicker outer protective hair on a mammal's skin. Guard hairs can differ in colour to the underfur on the skin. As the detached hair was darker than some of the haired skin on the garment, this suggested the lighter hair still attached was the underfur. Diagnostic features were present in the form of closely spaced imbricate cuticular scaling and continuous ovoid medulla patterning, comparable to kurī reference images (Figs. 6.35 & 6.36). The Medulla Index for the cloak and reference hairs measured more than 0.5, in that the diameter of the medulla comprised more than half the diameter of the shaft.

D10.172B larger light coloured weka skins

***Figure 6.37*. Weka feathers at the top and bottom of left-hand skin on Central Otago inner weka skin garment. Found Cottesbrook Station, Strath Taieri, 1881. Estimated age 17th century. Hocken collection. Otago Museum, Dunedin D10.172B. Images by Hokimate Harwood, 2017.**

When examined in 2017, the larger section of inner weka skin garment (D10.172B) consisted of two skins sewn together reaching 40cm total across (Fig. 6.37) (Otago Museum, 2006, pp. 50, 196). In 2017, both skins appeared lighter in colour than D10.172A. Feathers were present at the base of the skins, with small patches towards the top. The left smaller skin of D10.172B measured 18cm long (down) x 20cm across (wide) with two wing holes towards the top. The edges of the holes were 7.5cm apart, with the hole on the left measuring 2cm across and 1.5cm on the right. Assuming the holes in D10.172B were tightly cut around the wings, and the wings were in the centre of the holes, the wings were 9cm apart. This is slightly smaller than an average adult weka. Evidence of seams along the left, right, and bottom of the smaller skin were sewn with roughly scutched flax thread twisted using the rolling process (miro). The threads had been pulled or sewn through the holes, knotted, and carried to the next hole.

In 2017, the barred cream and brown weka feathers at the base of the left weka skin were observed with white shafts, dark brown down, white downy barbs, and dark brown downy barbules (Fig. 6.37). At the time of the study, many of the pennaceous barbs and patterning at the feather tips were missing. The longer cloak feathers measured 5cm long x 2cm wide, and the shorter downy feathers 2cm. The garment's weka feathers shared similarities with the buff weka skin in the Te Papa collection (OR.004749) in that the barred cream-brown feathers of the lower side belly or flank measured between 5cm-6.5cm (Fig. 6.32). Distinct cream and brown feathers at the top of the smaller skin on the left of D10.172B confirmed the skin is a buff weka and the feathers originated from the neck or lower throat (Figs. 6.32 & 6.37). The garment feathers measured 2cm long, and similar weka feathers in the museum skin measured 2cm-3cm long, and both had cream pennaceous barbs and brown spots at the feather tips, and greyish-brown down. The positioning of the wings, belly, and throat feathers revealed the skin was cut down the back of the bird.

The larger rectangular skin on the right of the Otago Museum D10.172B weka skins reached 20cm across and 21cm down in 2017. Brown weka feathers near the base of the right skin originated from the belly based on macroscopic museum skin comparisons. A skin-covered wing hole remained near the top left of the skin. The adjacent hole was cut out of the skin to create an arc shape near the top that measured 6cm deep. It is presumed the arcs in the weka skins (D10.172A & D10.172B) formed a neckline to go around the shoulders of the wearer, and the feathers pointed down. There were additional signs of seams with threading holes along the bottom and right of the skin (D10.172B), indicating the entire garment was at least two skins long (high) and at least five skins wide (across) to comfortably fit the body (Hamilton, 1892).

D10.173 Light moa feathers

***Figure 6.38*. Moa feathers from a seam on the Central Otago inner weka skin garment. Found Cottesbrook Station, Strath Taieri, 1881. Estimated age 17th century. Hocken collection. Courtesy of Otago Museum, Dunedin D10.173. Image by Hokimate Harwood, 2017.**

Hamilton (1892) initially described a narrow strip of moa (Dinornithiforme) skin with double-shafted feathers sewn over one of the weka skin seams (possibly D10.172A or D10.172B) (p. 487). He noted the moa skin was decayed, moth eaten and fragile, and measured 7.6cm long by 6.3mm wide, and still carried dark greyish down that detached upon handling (Hamilton, 1892, p. 487). The moa skin had degraded and was not available for study at Otago Museum in 2017. However, six surviving moa feathers were personally examined from this item in 2017 at Otago Museum, Dunedin (D10.173) (Fig. 6.38). Some of the feathers were broken, and the two longest feathers measured 6cm long each, and both had after-shafts, seen as a smaller additional feather growing from the base of the larger feather, a common feature in ratite feathers (Hamilton, 1894, p. 236; Rawlence, Wood, Armstrong, & Cooper, 2009; White, 1885). The feathers were observed as off-white with light yellow or cream at the tips. They resembled semi-plumes of predominantly downy barbs with undeveloped contour features, in that they lacked developed pennaceous barbs at the feather tips. The soft lighter coloured downy feathers were consistent with ventral (breast and belly) feathers on ratites. In contrast, ratite back feathers are typically more robust, with darker pronounced pennaceous barbs at the tips (see Fig. 6.13).

6.3.5 Otago, Lake Wanaka (Oanaka) bird skin cloak

In 1993, an historical burial of a woman wrapped in a bird skin cloak thought to be 350-400 years old was found in Hospital Flat, Glendhu Station, at the Southern end of Lake Wanaka (Oanaka), Otago, in the South Island (Ngarimu-Cameron, 2008; Wilson, 2014). The woman and cloak were sent to the Pathology Department at Otago University for examination and for DNA analysis to be conducted on the skins, which were apparently numerous rare and extinct bird species, however the results to date have not been verified or published (Ngarimu-Cameron, 2008; Wilson, 2014). The woman was eventually returned to her iwi for re-burial with her kākahu, therefore personal examination of the cloak and further investigations were not possible for this research. Glendhu Station is 240km from Middlemarch station where the Central Otago Strath Taieri weka skin garment in Otago Museum (D10.172A & D10.172B) was located. Both involved cave or shelter burials of women wrapped in sewn bird skin cloaks made around the 17^{th}-18^{th} centuries.

6.4 Surviving Māori Feather Cloaks Collected During Cook's Voyages 1750-1780 A.D.

The seven collated feather cloaks attributed to the New Zealand voyages of Captain James Cook were the few known Māori feather garments dating between 1750-1800. Banks' and Sparrman's collections transferred to the Museum of Ethnography (National Museums of World Culture), Stockholm, Sweden (Rydén, 1963). Cook's other collections were dispersed amongst numerous British and European public museums and private collections. Three museums in the United Kingdom hold significant historical feather cloak collections namely Pitt Rivers Museum, University of Oxford, in Oxford England that holds important Forster and Banks collections; the Museum of Archaeology and Anthropology, University of Cambridge in Cambridge, England; and the Hunterian Museum, University of Glasgow, Glasgow, Scotland. Relevant collection records and images for each cloak were provided for this research by the museums between 2017-2019.

6.4.1 National Museums of World Culture, Stockholm Sweden cloak with bird skin

***Figure 6.39*. Kaitaka (fine Māori cloak). Muka, dye, mammal skin, dog skin and hair, bird skin, tapa (bark cloth); close double pair twining, sewing, tāniko, knotting. Production mid-18th century, location unknown. Banks Collection (via Alströmer donation, 1848). Acquired on Cook's 1st voyage (1768-1771). Image courtesy of the Museum of Ethnography (National Museums of World Culture), Stockholm, Sweden 1848.01.0063.**

An 18th century kaitaka in the Museum of Ethnography in Stockholm, Sweden (1848.01.0063) is a superb example of Māori weaving (Fig. 6.39). Constructed of muka and close interlocking double pair twining, it was decorated with strips of mammal, bird and dog skin and hair, tapa (bark cloth), and a striking deep tāniko border at the base. All facets of an esteemed garment.

It was catalogued in the Banks collection and acquired by the Alströmer Museum in 1778, then Stockholm in 1848 (Rydén, 1963; Simmons, 1981, p. 33). Detailed images provided by the Museum in 2018 facilitated additional research on the cloak construction and adornment. This unique and striking cloak fuses several aspects of historical and modern weaving practices. Close (compact) single paired twining (whatu aho pātahi), has little space between the rows, as seen in dogskin cloaks made in the late 18th and early 19th centuries. Feather cloaks made from the late 19th century on typically have spaced double pair twining, whatu aho rua. The Stockholm cloak (1848.01.0063) has close double pair twining, a combination of these two techniques, producing a striking pattern rarely recorded in kākahu Māori (Fig. 6.40).

***Figure 6.40*. Kaitaka (fine Māori cloak). Left: left hand border with muka bundles. Right: detail of a middle plaited muka bundle. Images courtesy of the Museum of Ethnography (National Museums of World Culture), Stockholm, Sweden 1848.01.0063.**

The kaupapa (foundation) and neckline had sewn plaited and twisted muka bundles embellished with small bindings with white dog hair and skin now mostly missing (Fig. 6.40). The muka bundles appeared sewn into the backing and secured with half-hitch knotting. The collection records described sewn muka also on the reverse of the cloak.

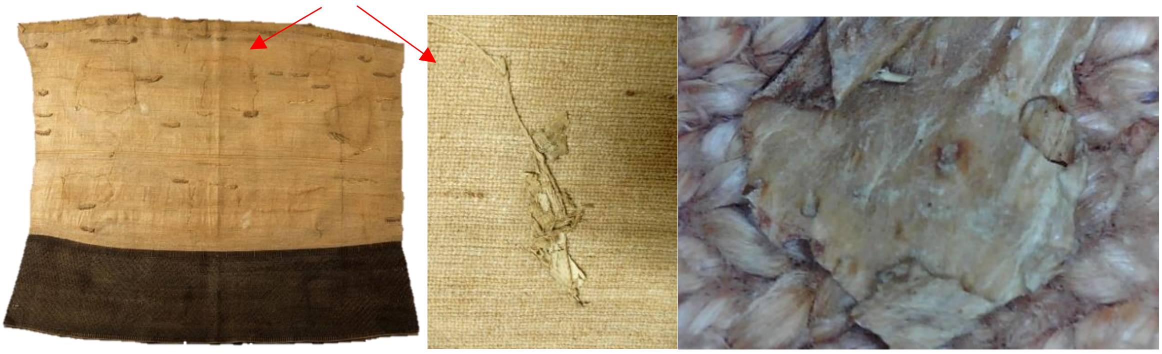


***Figure 6.41*. Detail bird skin on knotted running cord in top centre of the kaitaka (centre). Right: detail of remnant feather shafts and pterolysis (feather tracts). Images courtesy of the Museum of Ethnography (National Museums of World Culture), Stockholm, Sweden 1848.01.0063.**

The kaupapa had remnants of at least seven different-sized shapes outlined by a running muka cord with bird skins sewn, bound, or tied with half-hitched knots (Fig. 6.41). The shapes were possibly whole bird skins of unidentified species, and appeared thinner, and more fragile than the dog skin. Light-coloured calami (base of the feather shafts) remained in the bird skins.

***Figure 6.42*. Detailed images of white hair sample from muka bundle along the neckline of kaitaka cloak. Centre: detail of white hairs. Right: photomicrographs of white hair. Images courtesy of the Museum of Ethnography (National Museums of World Culture), Stockholm, Sweden, 1848.01.0063.**

No distinctive morphological feather features (barbs or feather down) were present to assist with bird species identification. However, white hair samples from a muka bundle on the neckline were analysed using light microscopy from images supplied by the Museum of Ethnography in 2018 (Fig. 6.42). Microscopic cloak hair images were compared to Te Papa reference hair images in 2018. The cloak hair images showed wide, mosaic-petal outer cuticular scaling and limited inner medulla patterning consistent with reference white dog (kurī: Te Papa LM000828) 'underfur' hair images observed near the shaft root (Fig. 6.43). Described as a fragmented medulla, the Medulla Index was less than 0.5, in that the diameter of the medulla was less than half the shaft diameter, a feature of this section of shaft.

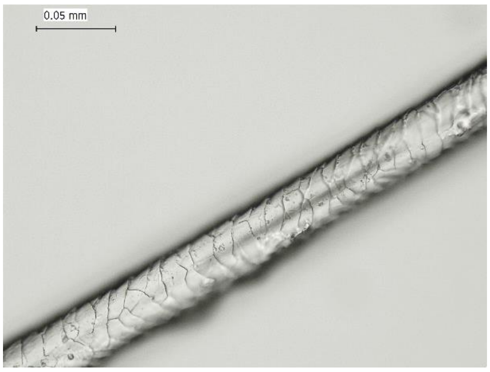


***Figure 6.43*. Photomicrograph of a white belly 'underfur' hair from a kurī (Māori dog: *Canis lupis familiaris*) hair towards the shaft root, with large cuticular scaling and fragmented medulla patterning at 400x magnification. Te Papa LM000828. Image by Hokimate Harwood, 2018.**

Human hair was also recorded amongst the muka in the tāniko border (Campbell, 2011, p. 3). Bound dyed segments of dyed tapa or bark cloth were also tied along the borders and in the tāniko with a running thread (Fig. 6.44) (Blackman, 2011, p. 92). When Cook visited New Zealand, bark cloth was not abundant in the climate, and seen as a rare, valuable trade item.

Figure 6.44. **Kaitaka (fine Māori cloak). Detail of lower tāniko border design with knotted dyed bark cloth attachment. Images courtesy of the Museum of Ethnography (National Museums of World Culture), Stockholm, Sweden, 1848.01.0063.**

The Greek key motifs that form the distinctive elaborate tāniko design at the base have created international research interest (Fig. 6.44) (Blackman, 1985, 1998, 2011; Kaeppler, 1978; Mead, 1968, p. 49; Porter, 1977; Shawcross, 1970, p. 325). Mead (1969) classified this rare kind of cloak (D8), as closely twined with body decorated with some skin strips and dominant tāniko border, as observed by Monkhouse in Poverty Bay in October 1769 (p. 48). The unusual tāniko design was technically high-quality, in that the muka threads ran on from the kaupapa (foundation) into the tāniko (Blackman, 2011, p. 92). The border measured 32cm deep, and upper and lower sections consisted of vertical zig zag patterns; and central area of three parallel lines forming concentric diamonds across the black background, so that the design was enhanced by small squared spirals of natural colour attached to the lines (Blackman, 2011).

***Figure 6.45*. Detail of tāniko design at the base of a kaitaka cloak in the National Museum of Ireland, Dublin, Ireland (AE:1882.3729). Made 1500-1800. Collected through Patten or King?, from Cook's 2nd or 3rd voyages. Trinity College Dublin Collection. Image courtesy of Rachel Hand, 2003.**

A kaitaka cloak with similar tāniko motifs is housed in the National Museum of Ireland in Dublin, Ireland (AE:1882.3729) (Fig. 6.45). This kaitaka has an estimated age of 1500-1800 A.D., it is made of muka, and measures 133cm x 183.5cm (Cherry, 1990). Based on images supplied in 2019, the tāniko border is around 24cm deep. It is understood that this cloak was collected by Dr. James Patten, the Resolution surgeon on the second voyage (1772-1775) or James King, the astronomer on the third voyage (1776-1780), who both donated their collections to the Trinity College Dublin (Freeman, 1949, p. 8; Kaeppler, 1978, p. 174; Pendergrast, 2005, p. 96). Pendergrast (2005) rightly questioned whether they had the same provenance, production history, and location based on the stylistic parallels (p. 96).

6.4.2 Museum of Archaeology and Anthropology Cambridge University dogskin cloak

***Figure 6.46*. Māori dogskin cloak. Muka, dog skin and hair, kākā feathers, dye; close single pair twining, sewing, plaiting, knotting, and binding. Produced 18th century. Cook Collection, Trinity College, Sandwich Collection. ©Museum of Archaeology and Anthropology Cambridge University, Cambridge, England D 1924.80.**

A finely made dogskin cloak held in the Museum of Archaeology and Anthropology, Cambridge University in Cambridge, England (D 1924.80) was included in the study (Fig. 6.46). It was made from muka with a backing of fine close single pair twining, referred to as pauku or pukupuku (Hīroa, 1926, p. 74). The red feathers on the side borders were not the focal point, however the addition of red feathers on a prestigious kahu kurī signifies an association with status (mana) and sacredness (tapu). Information obtained in 2017 from the museum and literature, specified it was one of the few Cook-collected cloaks fully adorned with pale dog skin strips. It was thought to be collected on Cook's first voyage on the east coast of the North Island in October 1769 and accessioned through the Trinity College Dublin collection in 1771 (Thomas et al., 2016, p. 105). It was constructed of muka (flax), and closely twined with single pairs of aho wefts and horizontally sewn to secure the vertical dog skin strips approximately 3-4mm wide and 63cm long to cover the surface (Shawcross, 1970, p. 323). There is debate as to whether the tassels and wider edge is the neck or baseline, however a running plaited cord and possible cloak ties on the neckline were recorded along the unadorned top edge (Fig. 6.46) (Shawcross, 1970, p. 322).

***Figure 6.47*. Māori dogskin cloak. Left hand side of cloak with plaited cord, bound dog hair and kākā feathers, and sewn dog skin strips (left); and feather detail (right), image by Rachel Hand, 2019. Produced 18th century. Cook Collection, Trinity College, Sandwich Collection. ©Museum of Archaeology and Anthropology Cambridge University, Cambridge, England D 1924.80.**

The cloak was personally examined for this study in 2019, and a running plaited cord along the left-hand side, with bound light-coloured dog hair and remnants of around 6 orange underwing covert feathers from a kākā were recorded (Fig. 6.47). The method of binding the feathers and hair first with muka thread, and then integrating the feather base, hair and thread into the plait resulted in feather and hair loss. The weaving direction of the plait itself was orientated towards the assumed top of the cloak, so the plait was inverted (Fig. 6.47). If the provenance is correct, that it was collected in the North Island, then the orange feathers likely originated from the underwing of the North Island kākā (*Nestor meridionalis septentrionalis*) (Fig. 6.48).

***Figure 6.48*. North Island kākā (*Nestor meridionalis septentrionalis*). Collected by D Hume, 9 June 1993. Aongatete, Bay of Plenty. Te Papa OR.025025. Right: detail of underwing (top), and belly feathers. CC BY 4.0.**

It was reminiscent of impressive kahu kurī made in the 19th century, however most of the dog hair on this cloak was absent (Figs. 6.21 & 6.49). A similar cloak collected by Cook in the

British Museum in London (Oc,NZ.125) was made of close single paired twining and covered in pale hairless dog skin strips (Thomas et al., 2016, p. 102). Roth (1923) referred to this skin as greenhide (p. 91). It had tassels on one edge, and possible cloak ties on the opposite edge. The tāniko border was covered with hairless dog skin tassels. Another fringed dogskin cloak in the Banks collection at the Museum of Ethnography in Stockholm, Sweden (1848.01.0005), had dog skin strips and a narrow tāniko border around the edges (Rydén, 1963, p. 82). These kākahu were classified as pūahi, cloaks made of hairless pale dog skin strips, a fringe on one edge with a narrow dyed tāniko border, typically underneath the fringe (Fig. 6.49) (Hamilton, 1972, p. 286; Mead, 1969, p. 47).

***Figure 6.49*. Māori dogskin cloak. Detail of sewn dog skin strips (on front); and (right) dyed twined band along base on reverse side. Produced 18th century. Cook Collection, Trinity College, Sandwich Collection. ©Museum of Archaeology and Anthropology Cambridge University, Cambridge, England D 1924.80. Images by Rachel Hand, 2019.**

In 2019, from personal examination of the Cambridge Museum dogskin cloak (D 1924.80), the dyed muka bottom border appeared to be constructed using close single pair weft twining where each dyed aho (wefts) strands appeared every alternate whenu (warp), sometimes skipping a whenu in the weaving process (Fig. 6.49).

6.4.3 The Hunterian Museum, University of Glasgow feather cloaks

GLAHM E.422 Kaitaka with kōtare feathers and wool

***Figure 6.50*.** **Kaitaka (fine Māori cloak). Muka, wool, brown kiwi, tūī, kākā, pūkeko, kōtare, kākāpō, and white feathers, dog skin/ hair; close single pair twining, tāniko, binding, sewing, knotting. Made 1760-1770. Captain John Laskey. Cook voyage collection. Hunterian Museum, University of Glasgow, Glasgow, Scotland GLAHM E.422.**

The Hunterian Museum, University of Glasgow, in Glasgow, Scotland had an exceptional close single pair twined Māori feather cloak, with dog skin and hair and fine decorated borders (GLAHM E.422) (Fig. 6.50) (Blackman, 2011). According to the museum collection records it was made in the mid-1700s. An examination of the material and technical aspects of the cloak in 2017 from images provided by the Hunterian Museum assisted in species identification and feather types.

Figure 6.51. **Detail of kaitaka feathers. Left: orange kākā and turquoise kōtare (kingfisher) feathers. Right: green kākāpō, black tūī, blue pūkeko and orange kākā feathers. Made 1760-1770. Captain John Laskey. Cook voyage collection. Hunterian Museum, University of Glasgow, Glasgow, Scotland GLAHM E.422.**

The 14 rows of feathers form a check pattern, and most feathers point towards the neckline. For this study at least seven bird species were recorded namely brown kiwi, kākā, kākāpō, unidentified white feathers (Fig. 6.55); and tūī (*Prosthemadera novaeseelandiae*), pūkeko (*Porphyrio melanotus*), and kōtare (sacred kingfisher: *Todiramphus sanctus vagans*) identified from museum images provided in 2017. In the late 18th century, all the known bird species were still common and widely distributed. The most common feathers were brown kiwi, with darker back feathers towards the top and bottom of the cloak, and downy light-coloured ventral (front) feathers in the middle. Towards the centre, orange kākā feathers, with 2-3 turquoise kōtare feathers were identified in 2017 from images (Fig. 6.51). The striking kōtare feathers originated from the upperwing or rump (uppertail) from studies of Te Papa museum birdskins in 2017 (Fig. 6.52).

***Figure 6.52*. Kōtare (sacred kingfisher: *Todiramphus sanctus*). Unknown location, no collection data. Te Papa OR.016581. CC BY 4.0. Detail of upperwing coverts (centre), and rump/ uppertail coverts (right). Images (centre & right) by Hokimate Harwood, 2017.**

Down the centre, a bunch of large mottled green kākāpō feathers were identified in 2017 as originating from the sides, back and chest of an adult bird (Figs. 6.17 & 6.51). The rest comprised of a mixture of orange and red kākā feathers from the underwing and belly respectively; and medium sized lower back and uppertail covert feathers from a tūī (Figs. 6.51 & 6.53); and large pastel blue pūkeko feathers from the breast and belly (Figs. 6.54, 6.55 & 6.56).

***Figure 6.53*. Tūī (*Prosthemadera novaeseelandiae*) on flax. ©Peter Reese, Kāpiti Island, 2006.**

Unidentified white feathers decorating the top centre of the cloak have been likened to gull (*Larus*) feathers (Fig. 6.55) (Simmons, 1981). Most New Zealand seabirds, including many vagrants, have some white plumage. Pūkeko have white vent (undertail) feathers, however based on comparisons to museum bird skins the structure and colouring is not consistent with the cloak feathers that have a brownish tinge to some feather tips (Figs. 6.54 & 6.55). The feathers appear to have originated from a shore or water bird but without personally examining the cloak, it was not possible to verify the feathers for this study. It is evident that the purpose of these contrasting white feathers was to draw the attention of the observer (Figs. 6.50 & 6.55). A concept in cloak weaving referred to as a 'colour lift' (Te Kanawa, 1992, p. 26).

***Figure 6.54*. Pūkeko (swamphen: *Porphyrio melanotus*). Right: detail of breast feathers. Image by Kathysg, 2019, from Pixabay.**

Two twining techniques were employed for feather attachment. In one method, the feathers were held straight and in place (not bent) by twining around the feather shafts (Figs. 6.51 & 6.55 (left)). This process was discussed in Chapter Five, in a twined Sisi Fale (overskirt) from Tonga, made mid to late 1700 and now part of the Forster collection, in the Pitt Rivers Museum

(1886.1.1332). In the other technique, bent feathers were secured to the adjacent warps with two strands of closely twined weft threads (aho) (Fig. 6.56). A variation of this method is the standard bent feather attachment seen in Māori cloaks from the 19th century onwards, a spaced double pair interlocking twining (Fig. 6.6). While most of the cloak feathers pointed toward the top, one bunch of pūkeko feathers towards the bottom right faced the tāniko border, inserted towards the end of the cloak making process (Fig. 6.55 (right)). There is a transition or variation of techniques and advancement of feather twining within this one kākahu.

***Figure 6.55*. Detail of kaitaka feathers. Left: detail of straight twined white feathers. Right: bent twined pūkeko, orange kākā feathers facing neck and baseline. Made 1760-1770. Captain John Laskey. Cook voyage collection. Hunterian Museum, University of Glasgow, Glasgow, Scotland GLAHM E.422.**

The feathers were likely inserted facing upwards when the cloak was constructed and remained in this position until the decorative borders were added along the bottom and sides. Secured bent feathers facing down as they are on modern cloaks are practical and visually appealing. If the cloak had been worn with the straight twined feathers pointing towards the neck, and the feathers were not bound first, this technique would result in significant feather loss.

***Figure 6.56*. Detail of borders in kaitaka. Left: tightly woven dyed side border. Centre: dog skin and hair attachments in middle of tāniko border. Right: skin strips on running cord on side border. Made 1760-1770. Captain John Laskey. Cook voyage collection. Hunterian Museum, University of Glasgow, Glasgow, Scotland GLAHM E.422.**

Attached dog skin strips ran along a cord on the right side border, while muka bindings of pale dog skin and hair decorated the bottom left corner of the tāniko border (Fig. 6.56 (centre & right)) (MacKie, 1985, p. 16; Simmons, 1981, p. 46). Fine twined weaving of intricate dyed muka also decorated the left side border (Fig. 6.56 (left)). An absence of symmetrical design could indicate that there were contributions from different weavers.

***Figure 6.57*. Detail of green wool inserted in to kaitaka. Made 1760-1770. Captain John Laskey. Cook voyage collection. Hunterian Museum, University of Glasgow, Glasgow, Scotland GLAHM E.422.**

Another interesting facet of this early kākahu was the presence of processed wool and sewing, in that the small segments of European green wool were probably added in during construction (Figs. 6.51, 6.55 & 6.57) (Lander, 2011, p. 66). There was a loosely knotted and threaded muka cord running along the base of some kiwi feathers near the cloak centre, and it was unclear if it secured the feathers or served as a decorative element (Fig. 6.56 (centre)).

***Figure 6.58*. Kaitaka paepaeroa (fine Māori cloak with vertical aho, weft rows). Muka, dye, red wool, dog skin; spaced double pair twining, sewing, threading, plaiting. Forster collection from Cook Voyage, 18th century. Pitt Rivers Museum, University of Oxford, Oxford, England 1886.1.1132. Right: detail of red wool near bottom left hand corner, twined into cloak.**

Members of the Endeavour crew gave or traded small items made of wool such as hats, blankets, and scarves, and that cloak makers subsequently picked and unravelled these items and added them to their cloaks (Lander, 2011, 2017). Cloaks with sparse red or blue wool adornments were collected on Cook's subsequent voyages (Lander, 2017). For example, a Cook-collected cloak in the Pitt Rivers Museum in Oxford (1886.1.1132) had a segment of red wool twined into the cloak during construction. Known as pāheke (to trickle or flow) design, the wool strand was twined in and out of the aho (wefts) and the two ends of the strand secured into subsequent weft rows (ara) (Fig. 6.58) (Blackman, 2011, p. 87; Lander, 2011, p. 66). Upon completion, the cloak was turned 90° on its side and final embellishments like ties were added. The wool inserts in both Cook cloaks represent an experimental stage or creative engagement at this time that reinforced Māori traditions in which new materials and techniques were continuously sought, exchanged, and introduced into artforms and adornment.

***Figure 6.59*. Shaping in the weft rows towards middle of kaitaka. Made 1760-1770. Captain John Laskey. Cook voyage collection. Hunterian Museum, University of Glasgow, Glasgow, Scotland GLAHM E.422.**

Modern kākahu have inserted short weft rows, bias, or shaping darts (aho poka) to accommodate the shoulders or hips (Blackman, 2011, p. 86). It was understood that shaping was infrequent in pre-European clothing, a later advancement (Hamilton, 1892; Hīroa, 1926; Simmons, 1968, 1981). The Hunterian Museum kaitaka (GLAHM E.422) featured shortened angled weft rows in the cloak's centre creating subtle shaping towards the top and bottom (see Figs. 6.50 & 6.59).

GLAHM E.453 Unfinished Kaitaka with two bunches of kākā feathers

***Figure 6.60*. Kaitaka (fine Māori cloak). Muka, dye, kākā feathers; close single pair twining, sewing. Captain John Laskey. Bequeathed by Dr William Hunter, 1783. Cook voyage collection. Hunterian Museum, University of Glasgow, Glasgow, Scotland GLAHM E.453.**

The Hunterian Museum, University of Glasgow had a second rare Cook-collected cloak, an unfinished kaitaka with kākā feathers (GLAHM E.453) (Fig. 6.60) (Lander, 2011, p. 65). Examined from images and information provided by the museum in 2017, this kākahu had strands of loose whenu (warps) hanging from what was possibly the intended top of the cloak. It was made of muka and close single pair twining and imaged in MacKie (1985). A thick dyed brown strand of muka was sewn 1cm in from the border. The orientation was such that the weaver possibly commenced the cloak in the top left corner and worked across and down the cloak, and the loose strands suspended underneath as the weaving progressed. Two small bunches of red kākā feathers from the underwing were 'fixed' into the backing near the centre of the cloak (Fig. 6.61) (Simmons, 1981, p. 46). The feathers appeared to have been bunched then twined 'straight' into the cloak, like the GLAHM E.422 cloak feathers, and if the cloak were to be turned 180°, the feathers would face the cloak base line, how cloaks are made today.

***Figure 6.61*. Detail of two bunches of red underwing kākā feathers near centre of cloak. Courtesy of Hunterian Museum, University of Glasgow, Glasgow, Scotland GLAHM E.453. Image courtesy of University of Auckland, by Maureen Lander, 1998.**

The insertion of red feathers in a garment, a religious item, or weapon, symbolised the importance of the piece. As discussed in Chapter Five, red feathers in Māori Society represent the sacredness and rarity of the colour, and mana or authority of the person brandishing the red feathers. The primary source of red feathers in Māori adornment derive from the red underwing and belly feathers from the kākā (Fig. 6.62).

***Figure 6.62*. South Island kākā (*Nestor meridionalis meridionalis*). Underwing, and detail of median, lesser coverts (right). Collected by G. Taylor, Rotoiti, St. Arnaud, South Island. Te Papa OR.028056. Images by Hokimate Harwood, 2007.**

There are two similarly unfinished kaitaka (finely made) cloaks in the Te Papa collection (ME007852 & ME007853). Cook purportedly collected both cloaks in 1777 on his last New Zealand voyage. A Te Papa kaitaka (ME007853) of spaced double pair twining was one of the earliest examples with this principal technique of 19th century cloak manufacture, and unfinished measured 172cm x 53.5cm (Fig. 6.63). Dyed light brown outer warp strands (whenu tāpiri) were bundled near the top edge (Fig. 6.63 (right)). The whenu tāpiri starts and finishes each weft row stipulating the intended cloak length. In each case, it appeared the cloaks were commenced at the base (bottom right) and were quickly finished in the top left, using a plait along the top, or neckline.

***Figure 6.63*. *Kaitaka* (Māori fine cloak). Muka; spaced double pair twining; plaiting, knotting. Right: detail of whenu bundle. Made 1700-1777, New Zealand. Collected on Cook's 3rd Cook voyage (1777). Gift of The Imperial Institute, 1955. Te Papa ME007853. All Right Reserved.**

Other unfinished examples exist in international museum collections. Two in the National Museum of Ireland, Dublin, Ireland (AE:1882:3731 and AE:1897.286), were part of the Trinity College Dublin collection, and both had estimated production dates of 1500-1800 A.D. (Cherry, 1990). Based on images supplied in 2019, both were constructed of muka using spaced double pair twine. The first (AE:1882:3731) was 62.3cm x 114.5cm and had a large ornate dyed reddish-brown plait adorning (at least) one side border, and several coloured or dyed brown whenu running down the length of the cloak (Cherry, 1990, p. 44). The second (AE:1897:286) reached 101cm x 155cm and was similarly adorned with reddish-brown additions (Cherry, 1990, p. 45).

Māori gifted or traded certain cloaks and unfinished work to interested European collectors, while other cloaks were only observed and not collected, or retained such as the fully covered parrot feather cloaks and birdskin clothing (Lander, 2011, p. 65). Cloaks were valuable trade items, in the 19th century, as a cloak typically took 2-3 years to finish (Salmond, 1997, p. 486).

6.4.4 Weltmuseum (World Museum) Vienna, Austria kaitaka

***Figure 6.64*. Kaitaka (fine Māori cloak). Muka, dye, brown kiwi, kākā, pūkeko and tūī feathers, dog hair and skin; close single pair twining, tāniko, binding, sewing, knotting. Production/ collection date c.1770. James Cook collection, museum acquisition date 1806. Weltmuseum Wien (World Museum Vienna), Vienna, Austria Inv. No. 25.**

A beautifully crafted kaitaka in the Weltmuseum Wien (World Museum in Vienna) in Vienna, Austria, exhibited corresponding traits with other cloaks collected by Cook around the same time. Firth (1931) catalogued a Māori cloak in the Vienna Museum with tāniko borders and red feather tufts (p. 101). Images and information provided by the museum in 2017 and 2018 assisted with this study in the identification of cloak materials using comparisons to reference images of museum bird skins to ascertain feather types. It was described as a fine flax cloak of close single paired twining with a decorative coloured tāniko border and scattered bunches of bound kākā, brown kiwi, tūī and pūkeko feathers, and tufts of light dog hair twined into the foundation (Fig. 6.64). Simmons (1981), described the feathers attachments as quillets and that they were laid on the weaving (p. 22). Scattered bunches of orange kākā covert feathers originating from the underwing covered most of the cloak. Brown kiwi body feathers were more prominent in the lower half of the cloak (Figs. 6.64 & 6.65 (left)). Towards the top left of the cloak, iridescent bluish black feathers were identified as tūī feathers from the uppertail, and pastel blue feathers in the cloak's centre left were identified as the breast or upperbelly feathers of a pūkeko in 2018 (Figs. 6.53, 6.54 & 6.65).

***Figure 6.65*. Detail of feathers in kaitaka. Left: brown kiwi, kākā, dog hair tufts. Centre: iridescent blue tūī feathers. Right: detail of pastel blue pūkeko feathers. Production/ collection date c.1770. James Cook collection, museum acquisition date 1806. Weltmuseum Wien (World Museum Vienna), Vienna, Austria Inv. No. 25.**

The kaitaka in the World Museum in Vienna, Austria (Inv. No. 25) had similar species, feather types, and feather attachment techniques as the Hunterian Museum cloaks GLAHM E.422 and GLAHM E.453. In that the Vienna cloak (Inv. No. 25) and the Hunterian Museum cloak (GLAHM E.422) both had kākā, brown kiwi, tūī, and pūkeko. They both integrated close single pair twining, and most feathers were bound together straight then twined into the foundation. In both, most feathers pointed up, with the tāniko at the base, and had at least one bunch facing down, located towards the bottom right of the cloak just above the tāniko base, blue pūkeko in the GLAHM E.422 cloak (Fig. 6.55), and orange kākā in the Vienna (Inv. No. 25) cloak. The identified bird species were still common or widespread in the North Island and South Island in the 1770s, and were popular from the 19th century on in Māori cloak production (Bull, Gaze, & Robertson, 1985; Harwood, 2011a).

Natural dyed muka borders outlined the Vienna museum cloak (Inv. No. 25), and the sides decorated with small brown sewn sections of muka were comparable to the borders in the Hunterian Museum GLAHM E.453 cloak. Also, the Vienna (Inv. No. 25) cloak was embellished with a short section of sewn muka with dog skin in the bottom left hand corner, like the dog hair adornment in the GLAHM E.422 cloak.

This style of kaitaka was consistent with a type of cloak described as a Pekerangi, defined as a kaitaka with small tufts of red feathers (or hair or wool) positioned across the cloak with a tāniko border (Hamilton, 1972, p. 285; Mead, 1969, p. 113; Simmons, 1981). Banks in October 1769 referred to this type of cloak on the east coast of the North Island as having tufts of red kākā feathers (Beaglehole, 1962a). Possibly collected on Cook's third voyage, Kaeppler (1978) understood the Vienna Museum feather cloak (Inv. No. 25) was part of Cook's collection in the Leverian Museum, London, England, which was later disseminated to different establishments at auction in 1806 (p. 171). It was purchased by Fichtel and numbered 100, then Schreibers inventory number 177, and eventually catalogued in Vienna as Inv. No. 25 (Kaeppler, 2011, p. 159). The unique attachments of the feathers pointing towards the neck and away from the tāniko base, link it to other early 19th century Māori cloaks such as the Bellinghausen collection of 1821 in the Museum of Anthropology and Ethnography (Peter the Great Museum of Anthropology and Ethnography) of the Russian Academy of Sciences (Kunstkammer) in Saint Petersburg, Russia (МАЭ №. 736-130) (see International Register) (Barratt, 1979; Simmons, 1981, p. 44).

6.4.5 Pitt Rivers Museum, Oxford, England cloaks

Pitt Rivers Museum Kahu waero with kurī and small bunches of dark feathers

***Figure 6.66*. Kahu waero (Māori cloak with dog hair tufts). Muka, dye, dog skin and hair, and feathers; close single pair twining, tāniko, plaiting, binding, twisting, half-hitch knotting, sewing. Banks' collection, collected on Cook's 1st voyage 1769-1770. Pitt Rivers Museum, University of Oxford, Oxford, England 1886.21.19.**

The Pitt Rivers Museum, University of Oxford in Oxford, England holds an exceptional dog hair cloak (1886.21.19) collected on Cook's first voyage and thought to be the only surviving kahu waero collected before 1800 (Fig. 6.66) (Wallace, 2007). It has also been called a kurī purepure (spotted dogskin cloak) (Tapsell, 2009, p. 100). A whakataukī that acknowledges the status of such a cloak states: *He māhiti ki runga, he paepaeroa ki raro, koia nei te kākahu o te Rangatira* - White dog tails cloak above, a wide tāniko cloak below, that is the dress of the chief (Mead & Grove, 2001). Joseph Banks sent his collection of Tahitian and Māori objects to Christ Church in Oxford in 1771, and they mistakenly appeared as part of Dr. Charles Pope's collection when transferred from the Ashmolean Museum to the Pitt Rivers Museum in 1886 (Coote, 2004, p. 115). The kākahu was made using muka and close single pair twining, and decorated with a deep tāniko border, and plaited and twisted bundles of muka strands to secure bunches of long white dog hair extensions across the kaupapa (Coote, 2004, p. 117). Blackman (1985) made a detailed assessment of the unique tāniko pattern. The dog hair tassels (awe) were created by knotting or close half-hitches using a muka thread (Blackman, 2011, p. 87). The cloak was personally examined and imaged in 2019, and some bundles were also twisted and plaited using the muka and hair. According to museum records, the cloak was finished along the top edge where it was plaited and folded over with lengths of dog skin.

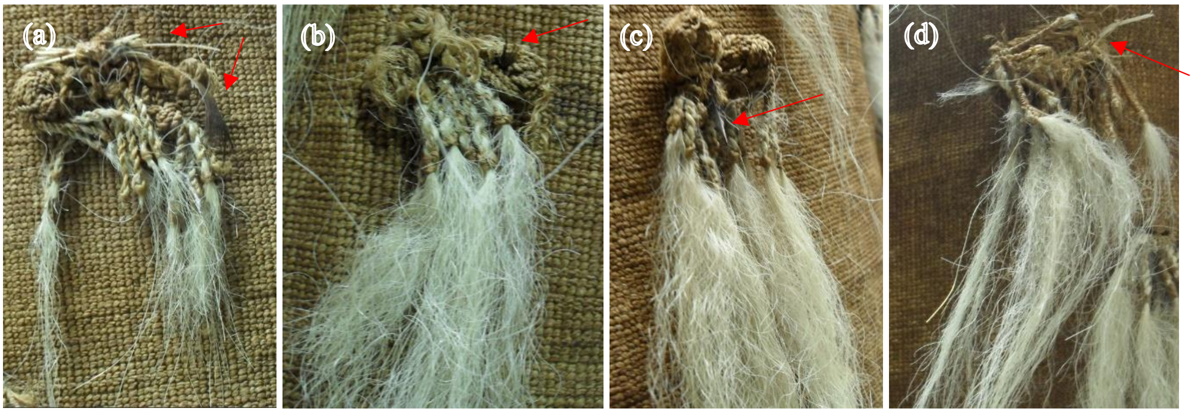


***Figure 6.67*. Feather fragments in kahu waero (Māori cloak with dog hair tufts). From left to Right: (a) Brown feather fragment in cloak centre; (b) Dark feather tip towards cloak centre; (c) Light downy feather fragment in upper middle area; (d) Feather shafts towards centre of top right-hand quarter of cloak. Banks' Collection, collected on Cook's voyage 1st voyage 1769-1770. Pitt Rivers Museum, University of Oxford, Oxford, England 1886.21.19. Images by Hokimate Harwood, 2019.**

The cloak has more than 60 tassels of dog hair (Blackman, 2011, p. 92). Located down the centre, and towards the upper right-hand corner of the cloak, a small bunch of brown feathers were recorded attached to a dog hair bundle (Fig. 6.67(a) (far left)) (J. Coote, personal communication, September 6, 2018). When the cloak was examined for this research in 2019, these feathers were located with the assistance of museum staff. Approximately seven shaft fragments were counted, bound, and fastened horizontally to the top of the muka bundle with dog hair attachments (Fig. 6.67(a)). Further inspection of the cloak in 2019 revealed at least three more dog hair bundles with feather fragments attached (Fig. 6.67). One feather had brown pennaceous barb fragments towards the tip, it had a cream coloured shaft, then on the dorsal side barbs of cream-light brown and then dark brown-black towards the feather tip, with the very tip missing. The original size would have been longer than 5cm, unfortunately not enough feathers or barbs remained for positive species identification in 2019.

***Figure 6.68*. Detail of kahu waero (Māori cloak with dog hair tufts), of muka bundles with white dog hair attached. Pitt Rivers Museum, University of Oxford, Oxford, England 1886.21.19.**

Just above and to the right of the initial dark brown feather fragments (Fig. 6.67(a)), another feather fragment 1cm long with dark brown-black pennaceous barbs at the feather tip was located in 2019 protruding from the top of a muka bundle in a dog hair adornment (Fig. 6.67(b)). The feather pointed out horizontally, and the rest of the feather fragment could not be detected. Almost directly above these two feather fragments in the upper centre of the cloak was a light grey-white downy barb protruding from the middle of the muka bundle, measuring around 2cm long (Fig. 6.67(c)). The attachment method at the top of the small muka bundle could not be determined. In 2019, two small sections of calami (the base of feather shafts), were located towards the centre of the top right-hand quarter of the cloak (Fig. 6.67(d)). At least two cream shafts were recorded with horizontal orientation at the top of a muka bundle with dog hair attachments. There was no clear indication of the attachment method. One segment of the shaft was at least 3cm long, the other 1cm, with the remaining parts of the feathers concealed underneath the muka.

***Figure 6.69*. Taiaha kura (long Māori fighting staff). Wood, red wax, muka, kākā feathers, dog hair; plaiting, knotting, binding, tying. Made 1800-1850; New Plymouth. Purchased 1904. Te Papa ME000020. Right: Detail of dog hair binding. All Rights Reserved.**

The plaited muka segments had been joined to create larger bundles sewn into the cloak's foundation, Roth (1923) assumed they were twined (Fig. 6.68) (p. 95). Roth (1923) did not observe any feathers but illustrated how the dog hair was tied together with half-hitch knotting, a process common in attaching awe (feather and hair adornment) on taiaha kura (adorned long Māori fighting staffs) (Fig. 6.69) (p. 94). Binding and knotting feathers and hair securely holds the material fibres together during movement.

Pitt Rivers Museum Dusky Sound cloak with knotted parrot and duck feathers

***Figure 6.70*. Kahu huruhuru (Māori feather cloak). Cabbage tree, muka, parrot and duck (?) feathers and skin; spaced single pair twining, cutting, knotting. Collected Dusky Sound, 1773 on Cook's 2nd Voyage. Forster collection No. 102. Pitt Rivers Museum, University of Oxford, Oxford, England 1886.1.1134.**

Roth (1923) and Hīroa (1926) discussed a cloak in the Pitt Rivers Museum in Oxford with knotted feathers and bird skin on a running cord down the vertical warps (Fig. 6.70). The museum records stated that it originally had parrot and duck feathers, and was collected by the Forsters in Dusky Bay (Sound), in the South Island on Cook's second voyage (1773), but the species had not been confirmed (Wallace, 2002, p. 178; Wallace, 2011, p. 57). Examination of images provided by the museum 2017-2018 and from personal examination in 2019, showed no diagnostic characteristics in the feather remnants to aid in species identification.

***Figure 6.71*. Tī kouka (Cabbage tree: *Cordyline australis*). Image by Hokimate Harwood, Whakatāne, Bay of Plenty, 2019.**

Pitt Rivers Museum records stated the cloak was made from the leaves of roughly scutched cabbage tree (Tī kouka: *Cordyline australis*) with a muka cord near the top (Fig. 6.71). The British Museum in London identified the plant material in 2012-2013 using scanning electron microscopy (Cartwright, 2014). Most 19th century Māori cloaks in collections comprise of flax (*Phormium*). The cloak was studied on display in 2019, and no feather barbs or down were apparent. Construction comprised of spaced whatu aho pātahi (single pair twining), with subtle shaping apparent. Commencement was from the top of the cloak, as there were no tags, except for a fringe along the base comprising of residual whenu (warps) threads. On what was once thought to be a fully feathered cloak, there were only remains of unverified feather shafts in 2019, many of which were associated with fragments of bird skin (Fig. 6.72) (Roth, 1923, p. 87). Museum records referred to skin strips bent and held in place by the wefts (aho), in other places only feathers were present, with no associated skin fragments (Roth, 1923).

***Figure 6.72*. Detail of kahu huruhuru (Māori feather cloak), bird skin and feather shaft attachments. Collected Dusky Sound, 1773 on Cook's 2nd Voyage. Forster collection No. 102. Pitt Rivers Museum, University of Oxford, Oxford, England 1886.1.1134.**

The feather attachment was depicted as parallel, vertical running threads alongside the warps sustaining the cords that bound and twined the feathers against the warps with the horizontal wefts (Figs. 6.72 & 6.73) (Roth, 1923, p. 87). The cords that originally held the feathers and skin occurred every 8-12 warps (Roth, 1923, p. 87; Simmons, 1981, p. 3). The feathers appeared to be 'attached to cords at intervals by half-hitching', with half-hitching at intervals also on a cord along the neckline (Simmons, 1981). Hīroa (1926) considered that the feather binding comprised of spaced overhand knots, where the sustaining cord was treated as a warp and incorporated into the rows of single pair twining (p. 144). Overhand knots are another name for half-hitching, except that the overhand knot is tied at the end of a cord, and the half-hitch is attached to an object like feathers, hair, or skin. Hīroa's (1930) use of the generic term ‘overhand knot’ appeared to describe feather tying methods. Mead (1969) asserted this technique rarely appeared in cloaks made after the 19th century (p. 77).

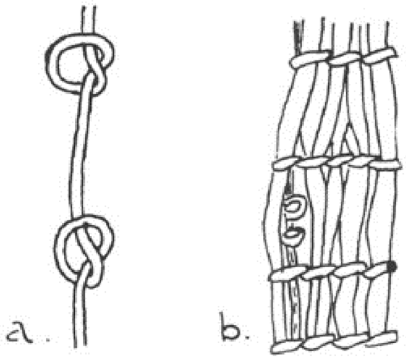


***Figure 6.73*. Diagram of feather/ skin attachments with half-hitch knots in kahu huruhuru. Collected Dusky Sound, 1773 on Cook’s 2nd Voyage. Forster collection No. 102. Pitt Rivers Museum, University of Oxford, Oxford, England 1886.1.1134. From Hīroa (1926, p. 144), after Roth (1923, p. 89); [Fig. 69].**

Loose and tight half-hitch knots have appeared in taiaha kura where feathers and dog hair were fixed to the collar (Fig. 6.69). Simmons (1981) also recorded half-hitching in dog skin attachments in the Pitt Rivers Museum cloaks No. 103 (1886.1.1132), No. 104 (1886.1.1137), and No. 106 (1886.1.1133) (p. 6). This technique is consistent with the feather attachment in fine Sāmoan feather mats, discussed in Chapter Five, that incurs feather loss (Hīroa, 1926).

The Forster collection at Pitt Rivers Museum originated from a much larger group of objects gifted by Reinhold Forster and his son Georg from Cook’s second voyage 1772-1775. It was a substantive collection of eighteenth-century Pacific art and material culture comprising of ornaments, clothing, utensils, weapons, and musical instruments from Tahiti, Tonga, New Zealand, Rapa Nui (Easter Island), the Marquesas, Vanuatu, New Caledonia, and Tierra del Fuego. The Forster collection was sent to Oxford in January 1776 along with a manuscript ‘Catalogue of Curiosities sent to Oxford’ and housed at the Ashmolean Museum until 1886 when it was transferred to the Pitt Rivers Museum. The cloak is listed on page 7 of the ‘Catalogue’, and thought to be in Georg Forster’s hand, referred to as No. 102 under the heading ‘New Zeeland’ and described as ‘a feathered coat, made of the N.Z. flax, & interwoven with parrots & ducks feathers: this from Dusky Bay’.[3]

[3] http://web.prm.ox.ac.uk/cookvoyages/index.php/en/the-objects/102-objects/new-zealand/311-1886-1-1134.html

***Figure 6.74*. Cloak label for kahu huruhuru (Māori feather cloak). Collected Dusky Sound, 1773 on Cook's 2nd Voyage. Forster collection No. 102. Pitt Rivers Museum, University of Oxford, Oxford, England 1886.1.1134.**

The Ashmolean Museum provided a handwritten label by Edward Evans, the Assistant Keeper, shortly before the 1886.1.1134 cloak was transferred to the Pitt Rivers Museum in 1885-1886 (Fig. 6.74). It read:

> 1134. New Zealand cloak of coarse manufacture, made of the native flax-plant (*Phormium tenax*, Forst.) Captain Cook's Collection, No. 102. Printed 1836 Catalogue p. 185 No. 236-257. (From the storeroom in the Old Clarendon building, 1881) Possibly one of the articles of dress, obtained at Poverty Bay, mentioned in Cook's 1st voyage, vol: 2 p. 298. (Compare the make of this article with that of the Cape, or Poncho worn by the Clapet Indians, Straights of Juan de Fuca, No. 852) and what Cook says in his 3rd voyage, vol: 2 p. 280 and pp. 325, 326.

The museum records acknowledged that this label contradicted the museum locality catalogue stating the locality was Poverty Bay and not Dusky Bay. Cook wrote of a dog skin and feather 'jacket' at Poverty Bay in 1769, but not collecting one (Cook & Smith, 1842a). The original Dusky Bay cloak could have been mislabelled or mistaken for this cloak, and the Ashmolean museum label description could have depicted the Pitt Rivers Museum cloak (1886.1.1134) with the inconspicuous feathers and skin overlooked, and cabbage tree misidentified as flax.

Few early full feather cloak sightings were recorded. Of the six weeks spent in the Dusky Sound in Autumn 1773, the Resolution crew only had one week of continued good weather, the rest of the time it rained (Forster, 2000, p. 109). This could explain the limited observations, as feather cloaks would not be considered ideal clothing in wet conditions. One interesting report from when Cook's Resolution crew were in Dusky Bay (Dusky Sound), and Georg Forster wrote on 6th April 1773 that the Māori dressed in mats of New Zealand flax plant, interwoven with feathers; their ears adorned with small pieces of white albatross skins, and stained with red ochre (earth, kōkōwai) (Forster, 2000, p. 87). In other records, Forster noted the Māori were ‘wrapped in mats made of the flax plant and woven with parrot feathers’ (Hoare, 1982, p. 249). Whether this was a regular occurrence is unknown. William Wales journaled on 11th April 1773 in Dusky Sound that the visiting men and women were clothed in a type of flax mat intermixed with feathers and referred to as *ahou* (‘ahu, or kahu) (Beaglehole, 1961, p. 780). Forster recorded an exchange on 7th April 1773 where one of the local high-ranking men in a group desired one of the crew’s European ‘boat-cloaks’, described as a large red cloak, or blanket (Forster, 2000, p. 87). Cook commissioned the production of a boat-cloak of red-baize and gifted it to the man in the following days (Forster, 2000). On 19th April 1773, in return for the esteemed red boat cloak, Captain Cook and Johann Reinhold Forster were each presented with a “new cloak or piece of cloth made of the flax plant, curiously interwoven with parrots feathers” (Forster, 2000, p. 97). William Hodges, the ship’s artist received a similar piece (Forster, 2000, p. 98). The cloaks were said to be intertwined with parrot (red kākā) feathers, with a complete covering or a few feather quillets (bunches) in the ‘South Island style’ (Simmons, 1981, p. 3).

This gesture was surely in reciprocity for the red boat cloak as red items and kākahu were integral trade items in creating and maintaining important relationships (Forster, 2000, p. 438). One of these cloaks is possibly in the Pitt Rivers Museum Oxford collection (potentially 1886.1.1134), and that the feathers had fallen off, similar to a cloak in the Kuntskamera Museum (МАЭ №. 736-129) in St. Petersburg, Russia (see International Register) (Hoare, 1982, p. 258). This was not an isolated example of an early exchange of prestigious garments. Jean-François-Marie de Surville, a French merchant captain with the French East India Company who commanded a voyage of exploration to the South Pacific on the St. Jean Baptiste 1769-1770, exchanged a red jacket for a chief’s dogskin cloak in December 1769 near Doubtless Bay, in Northland (Dunmore, 1981, p. 139; Ollivier, Hingley, & Spencer, 1987). Queen Charlotte Sound was a popular trading site for pounamu (greenstone) and obsidian (volcanic glass) between North and South Island Māori (Simmons, 1981, p. 4). It is plausible that a cloak collected in Dusky Sound was made in the South Island. Whereas a cloak collected in Queen Charlotte Sound could have North or South Island provenance (Simmons, 1981, p. 4). There were no full feather cloaks collected in Queen Charlotte, but numerous cloaks with dog skin in the corners were acquired (Colenso, 1877, p. 145; Forster, 2000, p. 122; Simmons, 1981, p. 5).

Georg Forster catalogued the birds in Dusky Sound on 17th April 1773 as coastal species including ducks, shags, oystercatchers (*Haematopus*), weka, albatrosses, gulls, and penguins (Forster, 2000, p. 96). Inland species included hawks, pigeons, and parrots, 'one small and green [kākāriki], and the other very large, greyish green with a reddish breast', possibly South Island kākā or kea (Forster, 2000). Archaeological bird remains around Dusky Sound comprised of South Island brown kiwi, kererū, kākā, a variety of ducks, oystercatchers, weka, kākāpō, kākāriki, gulls, terns (Family Sternidae), albatrosses, and penguins (Family Spheniscidae) (Coutts, 1969). Native parrots and ducks would have been common and widespread in the North and South Islands at this time. Bundles of paradise duck feathers were found in the Lee Island rock shelter site, and this species has also been incorporated into contemporary cloaks, as has the introduced mallard (*Anas* spp.) (see Chapters Seven & Eight) (Harwood, 2011a; Holdaway, 1991). The discrepancies in cloak records and provenance therefore leaves the locality of Dusky Bay (Sound) cloak as questionable without more evidence and research on the material and archival components (Simmons, 1981, p. 3).

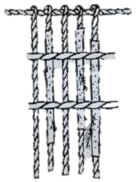
6.5 Discussion

6.5.1 Comparisons of clothing

***Figure 6.75*. Map of New Zealand with South Island recorded collection locations of surviving historical Māori feather cloaks. Map by Raymond Coory (Te Papa), 2006.**

Six surviving historical Māori feather cloaks produced between 1500-1700 A.D., found in the South Island were recorded with some collection provenance (see Fig. 6.75 & Table 6.2).

Table 6.2. **Summary of historical and Cook-collected cloaks produced from 1500-1800 A.D. containing feathers and bird skin.**

Locality of cloak found/collected	Cloak image	Description of cloak	Estimated date of cloak production	Cloak collection history	Current cloak location and identifier
Lee Island, Lake Te Anau. North Fiordland National Park. South Island. (Section 6.3.1)	 Southland Museum and Art Gallery 88.258.57(a).	Fragments of muka cloak (88.258.57 (a & b)) use spaced single pair twining to secure brown kiwi skin strips running down warps. 88.258.57(a) has dog skin along neckline using half-hitched sewing and binding.	16^{th}-17^{th} century.	Found in a cave/ rock shelter in 1979, burnt around edges near fire.	Southland Museum and Art Gallery Niho o te Taniwha 88.258.57(a) & (b).
Lake Hauroko, South Fiordland National Park. South Island. (Section 6.3.2)	 Simmons (1968)	Flax cloak has half-hitching across weft rows, and diamond hitching down warps that secure kākā and kākāpō and possibly weka? bird skin strips around the edges. Dog skin is half-hitched along neckline.	17^{th} century.	Found in a cave/ rock shelter in 1967, wrapped around a woman. Not collected, information recorded at the site.	In situ, where it was found. Replica in Otago Museum, Dunedin, D96.106.
Central Otago, South Island. (Section 6.3.3)	 From Simmons (1968) after Hamilton (1892).	Garment of spaced single pair weft twining. Kākāriki skin was placed down warps in middle of cloak and twined dog skin strips hanging from borders. Used harakeke/ muka, cutting, drying skins and knotting?	Unknown.	Unknown. Had been in Otago Museum when Hamilton (1892) initially described it.	Otago Museum, Dunedin. Currently missing.
Cottesbrook Station, Strath Taieri, Central Otago. South Island. (Section 6.3.4)	 Otago Museum D10.172	Outer garment of partly dressed plaited flax warps has placed / intertwined albatross and some weka feathers, with half-hitch weft twining across the rows.	17^{th} century?	Found in a cave/ rock shelter in 1881, wrapped around a woman.	Otago Museum, Dunedin, Hocken collection, D10.172.

Cont'd. Cottesbrook Station, Strath Taieri, Central Otago. South Island. (Section 6.3.4)	 Otago Museum D10.172A	Inner garment of two pieces of sewn weka skins (D10.172A & D10.172B) and detached moa feathers (D10.173). D10.172A has one seam of half-hitch sewn/ bound dog skin. Uses skin drying; cutting, sewing, and knotting with flax/ muka.	17th century?	Found in a cave/ rock shelter in 1881, wrapped around a woman.	Otago Museum, Dunedin, Hocken collection, D10.172A & D10.172B, D10.173.
Hospital Flat, Glendhu Station, South Lake Wanaka, Otago. South Island. (Section 6.3.5)		Garment made of numerous bird skins of rare and extinct native bird species sewn together with knotted muka thread.	17th century.	Found in a cave in 1993, wrapped around a woman.	Returned to local iwi (people) for re-burial.
COOK COLLECTED CLOAKS FROM THE 18TH CENTURY					
Queen Charlotte Sound, South Island. (Section 6.4.1)	 Museum of Ethnography, Stockholm, Sweden, 1848.01.0063	Fine muka kaitaka of close single pair twining with deep tāniko base and strips and remains of patches of bird and dog skin half-hitched across cloak. Dog skin is folded/ layered along the neckline.	Mid-18th century.	Acquired during Cook's 1st voyage in 1770, Collected Queen Charlotte Sound, South Island.	Museum of Ethnography, Stockholm, Sweden, Banks Collection 1848.01.0063.
Unknown. (Section 6.4.2)	 ©Museum of Archaeology and Anthropology, Cambridge University, England D 1924.80	Muka dogskin cloak, closely single pair twined with dog skin strips sewn to backing. Dyed twined strip and long skin tassels decorate the base. Bound dog hair and kākā feathers are secured to a plaited cord on the side border of cloak.	18th century.	Cook Collection, 1st voyage. Trinity College, Sandwich Collection.	Museum of Archaeology & Anthropology Cambridge University, Cambridge, England, D 1924.80.
Unknown. (Section 6.4.3)	 Hunterian Museum, University of Glasgow E.422	Muka kaitaka of close single pair twining. Features brown kiwi, tūī, kākāpō, pūkeko, kākā, kōtare and white feathers with segments of dog skin/ hair. Feathers are twined with bent and straight shafts, most point up. Tāniko at base, with coloured wool inserts.	18th century (made 1760-1770).	Unknown provenance. Collected on Cook Voyage. Capt. John Laskey.	Glasgow Hunterian Museum, Glasgow, Scotland, GLAHM E.422.

Unknown. (Section 6.4.3)	 Hunterian Museum, University of Glasgow E.453	Unfinished muka kaitaka of close single pair twining. Two bunches of bright red kākā feathers are attached in the middle.	18th century.	Unknown provenance. Collected on Cook voyage. Capt. John Laskey. Bequeathed by Dr William Hunter (1783).	Glasgow Hunterian Museum, Glasgow, Scotland, GLAHM E.453
Unknown (Section 6.4.4)	 Vienna Museum, Austria 25	Muka kaitaka of close single pair twining with dyed tāniko along the base and scattered tufts of dog hair, kākā, brown kiwi, pūkeko and tūī feathers mostly pointing up.	18th century (c.1770).	Collected on Cook voyage. Possibly confused with cloak from Leverian Museum.	Weltmuseum Wien (World Museum Vienna), Vienna, Austria, 25.
Unknown. (Section 6.4.5)	 Pitt Rivers Museum 1886.21.19	Kahu waero, of muka and close single pair twining with half-hitched dog skin along folded neckline. Bound dog hair attachments and at least four small bunches of dark feathers are scattered across cloak. A deep tāniko at base.	18th century.	Collected on Cook's 1st voyage in 1769-1770.	Pitt Rivers Museum Oxford University, Oxford, England, Banks Collection 1886.21.19.
Dusky Bay? (Sound), west Fiordland, South Island. (Section 6.4.5)	 Pitt Rivers Museum 1886.1.1134	Roughly scutched cabbage tree cloak using spaced single pair twining. Once thought to have parrot and duck feathers (?), now has shafts and bird skin strips attached by half hitching with plant fibre cords.	Early-mid 18th century.	Possibly confused with Poverty Bay cloak. Collected on Cook voyage in 1773-1774.	Pitt Rivers Museum, Oxford University, Oxford, England, Forster collection 1886.1.1134.

Fortunately, they all appear to still be in New Zealand. Most of the seven feather cloaks collected by Cook (1769-1777) have unverified collection locations. It should be clarified that collection sites do not necessarily refer to the area it was produced. However, similarities in some weaving, designs or styles, and feather attachments hint at associated production locations or weavers in some of the kākahu (Simmons, 1981). Only five of the thirteen cloaks made before European colonisation (pre-1800) were personally examined for this study. Fortunately, some were already well-documented, allowing for an in-depth and broader review of materials, techniques, and ethno-ornithological context. Generalisations cannot be made based on so few examples. In terms of clothing, Mead (1969) stated that the presence of a taonga (treasured item) does not mean that it was fashionable (common) as it may have been used long beforehand, or after (p. 34). However, each individual piece can provide information about the knowledge and skill of the weaver at that time pertaining to the significance of colours, designs, materials and techniques; and finally how these factors were influenced by the environment, social (iwi Māori) or cultural (tāngata Māori), and personal aspects.

6.5.2 Significance of colours, materials, and design

The feathers and skins of certain bird species appeared in several historical cloaks. Specifically, kākā (5 cloaks), brown kiwi (3), and two cloaks each have kākāpō, tūī, pūkeko, and at least one garment has confirmed weka feathers (Table 6.2). Albatross and the (light) moa feathers likely represented prestige or authority (mana) in Māori society at the time. Likewise, the rarity and chiefly associations of kurī signified societal status in most (nine of the thirteen) cloaks. The bright colours of kākāriki and kōtare (kingfisher) feathers potentially communicated a specific significance and connection of the bird to the weaver or wearer (Harwood, 2011b). Most of the species found in the cloaks reviewed here were identified in Te Papa's Māori cloaks made from the late 19th century on, except for moa, kōtare and gull (Harwood, 2011a).

For Māori, the significance of the colour red can be traced back to Polynesia in that the tapu (sacred) colour symbolises the associations with the gods (atua), chieftainship or royalty (Rangatiratanga), and mana (status and authority) (see Chapter Five). The saying *me te atua e kukā ana*, likens a Rangatira to the gods when he is adorned and anointed with red ochre and oils, and decorated with red feathers (Riley, 2001, p. 108). The long red tail streamers of red-tailed tropic birds (amokura: *Phaethon rubricauda*), and red feathered passerines and members of the parrot family, are hence desired in Polynesian and Māori featherwork.

Kākā provided bursts of red in the historical cloaks, and in small bunches, these feathers were identified in pekerangi cloaks, sometimes associated with kurī skin or hair, and also observed in Māori weaponry (Hamilton, 1972; Mead, 1969). The Museum of Ethnography in Stockholm Sweden holds a rare intact kahu kura, or red dyed cloak, part of Joseph Banks' collections acquired on Cook's first voyage, and described as a spaced single pair twined shaggy cape painted or dyed with kōkōwai (1848.01.0006) (Rydén, 1963, pp. 83–84). A similar cloak in the British Museum London (Oc1982,Q.712) is thought to be an early form of korowai, but has no confirmed provenance (Starzecka et al., 2010, p. 121). The Polynesian origin of this form of clothing could have evolved from or even pre-empted the concept of the revered *'ahu 'ula* (Hawaiʻian (red) feather cloaks) and French Polynesian *maro ura* (sacred red girdle), such as the dyed and plaited maro in the British Museum (Oc,EP.36).

Kākā feathers were confirmed in at least five historical cloaks, primarily from their reddish feathers (Table 6.2). Tail and wing feathers were recorded in the rockshelter on Lee Island, that the bundles did not include the orange-red underwing coverts indicate these were removed for clothing, adornment, or ceremonial purposes as can now be confirmed by this study (Holdaway, 1991). The orange-red underwing and red-brown belly feathers from North and South Island kākā were the primary sources of culturally and socially invaluable red feathers, and were identified in 43 of 110 Māori cloaks in Te Papa produced from the 19th century on (Harwood, 2011a). A preliminary list of around 600 cloaks in the International Register, counted around 150 cloaks with kākā feathers. Kākā underwing feathers range in colour from yellow to dark red, with varied barring patterns. To a lesser extent kea feathers were also probably used in historical cloaks. The limited number of red (crown) feathers from kākāriki were also likely too small for twining. In pre-European New Zealand, kākā were common and widespread in native forested areas, present throughout the North, South and Stewart Islands and some offshore islands, with fossils of both subspecies found throughout the two main islands and in North Island middens (Chambers, 2010; Heather & Robertson, 1996; Holdaway et al., 2001). Kākā were recorded as large flocking parrots and travelled long distances including between islands for seasonal food sources (Higgins, 1999, p. 626).

Kākā are often mentioned in whakataukī (sayings and traditions) such as *He ō kākā,* referring to the behaviour of kākā carrying a stone that contained the mana and authority of the spirit world of Hawaiki to Aotearoa (Best, 1977b, p. 196; Orbell, 2003, p. 51; Riley, 2001, p. 107). Parrots tend to vocalise loudly which is reflected in the saying *he kākā waha nui* when referring to someone who is verbose or noisy (Best, 1977b, p. 194; Orbell, 2003, p. 48; Riley, 2001, p. 111). Rare kākā of a lighter colour were known as kākā kōrako, an example can be seen in the Te Papa collection (Te Papa OR.001127); and the fully red feathered kākā were kura, or kākā kura, and considered tohu (propitious signs) or ariki, or kaea, the leaders of a flock (Best, 1977b, p. 193; Orbell, 2003, p. 49; Riley, 2001, pp. 109, 113; Williams, 1906). Such birds were so revered by Māori that they were singled out, as in an infamous Ngāti Urunumia (Ngāti Maniapoto) command "Ka eke te kākā parakiwai; kaua e takiritia. Engari ka eke te kākā kura; takiritia!" in that "if an ordinary kākā should appear, do not snare it, but if a kākā kura comes - snare it!", referring to the capture of a Ngāti Maru chief (Best, 1908, p. 261; Smith, 1912, p. 98). Kura was also another term for chief (Williams, 1957). Some captured kākā were kept as pets (mōkai) or decoys trained to lure other birds, as their intelligence and ability to talk was also seen as another favourable quality for Māori (Best, 1977b, p. 201).

***Figure 6.76*. Kahu kiwi (kiwi feather cloak). Muka, dye, brown kiwi feathers (including white albino) feathers; spaced double pair twining, plaiting. Made 1800-1900. Te Papa ME001378. All Rights Reserved.**

White (and albino) feathers, brown (brown kiwi and weka), and red kākā feathers were the most common feather colours recorded in this small study of historical Māori cloaks (Table 6.2). The light coloured moa feathers from skin strips (D10.173) originally covered the seam in an historical cloak in the Otago museum (possibly D10.172A/B). Albino (white) brown kiwi feathers appear in kahu kiwi (kiwi feather cloaks) as a colour contrast or talking point, and typically do not fully cover a cloak (Fig. 6.76) (Harwood, 2011a). Contrasting coloured albino feathers in a cloak augments the aesthetic value in the design, and spiritual significance in the colour white. It also reflects the unique and rare quality of white feathers, elevating the status of the cloak and therefore wearer. New Zealand birds that displayed leucism, albinism, or abnormal colouring were revered by iwi Māori. Māori had albino birds as pets that were coveted and treasured (Buller, 1888a). Highly valued birds such as brown kiwi, kākā, kākāpō, kererū and tūī exhibited relatively common forms of colour mutations, increasing their inherent value. Before European arrival, brown kiwi varied from albino white birds, to birds with some white feathers, light cream, light brown, to rusty brown feathers, to almost black plumage. Kākā ranged from albino white, to partial yellow, orange, and bright and dark red colouring (Buller, 1888a, p. 152). A genetically recessive albino mutation inhibits pigment (melanin) development that can result in the beak, feet, and eyes appearing red or pink and the feathers white (Fig. 6.77). Alternatively, leucism can be caused by a dominant genetic trait and is defined as a complete lack of pigment in all or part of the plumage (Guay, Potvin, & Robinson, 2012). These abnormalities can be associated with genetic mutation, diet, age, disease, parasites, and even injury (Guay et al., 2012).

***Figure 6.77*. Detail of albino North Island brown kiwi (*Apteryx mantelli*) feathers. Dry skin, ventral detail. Collected by Mr Bell, 17 October 1971, Whitianga, Coromandel Peninsula, New Zealand. Te Papa OR.016533. Image by Jean-Claude Stahl (Te Papa), 2016.**

Other coloured feathers of note included green kākāriki and kākāpō, blue pūkeko and kōtare, black tūī and then brown kiwi and weka, and the dark unidentified feathers in the Pitt Rivers Museum kahu waero (1886.21.19). The few earlier cloaks appeared to have fully covered feathered skins for warmth but would have made movement challenging, whereas the Cook cloaks had small feather bunches as the close (compact) twined weaving provided the required warmth and comfort. Further to this, 19th century cloaks had variations of feather coverings and spaced weaving, when warmth in cloaks was no longer a concern with the introduction of European materials and clothing.

Kākāpō skin and feathers were identified in at least two historical cloaks dating from the 17th and 18th centuries (see Table 6.2). The mottled green feathers were only identified in one (out of 110) of Te Papa's Māori cloaks (Harwood, 2011a). Listed in the International Register the Te Papa cloak (ME014499) was probably made in the late 19th century in the North Island. Natural kākāpō distribution included the North and South Islands at all altitudes until the late 1800s, however archaeological remains indicate kākāpō were not that prominent in Central Otago and Canterbury plains (Chambers, 2010, p. 249; Heather & Robertson, 1996; Higgins, 1999, p. 635; Holdaway et al., 2001; Wood, 2006). Māori travelled between the North and South Islands to acquire and trade in pounamu, seal, and kākāpō skins and feathers to be fashioned into prestigious cloaks (Best, 1908; Best, 1977b, p. 174; Tipa, 2006, p. 194). The mention of kākāpō cloaks in whakataukī, and the presence of kākāpō feather bundles in the Lee Island rock shelter site intimates kākāpō skins and feathers have been utilised in adornment and fine clothing for several centuries (Holdaway, 1991). The whakataukī 'Me ka uhi rānei koe ki te huruhuru kākāpō pū mai o te tonga' applied to a person complaining of the cold, as bird skin was a garment of warmth and prestige; the saying was also a lament for orators honouring the passing of a distinguished person (Grey, 1853, p. 329; Orbell, 2003).

The identification of brown kiwi skin and feathers in at least three historical cloaks reflects their ongoing importance in prestigious kākahu (Table 6.2). At least one historic cloak in Southland Museum and Art Gallery Niho o te Taniwha (88.258.57(a) & 88.258.57 (b)), probably used South Island brown kiwi, and resembled a modern kahu kiwi in its original state. The two Cook-collected cloaks with brown kiwi, in Vienna Museum Austria (Inv. No. 25) and Hunterian Museum in Glasgow, Scotland (GLAHM E.422), have unconfirmed provenance yet similarities in feather use indicate they originated from the same area. Brown kiwi body feathers were identified in 52 (of 110) Māori cloaks in Te Papa's collection made from the 19th century (Harwood, 2011a). In the International Register they were the most common cloak species to date, counted in roughly half of the (c.600) cloaks. Historically North Island brown kiwi were common throughout the North Island in late Pleistocene and Holocene fossil and midden remains (Worthy, 2010a, p. 20). Adult birds are described as sedentary and territorial throughout the year (Marchant & Higgins, 1990, p. 73). Similarly, South Island brown kiwi were formerly abundant across the South Island at low elevations (Worthy, 2010a, p. 21). There are clear genetic and morphological distinctions between North Island, Ōkarito, and Southern brown kiwi in that the plumage of the smaller North Island species has a rougher texture and is more reddish brown, whereas the larger South Island kiwi have lighter greyish brown plumage with dark feather margins (Buller, 1888b; Marchant & Higgins, 1990; Worthy, 2010a). Specific names for kiwi, include kiwikura and kiwi nui; tokoeka for Southern brown kiwi; rowi for Ōkarito brown kiwi; roa for great spotted kiwi (*Apteryx haastii*); and kiwi pukupuku for little spotted kiwi (*Apteryx owenii*) (Best, 1977b, p. 166; Buller, 1888b, p. 322; Orbell, 2003, p. 28; Worthy, 2010a, p. 355). Some of the traits or appearance of kiwi indicated the importance of the bird, Buller (1888b) recorded Māori calling a reddish kiwi in the Pirongia mountains a 'kiwikura', pertaining to the colour and (hence) importance of the bird (p. 310).

Around 500 years ago, several species of brown kiwi and moa present in the South Island were likely taken for food, and the feathers and skins subsequently fashioned into clothing (see Table 6.2) (Worthy, 2010a). Moa comprised of at least ten species of birds in the Dinornithiformes order, and were a major component of Māori diet and culture; their giant stature unlike any other Polynesian birds, with larger birds weighing 25-250kg and reaching 3m (Holdaway, 1989; Worthy, 2010b; Worthy & Holdaway, 2002). The smallest, extinct little bush moa (*Anomalopteryx didiformis*) was estimated to be the size of a turkey (*Meleagris gallopavo*) (Szabo, 2017a). Moa were possibly named after fowl in the Pacific because it was common, and frequently eaten, and chicken hackle feathers have a similar structure to smaller ratite feathers (see Chapter Five). Kuranui was an alternate North Island name for moa, possibly referring to its importance (kura) and large size (nui) (Best, 1977b, p. 183; Hongi, 1916, p. 66).

Ratite feathers have a unique structure and Māori would have favoured the large warm skins for adornment and warmth. The significance of moa feathers was recorded by British missionary William Colenso (1811-1899) in the line from one old waiata (song): *Ko te manu hou nei e, te moa, hei tia iho mo taku rangi*, where a person refers to a moa feather(s), and placement on their head (Best, 1977b, p. 183). Large red moa feathers also adorned the hair of deceased Rangatira (chief/ leader) on the east coast of the North Island, the feathers 'te rau o piopio' (the feather of piopio), represented the last of the species before their extinction 500 years ago (Best, 1905; Colenso, 1879; Gudgeon, 1897; Hill, 1913). Despite having only one example of clothing to study, the significance of moa feathers in a Māori garment cannot be understated. Archaeological evidence fuels modern speculation that moa were purely a food source, exploited with little consideration for their broader cultural importance for Māori. Yet, moa remain in the collective memory of iwi Māori. Whakataukī and pūrākau (sayings and traditions) like *kua ngaro i te moa*, laments the loss of these birds. Where timeless moa depictions in rock art (Fig. 6.4), personal adornment, and incorporation into clothing implies a stronger connection that is yet to be fully explored.

Few moa feathers in museum collections have verified species attribution (Rawlence, Wood, Scofield, Fraser, & Tennyson, 2012, p. 23). Determining the moa species in the Otago Museum cloak (D10.173) would involve more detailed scientific analyses, as there is little distinction between moa and kiwi feather down using light microscopy (see Chapter Two). Therefore, until further positive identifications of species and feather types in museum specimens occur, alternative methods are proposed such as genetic analysis.

The moa feathers in Otago Museum (D10.173) studied in 2017 appeared almost white. No species of moa are considered to have naturally been this light or white, so this was possibly a genetic mutation, or a result of fading (A. Tennyson, personal communication, November 19, 2018). Feather colour is still poorly known for some moa species, with variations in feather colour and size apparent on the same bird and between species based on the diversity and morphology of species, size, shape and habitats (see Table 6.3) (Anderson, 1989, p. 69). A moa feather found in a Lake Wakatipu cave in Otago was pure white, and some upland moa feathers in Otago Museum (Av10791.1) are also light coloured (Rawlence et al., 2009; White, 1885, p. 83). Moa plumage ranged from white, cream, grey, reddish brown, brown, dark red, reddish to chestnut, dark brown, and black and dark purple (Anderson, 1989, p. 72; Hamilton, 1894, p. 236; White, 1885, p. 83). The majority resembled brown kiwi, tan to light brown down at the feather base, changing to dark brown then black at the very tip (Fig. 6.13) (Rawlence et al., 2009). The down is prominent, and there are a lack of barbules at the feather tip (pennaceous barbs) creating a hair-like appearance (Rawlence et al., 2009).

Hamilton (1892) acknowledged the significance of the Strath Taieri cloak as the first (and only known) example of moa in Māori clothing. Simmons (1968) speculated that as Māori are drawn to the unique, that moa were already in decline when it was used, and that moa skin would have been a highly regarded item, rather than just functioning as insulation in the garment. All moa species were extinct by 1600; seven of which were in the South Island, with numerous sites with moa remains were distributed throughout the Otago coast and inland (Table 6.3) (Anderson, 1989; Worthy, 2010b).

Table 6.3. **List of possible South Island moa species likely used in Strath Taieri garment D10.173 (Otago Museum, Dunedin).**

Species	**Distribution and habitat**	**Known physical/ feather characteristics**	**Reference/ Source**
Little bush moa *Anomalopteryx didiformis* (Owen, 1843)	Formerly widespread in closed canopy forests, found in fossil sites and middens, rare in Otago coastal dunes.	The little bush moa was lightly-built. Its legs were bare and scaly, and it had shaggy hair-like body feathers. Yellowish brown feathers. Aftershafts present.	1. Worthy, T. H. (2010b, p. 12). 2. Szabo, M. J. (2017b). Little bush moa. In C. M. Miskelly (Ed.), *New Zealand Birds Online*.
Upland moa *Megalapteryx didinus* (Owen, 1882)	South Island only, found in fossil sites and middens, common in subalpine zones especially Otago.	A relatively small, slender moa with mottled plumage from the base of the bill to lower legs. Feathers range from grey at the base deepening to reddish-brown at the tip some purple, various shades of brown with light tips, or tan brown with dark tips.	1. Worthy, T. H. (2010b, p. 13). 2. Szabo, M. J. (2017e). Upland moa. In C. M. Miskelly (Ed.), *New Zealand Birds Online*. 3. Rawlence et al. (2012)
Heavy-footed moa *Pachyornis elephantopus* (Owen, 1856)	Identified in South Island fossil sites and middens. In subalpine area mainly, also Southland dunes.	Large and stocky with shaggy hair-like feathers. Had speckled patterning like the upland moa, or plain or slightly streaked. Feather dark brown-black at base, white at tip.	1. Worthy, T. H. (2010b, p. 14). 2. Rawlence et al. (2012). 3. Szabo, M. J. (2015). Heavy-footed moa. In C. M. Miskelly (Ed.), *New Zealand Birds Online*.
Crested moa *Pachyornis australis* Oliver, 1949	Found in South Island fossil sites. Inhabited subalpine shrublands and grasslands, coastal dunelands in Southland.	Large and the only species to have a crest feathers growing from the top of the skull, possibly used for courtship.	1. Worthy, T. H. (2010b, p. 14). 2. Szabo, M. J. (2013). Crested moa. In C. M. Miskelly (Ed.), *New Zealand Birds Online*.
Eastern moa *Emeus crassus* (Owen, 1846)	Found in fossil sites and middens. In South Island, only east of the Southern Alps in lowland areas.	Relatively short-legged, bulky, medium-sized. The shaggy body feathers extended on to the upper leg. Feathers tan brown at the base with dark tips.	1. Worthy, T. H. (2010b, p. 15). 2. Rawlence et al. (2012). 3. Szabo, M. J. (2017a). Eastern moa. In C. M. Miskelly (Ed.), *New Zealand Birds Online*.
Stout-legged moa *Eurapteryx curtus gravis* (Owen, 1870)	Found in South Island fossil sites and middens. Once more common in dry eastern regions.	Short-legged, bulky moa. Feathers had plain or slightly streaked plumage. Feathers tan brown at base with dark tips.	1. Worthy, T. H. (2010b, p. 16). 2. Rawlence et al. (2012). 3. Szabo, M. J. (2017d). Stout-legged moa. In C. M. Miskelly (Ed.), *New Zealand Birds Online*.
South Island giant moa *Dinornis robustus* (Owen, 1846)	Found in South Island fossil sites including dunes, caves, swamp sites and middens. Widespread. Largest were in lowlands and eastern regions.	Very tall, relatively slender moa, (♀ 2m at the back, ♂ 1m). Feathers had plain or slightly streaky appearance. Aftershafts present. Long, silky, and delicate.	1. Worthy, T. H. (2010b, p. 18). 2. Szabo, M. J. (2017c). South Island giant moa. In C. M. Miskelly (Ed.), *New Zealand Birds Online*.

***Figure 6.78*. Upland moa? (*Megalapteryx didinus*) feathers. Collected Takahē Valley, Fiordland South Island, 1949. Te Papa S.027950. CC BY 4.0.**

One of the more studied moa species, the upland moa (*Megalapteryx didinus*) were restricted to the South Island only, they were common in subalpine zones (between montane forests and alpine grasslands) especially in the north-west Nelson, Fiordland, and Otago where fossils were found, but uncommon in eastern and lowland areas (Table 6.3) (Allen, Bellingham, Holdaway, & Wiser, 2013, p. 34; Worthy, 1998; Worthy, 2010b, p. 13). Intact upland moa feathers found in Takahē Valley in Fiordland (Te Papa S.027950) ranged from 10-12cm long with distinct colouring and pennaceous barbs at the tips (Fig. 6.78). Some moa feathers can reach 20cm long, the longest Otago Museum cloak feathers (D10.173) were 6cm (Hutton, 1871, p. 173).

***Figure 6.79*. Kahu weka (weka feather cloak). Candlewick, weka & albatross feathers, wool; spaced double pair twining, plaiting. Made after 1800. North Island. Purchased 1979. Te Papa ME014161. All Rights Reserved.**

The Strath Taieri cloak in Otago Museum (D10.172) contained both albatross and weka feathers (Table 6.2). Around 30 cloaks, of approximately 600 cloaks in the International Register feature weka feathers. Of these, 12 cloaks are held in the Te Papa collections (Harwood, 2011a). There is an example of a kahu weka with albatross feather borders at Te Papa (ME014161) (Fig. 6.79). The majority of the weka feathers in the Te Papa cloaks were made after 1800 and likely incorporated North Island weka (*Gallirallus australis greyi*) as the identified feathers were chestnut brown, and not the darker (western weka) and lighter (buff weka) feathers seen in their southern counterparts (Marchant & Higgins, 1993; Worthy, 2010c).

The four subspecies of weka were formerly widespread throughout the North and South Islands and Stewart Island (Rakiura), differing in distribution and plumage. The two South Island subspecies vary in size and have light to dark plumage depending on rainfall gradients (Worthy, 2010c, p. 181). Western weka (*Gallirallus australis australis*) are generally darker, and were formerly widespread throughout Nelson, Marlborough, West Coast, and Fiordland regions where it has light and dark morphs and are presently declining in numbers and distribution (Worthy, 2010c, p. 181). Buff weka (*Gallirallus australis hectori*) are lighter in colour and were found throughout the eastern areas of Marlborough to Southland where there is low rainfall, however numbers have since died out on the main islands (Worthy, 2010c, p. 183). Weka are generally flightless and sedentary, and limited to territories for most of the year (Marchant & Higgins, 1993, p. 508). At the time the Strath Taieri garment was made both southern subspecies occupied the South Island, however buff weka appeared to have been utilised in the garment feathers (Otago Museum D10.172B) based on the patterning and lighter colouring. The unconfirmed weka feathers in the Lake Hauroko burial cloak reiterates a possible early preference for this bird.

White albatross feathers were identified in at least one of the 110 Te Papa museum's Māori feather cloaks studied in 2007 (Harwood, 2011a). It is difficult to gauge just how common they were in kākahu, however cloaks covered in albatross feathers (kahu toroa) were certainly recorded and named accordingly (Hamilton, 1972, p. 286). White toroa feathers decorated waka (vessels), and feathers and skin promote the enhancement of a person's appearance validating their position, hence the whakataukī: *Toroa e! Toroa whakapai tangata: Huia e! Huia tangata kotahi* (Best, 1977b, p. 123; Orbell, 2003). Toroa was also the name of the eponymous ancestor and great ocean navigator and Rangatira of the Mataatua waka.

Little is recorded of Māori historically working with kōtare feathers, however kōtare, penguin, and kiwi feathers were attached to trolling fish-hook lures (pā kahawai) (Best, 1977a). The Māori diet did not casually include the adult kōtare birds as they eat geckos, which are associated with death (Best, 1908, p. 272). There are also practical reasons why Māori refrain from eating carnivorous birds, in that fruit and nectar-eating birds are more appetising. Some Māori consider kōtare as an omen or messenger of news pertaining to death, possibly because of their supreme predatory skills (Orbell, 2003, p. 111). In the Society Islands, the kingfisher and heron were sacred, and embodied the gods when they fed on sacrificial offerings, as discussed in Chapter Five (Ellis, 1833, p. 258). Addressed as 'E Atua' (god) in the islands, these birds were respected and revered, and not hunted (Cook & Smith, 1842a, p. 105). It has been theorised the royal blue feather cloaks in Rapa comprised of blue kingfisher feathers (Cameron, 2012, p. 102). In Tierra del Fuego (an archipelago of Chile), the indigenous peoples also had a 'superstitious regard' for kingfishers and herons (Forster, 1996, p. 140). The contrasting bright coloured feathers offer an interesting dynamic to the tapestry of the Hunterian Museum GLAHM E.422 cloak, and the insertion of concealed or contrasting feathers point to a personal relationship between the bird and weaver, in that the weaver purposefully selected this species and feathers (Harwood, 2011b). Kōtare are currently common and widespread in the North Island (except the central plateau) and along the North and East coasts of the South Island, however historic distribution is more ambiguous with few Holocene fossils, indicating they may have colonised New Zealand relatively recently or were limited to coastal habitats before deforestation between the years 1400-1600 A.D. (Atkinson & Millener, 1991, p. 163; Gill, 2010a, p. 273; Higgins, 1999, p. 1182; Holdaway et al., 2001, p. 136; Robertson, Hyvönen, Fraser, & Pickard, 2007).

Tūī and pūkeko were counted in the same two historical cloaks (see Table 6.2). Striking iridescent bluish-black body and wing feathers from the tūī were identified in 35 of Te Papa's Māori cloaks, and over 100 (of around 600) cloaks in the International Register made from the 19^{th} century onwards (Harwood, 2011a). Tūī are the largest and most widely distributed endemic honeyeater, efficiently adapting to modified environments since human arrival (Higgins, Peter, & Steele, 2001). Historically found throughout the North and South Islands in subfossil remains, tūī are the most abundant passerine in midden sites (Gill, 2010b, p. 291; Heather & Robertson, 1996, p. 405). Much like the kererū, tūī were a highly regarded food, cooked and potted, the sweetened meat was relished for months (Best, 1977b; Orbell, 2003, p. 66). Admired for their boldness and skilled aviation in chasing other birds, called 'manu tute', their loud proficient vocalisations were compared to a person with impressive oratory skills and when caught some were kept as pets or mōkai and trained to talk (Best, 1977b; Orbell, 2003). Early explorers understood this bird to have a relationship with the gods (Forster, 2000).

Ventral blue, and some dorsal black and white vent (undertail) feathers from pūkeko were identified in 11 of Te Papa's cloaks (Harwood, 2011a). Based on preliminary data, around 30 cloaks (of approximately 600) in the International Register recorded pūkeko feathers. The two Cook-collected cloaks at the Hunterian Museum in Glasgow (GLAHM E.422) and Vienna Museum (Inv. No. 25) both had close single pair twining and used dog hair (or skin), brown kiwi, kākā, tūī and pūkeko feathers. Pūkeko are currently distributed throughout the North Island mainly, and parts of the South and Stewart Islands, and were only locally common before the 1850s, but historically only known from a few recent fossils and midden sites on the main islands no older than 400 years old, indicating they were not present pre-human arrival (Holdaway et al., 2001; Marchant & Higgins, 1993; Robertson et al., 2007; Worthy, 2010c, p. 188). Pūkeko are generally poor flyers, and largely sedentary, preferring wetlands or estuaries and feeding on seeds, fruits, insects, frogs, lizards, fish, young birds, eggs, and small mammals (Marchant & Higgins, 1993). The swamphen was not a major component of the Māori diet possibly due to them eating lizards, but the feathers and skin were scented and tied around the neck for adornment (Orbell, 2003, p. 119). There is an example of a 19th century pūtatara (Māori shell trumpet) in Te Papa (ME003937) with pūkeko skin and feathers attached to the instrument with a muka cord.

The dog population was more accurately less than what was perceived from Cook's voyage records, as only a limited number of dogs (kurī) must have accompanied Māori to Aotearoa, hence establishing their inherent value in that they were rare and associated with tūpuna (ancestors) (Colenso, 1877; Thomson, 1922). A tradition tells of the eponymous ancestor Turi arriving in Aotearoa in the Aotea waka (canoe) wearing an infamous cloak of twelve dog skins (Hīroa, 1966). Europeans depicted kurī as plain black, pure white, or with spotting and mixes of yellow, brown and reddish brown, and seen as a valuable resource for food and adornment in clothing and weapons (Colenso, 1877, p. 140; Forster, 2000, p. 125; Tregear, 1904). Dogs were proficient at hunting and catching ground dwelling birds, personifying aggressive and courageous leadership traits that transferred to a person's clothes, weaponry, and status (Colenso, 1877, p. 150). Dog skin and hair were identified in at least nine of the thirteen historical cloaks for this study. Its use in conjunction with bird skin and feathers as only small additions in the collars or borders in most of the historical cloaks, speaks to its rarity and value in Māori society (Pendergrast, 1987). The Cambridge Museum dogskin cloak (D 1924.80) was the exception in that the kākā feathers were used as embellishment in the side border. Dog skin and hair feature in at least five of the seven feather cloaks collected by Cook, where a refinement in twining and sewing by the end of the 18th century facilitated an increase in dogskin cloaks up to the mid-1800s. At this time, close (compact) single pair twined cloaks covered in stripped dog skin were amongst the most prestigious and valued of cloaks due to the quality of the materials and level of work and time involved in producing them. The cessation of dogskin cloak production occurred in the latter half of the 1800s due to the local extinction of kurī from interbreeding with European sheep dogs, and the introduction of ready to wear European clothes replacing traditional status wear.

To date, the birds in this study were all identified as native species. Cook apparently liberated fowl (feral chicken: *Gallus gallus*) in Queen Charlotte Sound in 1773 that were still extant by 1777 (Scofield & Worthy, 2010, p. 27). It was probable that this population and offspring formed part of the local diet and feathers subsequently fashioned into attire. Based on current museum collection records, the only introduced materials identified in pre-19th century feather cloaks were the coloured wool inserts in the Cook-collected GLAHM cloak (E.453) in Scotland. Red wool used to produce a pāheke pattern in another 18th century cloak (Pitt Rivers Museum 1886.1.1132) can also be observed in kākahu made after 1800, continuing with this use of introduced material (Lander, 2011). The bark cloth (tapa) in the Museum of Ethnography cloak in Sweden (1848.01.0063) was probably processed from trees in the warmer climates of New Zealand. Even though successful harvesting was limited, the small pieces processed would have been highly valued for personal adornment or as trade items, much like the small embellishments of dog skin and hair in feather cloaks.

Harakeke was generally present where people resided or travelled, an invaluable resource harvested by those who have a relationship to the area, and skillfully fashioned into items and materials for clothing, housing, fishing, and hunting (Maihi, 2011, p. 35). It replaced Pandanus as the primary plant for weaving in the Pacific, as no other New Zealand plant material provided the required versality, strength and warmth. Harakeke and cabbage trees are taonga species, creating warm clothing and ropes for use in daily life and travelling. They are both widespread in the North and South Islands, and associated with forest edges, and wetland or swampy areas (Czernin & Phillips, 2005; Kirk, 1889; Salmon, 1986).

In this study, human hair was observed in the plaited garment with albatross feathers in Otago Museum (D10.172). Hair was also recorded in the tāniko border of the kaitaka at the Museum of Ethnography, Stockholm, Sweden (1848.01.0063) (Campbell, 2011). Mead (1969) also recorded the presence of human hair in kākahu Māori. Human hair originating from the head is tapu and therefore sacred and its use restricted (Best, 2005, p. 329). Its presence is likely from incidental transfer from the weaver or wearer, however, the intentional addition of human hair adds another personal or spiritual element that could pertain to the kākahu and wearer. Human hair plaited in a section of 2-ply threads was found alongside dog hair, feathers, and bark in Monck's cave in Canterbury (South Island) (Skinner, 1924, p. 160).

The development of tāniko in the second half of the 18th century also elevated artistic avenues for weavers, expressing new innovative materials and methods, and artistic skills and knowledge in creating and incorporating different colours and designs in cloaks. Tāniko designs and techniques were already advanced in the Cook-collected cloaks as distinguished decorative elements in the borders of prestigious cloaks. There is the possibility that aspects of certain designs came from or evolved from designs on Pacific tapa cloth, reimagined in Māori weaving and clothing (See Chapter Five). There are indications of similar tāniko designs in some of the Cook collected cloaks in different collections in the Ethnographic museum in Sweden (1848.01.0063) and National Museum of Ireland in Dublin (AE:1882.3729).

6.5.3 Significance of techniques

The preparation of muka consists of scutching, drying, and tightly rolling two adjacent flax fibres into cords (miro) simultaneously along the leg with a flat palm so they twist and join together as they are rolled to prevent separation and to form the warp and weft strands (Simmons, 1968, p. 6). Variations of this technique is apparent in all the studied historical cloaks. This ancient method was recorded in Maohi (Māori) in Tahiti, when men prepared cordage for ropes and nets (Oliver, 1974, p. 140). A Tahitian feather girdle in the British Museum (VAN 348) consists of a sennet-tied bark cloth waistband, with loose descending twisted cords (miro) with bound pigeon and parakeet feathers at the ends.

Overhand knots and half-hitch weaving was an integral process in historical cloak production as a means of accessorising with skins, feathers, and hair. Blackman (2011) believed half-hitch weaving could have been a southern development (p. 90). Overhand knotting was employed in the binding of feathers and dog hair in Hawaiʻian feather capes, Tahitian taumi (breast plates), and in taiaha kura and kākahu Māori. In contrast, half-hitching is associated with the attachment or joining of warps or skins together, and for attaching skins to a muka backing. The half-hitch weft carries one cord behind the warp threads and another in front, half-hitching it to the back thread between the warps (Simmons, 1967a, p. 368; Simmons, 1968, p. 4). The half-hitch weft creates a blanket stitch in sewing, a half-hitch in rope work, and a loop in netting (Blackman, 2007, p. 28). Hīroa (1926) suggested full twining evolved from basketry, and the half-hitch weft from house building (p. 97). He observed roped half-hitching in an Aitutaki fish netting method, unique to the Cook Islands (Hīroa, 1944a, p. 226).

The binding of feathers and hair offers a stability and structure to accommodate movement, and is probably one of the more secure forms of feather attachment. It is rarely seen in contemporary kākahu in which the twining is preferred in warm clothing and in preventing feather loss. The binding of feathers and hair before they are twined into the muka backing appears to be an old practice. After the 19th century, weavers often used soap or harakeke gum to wrap the feather down at the base around the feather bunch to keep them together before they were bent and twined into the backing (Te Kanawa, 1992). The binding of feathers and dog hair in Polynesian attire served a similar purpose in securing adornments to attire to communicate status and strength. A prime example of this can be observed in Tahitian taumi of bound dark feathers contrasting against the light dog hair (see Chapter Five, Fig. 5.44). This combination of both feather and dog hair binding in Māori clothing has been applied in the Cook-collected cloaks and in Māori weaponry like taiaha kura.

Twining has been established as one of the methods in clothing to secure animal skins and feathers across the Pacific in Polynesian and in North and South American attire (see Chapters One & Five). It has also been identified in textiles thousands of years old in Europe, verifying its historical and universal application (see Chapter One). It can be argued that single and double pair twining where the feathers are bent and twined into the cloak is the most secure weaving method for fine Māori cloaks (Hīroa, 1926, p. 155). Close single pair twined cloaks are generally implemented with warps (whenu) and aho (wefts) roughly the same size to produce a uniform pattern. Full twined weaving was worked into all the historical feather cloaks except for the Lake Hauroko cloak and Otago Museum Strath Taieri outer plaited garment (D10.172). Hamilton (1896) also described a cloak fragment of single pair weft twining in a dry cave in the Upper Taieri (p. 174). Another small fragment of spaced single pair twined 15th century fabric was uncovered from Kaitorete at Banks Peninsula (Blackman, 2007, p. 30; Jacomb et al., 2004). So various techniques were employed within and across regions over centuries. In that the remaining studied feather cloaks had variations of close and spaced, single and double pair (interlocking) twining in clothing to secure bird skins and feathers. Only one cloak in the Hunterian Museum in Glasgow (GLAHM E.422) specifically featured bent twined feathers as the attachment method. Feather cloaks from South and North America and the Pacific, including the Hawaiʻian ʻahu ʻula (feather cloaks) had bound feathers often bent at the base of the shaft to effectively secure it to the backing netting (Chapter Five). Double pair twining in 19th century cloaks created a robust foundation, securing the feathers while the spaced rows accommodated feather length. The disestablishment of close single pair twining likely resulted from the diminished need for warm clothing after European settlement, and decline and cessation of dogskin and war cloak manufacture.

Several significant techniques recorded in Cook-collected cloaks were not directly associated with feathers, yet illustrate a variety of skills and knowledge at the disposal of Māori weavers over time. Tāniko was recorded in four of the seven Cook-collected cloaks with feathers, so twining and tāniko techniques were already advanced. Developed from wrapped twining in basketry, one element is passed horizontally across the warp stems usually on the inside of the article, tāniko was then adapted using dyed muka to create geometric designs in clothing (Hīroa, 1926, p. 19). Tāniko used coloured fibres in which instead of interlocking pair wefts in the twined kaupapa, the wefts were alternately given full and half twists where a full twist brought the colour of the same aho (weft) to the front again (Blackman, 2011, p. 81). This pattering is specific to Aotearoa, yet types of wrapped twining is common in ancient North American basketry, and coloured patterned borders resembling tāniko were collected in twined cloaks from Nootka Sound (Nuu-chah-nulth) in British Colombia (see Chapter One) (Hedges, 1997). Close twining using dyed single paired aho (wefts), in which each coloured aho strand appeared every alternate warp, was recorded as a decorative element in at least one Cook-collected cloak with feathers, at the base of the Cambridge Museum (D 1924.80) dogskin cloak (Hīroa, 1926, p. 75). This early technique was thought to have developed into tāniko wrapped twining and was also observed in a post-European private marae (Māori meeting grounds) cloak collection (see Chapter Eight) (Hīroa, 1926, p. 221). The practice of alternating or skipping whenu, was also employed for twilled twining, another historical weaving method recorded in some older dogskin cloaks; and several Cook-collected cloaks featured the more advanced form of wrapped twining, or tāniko (Hīroa, 1926, p. 101).

The twisting, wrapping, or intertwining of feathers in and around the cloak warps observed in the Strath Taieri Otago Museum garment (D10.172), was also practiced in Californian feather work (Hīroa, 1926, p. 144; Willoughby, 1922). A researched North American 'feather blanket' had split turkey feathers that were tightly wrapped about plant fibre warps so the feather down was on both sides and held together by twined pairs of fibres (Pearlstein, 2010, p. 90).

Raranga, referred to as finger plaiting in Polynesia, is defined as a flat folding over of elements to produce mats and clothing, baskets, satchels, sails, and fans (Hīroa, 1926, p. 26). Rare historical plaited capes are currently located in the Banks collection at the Ethnographic Museum in Stockholm, Sweden (1848.01.0064) and in Te Papa (ME001685) (see Fig 1.1 in Chapter One). Plaiting served as a decorative component, where the braiding of three or more strands for cords or rope secured feathers and dog hair in cloaks and weapons. As observed in the outer garment found at Strath Taieri in Otago Museum (D10.172), and the Cook-collected dogskin cloak in the Museum of Archaeology and Anthropology Cambridge University (D 1924.80) for this study. Feathers were attached to the tauri (collar) in taiaha kura by means of twining, plaiting, binding, insertion, and overhand knotting bunched feathers with muka cords. A taiaha in Te Papa (WE000201) has twined plaited cords with interwoven red kākā feathers at the top of the collar (Fig. 6.80). Plaiting is also commonly employed for the whiri neckline in which the remaining whenu or warp threads can be integrated into the decorative border for protection around the nape, and establishes this technique as both decorative and functional.

***Figure 6.80*. Taiaha kura (long Māori Fighting staff). Wood, muka, kākā feathers, pāua (*Haliotis* shell), dog hair, red cloth; carving, plaiting, miro, binding. Made 1750-1850. Bequest of Kenneth Athol Webster, 1971. Te Papa WE000201. All Rights Reserved. Right: detail of feather attachment at the top of the collar (tauri). Image by Hokimate Harwood, 2009.**

Stokes' (n.d.) unpublished manuscript in the Bernice Pauahi Bishop Museum in Honolulu Hawaiʻi catalogued twined Rapa Island cloaks in French Polynesia (detailed in Chapter Five). Stokes described several cloaks with plaited (braided) warps held together with wrapped twining in spaced rows (Plates 8552 and 8553) (Hīroa, 1926, p. 97). The foundation of Tahitian taumi (warrior breast plates) incorporate cords of 3-ply plaited (braided) plant fibres and overhand knotted dark feathers with tightly bound dog hair adorning the outer edges (see Fig. 5.44 in Chapter Five) (Thomas et al., 2016, p. 95). Ancient native North American weaving from pottery impressions in Missouri have also been illustrated incorporating plaited warp threads joined by single pair twining (Holmes, 1884, p. 410).

Historical Māori cloaks reiterate the interchangeable value of kurī and certain birds as important cultural resources, where strips of dog skin in prestigious cloaks could be accompanied by small tufts or bunches of important feathers, and vice versa. These practices dissipated after the 19th century and of the c.600 Māori cloaks with feathers listed in the International Register only six featured both mammal (mostly dog) hair and feathers, where the feathers were the predominant feature. The large volume of cloaks made after 1850 reflects the different European fashions, materials, and styles in which weavers experimented with these cultural exchanges and certain specialised cloaks evolved, while other cloaks mixed with various materials were also on trend. A comparison of the bunched dog hair adornment in the Cook-collected Pitt Rivers Museum cloak (1886.21.19) and a stunning kahu waero (dog hair tassel cloak) made by Te Wharetoroa Tiniraupeka (Ngāti Tunohopu, Ngāti Whakaue, Te Arawa) in the late 19th century (Te Papa ME015529), exemplified the detail and distinction afforded to such esteemed clothing.

On his first New Zealand voyage, Cook recalled a dogskin cloak resembling bear fur in mid-October 1769 near Poverty Bay, on the East Coast of the North Island (Cook & Smith, 1842a, p. 129). Banks on the same voyage, believed the chief luxury of Māori dress consisted of the 'skins and hairs of dogs and skins of divers[e] birds' (Beaglehole, 1962b, p. 5). In April 1773, Georg Forster suggested Māori preferred this attire in the humid climate, as '… they now wear the skins of dogs and of birds' (Forster, 1777, p. 158; Forster, 2000, p. 95). Forster suggested the Māori diet relied on fish, and dogs and birds were enjoyed when partaken, with dog skins more prized for warm clothing than anything else (Forster, 1996, p. 141).

On the French expedition to New Zealand in 1769-1770, the first officer Guillaume Labé on the St Jean Baptiste journaled in December in Northland, that the men wore sewn dogskin waist garments and the women were dressed in birdskin skirts (Dunmore, 1981, p. 243). John Nicholas (1784-1868), a ship companion of the Anglican missionary Reverend Samuel Marsden (1765-1838), noted that at the Mission Rangihoua in Northland in February 1815, the Rangatira (chiefs) and toa (warriors) wore dogskin cloaks with the fur cut in white squares or long mottled strips, while others wore feather cloaks (Salmond, 1997, p. 494).

Distinguished kahu kiore (ratskin cloaks) from *Rattus exulans* were recorded in the north in the 19th century (Parata, 2017). Parata (2017) recollected that when Ngāpuhi came to attack Ngāti Wai in the first half of the 19th century, renowned peacemaker Hōri Kīngi Te Wharerahi (Wharerahi) of Ngāpuhi, Te Patukeha, Ngāi Tawake and Ngāti Tautahi, and Te Uri-o-Ngongo, facilitated a treaty between the tribes by exchanging his kahu kiore for a mere called 'Muramura' from Ngāti Wai. Unlike the dog, which was a constant human companion, Māori-kiore interactions were limited based on records from Cook's voyages. Banks for example rarely recorded the species and only ventured into the bush in Thames and Queen Charlotte Sound (Banks, 1896; Beaglehole, 1962b, p. 4). As kiore also travelled with Māori to Aotearoa, they have direct ancestral connections to tūpuna and throughout Polynesia (Best, 1977b). In the north, Ngāti Wai are kaitiaki (guardians) of kiore and traditions continue to see them protected as taonga species, an environmental indicator, and resource for traditional food and clothing (Boswell, 2018; Parata, 2017).

No complete Māori birdskin garments have appeared in Cook's collections and few full skin cloaks exist in museum collections. Otago Museum houses the historical (pre-18th century) detached weka skin garment from Strath Taieri (D10.172A, D10.172B). There is a huruhuru kurī (dog pelt cloak) in Puke Ariki Museum in New Plymouth (A79.966), originating from Taranaki and made in 1800-1810 A.D.; and a processed seal skin fragment (MHE 23.2) in Auckland War Memorial Museum Tāmaki Paenga Hira recovered from Te Kūiti, Waikato (Reid, 1987; Tamarapa, 2011, p. 177; Wallace, 2007).

Kiwi skins were apparently still worn in the early 19th century, and South Island Māori attained kākāpō skins specifically for maro (aprons) for young women (Roth, 1923, p. 46). Anglican missionary William Yate (1802-1877) observed a kiwi skin cloak in the 19th century, it was held in such high regard by its owner who refused to part with it (Yate, 1835, p. 59). Studies of museum bird skins confirmed that kiwi and moa skins have sufficient thickness and strength for clothing, while albatross, weka, pūkeko and the larger parrots, kākā and kākāpō could be viable for clothing if prepared with modern techniques (N. Hyde, personal communication, July 1, 2017; Stapleton, 1970, p. 40). Stapleton (1970) assumed early Māori skin garments were not prevalent because the techniques were not recorded in the literature (p. 35). However, Māori rarely recorded or spoke to outsiders of common or daily practices, as knowledge and these skills were typically disseminated and transferred practically and orally over generations. This often resulted in European ethnologists (or anthropologists) observing and recording the traditions and customs of indigenous peoples in the 19th century, often out of context.

Some of the 19th century European literature detailed the methods used to prepare and preserve skins and feathers. Huia skins were stretched with sticks and dried with the inside facing a fire and preserved through the drying and smoking process (Enys, 1875, p. 204). On Lee Island, Fiordland, there was evidence of fires, drying racks, skins, fibres, feathers, and tools in the shelters (Anderson & McGovern-Wilson, 1991). Dog skin strips were naturally dried rather than manually processed and were easily manipulated compared to the larger intact skins (Trotter & McCulloch, 1989, p. 69). The larger dog skins were 'flayed, .. cleaned and stretched in a hollow frame, and then hung up in the wind to dry gradually, protected from the sun, rain and dew' (Colenso, 1877, pp. 150–151). Some sort of preservation process occurred with the Otago Museum weka skins (D10.172A & D10.172B) that included removing fat tissue and muscle and drying, that maintained the integrity of the material to be so well-preserved (Stapleton, 1970). Hamilton (1892) believed the weka skins had been well-prepared and dressed and were likely rubbed with wood-ashes (p. 487).

Some of the first fabrics from Neolithic sites consisted of sewn animal skins, probably from rare or dangerous animals worn by hunters for prestige, protection and insulation, and the meat eaten (Gillow & Sentence, 1999, p. 11). The skin membrane itself is semi-permeable resulting in a warm and insulated covering. However, animal skins are weak, brittle, and fragile and prone to decay, rotting and attack from micro-organisms and the climate if not preserved correctly (Stapleton, 1970, p. 36). Caves, shelters, and crevices sometimes lack moisture, resulting in a dry and sterile environment. These conditions allowed some of the cloaks described here to survive for long periods. In North America and as early as prehistoric Neanderthals in Europe, chewing the skins produced an enzymatic mechanism, and oils and wood ash functioned as tanning methods (Stapleton, 1970, p. 37). Māori also use tree bark (containing a soluble tannin) as a drying agent and mordant for dyeing plant fibres, fixing the colour (Stapleton, 1970). Women performed the traditional skin preparation of reindeer (*Rangifer tarandus*) clothing in the Sámi of Finnmark and Norway, and in the Evenk culture in Siberia and Russia (Klokkernes, 2007). The skin is lightly stretched out of strong direct sunlight, and tannins from leaves, fruit bark, and wood of higher plants preserves the skin and fixes the colour (Klokkernes, 2007, pp. 57, 65). Techniques of smoking and rubbing the natural fats and oils from land mammals and fish, lubricated and waterproofed the animal skins, functioning additionally as an effective tanning agent (Klokkernes, 2007, 2008). Most indigenous cultures employ a variety of 'semi-tanning' methods, compared to more comprehensive tanning based on contemporary standards (Klokkernes, 2007, p. 57).

Māori followed seal colonies around the southern coasts of Aotearoa, depleting populations in the habitable areas. In March 1770, Banks saw few seals and sea lions (Family Otariidae), and little evidence of Māori use, only that the teeth were fashioned into a type of needle (Beaglehole, 1962b, p. 5). Visiting different areas, Georg Forster indicated that seals were numerous in April 1773 (Forster, 2000, p. 92). Cook's crew killed seals in Dusky Sound, and the "skins were made use of for our rigging; the fat gave oil for our lamps; and the flesh we ate" (Hall-Jones, 1968, p. 49). Southern traditions mention seal cloaks, with sealskin clothing worn alongside plaited flax shoulder mats recorded in the Chatham Islands (Rēkohu) (Skinner, 1923, p. 108; Tregear, 1904, p. 236). Stapleton (1970) doubted the use of sealskin in the lower South Island, citing sealskin boots in a Fiordland cave as the only example (p. 37). Ancient organic materials have a better chance to survive degradation if stored in ideal conditions, so suppositions based on the absence of material evidence can be erroneous.

Early Hawai'ian royal feather sashes and capes dating from the 16th to 17th centuries incorporated small passerine bird skins attached to a netted backing. Several of these historical 'ahu 'ula (kahu kura) reside in the British Museum and Vienna, one from Cook's third voyage (BM Oc1982,Q.747) is discussed in Chapter Five (Fig. 5.18). Hīroa (1944b) regarded skin capes as an integral evolutionary stage in Hawai'ian clothing where ultimately intricate feather knotting became the standard in cloak production by the 18th century. This is akin to the early stages of kākahu Māori in which bird skins combined with fibre techniques. Over time a refinement in weaving followed; feathers replaced skins, and twining became the standard practice in Māori cloak manufacture (Hīroa, 1926).

Skin clothing was used around the Pacific. Indigenous Australian groups produced possum (Family: Phalangeridae) and kangaroo (Family: Macropodidae) skin cloaks (Couzens, 2011; Riley, 2016). The peoples of Tierra del Fuego wore small garments of seal and guanaco (*Lama guanacoe*) skins (Forster, 1996, p. 210). Banks wrote that the Yahgan women of Tierra Del

Fuego wore scraps of birdskin around the waist (Campbell & Black, 2013, p. 414). Early in the 18th century in southern California, the native American women wore shoulder garments of deer skin, where the “better sorts” had the skin of a large bird (Shelvocke, 1726, p. 405). Cook journaled in April 1778 that the native Americans in Nootka Sound with their bodies oiled and painted red, they dressed in skin garments of bear, wolf (*Canis lupis*), and the sea-otter (*Enhydra lutris*) with the hair facing outward (Cook & Smith, 1842a, pp. 276–277).

***Figure 6.81*. Ngira (Bone needle). Bone, muka; carving, drilling. Purchased 2003. Overall: 1.42mm (width), 42.73mm (length), 0.83mm (depth), 0.1g (weight). Te Papa ME023194. All Rights Reserved.**

Sewing was well developed when Europeans arrived in New Zealand (Wallace, 2006). Bone and shell needles were employed in sewing for skins and textiles and as cloak pins (to hold the cloak ends together for wear), the terms for which were sometimes interchangeable as they were sometimes used for both purposes (see Fig. 6.81). Needles have been fashioned from shells, wood, bird and mammalian bones and feather quills (tuaka); in which the quills operated as effective sewing utensils (toromaka) for mending kākahu, where the pointed calamus (feather base) served as the point for threading, and the feather tip secured the muka as the needle was pulled through the object (Best, 1898, p. 652). A study of early excavation sites on the Otago Peninsula recovered needles, fish-hook points, and bird spears, bird-shaped amulets, mostly made from the bones of a variety of seabirds, whale, and seal (Simmons, 1967b; Skinner, 1960).

6.5.4 Significance of language, function, social, and environmental influences

It appears that Māori and European encounters instigated introductions to high-ranking Māori (typically men) outfitted in their best attire; such as dog and feather cloaks, weaponry, feathers in the hair or ears, pounamu or bone adornment and weaponry, and bodies and hair painted with oil and red kōkōwai (Beaglehole, 1962a, 1962b, 1967; Morrell, 1958; Parkinson, 1984; Salmond, 1991). This level of engagement communicated the rank or status of the individual in which any possible issues, future trading or resource use could be negotiated. According to the literature, only the high ranked had the esteemed feather and dog cloaks, worn only on certain occasions or in extreme cold weather, and unadorned warm twined cloaks were more commonly worn by both sexes (Roth, 1923, p. 10). With few records of Māori naming specific historical cloaks, it is possible that the generic name for kākahu (cloaks), and clothing in the Pacific was another form of the word ahu (kahu or cloak). Early European voyagers recorded the word ‘Ahou’ (ahu) or ‘Kak’ahoo’ (kākahu) when referring to Māori wearing any cloth or cloak including the parrot feather cloaks (Beaglehole, 1961, p. 780; Beaglehole, 1967, p. 817). It is not clear as to whether Māori used generic terms to denote this cloak or all cloaks, or whether Europeans misheard, misinterpreted, or made this assumption. It is theorised that the absence of the consonant ‘k’ and ‘h’ in early European records came from dialectical differences, or an emphasis on specific consonants recorded in the Māori language after colonisation (Harlow, 2007). In the 19th century, increased interest from European admirers and collectors facilitated classifications of the more distinguished cloaks, such as kahu kiwi (kiwi feather cloaks) and kahu kura (treasured red/ red feather cloak) (Mead, 1969). Like the treasured Polynesian feather cloaks in Hawai‘i (‘ahu ‘ula); the mourning pigeon feather cloaks in Tahiti (‘ahu rupe); and fine cloaks in Rapa (Ka‘ure‘e) (see Chapter Five). Despite limited written records of early clothing terminology, Māori have adhered to this ancient naming system through to today.

Optimal conditions for preserving archaeological textiles occur in the absence of water, a lack of oxygen, or at a temperature below 5º C, in arid or freezing conditions, in nitrogen rich peat bogs, or acidic microenvironments (Smith, 2013). Historical feather cloaks were found in Central Otago at Lake Wanaka and Strath Taieri; and in Fiordland, on Lee Island and Lake Hauroko in the lower South Island (Fig. 6.75). Central Otago has a cold and dry climate, with low humidity and snow in ranges over winter and spring, and little variation in rainfall with droughts in summer (Peat & Patrick, 1999; Worthy, 1998). In contrast, Fiordland has high rainfall and low temperatures, with annual average rainfall reaching 7,000-8,000mm west of lake Te Anau (Peat & Patrick, 1996, p. 30). Lee Island has frequent and heavy rainfall with 2800mm of precipitation per year, and a low 1600 hours of annual sunshine (Morrison & Anderson, 1991, p. 3). The mean annual temperature is about 10° C with a maximum seasonal variation of +/- 4 degrees in mean monthly temperatures (Morrison & Anderson, 1991). No historical feather cloaks (pre-1750) legitimately collected in archaeological sites to date have provenance to the North Island. This does not imply feather or bird skin cloaks were not made in the north, merely that environmental factors, and possibly social factors did not facilitate their survival or legal protection over the years.

The restricted number of full feather cloaks observed and collected on Cook's voyages potentially correlated with seasonal wear. There are several anecdotal entries in Banks', Cook's, and the Forster's journals of bird skin and red kākā feather cloaks. Presumably, the records refer to cloaks with red feather tufts, and the full skin cloaks were not available or just not traded. Banks on the first voyage stayed on the coast and travelled during the warmer months (October 1769-April 1770) (Beaglehole, 1962b, p. 11). Maureen Lander (2017) theorised about the lack of feather cloak sightings by Cook's crews and considered the time of year and locations of their coastal stops around New Zealand on the three voyages 1769-1777 reduced potential records:

> "..they were coming across coastal settlements, and the people who needed the warmth of feather cloaks were inland and in the mountains. In places like Te Urewera and parts of the South Island where the feather cloaks would have been needed, people may also have been wearing them with the feathers facing inwards, like the woman found at Lake Hauroko. They are also known to have sometimes worn dog skin cloaks with the hair facing inwards, which makes sense. Protection on the outside, warmth on the inside." (Lander, 2017)

Major deforestation 400-600 years ago, and ongoing hunting pressures for certain birds in areas reduced species distributions and abundance (Holdaway et al., 2001, p. 136). Māori lived according to the seasons and food availability, moving between inland bush for birds then fishing on the warmer coasts. In cloak manufacture, the bird skin or feather materials of interest are measured against the availability and distribution of the species, the rate or the amount the species appears in the cloaks, the quality (the superior aspects) of the material, and societal preferences for certain birds, skins, feathers, colours, or designs. Infrequent or migrating birds such the large seabirds, red-tailed tropic bird, the cuckoos (Family Cuculidae), and herons (Family Ardeidae) were not widely distributed or available all year and so were greatly prized when acquired. This was more so for rare, or anomalous coloured birds and feathers.

There are hierarchies in the social significance of specific birds, feathers, and feather colour in Polynesian and Māori culture. Aggressive, or birds of prey, such as man-of-war birds (frigate birds), hawks, falcons, and eagles are considered synonymous with courage and power. Enigmatic owls and kingfishers reinforce spiritual and emotional ties that relate to their sudden appearance. Rare, graceful birds such as toroa, kōtuku (white heron: *Ardea modesta*), huia, and tākapu (gannet: *Morus serrator*) appeal to the imagination and social aspect of status and commodity in trade. There is a record of gannet feathers, a bird associated with the Bay of Islands, being traded for a fine cloak in the early 19th century (Salmond, 1997, p. 485).

The movement of valued taonga such as pounamu, feathers, birds, and cloaks and whakairo (carvings), through gifting and exchange was a regular occurrence in Māori society. After European contact, Māori in the Nelson and Marlborough Sounds area of the South Island traded in fish, and stone axes in exchange for steel axes; flax and feather garments for cotton, canvas and wool fabric clothing; pounamu adornments for medals, ribbons and beads; and bone hooks and spear tips for nails etc. (Mitchell & Mitchell, 2004, p. 155). David Samwell, a surgeon on Cook's third voyage noted on 24th February 1777, that Māori in Queen Charlotte Sound brought cloaks, pounamu ornaments and some stone adzes (cutting tools) in exchange for hatchets etc. (Beaglehole, 1967, p. 1001). The appearance of wool in some of the Cook cloaks reflects the willingness of Māori to embrace new materials and techniques where anything new, unusual, or atypical was wanted. The collecting behaviour of Europeans already started to influence what was made and traded, in the form of unfinished kākahu. Māori 'artefacts' remained important means for commerce in to the 19th century (Firth, 1959).

What is known of 19th century cloaks such as kaitaka, is that the tāniko was rarely seen at the neck edge (Blackman, 2011, p. 83). The tāniko, the decorative talking point of the cloak is generally situated along the base where observers can view it, and with the feathers pointing towards the cloak's base, with any fringes or ties along the neckline. Cook-collected cloaks in Cambridge Museum (D 1924.80) and Pitt Rivers Museum (1886.1.1134) both have fringes at opposite edges of the cloak. Some 19th century Māori photographic portraiture in the Te Papa collection show men and women wearing cloaks with the tāniko borders towards the top of the cloak, presumably to showcase this unique element in the image (Te Papa O.025619, O.025610, O.025617, B.008173). Weavers apparently considered and experimented with the orientation of cloaks during Cook's voyages. An exceptional Cook-collected kaitaka paepaeroa in Pitt Rivers Museum in Oxford (1886.1.1132) was turned 90 degrees so that the warps ran horizontally, and the wefts vertically. This type of cloak increased in occurrence in the 19th century. There are feathers in the studied cloaks with atypical orientation, such as in the Vienna Museum in Austria (Inv. No. 25), and Hunterian Museum in Scotland (GLAHM E.422). In that several feather bunches have the 'preferred' orientation, by todays standard, pointing towards the base, yet the majority point towards the neckline. Pendergrast (1987) thought the Vienna cloak could have been woven the right way up, instead of being turned around after completion (as seen today). As twined feather cloaks were still in the early stages of development in the late 1700s, it can be argued that these were unintentional errors and the weaver(s) realised after making them that most of the feathers faced the wrong the direction, and the cloaks subsequently given away. As both cloaks have similar birds and feather use, however, it is possible these cloaks were possibly associated and the techniques intentional. Disorientation also occurred with writing or letters facing the wrong direction in 19th century cloaks as seen in the International Register, in Te Papa cloaks ME014386 and ME015747; and Field Museum Chicago cloak 88524. Also, a 19th century British Museum kākahu (Oc1854,1229.133) has feathers pointing towards the neckline (see Chapter Seven).

The burning of personal attire, whether accidental or intentional, also merits discussion. Māori see clothing, particularly prestigious cloaks as an extension of the body, and therefore had a degree of inviolability afforded them, so if a cloak was compromised or any physical damage was beyond the desire to keep or repair it, the most effective disposal method was burning. It was thought the fire-damaged Lee Island cloak (88.258.57(a) & 88.258.57 (b)) in Southland Museum and Art Gallery Niho o te Taniwha was worn (used) and brought onto the site (Anderson & McGovern-Wilson, 1991, p. 80). The Fiordland site is cool, cloudy, and windy, and the caves provided adequate shelter for feather, fibre, and skin preparation, where an open fire would quickly dry out wet skins and cloaks, but where accidental burnings also could have occurred. Carbonisation was observed in 15th century fibre artefacts from a burned-out shelter site at Kaitorete Spit on the Canterbury coast, South Island (Jacomb, et al., 2004). Located in 2000 in a sand dune, the site had associated cooking fires and preserved segments of a plain but finely made shoulder or waist garment of close single pair twining (Jacomb, et al., 2004, p. 293). Partly carbonised, twined, and plaited textile fragments were described from a Raupa site in the Hauraki Plains of Coromandel in the North Island dating from around 1820 (Lander, 1992). Found in a shallow pit with a large wooden bowl, the woven pieces appeared to originate from a shoulder or waist garment with tags, and remnants of red kōkōwai transferred from the wearer (Lander, 1992, p. 8).

Nineteenth century European ethnologists reported that dogs were associated with men and rank, and in making dogskin cloaks, the women constructed the muka backing and men tended to drying and sewing the skins on to the garment (Colenso, 1877, p. 151; Tregear, 1904). Both men and women learnt weaving as students specialising in certain aspects, where men concentrated on the whakairo, or ornamental borders of mats (Hamilton, 1972, p. 280). Dogskin cloaks had societal and personal value and the owner rarely parted with them in the cold weather (Colenso, 1877, p. 146). That the historical burial feather cloaks (1500-1700 A.D.) with small dog skin and hair adornment were connected to women, was socially acceptable for this use. As it confirms that some distinguished feather cloaks were worn by women of rank, while the exclusive kahu kura were reserved for men (Hīroa, 1926, p. 305).

The arrangement of a person of rank after death in a sitting position appeared to be widespread throughout New Zealand (Best, 1934; Tregear, 1904; Yate, 1835). Dressed in their superior garments, hair combed, oiled and adorned with feathers, tufts of white albatross down attached to the ears, elaborate pendants worn around the neck, and kōkōwai smeared on the face, with personal weaponry and other valuables placed at their side (Best, 1934, p. 107). Kiwi and dogskin cloaks were choice garments in life and death, and grieving visitors also brought kākahu as a sign of respect (Best, 1934; Hīroa, 1966; Tregear, 1904, p. 390).

A netted cloak with red feather fragments removed from an archaeological cave site in Hawaiʻi was purportedly described as burial attire (Brigham, 1918). This ʻahu ʻula is now located in the Bishop Museum (No. 9070) along with two associated feather images (ʻaumakua), carvings and wooden objects (Brigham, 1918). In 1874, when Hawaiʻian King Lunalilo died he was buried with his fine feather cloak (Brigham, 1899, p. 8). The Tahitian mourning cloaks of dark pigeon feathers introduced in Chapter Five reinforced the premise that feather cloaks played a pivotal role in Polynesian death customs. Subsequently, notable, or personal Māori cloaks owned by the deceased would be integrated into formal burial practices. Maureen Lander (2017) surmised that "people used feather adornment for rituals of encounter. They dressed their waka and their gateways. They dressed their carvings and adorned their own hair with feathers. From my reading [ngā mōteatea], I found that feathers (and birds) got brought into play metaphorically at times of life and death. People who have passed on become 'birdlike'. So, it's then I know that feathers have something to do with a change of state." This transition of stages enables the essence of a life force (mauri) contained within the feathers and their movement to perform a role that discloses the mana (status) of the person, the tapu (sacred) nature of the event, and the kōrero (history) that continues for generations (Tapsell, 1998).

6.6 Conclusions

Each of the studied kākahu incorporate various aspects of ancient and Polynesian influences; European influences from materials and collecting behaviours; and aspects of 'modern' Māori feather cloaks that exemplifies current techniques; and individual weaver behaviours. As discussed in Chapter One, twining dates back thousands of years and is represented in most indigenous civilisations. Polynesian clothing incorporating feathers required various forms of weaving and feather attachment techniques, few of which involved the twining of bent feathers into the garment, as used by Māori (see Chapter Five). Cloaks collected by Cook that were unfinished and incorporated coloured wool also marked the initiation of what would become an unprecedented acceleration of European influences in Māori feather cloak production in the 19th century. Where Māori cloaks made after 1800 that assimilated introduced materials such as wool, cotton, and exotic birds into kākahu were also expeditiously acquired for private collectors and world museums (see Chapter Seven, and the International Register).

Hīroa (1926) stated that Māori clothing developed from a refinement from simple to complex techniques over time. Mead (1969) suggested it was this technology and functionality of cloaks, and the association between the two that facilitated the change from pre- and post-European clothing. Other studies maintained that Māori clothing evolved not necessarily from a refinement in techniques but from functional adaptations to specific environmental (climatic) needs, the availability of material resources, plus stylistic innovations relating to changing social conditions and values, and personal creativity (Jacomb et al., 2004, p. 295). That these adaptive and creative skills are inherent in Māori and all nomadic indigenous cultures (Jacomb et al., 2004). It is more likely all these factors influenced and continue to influence cloak development to varying levels depending on the time, location, and social and personal factors relating to each weaving community. Much like European fashions that reappear decades later, the premise of Māori clothing similarly undergoes ongoing changes that do not start and stop evolving at specific dates. Weaver ideas and practices are continually used, re-used, changing, and adapting to external and internal influences. Unfortunately, these early weavers can only communicate through their kākahu that remain, to be studied in conjunction with modern cloaks and weavers to ascertain the layers of knowledge within taonga tuku iho (taonga handed down).

Twining and social constructs surrounding bird and red feather use were already established when Māori arrived in Aotearoa. Early major influences in Māori feather cloak production incorporated the materials and methods adopted and adapted to produce warm twined clothing, an abundance of large birds (e.g. moa) for skin clothing, and the time and social freedom to experiment with different cloak types and styles depending on what was wanted and needed. There is substantial evidence now that twined, plaited garments, and skin cloaks were continually made over a 400-500-year period. This contradicts past evaluations that Māori clothing was divided into defined stages of development. In fact, with each generation, Māori clothing is still changing and adapting.

Bent and straight twined feathers appeared in one Cook-collected cloak in the Hunterian Museum (GLAHM E.422), where twined bent contour feathers formed the standard practice from the 19th century onwards. Wing feathers are larger and more rigid than body feathers, they also offer limited warmth or insulation in that they have reduced feather down. Conceivably, weavers kept the feathers straight, and started weaving in what was their top left-hand corner with the feathers pointing towards the neckline and finished in their bottom right hand corner. As in the other similar museum cloak in Vienna Austria (Inv. No. 25), construction finished at the bottom with a decorative tāniko border. In modern cloaks, the cloak is typically turned 180° before the tāniko is added at the base, so the feather tips point towards the tāniko (cloak base) upon completion. Orientation of 18th century cloaks poses a dilemma in the interpretation of how the cloaks were worn. In that assumptions about additions like fringes, tāniko, feather positioning, and neck ties to determine orientation of cloaks be re-evaluated. The other explanation for these discrepancies was that they were accidental or unintentional embellishments that justified the willingness of the owners to readily part with them.

The assimilation of animal skins in historical cloaks warrants a re-examination of the status of these select animals and birds in Māori clothing practices. The prevalence of bird and dog materials in 18th century kaitaka substantiate the superiority of these types of cloaks in the 19th century where they were greatly admired, treasured, and coveted (Maihi, 2011, p. 40). These specialised variations of twined kaitaka, feather cloaks, and dogskin cloaks that combined bird skin, and kurī skin and hair represented the highest levels of the artform until the mid-1800s when production gradually dissipated and largely disappeared in their traditional forms.

It was not possible to make assumptions of weaver and wearer behaviour from the small number of cloaks in this study. The majority of examined historical feather cloaks were however associated with high ranking women. In contrast observations of feather cloaks during the Cook voyages indicated that feather cloaks, and specifically parrot (probably kākā) feather cloaks were exclusively worn by high ranking men. Where at first contact with Europeans in the 18th century, Rangatira (leaders) were identified by their higher standard of dress. Fine kaitaka appeared in Cook's collections as plain (sometimes unfinished), or cloaks decorated with tāniko, dogskin, dog hair and bird feathers, with the skin still attached in some examples, in small amounts in the corners or sides (Pendergrast, 2005, p. 96). It is assumed the feather cloaks observed by Cook and his crew adorned only high-ranking individuals. However, Cook only travelled around the coasts and rarely inland, so much is still unknown of the true distribution of feathered kākahu or their function at this time.

Despite the small number of historical feather cloaks available for examination, the study demonstrated preferences for specific birds, feathers, and colours in pre-and post-European Māori cloaks. In that brown kiwi and weka; red and orange kākā feathers; white albatross; green kākāpō and kākāriki; and iridescent black tūī and blue pūkeko feathers that were recorded in this timeline were also represented in cloaks made after 1800 (see International Register) (Harwood, 2011a). Determining bird abundance and distribution creates a better understanding and interpretation of whether weavers were using what was environmentally available over what was socially or personally preferred. In some cases, this is possibly all three. Most of the birds identified in historical Māori cloaks dating from 1500-1800 A.D. were typically sedentary birds, either flightless, or low flying and generally remained in their home range or territories except during breeding and changes in seasonal food availability. The exception is the albatross which is an infrequent powerful circumpolar migrator capable of travelling over 10,000km, so Māori would have needed to translocate birds or feathers from known breeding grounds (Marchant & Higgins, 1990).

Positive material and technical identifications of textiles is an integral starting point of research in the interpretation of kākahu Māori. It can aid in the placement of Māori cloaks in the correct geographical, historical, and social context. The methods involved in plant, bird, and animal identification of historical artefacts can be contentious, and therefore ethical and scientific practices that limit damage, and maintain the physical and spiritual integrity of the garment are recommended. At present, light microscopy facilitates quick, accurate, and cost-effective feather identification, given there is adequate macroscopic and microscope diagnostic features from the sample and complete reference images of microscopic feather down and feathers and bird skins for analyses and comparisons. It is possible to identify species with DNA analysis from just the feather barbs and shafts, with varying amounts of destruction (Boonseub, Johnston, & Linacre, 2012; Rawlence et al., 2009; Speller, Nicholas, & Yang, 2011). Therefore, multiple scientific techniques that look at the physical, genetic (DNA), and chemical (isotopic) make-up of the cloak materials (specifically feathers, hair, and muka) could assist in species identification and locating provenance, and should be considered if and when it is appropriate, and most importantly required (Hartnup et al., 2011; Harwood, 2011a; Scheele & Smissen, 2010).

Some of the early historical feather cloaks dating from 1500-1700 A.D. located in South Island rock shelters remain in New Zealand and have recorded collection provenance and hence have affiliations to iwi and hapū Māori. Degradation has naturally occurred over time due to their age, and the change in climatic and environmental conditions including movement into museum collection stores. In contrast, the feather cloaks made and collected in the 18th century by Cook are in relatively good physical condition for study, yet there is no definitive evidence of collection provenance for any of these kākahu (Shawcross, 1970). That they are also all currently held in the United Kingdom or European museums, makes personal examination difficult for Māori and traditional practitioners. The Pitt Rivers Museum cloak (1886.1.1134) is the only Cook-collected cloak to have a recorded provenance, and as the description does not align with the label, its origin requires confirmation through further research. The small details of cloak records, materials, techniques, patterns, and styles from this time should be studied closely and compared to assist in the possible determination of provenance. For example, the two Cook collected kaitaka in Hunterian Museum (GLAHM E.422) and Vienna Museum (25) as well as the two kaitaka with similar tāniko designs in the Museum of Ethnography in Stockholm, Sweden (1848.01.0063) and National Museum of Ireland Dublin (AE1882: 3729) could provide a unique opportunity to explore potential connections. At present, no confirmed early feather cloaks show recorded associations with the North Island. Research on cloak materials and techniques can be compared to other pre-European textiles from the North and South Islands. However, as these historical cloaks are the only remaining examples of earlier feather clothing it can be problematic and probably imprudent to assume they were ‘typical’ or commonly made at these times and places. Their existence nonetheless is conclusive evidence that Māori feather cloaks were historically esteemed and worn in life and death customs by men and women.

The fragility of historical cloaks often prevents research to further our collective understanding surrounding them. Replications of such cloaks can mitigate further exposure and potential damage ensuring iwi, and weavers and researchers can continue to increase the ever-growing body of knowledge and appreciation for these kākahu (Bonica, 2017). The Lake Hauroko cloak replica in Otago Museum is a prime example (D96.106). Ngāti Wai have also commissioned a contemporary kahu kiore to be made (Parata, 2017). A 20th century water rat skin cloak located in the National Museum Australia in Canberra (2007.0008.0001) reiterates a continued resurgence of historical practices in contemporary settings.

It is acknowledged that terminology can be a limitation when documenting the finer details of cloaks, as different researchers had varying knowledge and experience in materials, techniques and language, notes were often confused or misinterpreted (Hīroa, 1924; Roth, 1923; Smith & Laing, 2011). In the 19th century, specialised clothing emerged with specific materials, techniques, and classifications, some of which have inter-mixed (Mead, 1969). Iwi Māori also have different naming systems, and so as centuries have passed, the associated kōrero from cloak owners and weavers has been lost, making recording the remaining tangible aspects invaluable.

The few surviving historical cloaks made before 1800 are each unique, but with enough commonalities that can inform researchers as to what was potentially deemed a standard or regional practice, or an individual's preference. Their shared characteristics are in turn the foundation for a need to cross-examine different museum collections and historical records. Studying and documenting in detail the materials, techniques, and designs of each cloak can further enhance the mātauranga (knowledge and traditions) and acknowledge the mana (authority) of individual kākahu. Future archival, graphic, and records research involving comparative detailed studies of the Cook cloaks should be undertaken particularly regarding specific bird and feather use, and designs and techniques particularly of tāniko for possible provenance determination. The accumulation of oral traditions of terminologies, bird use, and cloak production should be supported within iwi Māori and weaving communities, as each rohe had their own naming systems, weaving knowledge and patterns, and hunting and tikanga (customs) pertaining to birds (Cowan, 1905). Recording iwi Māori traditions of South Island and Moriori hapū by self-appointed researchers could add additional knowledge to previously recorded southern knowledge of kākahu (Beattie, 1918-1994; Te Maihāroa, 1957). Appropriate access to taonga and records in museums for researchers, kaitiaki (caretakers), and iwi Māori can contribute towards a growing knowledge base. Clear and respectful communication with iwi as to the research and its findings is ethically and culturally vital and the responsibility of the researcher, and creates a trusting reciprocal relationship where an exchange in ideas can initiate discussions.

Further historical collections research on when, where, and how the cloaks were made, found, or collected is also encouraged. It is recommended that continued projects addressing accessibility to overseas collections facilitated by shared digitised image databases of mammalian hair and feathers (species); cloak and tāniko designs; and weaving techniques be initiated and supported. This knowledge can assist in the possible reconnection of cloaks to an area or weaver and enhance the ongoing care and survival of this important artform.

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CHAPTER SEVEN: THE POSSIBLE INFLUENCES OF EUROPEAN SETTLEMENT ON MĀORI FEATHER CLOAKS FROM THE 19TH CENTURY

Mā wai anō e whai ngā tini raweke a te Pākehā.

Who indeed can follow the many devices of the Pākehā (Mead & Grove, 2001)

7.0 Abstract

European colonisation has had a profound impact on Rangatiratanga (Māori sovereignty) and Kaitiakitanga (guardianship) stemming largely from the displacement of Māori land in the 1800s. Ongoing impacts on Māori language, religion, politics, laws, economy, diet, health, and learning systems has also directed Māori artforms. The feather identification of Māori cloaks in the Museum of New Zealand Te Papa Tongarewa (Te Papa) indicated a major phase in cloak production facilitated by European (Pākehā) settlement in the 19th century that has rarely been explored from the perspective of bird and feather use (Harwood, 2011a, 2011b). This study provided an in depth ethno-ornithological analysis of Māori cloaks produced after colonisation, measuring the parameters and extent of change from potential European, social (iwi Māori), cultural (tāngata Māori), personal, and environmental influences. This was achieved by examining these factors, significant materials and techniques, and representative cloaks based on an International Register of approximately 600 Māori feather cloaks collated from close to 100 public museum collections around the world. While it was a preliminary list, it was the most complete catalogue of its kind, and for this timeline listed in detail feather cloaks produced after 1800. Over twenty-nine bird species were recorded in the Register, 18 native and 11 introduced birds. The research confirmed that muka (scutched harakeke: *Phormium tenax*), finger twining, tāniko (coloured patterned borders), and culturally significant birds like brown kiwi (*Apteryx* spp.), kererū (*Hemiphaga novaeseelandiae*), and kākā (*Nestor meridionalis*) were the most prominent traditional materials and techniques in late 19th century-mid 20th century cloaks. In conjunction, the decline of valued species such as kākāpō (parrot: *Strigops habroptilus*), huia (*Heteralocha acutirostris*), and kurī (Māori dog: *Canis lupis familiaris*) were accelerated by European-induced factors. Māori weavers responded by experimenting with exotics colours, figurative and geometric designs, symbolism, and writing along with the assimilation of introduced chicken (*Gallus domesticus*),

common pheasant (*Phasianus colchicus*), and peacock (peafowl: *Pavo cristatus*) feathers, and wool, cotton, and sewing from the late 1800s (Mead, 1969; Pendergrast, 1997). The study also confirmed that the concept of weaver 'signatures' were common but not necessarily exclusive to kākahu made after 1800 (Harwood, 2011b). An exponential increase in the production and subsequent acquisition of Māori cloaks in the 19th-20th centuries, and their subsequent placement in world museum collections in turn likely directed the creation and use of specific cloak titles and classifications, still in use today (Mead, 1969). Finally, the research confirmed that kākahu (cloaks) continue to play an important role in gifting, trade, and marae (Māori meeting ground) and whānau (family) events including tangihanga (funerals) confirming their ongoing function in Māori society.

7.1 Introduction

Ethno-ornithological research of historical Māori feather cloaks established that cloaks made as early as the 16th century were likely influenced by a combination of species and feather colour preferences, floral and avifaunal distributions, social values, functional design, and finally personal experimentation at the time (see Chapter Six). These early cloaks incorporated aspects of bird skins and feathers, dog skin materials; and twining, sewing, knotting, and plaiting techniques, following on from Polynesian customs and traditions. In accounts from Captain James Cook's New Zealand voyages (1769-1777), Māori feather cloaks were considered rare and exhibited developments in twined feather adornment with dog skin and hair, and tāniko (Mead, 1969; Pendergrast, 1997). An account from October 1769 in Anaura Bay relays that two 'chiefs' were invited on to Cook's Endeavour ship, one dressed in a jacket of dogs skin, the other covered almost entirely with small tufts of red feathers (kākā) (Beaglehole, 1962, p. 415). The few surviving 18th century cloaks remain in United Kingdom and European museums, and none were fully feathered.

In contrast, literature documenting 19th and 20th century Māori attire focussed largely on the material, technical, and functional aspects of cloaks, and pointed to an exponential increase in full and partially feathered cloaks adorned with a variety of materials and designs (Best, 1898; Hīroa, 1926; Mead, 1969; Pendergrast, 1997; Roth, 1923). The abundance and variety of cloaks produced from the late 19th century, warranted further investigation that integrated all three perspectives to determine what birds were used in these cloaks (the materials), how they were made (the technical), and how they were used and why (the functional) (Harwood, 2011a).

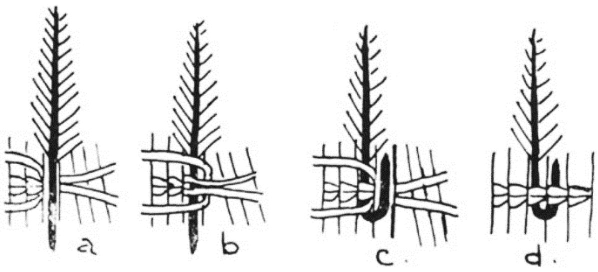

***Figure 7.1.* Orthodox Māori feather attachment, using two pair-interlocking weft twining. From Hīroa (1925); [Fig. 78.].**

Māori feather cloaks from the 19th century generally comprise of a muka backing of scutched (scraped) harakeke (New Zealand flax: *Phormium tenax*) (see Chapter One, Fig. 1.6). The standard 'traditional' technique in Māori feather cloaks after 1800 involved spaced double pair twining where the muka fibres formed two pairs of horizontal wefts (aho), that are finger twined around larger vertical warps (whenu) and the feathers secured to the backing warps via the 'two-pair interlocking' wefts (Fig. 7.1) (Hīroa, 1925; Te Kanawa, 1992, p. 34). As there is limited literature (or oral records) on early 19th century Māori feather cloaks, it is imperative to study surviving material evidence produced before and after this time.

***Figure 7.2.* Kahu huruhuru (Māori feather cloak). Muka, brown kiwi, kererū and kākā feathers, wool; spaced double pair twining, plaiting. North Island. Purchased 1979. Te Papa ME014165. All Rights Reserved.**

A richness and diversity in kākahu in which New Zealand native bird species were prominent in cloaks made after 1850, included brown kiwi (*Apteryx* spp.), kererū (*Hemiphaga* *novaeseelandiae*), kākā (*Nestor meridionalis*) and tūī (*Prosthemadera novaeseelandiae*) (Fig. 7.2) (Harwood, 2011a; Hīroa, 1911, p. 84; Pendergrast, 1987; Te Kanawa, 1992, p. 25). Increased cloak production from the second half of the 19th - early 20th century coincided with introduced wool and cotton materials, and striking geometric designs that incorporated feathers from newly introduced exotic birds such as domestic chicken (*Gallus gallus domesticus*), common pheasant (*Phasianus colchicus*), peafowl (*Pavo cristatus*), and helmeted guinea fowl (*Numida meleagris*), sometimes mixed with native bird feathers (Harwood, 2011a; Pendergrast, 1987, 1997). Essentially anything new and different was coveted.

Ethnologist Elsdon Best (1856-1931) was granted unique access to the language, customs, and traditions of Ngāi Tūhoe in Te Urewera towards the end of the 19th century. Best (1898) recorded some of the whakapapa (history) and tikanga (customs) of weaving traditions at a time when European influences were still relatively minimal in the Bay of Plenty. He also catalogued Tūhoe forest lore including anecdotal notes on historical names for various birds and feathers (Best, 1977). These studies were conducted in an ideal time and place, unfortunately he failed to capture knowledge surrounding Tūhoe bird and feather use in cloaks, and his records have been criticised for fragmenting Tūhoe knowledge (Binney, 2009a, p. 27).

With limited knowledge of the Māori language and weaving, British ethnologist, Roth (1923) attempted to illustrate historical New Zealand feather cloaks and unique examples from museum collections in the United Kingdom. Roth (1923) outlined some of the social context, and potential historical and geographical correlations between Māori weaving cultures in the Pacific and the Americas. A major contributing Māori scholar, Hīroa (1926) detailed Māori cloaks from Polynesia, and historical (pre-European) clothing up to the 20th century, and focussed on weaving materials and methods, and when and how they were applied over time. His argument for context was emphasised by the ancestral connections between Polynesian and Māori material culture, including some aspects of bird and feather use, particularly the significance of red feathers (Hīroa, 1930, 1944). Mead's (1969) work classified the multitude of cloaks from temporal phases in Māori history and considered the social and economic impacts of European culture relevant to cloak production and use. His interpretation of the technical, functional, and social adaptations of iwi Māori is now the foremost piece of literature on the social history of post-colonial Māori cloaks.

The identification and interpretation of bird and feather use in Te Papa's Māori cloaks introduced several key aspects in cloaks made after 1800 that include social, political, personal, and environmental influences (Harwood, 2011a, 2011b). In the absence of weaver input, the intellectual exchange between these factors was challenging in interpreting Māori feather cloaks from this era. As histories can be distorted and museum records not collected or retained, an in-depth cross-examination of the world's cloak collections from a largely material-based perspective alongside studies of Māori social history was justified.

The lack of documented feather cloaks until the latter half of the 19th century was highlighted in the limited graphical and literary evidence (Campbell, 1881; Mead, 1969, p. 131). A rare account came from John Nicholas (1784-1868) a ship companion of missionary Reverend Samuel Marsden (1765-1838), who recounted meeting Rangatira (Māori chiefs/ leaders) and toa (warriors) at the Rangihoua mission in Northland in February 1815, where they were seen dressed in impressive dog skin cloaks in squares or strips, and feather cloaks (Salmond, 1997). No feather cloaks could be positively identified in the works of the English explorer and artist George French Angas (1822-1886), who travelled throughout the central and lower North Island of New Zealand between August and December 1844 depicting Māori life and customs (Angas, 1979; Falconer-Grey, 2014). New Zealand artists Gottfried Lindauer (1839-1926) and Charles Frederick Goldie (1870-1947) were known for their life-like Māori portraits in the late nineteenth-early twentieth centuries. A few high-ranking men and women were shown robed in kahu kiwi (kiwi feather cloaks) in Lindauer's works at the end of the 1800s (Blackley, 1997; Mason & Stanhope, 2016; Mead, 1969). The early American Photographic Company, Burton Brothers Studio and Pullman and Son, portrayed Māori in various 'traditional' and European clothing, holding props to represent rank and prestige such as finely made cloaks, weaponry, and ornaments including feathers worn in their hair, borrowed from local collectors, dealers or museums (Corey-Pearce, 2005). Photographers and artists often replicated or re-used the same kākahu on models to romanticise Māori society (see Te Papa images A.004688 & A.004690).

7.1.1 Pākehā colonisation and settlement period

European settlement began soon after initial contact 1769-1840 starting from Cook (British), the Dutch and French voyages, whalers, sealers, traders, farmers, missionaries, and miners (Armitage, 1995; Belich, 1996; Mead, 1969). Reverend Marsden established the first Church of England mission in the Bay of Islands, Northland in 1814 and it spread thereafter (Belich, 1996; Ell & Ell, 2008). The Church Mission Society claimed to transform immodest Māori into respectable parishioners dressed in suitable European clothing (Corey-Pearce, 2005, p. 75). It was from the bible that many Māori learnt to read and write English, which subsequently diverted Māori away from traditional teachings and perceived questionable religious and spiritual practices (Anaru, 2011). Before this, illiteracy was an effective tool used against Māori in binding legal documents such as treaties, laws, and leases (Gibbons, 2002, p. 9).

By the early 1840s, missionaries claimed 42,700 Anglican converts, and 16,000 Māori Methodists (Belich, 1996, p. 217). In 1841, Bishop Pompallier reported that 45,000 Māori were in the process of converting to Catholicism, with some claiming they had 2-3 denominations, more accurately most Māori only gave the impression of conforming (Belich, 1996, p. 218). This was from an expected compliance with early European religions, and societal norms. Over 50 new Māori religions could be documented that deviated from English denominations as early as the 1820s, some of the more known movements began in the 1860s and merged aspects of Christianity with traditional Māori beliefs, and for the most part were directed towards the peaceful teachings of the bible including one of the most influential prophetic movements Pai Marire or Hauhau lead by Te Ua Haumene that emerged from Taranaki around 1862 (Belich, 1996). Others from this time appeared in Northland, namely Aperahama Taonui (c.1815- 1882) of the Hokianga; and tohunga Papahurihia (Te Atua Wera); Te Whiti-o-Rongomai and Tohu Kakahi of Parihaka; the formidable prophet generals Rīwha Tītokowaru of Taranaki and Te Kooti Rikirangi (Rongowhakaata) and Ringatū of the east coast; the Tariao and Pao Miere movements in and around Waikato; and Te Maiharoa's movement in the South Island in the 1870s (Belich, 1996; Binney, 2007; Binney, Chaplin, & Wallace, 1979; Stenson & Olssen, 1997). Initially, most of these earlier faiths built meaningful understandings of the old and new worlds, as a coping mechanism for such adverse change (Stenson & Olssen, 1997). The Māori religions that appeared later in the 19th century had identified with the ancient scriptures of Judaism that centred on the rising of the oppressed slave population and retention of lands and spiritual autonomy. They resonated strongly with Māori but were considered by Pākehā to be an afront to British authority and the traditions of the Church. The British mistrusted and misunderstood Māori political-religious agendas, and the Tohunga Suppression Act of 1907 legally re-enforced these concerns.

Land distribution caused much of the political and economic discord in 19th century New Zealand as colonists aimed to control this important resource within Pākehā laws and economies (Hawke, 1985). Most Māori religious and political movements stemmed from these land and health crises, induced by colonial greed and exacerbated by intertribal conflict in the musket wars, which had killed 20,000 people by the 1830s, as Māori Christianity and European settlement increased (Belich, 1996; King, 2003). One of the first instances of muskets in Māori warfare was observed between Ngāpuhi and Ngāti Whātua in 1807 (Belich, 1996; King, 2003). Ngāpuhi Rangatira, Hongi Hika returned from England and Australia in 1821 with 300 muskets for this purpose (Sissons, Wi Hongi, & Hohepa, 1987). A key aspect of contention from colonisation stems from the dissolution of Māori land rights initiated by the signing of the Treaty of Waitangi in 1840 between the crown and more than 500 Rangatira Māori (chiefs) (Belich, 1996, p. 193). The ensuing New Zealand wars 1840-1846 amplified land conflicts between Māori and Pākehā for much of the second half of the 19th century in direct response to the failed constitutional recognition of Māori sovereignty under the Treaty (Belich, 1996). In 1840 the amount of land in Māori title was just under 27 million ha, when the Waitangi Tribunal was formed in 1975 it was under 1.5 million ha (Asher & Naulls, 1987). By 1867, 28.1% of land was already occupied by Pākehā, and increased to 40% by 1881 (Stenson & Olssen, 1997). By this time, European farming had displaced independent Māori agriculture and economic viability (Belich, 1996). The wars of the 1860s probably started in Taranaki to which a total of 20,000 Imperial troops fought for the British campaign, 18,000 were based in the Waikato alone, against 5,000 resisting Māori (Belich, 1996, p. 236).

Some Māori feared that Pākehā infrastructure and governance relinquished Māori self-sufficiency and autonomy and stunted Māori aspirations (Binney et al., 1979). In the 19th century many Māori lived in the North Island, distinguished by 20 major tribal areas in 1891 (Belich, 1996). The remote areas of the Hokianga, central Taranaki, King country, and Te Urewera had the highest concentrations of Māori people and language, religion, and European resistance, in that Taranaki, Te Urewera region, and King country were each an independent Māori state, essentially governing themselves in the 1870s (Belich, 1996).

A drastic change in population dynamics after settlement can be anticipated in the colonisation of most indigenous cultures. Māori deaths from 1790 from European diseases to which there was little immunity were attributed to viral dysentery, influenza, whooping cough, measles, typhoid, venereal diseases, and various forms of tuberculosis coinciding with plummeting birth rates (Belich, 1996, p. 173; Hanham, 2003). James Cook estimated the Māori population in 1769 was 100,000, however he did only stop along the coasts (Mead, 1969, p. 100). By 1840 it had declined to 70,000; in 1874 - 48,000 and in 1896 - 42,000 (Belich, 1996, p. 178). The estimated Māori population in 1906 had again risen to 50,000; in 1936 - 82,000; and by 1945 it was 152,000 (Mead, 1969, p. 181). In contrast, by 1838 there were only 2,000 resident Europeans, and by 1854 the population reached 32,500 (Mead, 1969, p. 100). In 1870 Pākehā numbered 250,000; in 1881 it was 500,000 and had reached well over 750,000 by 1900 (Stenson & Olssen, 1997, p. 166).

Environmental impacts also exponentially increased over this period. Reduced native bird distributions coincided with the introduction of exotic species in 19th century Māori cloaks (Harwood, 2011a). There are over 65 native bird species on the main islands of New Zealand, 75% are endemic, and over 33 introduced bird species and 32 species of introduced mammals are now considered New Zealand fauna (Wodzicki & Wright, 1984). Birds were imported for biological control; as game birds; for sentimental reasons; for eggs, meat, or the feather industries (Long, 1981; Wodzicki & Wright, 1984). Since 1780, the vulnerabilities of native bird species accumulated rapidly due to overhunting (shooting); habitat clearance; and predation and competition from introduced European birds and mammals (Holdaway, 1989; Worthy & Holdaway, 2002). The first legislative attempt to control native bird hunting was not until the institution of the Protection of Animals Act 1872 (Miskelly, 2014).

Mead (1969) addressed the functionality of Māori feather cloaks by acknowledging their role in communicating the position of the wearer; as payment or items of exchange or gifting; and as mortuary robes, or to drape over coffins in a modern context (p. 179). ‘Traditional Māori clothing’ transformed into a solid economic commodity from the 19th century where once functional and prestigious cloaks were quickly produced as currency for collectors, and costume for events and cultural performances (Mead, 1969). By the mid-20th century cloak making had almost disappeared replaced by European clothing as the methods were labour and time intensive (Harwood, 2011b; McEwen, 1947; Mead, 1969). Supported by the New Zealand women’s welfare league and the Māori Arts and Crafts Institute, weavers like Rangimarie Hetet, Digger Te Kanawa, and Emily Schuster initiated a renewal by teaching Māori weaving outside of direct family members, and in wānanga (places of learning), and in books and exhibitions (Lander, 2011, p. 63; Puketapu-Hetet, 1989; Puketapu-Hetet, 1999; Te Kanawa, 1992). Today weaving represents a fusion of traditional and contemporary Māori visual art.

7.2 Methods and Methodologies

For this study, Māori bird and feather use drew from the research themes of language, what information is communicated by the cloak including the classification (type) or cloak title; the materials, namely plants, fibres, birds and mammals; the techniques, what weaving and feather attachment methods were employed; dominant cloak colours and designs; and the possible spiritual concepts surrounding the cloaks determining how it was made and used. The possible cultural (tāngata Māori), social (iwi Māori), or personal significance of the birds and feathers to the weaver or wearer were also discussed. These themes were analysed in relation to the temporal and environmental factors in which they were made, to determine how they influenced cloaks during this timeline.

This bicultural research was underpinned by Western (Pākehā) scientific tools to recover Māori knowledge regarding bird use in kākahu, by highlighting and comparing certain aspects of kākahu replaced, adapted, or accelerated by European settlement in New Zealand. Comparative matrix models have analysed data across mathematical and sociological studies (Vallier, 1973). The matrix model conducts thematic analysis in qualitative research for simple visual comparisons and contrasts in data, particularly interview data and interdisciplinary projects such as this (Gale, Heath, Cameron, Rashid, & Redwood, 2013). The matrix framework incorporated the material and technical composition of cloaks and acknowledged the tangible, in the physical world, and the intangible, the intellectual and spiritual realms. These aspects are inherently interwoven and produce layers of knowledge that can be unlocked with multiple disciplines in the fields of te pūtaiao (the natural world) and Mātauranga Māori (Māori knowledge). For each cloak or reference the following matrix was tabulated to record aspects of knowledge associated with the production and use of each kākahu (Table 7.1).

***Table 7.1*. Matrix method of data collection for each cloak relating to the main research themes and where they are placed in the temporal space, and physical and social environment.**

	Time period the cloak was made	*Where the cloak was made, climate*	*Birds & Plants available*	*Social & religious factors*
Who made/ wore the cloak				
The birds & plants used				
How were the feathers attached				
Why were the materials & techniques used				
What was the cloak called				
What did the cloak communicate				

The primary methods of investigating bird use in post-European Māori feather cloaks involved:

1. A search and review of major literature and graphical evidence from the 19th century to the present, that encompassed Māori feather cloak production and use, New Zealand native and introduced bird distributions and use, including European and Māori interactions with birds and cloaks.
2. Conducting oral history interviews with well-known National and Northern iwi (peoples/ tribe) weavers, and experts in Māori bird and resource management.
3. The creation of an International Register of Māori feather cloaks held in museums around the world, that recorded materials, techniques, images, museum numbers, cloak descriptions, provenance, and collection histories.
4. Feather identifications conducted based on personal observations, and images provided by museums 2016-2019. Identifications were made from comparisons of reference image databases of microscopic feather down and museum bird skins initially created in 2007 (Harwood, 2011a).

A study of literary works from the last 120 years encapsulated the research themes. Major publications incorporating material, technical and contextual analyses of cloaks and Māori weaving from the 1800s onwards were derived primarily from 19th and 20th century ethnologists (Best, 1898; Hamilton, 1972; Hīroa, 1926; Mead, 1969; Pendergrast, 1987). Mead's (1969) expansive knowledge on 'traditional Maori clothing' post settlement was the primary source of cloak classifications, use and social context for this chapter.

Bird taxonomic classifications and nomenclature followed the *Checklist Of The Birds Of New Zealand* (Checklist Committee, 2010). Microscopic and macroscopic feather identifications and analyses adhered to previous studies, with methods and conventions outlined in Harwood (2011a). Descriptions of New Zealand bird feather morphology referred to Harwood (2011a); *The Field Guide To The Birds Of New Zealand* (Heather & Robertson, 1996); and the *Handbook Of Australian, New Zealand & Antarctic Birds* (1990-2007). Historic and current bird and mammalian distributions and abundance observed Atkinson and Millener (1991); Holdaway, Worthy, and Tennyson (2001); Robertson, Hyvönen, Fraser, and Pickard (2007); Long (1981); Thomson (1922); and Wodzicki and Wright (1984). Best (1977), Riley (2001) and Orbell (2003) have formally published on aspects of Māori customs and traditions pertaining to birds and provided supplementary supporting literature of recorded knowledge, although some of the original sources of information could not be traced.

Oral history interviews of national and northern iwi weavers, artists, and conservationists were conducted in 2017. Semi-structured conversational questions pertaining to historical and contemporary cloaks; traditional and post-European cloak materials and techniques; and bird access, use, and management were included in the discussions. The interviews supplemented gaps in knowledge in the literature and research and have been cited in the text (e.g. Prime (2017)) to recognise the knowledge of each participant and the importance of the information imparted for this research (see Appendix One for ethics approval and Appendix Two for an example of an interview schedule). After each interview, the responses were analysed according to the corresponding theme, location, and time-period it was associated with.

The creation of an International Register of Māori feather cloaks was based on the substantial work undertaken by Auckland War Memorial Museum ethnologist David Simmons from his catalogues and indexes of Māori artefacts in Australian, United Kingdom, European, American and Canadian museums in 1978 (Simmons, 1981, 1996, 1997). Ethnologist Mick Pendergrast catalogued the materials, techniques, provenance, and collection history of Māori feather cloaks at Auckland Museum and the British Museum in London (Pendergrast, 1987; Starzecka, Neich, & Pendergrast, 2010). Pacific collections were compiled by Kaeppler & Stillman (1985) in American museums; Gathercole and Clarke (1979) in United Kingdom museums; and Bolton and Specht (1984) in Australian museums. Museums were contacted in New Zealand and overseas for inclusion in the study, staff were asked to provide production and provenance histories for permanent collection items, cleared of iwi and stakeholder permissions, and copyright. The cloaks for this study were produced from the 19th century on.

Previous qualitative and quantitative research have exhaustively analysed Māori cloaks after settlement (Hīroa, 1926; Mead, 1969; Pendergrast, 1987, 1997). What was lacking was an analysis from the perspective of bird and feather use. The Waka Mātauranga framework introduced by Black (2014) encompassed the various aspects of the research in that it fostered the essence of 'Te reo o te kākahu', and the relationship between the language and knowledge or kōrero (history) communicated in each cloak in order to re-examine previous research from this different perspective. The essence of understanding the language of a cloak, is interpreting what it conveyed through the skills and knowledge of the weaver, and the materials and techniques used. It supported a redirected approach from an ornithological view, with the promotion of Māori knowledge from scientific analyses and detailed comparisons.

7.3 Possible European influences on Māori feather cloaks made after settlement

According to the International Register over 100 museums around the world hold approximately 600 Māori feather cloaks produced after 1800 (Table 7.2). Over 30 New Zealand museums store around half the cloaks, and over 70 international museums hold the other half. Similar species were recorded in Te Papa's cloaks (110) in 2007 (Harwood, 2011a).

***Table 7.2.* A preliminary list of native and introduced (*) bird species recorded in Māori feather cloaks in the International Register, 1800 to present (n= c.600 cloaks, from c.100 museums).**

	No. cloaks with listed species	
Bird species (n≥ 30) adapted from Harwood (2011a)	**Te Papa cloaks (n=110).**	**International Register (c.600)**
Brown kiwi (*Apteryx* spp.)[1]	52	282
Kererū, N.Z. pigeon (*Hemiphaga novaeseelandiae*) (Gmelin, 1789)	45	152
Kākā (*Nestor meridionalis*) (Gmelin, 1788)[2]	43	150
Domestic chicken (*Gallus domesticus*) (Linnaeus, 1758)*	25	140
Tūī (*Prosthemadera novaeseelandiae*) (Gmelin, 1788)	35	106
Common pheasant ♂ (*Phasianus colchicus*) (Linnaeus, 1758)*	15	75
Peacock (Peafowl), Pīkake ♂ (*Pavo cristatus*) (Linnaeus, 1758)*	13	54
Pūkeko, swamphen (*Porphyrio melanotus*) (Temminck, 1820)	11	33
Kākāriki, parakeet (*Cyanoramphus* spp.)[4]	10	34
Weka, woodhen (*Gallirallus australis*) (Sparrman, 1786)[3]	12	27
Duck/ mallard (*Anas* spp.) (Linnaeus, 1758)[5]*	4	16
Wild turkey ♂ (*Meleagris gallopavo*) (Linnaeus, 1758) *	5	15
Albatross, toroa (Family Diomedeidae)[6]	4	7
Helmeted guineafowl (*Numida meleagris*) (Linnaeus, 1758)*	2	5
Banded rail (*Gallirallus philippensis*) (Linnaeus, 1776)	2	4
Kākāpō, night parrot (*Strigops habroptilus*) (G. R. Gray, 1845)	1	4
Kāhu, swamp harrier (*Circus approximans*) (Peale, 1848)	1	4
Emu (*Dromaius novaehollandiae*) (Latham, 1790)*		4
Long tailed cuckoo (*Eudynamys taitensis*) (Sparrman, 1787)	2	3
Huia (*Heteralocha acutirostris*) (Gould, 1837)**	2	2
California quail *(Callipepla californica)* (Shaw, 1798)*	2	2
Australasian bittern (*Botaurus poiciloptilus*) (Wagler, 1827)	1	2
Gull (Family Laridae)**		2
Ruru, morepork (*Ninox novaeseelandiae*) (Gmelin, 1788)	1	1
Yellowhammer (*Emberiza citronella*) (Linnaeus, 1758)*	1	1
Shining cuckoo (*Chrysococcyx lucidus*) (Gmelin, 1788)	1	1
Kea, alpine parrot (*Nestor notabilis*) (Gould, 1856)		1
Ostrich (*Struthio camelus*) (Linnaeus, 1758)*		1
Eastern Rosella (*Platycercus eximius*) (Shaw, 1792)*		1

[1] Includes brown and spotted kiwi.

[2] Includes North and South Island subspecies.

[3] North Island, buff, western and Stewart Island weka are included.

[4] Red-crowned, yellow-crowned and orange-fronted parakeet are included.

[5] All varieties that interbreed with *Anas superciliosa* are included.

[6] All albatross species of the genera Diomedea and Thalassarche are included.

**has unconfirmed identification/ s.

The kākahu with known bird species were added to the table count (Table 7.2). Kākahu with the highest recorded provenance in the International Register, not including David Simmons' attributions, were predominantly associated with the Bay of Plenty, Waikato, and Taupō, Taranaki, Whānganui, Wellington, and Kāi Tahu in the South Island. Production and ownership, including known master weavers from Ngāti Maniapoto and the Bay of Plenty were also recorded where possible. Cloaks associated with well-known dignitaries such as the Māori King, New Zealand Prime Ministers Richard Seddon (1845-1906) and Thomas McKenzie (1853-1930), and collectors Te Rangi Hīroa, Alexander Turnbull, Elsdon Best, George Grey, and Augustus Hamilton were also registered.

7.3.1 Language and classifications

The classifications of cloaks recorded by Best (1898) and Hamilton (1972) were introduced in the 19th century in part from a need for early European taxonomic distinctions. For example, early European voyages detailed the nomenclature of New Zealand flora and fauna, unfortunately this was not the case for clothing (Henare, 2005). In the 19th century the prestigious kahu kurī (dogskin cloaks) displaced kākā feathers in cloaks, and these in turn were supplanted by kahu kiwi or kiwi feather cloaks as status wear (Mead, 1969, p. 37; Pendergrast, 1997). Titles have adapted to social changes from the 19th century on, today Mead's (1969) extensive index of cloak titles form the basis of catalogues (classifications) used in museums.

Feather cloaks were defined by the presence of feathers, maintaining that the cloak title typically described the predominant bird present (e.g. kahu kiwi). Based on the International Register of museum collections and the literature, there were several styles (designs) of cloaks that incorporated feathers, described as follows. The highly esteemed kiwi feather cloaks (kahu kiwi), incorporating native brown kiwi feathers, were sometimes called Arikiwi (Hamilton, 1972, p. 286). In the context of this study, kahu kura or kahu kākā were defined as red cloaks covered with feathers from the kākā (Mead, 1969, p. 222; Tamarapa, 2011a, p. 187). Other full feathered cloaks of note included the kahu kākāpō, a cloak of kākāpō (night parrot: *Strigops habroptilus*) feathers, and kahu weka of weka (*Gallirallus australis*) feathers (Mead, 1969). Kahu huruhuru were fully covered feather cloaks that comprised of more than one bird species, and sometimes incorporated geometric patterns including check, triangle, diamond, and lozenge patterns. The korowai was known as a fine cloak worn by females, with a surface adorned with hukuahuka (tassels) (Best, 1898, p. 639; Hamilton, 1972, p. 285; Tamarapa, 2011a, p. 187). Tahuka are similar but with no tassels (Best, 1898, p. 640; Hamilton, 1972, p. 285). There were several definitions of korowai, with various forms of ornamentation ranging from hukahuka, feathers and tāniko (Mead, 1969). Some cloaks have all three, with varying designs that differed tribally (Te Kanawa, 1992). Korowai whakahekeheke have vertical bands of hukahuka, kārure (unravelling 2 or 3-ply tassels), or feathers, and sometimes tāniko borders (Mead, 1969, p. 225; Tamarapa, 2011a, p. 187). Pekerangi were described as a large shoulder garment with scattered small tufts of red feathers, hair, or wool (Hamilton, 1972, p. 285). Williams (1957) stated it had an ornamental border (p. 276). Mead (1969) suggested they have both tāniko and feather tufts, with a small number of kaitaka made after European arrival fitting this description (p. 113). Protective rain capes (pākē, hieke) were recorded after European settlement adorned with feathers and wool in the borders and neckline. Cloaks identified in the International Register were classed as forms of pihepihe, cloaks covered in pōkinikini strands (Tamarapa, 2011a, p. 189). Pōkinikini are made of flax leaves stripped at intervals and dried, then the scutched sections dyed black and the resulting cylindrical strands twined into a muka backing (Best, 1898, p. 642; Hamilton, 1972, p. 290; Tamarapa, 2011a, p. 189). Interchangeable waist and shoulder garments, that showed functional ambiguity namely piupiu, rāpaki, and pākē kārure, and that lacked a defined foundation or backing, were not analysed for the purposes of this research, and omitted from the International Register.

7.3.2 The decline and legal protection of native birds

Māori land confiscations, in conjunction with accelerated loss of native bird habitat; over hunting (by both Māori and Pākehā); and predation from introduced mammals all collectively resulted in a significant decline in vulnerable New Zealand bird species. In response, the Government assigned some legal protection for certain birds from the 1860s. These laws did slow some of the decline, but for Māori, it also prevented customary access to traditional foods and feathers for cloak making. Before European settlement, it is understood that birds had already decreased substantially over the centuries of Māori habitation in New Zealand, however within one hundred years of European arrival habitat loss restricted the viability of rare flora and fauna. In the 19th century, the replacement of traditional bird hunting methods such as snaring, trapping and spearing were superseded by quicker, more effective guns, muskets, and rifles (Figs. 7.3 & 7.4).

***Figure 7.3*. Waka kererū (pigeon trough). Wood, harakeke; carving, tying, knotting. Te Papa ME003952. All Rights Reserved.**

Waka kererū (pigeon troughs) were constructed from hollowed out wood filled with water and reti nooses placed around the trough to ensnare thirsty pigeons around the neck after they gorged themselves on sugary forest fruits (Fig. 7.3) (Best, 1977; Prime, 2017). Kevin Prime of Ngāti Hine recalled a place near Matawaia in Northland, they called Manutangohia, where they would 'acquire birds', insisting "there was still that thing of sustainability. They [Māori hunters] still didn't wipe them out, they knew that you can only kill so many and if you went over this amount, you're not ..[going to].. have any for the year after. That was especially so with the guns" (Prime, 2017). When discussing Māori use of firearms, Prime (2017) believed the traditional methods of catching birds were "well gone by the early 1900s, in 1840 they already had muskets…by the 1920s they would have already had .22 rifles, repeater rifles and shotguns" (Fig. 7.4). Guns were a valuable commodity in trade, gifting, intertribal conflict and hunting in the 19th century (Belich, 1996; Crosby, 1999). The musket wars involved intense intertribal tensions, starting in the early 1800s it had intensified by the 1820s and 30s leading up to the signing of the Treaty of Waitangi in 1840 (Belich, 1996). In 1831, 6,000 guns from Sydney were traded for flax, and in the same year a gun cost 27 shillings due to the demand (Belich, 1996; Firth, 1959, p. 488).

***Figure 7.4*. Flintock Musket. Steel, maple, brass, flint, leather. Produced Ketland & Company; gunsmith; circa 1820; England. Purchased 2000 with New Zealand Lottery Grants Board funds. Te Papa GH008078. All Rights Reserved.**

With Māori hunting, Hori Parata (Ngāti Wai) affirmed that “you only take that kai [food] at that time of the year and then you leave it alone” in that “we learnt our tikanga [customs] because it was respect of the ngahere [forest] and respect for the birds too….because I guess that’s how it was back in those days, … these days anybody can do anything.. but in those days, it had real significance” (Parata, 2017). With the removal and disassociation of people from the land, Māori inevitably lost some of these tikanga or connections to it. Prime (2017) believed that in the past “Māori were used to operating on a big area of land, they weren’t confined to a smaller area” and “once you sold a lot of land, they didn’t have that same understanding. I don’t think they understood that they were selling it. They understood that they were giving a right of occupation”. Today, this idea of kaitiakitanga, is a form of guardianship or custodianship, for Māori it more closely identified a people with their surroundings and the reciprocal connection they have to it. Prime (2017) recalled a kiwi bird sanctuary created by Moeahu (Ngāti Hine) the grandfather of Te Ruki Kawiti (1770s-1854), a prominent Ngāpuhi leader from the Bay of islands. *Te rāhui kiwi a Moeahu* (the kiwi reserve belonging to Moeahu), was aptly named for the ban on hunting kiwi within the land boundaries of Ngāti Hine as a deterrent for kiwi poachers (Shortland & Nuttal, 2008, p. 10). This warning was reinforced further by the naming of the area *Wahapako* (the clicking noise the mouth made from salivation) as a memory aid in telling the story of an illegal poacher caught and dispatched by the men of Moeahu six generations ago for eating protected kiwi in the area (Prime, 2017).

Today Northern rāhui on kukupā (kererū) occur in Ngāti Hine according to Prime (2017), in that there are still issues with taking pigeons when the numbers are limited, but “when we [Ngāti Hine] imposed the rāhui it was observed even by the people, … that a rāhui would have been far more effective than the [Pākehā] laws. The [Pākehā] laws have been around for 100 years and it still hasn’t been that effective really”.

***Figure 7.5*. Fairey and Plum Shooting Party, circa 1900. Image courtesy of Nelson Provincial Museum, Tyree Studio Collection: 176893.**

Vulnerable bird populations recovered with difficulty particularly when Pākehā encouraged seasons for game hunting, as farmers and bushmen were keen to make money from selling skins to museums and milliners (Hunter, 2011). The Protection of Certain Animals Act (1861) instituted the regulation of hunting introduced game birds, and amendments to the Protection of Animals Act Amendment Act (1868) effectively permitted that native kererū could be killed year-round for a time (Fig. 7.5) (Miskelly, 2014).

New Zealand has a land surface of 27 million hectares, 10% of which is currently shrubland and approximately 23% is forest, a reduction of more than 70% from its pre-human condition mainly due to historical fires, forest clearance, and logging (Allen, Bellingham, Holdaway, & Wiser, 2013). The devastating and ongoing impact of human settlement on vulnerable New Zealand native flora and fauna cannot be overstated. Very little of the predation of birds from kurī (Māori dog: *Canis lupis familiaris*) (Fig. 6.1) and kiore (Māori rat: *Rattus exulans*) from the time of Māori settlement can be quantified before European settlement. What has been documented is the overall devastation on birds of New Zealand and Pacific islands previously lacking land mammals (Atkinson, 1977; Holdaway, 1999). Native birds have declined from an overwhelming and accumulative combination of low and slow breeding rates, with susceptibilities to foreign diseases and parasites, hunting, predation, and competition pressures for shelter and food from introduced birds and mammals, and landscape changes also resulting in starvation (Checklist Committee (OSNZ), 2010; Heather & Robertson, 1996; Higgins, Peter, & Cowling, 2006). Modern competition and predation has mainly occurred from dogs, cats (*Felis catus*), rats (*Rattus* spp.), mustelids (*Mustela* spp.), Australian brush-tailed possum

(*Trichosurus vulpecula*), and gregarious and aggressive introduced birds, resulting in an advanced decline and extinction of many New Zealand species (Galbraith & Brown, 2004; Innes, Kelly, Overton, & Gillies, 2010; Millener, 1989). To date, fifty-nine New Zealand bird species have become extinct since first human contact (Robertson et al., 2017). Reinstituting traditional Māori rāhui (bans) and introduced Pākehā conservation practices managed more of the decline, despite legal management of only some native avifauna not starting in earnest until 1873 (Miskelly, 2014). From the 20th century the translocation of endangered birds for breeding purposes ensured some viable populations of vulnerable endemic species including brown kiwi and takahē (*Porphyrio* spp.) (Colbourne, 2005; Miskelly & Powlesland, 2013). Full protection was finally extended to most native birds with the Animals Protection Amendment Act 1910 stating that 'Every person who destroys, or injures, or captures any bird which is indigenous to New Zealand, or who robs or destroys the nest of any such bird, is liable to a fine not exceeding twenty pounds' (Miskelly, 2014, p. 31). Today most native birds are fully protected under the Wildlife Act 1953 which is instituted by the Department of Conservation.

7.3.3 The significance of certain native birds in Māori feather cloaks

***Figure 7.6*. Kahu kiwi (kiwi feather cloak). Muka, dye, brown kiwi (including white albino) feathers; spaced double pair twining, tāniko, plaiting. Made 1850-1900. Gift of Alexander Turnbull, 1913. Te Papa ME002701. All Rights Reserved. Right: detail of albino brown kiwi feather. Image by Hokimate Harwood, 2009.**

A provisional analysis of approximately 600 cloaks listed in world museums in the International Register, recorded that around half the cloaks featured brown kiwi (*Apteryx* spp.)

feathers, the most common species recorded (Table 7.2). At least 180 of these cloaks could be catalogued as kahu kiwi, fully feathered kiwi cloaks (Fig. 7.6). Only one cloak to date was identified with spotted kiwi (*Apteryx owenii*) feathers (Te Papa ME016788). Many traditional kahu kiwi are made today as they would have been 150 years ago, twined with the kiwi feathers woven into the backing with the ventral side facing out, whakaaraara style; to a lesser extent kiwi feathers are also woven in with the dorsal side facing out, as it is on a bird, known as tāmoe (Fig. 7.7) (Hīroa, 1911, p. 84). Whakaaraara, is to raise or erect something (Williams, 1957). The insertion of kiwi feathers in this manner created a large lustrous garment and elevated the status of the kākahu, weaver, and wearer. Where tāmoe is to press down on an object, it is also a form of chant to inhibit the evil effects of an enemy (Hamilton, 1972, p. 402; Williams, 1957). Master weaver Edward (Eddie) Maxwell (1939-2009) of Te Arawa, Ngāti Rangiwewehi, Ngāi Tūhoe, and Ngāti Awa, felt it was the weaver more than the materials that gave the cloak mana (authority and status) (Te Kanawa & Turi-Tiakitai, 2011, p. 30). In the 19th century, there was increased interest in kiwi cloaks, the feathers are large, voluminous, and striking and made the wearer appear endowed with size, authority, and wealth. Lander (2017) suggested these cloaks were produced more towards the end of the 1800s, in that:

> "They came into prominence around about the turn of the century, [20th century] .. especially to do with the Rotorua hosting of British royalty [in 1901]. Kiwi feather cloaks were a bit like fur cloaks… They were not the status cloak [originally]. The kahu kura [red feather cloak] would have been, also the kaitaka [fine cloak with tāniko borders], and the dogskin cloaks. Kiwi feather cloaks came into prominence and became the status cloak .. in the 1900s".

Figure 7.7. **Brown kiwi (*Apteryx* sp.). ©Peter Reese, 2009.**

The International Register collated several kahu kiwi with albino augmentation. Including vertical albino feather strips (Te Papa ME007612 & ME001378) (see Fig. 6.78); and single albino feathers (Te Papa ME002701) (Fig. 7.6) (Tamarapa, 2011a, pp. 100–101). A kahu kiwi (E1777) in Queensland Museum Brisbane was presented to Prime Minister Richard Seddon and incorporated albino kiwi in the borders (Simmons, 1997c). A cloak in Whānganui Regional Museum (1968.100.2), made by Tarihira Kereti (Ngāti Ruakā, Te Āti Haunui-ā-Pāpārangi) in the 19th century had thin white vertical albino feather strips (Horwood & Wilson, 2008, pp. 23, 144). A kahu kiwi (D.00078) in Bernice Pauahi Bishop Museum in Honolulu Hawai'i featured a short albino kiwi strip along the cloak base. The British Museum in London had a kahu kiwi (Oc1982,Q.737) with small blocks of albino brown kiwi feathers; and in the Nottingham City Museums & Galleries in England the albino kiwi formed a central design and bunches across a cloak (NCM 1945-139). Albinism in birds would generally be viewed by Māori as an omen or tohu (sign), good and bad depending on the bird, the area, and circumstances in which it was seen, as discussed in Chapters Five and Six (Best, 1977).

Figure 7.8. **Kiwi feather muff. Muka, brown kiwi feathers, twining. Made 1890-1920. Purchased 2013. Te Papa ME024137. All Rights Reserved.**

Historically, North Island brown kiwi (*Apteryx mantelli*) and South Island brown kiwi (*Apteryx australis australis*) were widely distributed (Worthy, 2010b). Tolerable of varying climates, and preferring podocarp and hardwood forests, increased land clearance caused substantial reductions in numbers since European settlement, resulting in local populations restricted to remaining forests, scrub, and farmland (Marchant & Higgins, 1990a, p. 73). Flightless native birds are particularly vulnerable, and hunting pressures were minimal until further decline was attributed to low productivity and predation from introduced mammals like dogs (Heather & Robertson, 1996, p. 168; Marchant & Higgins, 1990a, p. 73). Native kiwi bird skins were purportedly sold for £1 each in the late 19th century (Best, 1977, p. 170). Taxidermists also played a role in the business of bird skin preparation for personal and museum collections

(Crane & Gill, 2018). An acculturation of Māori-European materials and technical applications appeared in English fashions and styles, and as kiwi feathers were so unique the feathers were desired for non-traditional accessories (Fig. 7.8) (Hunter, 2011). A kiwi feather mantle (A1694.1) listed in the International Register located in the Denver Museum of Nature and Science in Denver, Colorado was thought to be a lambrequin mantel piece, however the cloak ties and kiwi feathers indicated it was a shoulder garment.

***Figure 7.9*. Kākahu/ kahu kura (red kākā feather cloak). Muka (N.Z. flax), dye, kākā feathers; spaced double pair twining, tāniko, plaiting. Makurata Paitini (Ngāi Tūhoe) weaver; made 1906; North Island. Augustus Hamilton Collection. Purchased 1914. Te Papa ME001683. Right: detail of kākā feathers and tāniko symbols in the cloak. All Rights Reserved.**

Kahu kura and kahu kākā both describe red, treasured, or red kākā feather cloaks. The term kura in this instance referred to the colour red or a treasured prestige item. Pre-19^{th} century fully feathered kahu kura were rare and highly valued, worn by high ranking individuals only on certain occasions. At least seven variations of kahu kura cloaks made after 1800 were collated in the International Register confirming their scarcity, with a quarter of nearly 600 cloaks in museums containing kākā feathers to date (Table 7.2). A remarkable kahu kura in Te Papa (ME001683) was made in 1906 by Ngāi Tūhoe tohunga kairaranga (master weaver) Makurata Paitini (1844-1930) (Fig. 7.9). Augustus Hamilton at the then Dominion Museum (now Te Papa) commissioned the cloak, taking a year to complete, it has her unique identifying marks of two small mirror-image triangles in the corners of the lower tāniko border (Fig. 7.9) (Tamarapa, 2011a, pp. 104–105). Makurata produced a similar kahu kura (Ethnology No. 5975) in the Auckland War Memorial Museum, with tāniko and kākā feathers, and the shortened version of her name “MA” “KU” added to the corners of the lower tāniko border (Pendergrast, 1987, p. 114; Te Awekotuku & Nikora, 2003). It was made around 1900 for Mr C. Nelson of Whakarewarewa and was on sold by his family for the sum of £70 to a Mr H.

Brett who presented it to the museum around 1914 (Pendergrast, 1987, p. 114). Makurata potentially has cloaks in other museums that have yet to be positively verified as hers.

Kahu kura are highly valued because of the scarcity of red feathers in New Zealand birds. The kākā or native parrot is one of the only native New Zealand birds with adequate red feathers, from the belly and underwing, which are featured in most post-European Māori cloaks (Fig. 7.10) (Harwood, 2011a). Feather research conducted in 2006, counted 200 of the brilliant red belly feathers, and a maximum of 200 underwing covert feathers on a North Island kākā (*Nestor meridionalis septentrionalis*) museum birdskin (H. Harwood, unpub. data). The colour of blood, red is considered sacred and represents authority and status (Rangatiratanga), and a connection to the gods in Hawai'i (see Chapter Five). Discussion in Chapter Six revolved around pre-19th century historical and Cook-collected cloaks and concentrated on the materials recorded, supplemented by accounts and artist impressions on the three expeditions 1769-1777. Early European explorers recorded bird skin attire, and vaguely described parrot cloaks, albeit they were rare, and only people (men) of rank were recorded wearing them. Of the 13 pre-European cloaks collated, at least 5 had kākā feathers (see Chapter Six).

***Figure 7.10*. North Island kākā (*Nestor meridionalis septentrionalis*). Collected by D. Hume, June 1993. Aongatete, Bay of Plenty. Te Papa OR.025025. Right: detail of underwing (top), and belly. CC BY 4.0.**

There are two subspecies of the endemic kākā originally separated geographically as South Island kākā (*Nestor meridionalis meridionalis*) and North Island kākā (*Nestor meridionalis septentrionalis*). Little morphological variations can be observed between individual birds, with limited genetic differentiation between the subspecies (Buller, 1888, p. 151; Chambers, 2010; Holdaway et al., 2001). Historically kākā were common in fossil deposits in the North and South Islands, and present in North Island middens (Chambers, 2010). They were still common when Europeans first arrived but by the early 20th century populations had been severely reduced to small, localised flocks (Heather & Robertson, 1996, p. 355). Habitat destruction, predation from introduced mammals and overhunting attributed to decline, they are currently only locally common and limited to the upper and lower North Island, the west coast of the South Island, Stewart Island, and some offshore islands (Higgins, 1999, p. 265; Robertson et al., 2007).

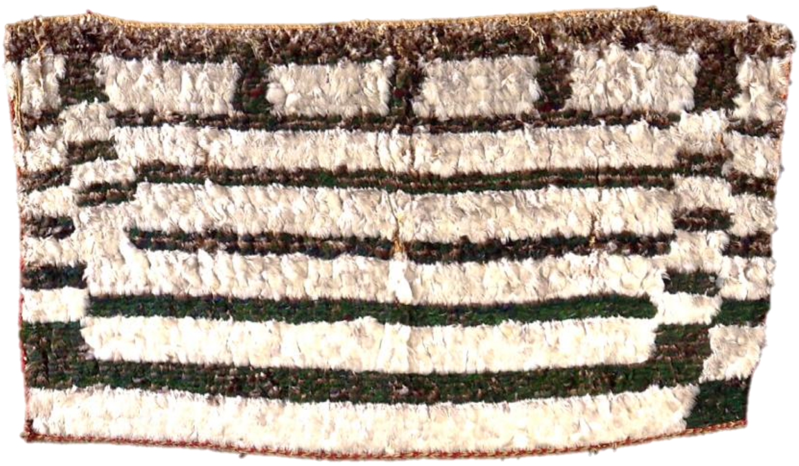

***Figure 7.11*. Kahu kererū (Māori pigeon feather cloak). Muka, cloth, wool, kererū, tūī, and chicken feathers; twining, plaiting. Made 1900-1920. Bequest of Mrs E. H. Blair in memory of her late husband, Archibald Anderson Watt, 1918. Te Papa ME003715. All Rights Reserved.**

Kererū or New Zealand pigeon (*Hemiphaga novaeseelandiae*) feathers were recorded in at least 150 of around 600 cloaks in museums in the International Register, with a small number classified as kahu kererū with pigeon as the predominant bird in the cloak, although it was more accurately higher (Fig. 7.11). Kererū are around 50cm long and weigh between 600-700g, distinguished by a metallic green head, neck, and upper breast separated from a white lower breast and belly by a horizontal line across the chest; and duller purplish-teal green back (Heather & Robertson, 1996; Higgins & Davies, 1996). The white breast and belly, and green neck feathers were common in most Māori cloaks made after 1800 as the contrasting green and white feathers augmented the geometric designs in many kākahu (Figs. 7.11 & 7.12) (Harwood, 2011a). Feather research conducted in 2006, counted 300 of the preferred green neck feathers and 500 of the white lower chest and upper belly feathers on an adult bird (H. Harwood, unpub. data). Examples of pigeon mourning feather cloaks from French Polynesia and Melanesia were studied suggesting there may be symbolic connections with pigeons, prestige, and death (see

Chapter Five). To date, no historical New Zealand Māori cloaks made before 1800 have been identified with kererū feathers (see Chapter Six). New Zealanders have maintained strong connections to kererū as it was prevalent in Māori and early settler diets (Best, 1977; Higgins & Davies, 1996). Two stoles, not of Māori origin, with the necks of pigeons sewn on to cloth were catalogued in the Fowler Museum at the University of California in Los Angeles in the United States (X65.8005 & X65.8007) (Simmons, 1982, p. 34).

***Figure 7.12*. Kererū (New Zealand pigeon: *Hemiphaga novaeseelandiae*). Collected by Mord, 1974; Normandale, Lower Hutt. Right: detail of green upperbreast (top), white lower breast feathers. Te Papa OR.018676. CC BY 4.0.**

Kererū are the only living endemic New Zealand pigeon and are currently locally common throughout most of the North, Stewart, and large offshore islands, and the coasts of the South Island, and the Chatham Islands (*Hemiphaga chathamensis*) which have a duller plumage (Heather & Robertson, 1996; Holdaway et al., 2001; Robertson et al., 2007; Worthy, 2010c). Historically it was also present on the Kermadecs (*H. n.*), and Norfolk Island (*H. spadicea*), now extinct (Heather & Robertson, 1996; Higgins & Davies, 1996, p. 1015; Holdaway et al., 2001, p. 134; Worthy, 2010c). Kererū were formerly abundant on both main islands in large podocarp forests when numbers decreased soon after European settlement from forest clearance and overhunting, until legal protection in 1921 slowed some of the decline (Heather & Robertson, 1996; Higgins & Davies, 1996). Additional factors impacting on kererū populations include collisions with building structures and vehicles; and predation and competition from introduced possums, rats, cats, mustelids and introduced common myna (*Acridotheres tristis*) and Australian magpies (*Gymnorhina tibicen*) (Higgins & Davies, 1996).

***Figure 7.13*. Kahu huruhuru (Māori feather cloak). Muka, tūī, kererū, kākā, banded rail, and kākāriki feathers; twining, plaiting. Gift of W. Leo Buller, 1911. Te Papa ME002058. All Rights Reserved. Right: detail of banded rail feathers and dark tūī feathers. Image by Hokimate Harwood, 2007.**

A small feather cloak included in the International Register in the Te Papa collection (ME002058) had alternating rectangles of black tūī and white kererū feathers (Fig. 7.13). In 2007, one single orange kākā feather in one of dark blocks in the middle, and two single light green kākāriki (parakeet: *Cyanoramphus novaezelandiae*) feathers in adjacent blocks near the top of the cloak were located (Harwood, 2011a). In the main kaupapa (body of the cloak) there were four small bunches of black and white barred banded rail (*Gallirallus philippensis assimilis*) feathers in adjacent blocks towards the bottom of the cloak (Fig. 7.13).

Striking iridescent tūī feathers were identified in 35 (of 110) Te Papa cloaks, and in over 100 (of c.600) cloaks in the International Register made after 1800 (Table 7.2) (Harwood, 2011a). The most identified feather types originated from the back, breast, belly, flank, and nape as well as the smaller upperwing coverts (Harwood, 2011a). White throat feathers (pōhoi or kumikumi) were identified in a kahu kiwi (ME014499) in 2007, discussed later (Figs. 7.14 & 7.55) (Best, 1977; Harwood, 2011a; Tamarapa, 2011a, p. 147). Feather research conducted in 2006, counted over 500 viable breast, belly, and back feathers on an adult bird (H. Harwood, unpub. data).

***Figure 7.14*. Tūī (*Prosthemadera novaeseelandiae novaeseelandiae*). ♂. Collected Nelson, Gift of Department of Conservation, 1987. Te Papa OR.025253.**

A dramatic shining black 'tūī cloak' woven in 2004 by weaver and artist Kohai Grace (Ngāti Porou, Ngāti Toa Rangatira, Te Āti Awa, Ngāti Raukawa), is currently registered in Te Papa (ME023873) in the International Register and comprised of modern materials that resemble the bird, including the white throat feathers (Fig. 7.15) (Evans & Ngarimu, 2005, p. 74).

***Figure 7.15*. 'Tūī cloak' by Kohai Grace. Harakeke, synthetic dye, copper wire, kererū feathers, and thread; twining, binding, scraping, twisting. Made 2004, Hongoeka Wellington. Purchased 2008. Te Papa ME023873.**

Tūī are the largest and most widely distributed endemic honeyeater, adapting to modified environments since human arrival and successfully co-habitating in urban landscapes (Higgins, Peter, & Steele, 2001; Robertson et al., 2007). They are known for their intelligence, territorial behaviour, noisy flight, and melodious vocalisations, which included the human vocabulary (Best, 1977). Populations declined in the 19th century from competition and predation from introduced birds and mammals, with numbers lowest around 1880, and increasing again soon after legal protection but not to previous levels (Higgins et al., 2001, p. 1194).

***Figure 7.16*. Kahu kiwi (kiwi feather cloak). Muka, cloth, kiwi and huia feathers, wool; sewing, spaced double pair twining, plaiting. Maker unknown. Bequest of Mrs E. H. Blair in memory of her late husband, Archibald Anderson Watt, 1918. Te Papa ME003714. All Rights Reserved. Right: detail of huia feathers amongst brown kiwi. Image by Hokimate Harwood, 2009.**

Included in the International Register was a stunning Te Papa kahu kiwi (ME003714) identified with huia (*Heteralocha acutirostris*) feathers in 2007 that exemplified beauty, prestige, and mana (authority) (Figs. 7.16 & 7.17) (Harwood, 2011a). On close inspection in 2007, a hidden row of black huia feathers was identified amongst the striking dark brown kiwi feathers (Fig. 7.16) (Harwood, 2011a). The feathers were secured with spaced double pair twining with the ventral side of the feather facing out, known as whakaaraara (Hīroa, 1911). The huia belly feathers were identified using microscopic analysis, and as a passerine they exhibited characteristic downy barbules with dark closely-spaced triangular nodes all along barbules, and villi (cilia-like) growths at the base of some barbules (Harwood, 2011a). In the cloak, the huia feathers were bound together and placed across the middle of the cloak in twelve bunches (Fig. 7.16). Another Te Papa kahu kiwi (ME014915) featured 6 single huia and 10 kākā feathers dispersed amongst the brown kiwi feathers (Harwood, 2011a). Te Kanawa (1992) stated that Māori used huia in cloaks, however the two Te Papa cloaks were the first confirmed identifications of huia feathers in a public museum cloak collection. Kiwi feather cloaks are already considered prodigious, the inclusion of another bird synonymous with Rangatiratanga (chieftainship) undoubtedly elevated the importance of these cloaks, particularly as the huia is now extinct made the find significant.

Figure 7.17**. Pair of huia (*****Heteralocha acutirostris*****). ♀ in front. Collected by Dr A Newman. Te Papa OR.001327. CC BY 4.0.**

Huia were one of the larger endemic passerines measuring up to 48cm long, with a pair of fleshy orange wattles, bodies of glossy black feathers, and 12 distinctive black tail feathers measuring around 20cm long with a 3cm wide white band at the tip (Fig. 7.17) (Buller, 1888, p. 8; Heather & Robertson, 1996, p. 164). Albinism and colour mutations were recorded, with variations of white birds and feathers, rusty red huia tail feathers, and grey downy birds, termed 'huia-ariki' (chiefly huia), they were revered and highly sought after by Māori (Buller, 1888). Huia were of scientific importance and exhibited distinct sexual dimorphism in bill size, the adult males had shorter straighter bills, 7cm along the ridge, and effective at penetrating wood when hunting for invertebrates, and the adult female's had 10cm long curved bills for extracting invertebrates from wood (Fig. 7.17) (Buller, 1888, p. 8; Heather & Robertson, 1996). Mating pairs were very tame and easily acquired by hunters and collectors (Buller, 1888; Orbell, 2003).

Figure 7.18**. Kōtore Huia (Huia (*****Heteralocha acutirostris*****) tail feather). Te Papa ME024121. All Rights Reserved.**

Huia tail feathers were typically worn in the hair by people of rank, sometimes on rare occasions the highest ranked chiefs and warriors brandished the fan of all twelve tail feathers, known as a marereko (Fig. 7.18) (Houston, 2010; Orbell, 2003; Phillips, 1963; Smith, 2011).

Angas (1979) portrayed individuals with the 12 tail plumes on his travels in the 1840s. Maureen Lander (2017) believed that if the tail feathers did not have the white tip, they would likely not have had that status. When worn upright on the sacred head of a Rangatira, all 12 huia tail feathers appeared celestial in origin, the black symbolising papatūānuku (the earth) and the white band, rangi (the sky or heavens) (Riley, 2001). Contrasting concepts of white and black, light and dark, day and night, te ao mārama and te pō nui, feature regularly in Māori philosophies and creation traditions (see Table 5.1 in Chapter 5). In turn, its relevance in the spiritual world materialised in prestigious personal attire, in the form of black and white checkered dog skin cloaks, and white feather plumes of kōtuku (white heron: *Ardea modesta*) and toroa (albatrosses) adorning black hair (Colenso, 1881, pp. 70–71). The number twelve was also an auspicious number correlating to the twelve names of Io (ancient supreme being) and Tāne (son of Rangi and Papa), and the twelve heavens and lunar months of the Māori year (Best, 1977, p. 293). When not in use, huia tail feathers and other small and precious personal items were stored in specially carved wooden vessels known as waka huia and papahou (Buller, 1888; Houston, 2010; Phillips, 1963). Māori wore whole and partial huia bird skins, of separated heads, beaks and feathers that were worn in the hair, in woven and European hats, around the neck and in the ears and nose, to signify wealth and rank (Buller, 1888; Hamilton, 1972, p. 297; Higgins et al., 2006). Study of an infamous 1878 Lindauer portrait showed Tukukino Te Ahiātaewa, a 19th century leader of Ngāti Tamaterā (Hauraki) wearing a female huia head suspended from his right ear (Auckland Art Gallery Toi o Tāmaki, 1915/2/56). Renowned chieftainess Rangi (Kuīni Wikitōria) Topeora (of Ngāti Toa Rangatira, Ngāti Raukawa) who signed the Treaty of Waitangi, was portrayed in another Lindauer work wearing stately attire of a kaitaka, multiple pounamu pendants, and huia feathers in her hair (Auckland Art Gallery Toi o Tāmaki, 1915/2/53). This painting was based on a photograph taken by E. S. Richards between 1863-1875 (Auckland Art Gallery Toi o Tāmaki, 1994/33/2/21). Europeans also had a fascination with the bird, with feathers and bills fashioned into Victorian ornaments including brooches (Fig. 7.19).

***Figure 7.19*. Huia (*Heteralocha acutirostris*) beak brooch. ♀. Huia beak, gold, metal. Unknown; goldsmith; circa 1900; New Zealand. Purchased 1996 with New Zealand Lottery Grants Board funds. Te Papa GH005020. CC BY-NC-ND 4.0.**

Large hunting expeditions were organised in the name of science, where hundreds of huia skins were collected for overseas museums in the second half of the 19th century, which was unequivocally a major factor in the loss of the huia (Oliver, 1930, p. 495). Naturalist Walter Buller (1838-1906) collected around 24 huia and sold them to the then Colonial Museum (now Te Papa) in Wellington, Canterbury Museum in Christchurch, and American and English museums (Bartle & Tennyson, 2009, p. 110). Te Papa currently houses 40 huia skins, collected between 1880 to 1911.[4] While the Natural History Museum (formerly part of the British Museum) in London have about 25 huia skins (M. Adams, The Natural History Museum, London, personal communication, August 30, 2019). Andreas Reischek (1845-1902), an Austrian naturalist has been credited (and criticised) for collecting and depositing over 900 bird specimens between 1877-1889 into the Naturhistorisches Museum Wien (Museum of Natural History in Vienna), including endangered and now extinct species, eight of which were huia (H-M. Berg, Museum of Natural History, Vienna, Austria, personal communication, September 4, 2019; Schifko & Gamauf, 2015; Westerskov, 1980, p. 285). The Weltmuseum Wien (World Museum Vienna) in Austria also holds Māori material collected by Reischek, namely several huia heads and tufts of huia tail-feathers that were gifts from prominent Waikato chiefs in 1882 such as King Tāwhiao (Ngāti Mahuta), Whatiwhatihoe (eleven feathers: Inv. No. 42.482); Wahanui Ngāti Maniapoto (Inv. No. 42.483); Whitiora (brother of the first King Pōtatau), Te Ngakau, Te Hemara Rerehau (nine feathers: Inv. No. 42.485), and Honana Te Maioha (Inv. No. 42.486) (Firth, 1931, p. 101; Moschner, 1958; Reischek, 1930; Schifko & Gamauf, 2015).

[4] https://collections.tepapa.govt.nz/topic/26771

The deliberate introduction of predators such as dogs, cats, rats, and mustelids in conjunction with accelerated hunting and habitat loss from clearing and burning in the 19th century all facilitated huia decline (Higgins et al., 2006). Traditional methods for sustainably hunting huia were abandoned with the arrival of guns in the 19th century. In 1874 more than 600 huia were reportedly killed and taken by Māori in the Wellington Province for European museums, and in 1888, 11 men acquired 646 skins between the Manawatū Gorge and Akitio in one month alone (Buller, 1888; Heather & Robertson, 1996, p. 419; Higgins et al., 2006, p. 1014). Regular hunting parties were organized as the price of feathers increased from 5*s* (5 shillings) to £1 each, and by 1915 single feathers were sold for £5 each (Higgins et al., 2006, p. 1015; Phillips, 1963).

Another factor contributing to the accelerated hunting and sale of huia memorabilia was the Royal Tour visit in 1901 of the British Duke and Duchess of Cornwall and York, the future King George V and Queen Mary. As a mark of respect, a huia tail feather was placed in the Duke's hat when visiting Rotorua, while the Duchess purportedly wore a tiki around her neck, a feather cloak and huia feather in her hair on the visit (Bassett, 1987; Phillips, 1963, p. 39). This event sparked national and international interest in huia feathers, and the trend of Māori wearing huia feathers in their hair was replicated by European men wearing the feathers in their hats after 1900 (Phillips, 1963, p. 39).

Ngāti Huia, a hapū of Ngāti Raukawa petitioned for the protection of huia in 1891, and they were protected nationwide from 1892 with full legal protection by 1906, with requests to prohibit traffic of huia tail feathers in 1902 (Miskelly, 2014). Collectors paid £3-4 for a live pair of huia for relocations to sanctuaries in the early 20th century, to no avail (Phillips, 1963). Huia were already too vulnerable, formerly throughout the North Island only, the low-flying birds were later largely restricted to small home ranges, widespread but scattered in the lower North Island and limited to higher mountain ranges from 1840, with the last official sighting in 1907 with unconfirmed reports up to the 1940s (Gill, 2010; Heather & Robertson, 1996, p. 164; Higgins et al., 2006; Watola, 2009).

***Figure 7.20*. Kahu kākāpō (Kākāpō feather cloak). Muka, red wool, dye, kākāpō and kākā feathers; spaced double pair twining, pōkinini, plaiting, scraping. Collected by Dr David Ramsey, donated to Museum in 1844. Perth Museum & Art Gallery, Perth & Kinross Council, Perth, Scotland 1978.73. Left to Centre: cloak, and detail of red wool threads and pōkinikini (Images courtesy of Perth Museum & Art Gallery, Perth & Kinross Council); Far right: cloak detail of kākā feathers (Image courtesy of Te Papa MA_I278949, 2008). All Rights Reserved.**

Kākāpō (night parrot: *Strigops habroptilus*) feathers and skin have been identified in at least two historical cloaks made before 1800, one made in the 17th century, the other collected on a Cook voyage (see Chapter Six). To date only five cloaks made after 1800 potentially have kākāpō feathers in museum collections according to the International Register, including the only recorded fully feathered kākāpō cloak, a striking kahu kākāpō in the Perth Museum and Art Gallery (Perth and Kinross Council) in Perth, Scotland (1978.73) (Fig. 7.20) (Roth, 1923, p. 91). The cloak is covered in 11,000 mottled green kākāpō body feathers and several single orange kākā (underwing) feathers (identified from images in 2008); strands of red wool; and pōkinikini threads of dyed and dried cylindrical harakeke tags along the bottom (Figs. 7.20 & 7.21) (Mead, 1969, p. 113; Roth, 1923, p. 91). The cloak was collected probably in the 1830s by Dr David Ramsey (1794-1860), a Scottish natural history collector and ship's surgeon (Richards, 2015, p. 165). The collection was donated to the Perth Literary and Antiquarian Society by Mr John Ramsey in 1842 (Idiens, 1979, p. 28; Richards, 2015, p. 165). David Simmons attributed the cloak to the 18th century and South Island, where kākāpō were more common, but this has not been confirmed (Idiens, 1979, p. 28). The wool was collected and purposefully twined or threaded through, possibly after construction. Wool has been inserted into Cook-era cloaks from the 18th century (see Chapter Six).

***Figure 7.21*. Kākāpō (*Strigops habroptilus*). Collected by Donald Merton, Mana Island, Wellington, July 1993. Gift of New Zealand Wildlife Service. Te Papa OR.025019. CC BY 4.0.**

Two kahu kiwi have been identified, one in the Te Papa collection (ME014499), listed in the International Register and discussed later, and the other in the Whānganui Regional Museum (1948.64.3), and both have brown kiwi, kākāpō, kākā and tūī feathers in common (personal observations, April 2016; Horwood & Wilson, 2008). The International Register also catalogued a striking feather cloak in the British Museum London (Oc1936,0607.1) with vertical bands of kākāpō and introduced game birds, made in the early 20th century, it was placed on Prime Minister Richard Seddon's coffin at his funeral in 1906 and presented to the museum by Sir Herbert Daw in 1936 (Simmons, 1996a; Simmons, 1996c; Starzecka et al., 2010, p. 125). The Horniman Museum in London had a kahu kiwi (37.82) with tūī and possibly kākāpō feathers (Simmons, 1996c). The South Canterbury Museum in Timaru also listed a kahu kiwi (957/15.1) with tūī and kākāpō feathers. The combination of brown kiwi and kākāpō speaks to the importance of the garment.

Kākāpō are large endemic parrots that can weigh over 2kg, they have distinctive mottled moss green feathers and are important to New Zealand's biological diversity and culture (Higgins, 1999, p. 633). Historical and fossil remains indicate kākāpō were present throughout the North and South Islands at all altitudes, but numbers had already declined in the North Island before European settlement, with scattered populations in the central and southern parts of the North Island, and south and west regions of the South Island until the early 20th century when they were classified as nearly extinct (Chambers, 2010, p. 249; Heather & Robertson, 1996; Higgins, 1999, p. 635). As kākāpō are sedentary, reduced North Island numbers would have required an increase in trade and movement of birds for feather use from the South to the North

Island. The nocturnal flightless parrots are vulnerable to human induced factors such as habitat destruction, overhunting and predation which was exacerbated by slow and reduced breeding in small and isolated populations (Higgins, 1999, p. 635). By 1952 wild dogs, possibly abandoned dogs of mixed European and Māori breeds, had exterminated large numbers of kākāpō along the west coast of the South Island (Thomson, 1922, p. 68). After 1980, the only remaining populations were limited to transferred individuals on predator-free offshore islands, they are now currently extinct in the wild (Chambers, 2010, p. 249; Robertson et al., 2007).

7.3.4 The significance of certain introduced birds in Māori feather cloaks

***Figure 7.22*. Kahu huruhuru (Māori feather cloak). Muka (N.Z. flax), wool, chicken, peacock, pheasant, turkey, and mallard feathers; spaced double pair twining, plaiting. Made North Island. Purchased 1979. Te Papa ME014163. All Rights Reserved.**

The simple rationale behind Māori employing whatever resource possible like chicken feathers and wool was "if it's available use it" (Lander, 2017). Māori cloaks in the Te Papa collections and International Register illustrate how exotic bird feathers were implemented into collages and innovative designs, as seen in a Te Papa cloak (ME014163), in which only single feathers from introduced birds were incorporated (Figs. 7.22 & 7.23) (Harwood, 2011a). For Māori weavers, introduced bird feathers were relatively abundant, varied, and multi-coloured, and most importantly had less restrictions on use. Abundant and versatile, feathers were also dyed and replaced native species to repair old cloaks. Some introduced species were assigned Māori names, from onomatopoeic naming or transliterations such as rakiraki (duck), heihei (chicken), pīkake (peacock), and peihana (pheasant) (Orbell, 2003).

***Figure 7.23*. Kahu huruhuru (Māori feather cloak). Detail of feathers in cloak with introduced bird species. Feathers from left to right: chicken, turkey, peacock, pheasant, mallard (duck). Te Papa ME014163. Images by Hokimate Harwood, 2007.**

Most native birds were still available to Māori until the mid-1800s. However, the decline and subsequent legal protection of native birds from hunting in the latter half of the 19th century facilitated a dramatic decrease in access to native birds and likely use in cloaks by the 20th century. The legal ramifications for hunting native birds did not deter a lot of Māori who relied on traditional foods in times of economic hardship, which was often.

***Figure 7.24*. Male mallard (*Anas platyrhynchos*), and detail of breast and belly feathers (right). No data. Gift of Mrs A.T.F. Westbury, 1961. Te Papa OR.010925. CC BY 4.0.**

Mallard was recorded in at least 4 of the 110 Māori cloaks at Te Papa incorporating white underwing, sides, and speckled ventral feathers (Fig. 7.24) (Harwood, 2011a). At least 16 cloaks in the International Register incorporated mallard and duck feathers (Table 7.2). Between 1867 and 1881 the Otago Acclimatisation Society introduced 23 mallards into New Zealand, after that the Societies steadily brought in birds up to the 1950s for breeding and later liberated them across New Zealand for shooting (Long, 1981; Thomson, 1922, p. 101). Current New Zealand mallard (*Anas platyrhynchos platyrhynchos*) populations are likely the progeny of a combination of the original American and English stock that hybridised with native ducks (Long, 1981, p. 56; Thomson, 1922, p. 102). Mallards are currently common and widespread in both main islands, adapting well to modified pastural land despite annual shootings, with 5 million birds counted in 1981, and increasing, it is now the most numerous waterfowl in New Zealand (Marchant & Higgins, 1990b; Robertson et al., 2007; Wodzicki, & Wright, 1984, p. 82; Worthy, 2010a, p. 45).

***Figure 7.25*. Kahu huruhuru (Māori feather cloak). Muka, multi-coloured chicken hackle feathers; spaced double pair twining; plaiting. Made 1900-1950. Gift of M. F. Keen, 1976. Te Papa ME013412. All Rights Reserved.**

Chicken was the most common introduced bird identified in Te Papa's cloaks and counted in a quarter of the total number of cloaks in the International Register (Table 7.2) (Harwood, 2011a). Domestic chickens were a versatile commodity, supplying meat and eggs, and weavers utilising the variety of different breeds, feather colours and types (Fig. 7.25) (Harwood, 2011a). Multi-coloured chicken hackle (nape) feathers share a similar shape, size, and colouring as brown kiwi back feathers and are sometimes confused with kiwi (Figs. 7.7 & 7.26). Tame heihei (roosters) have comparable feather types to hens (females), except they are typically larger and have brighter coloured feathers (Fig. 7.26) (Marchant & Higgins, 1993).

***Figure 7.26*. Rooster (tame heihei, male domestic chicken: *Gallus domesticus*). Centre and Right: detail of saddle and hackle feathers, respectively. Images by Hokimate Harwood, Staglands Wildlife Reserve and Café, Akatarawa, Upper Hutt, 2018.**

Chickens were utilised in Hawaiʻian feather cloaks (ʻahu ʻula) and are often associated with Pacific migrations (see Chapter Five) (Dancause, Vilar, Steffy, & Lum, 2011; Hīroa, 1944; Storey et al., 2012). Māori were certainly familiar with Polynesian fowl (moa), however it is not known whether fowl accompanied Māori to Aotearoa, as none appear to have survived. It is possible that with an abundance of avifauna already present in New Zealand, additional birds were superfluous. It is understood that red jungle fowl (*Gallus gallus*) originating from South East Asia is one of the primary genetic sources of the contemporary domestic chicken (*Gallus domesticus*), with domestication starting around 5,400 years ago on the Indian subcontinent providing the source of European chickens, with domestication dating from 3,500 years ago in Europe (Gongora et al., 2008; Marchant & Higgins, 1993, p. 372; Scofield & Worthy, 2010; Storey et al., 2012). Cook liberated fowls (feral chicken: *Gallus gallus*) in West Bay Queen Charlotte Sound in 1773, but on revisiting the spot in 1774 there was no trace of them, until, In 1777 Cook found fowl in the woods behind Ship Cove, but their fate after was not known (Long, 1981; Marchant & Higgins, 1993, p. 365; Scofield & Worthy, 2010, p. 27; Thomson, 1922, p. 109). In November 1778, Cook anchored at the mouth of Port Nicholson and gave Māori there chickens to domesticate, with unknown success (Marchant & Higgins, 1993). After this Māori likely acquired chickens from whalers (Thomson, 1922, p. 110). The first official record of successful introductions occurred when Reverend Marsden brought fowls from Sydney, Australia to the Bay of Islands in Northland in 1814 (Long, 1981, p. 164; Thomson, 1922, p. 110). From then Māori acquired and transported chickens throughout the country, with numbers escaping and becoming wild in the bush (Orbell, 2003, p. 178; Thomson, 1922, p. 110).

Chicken (heihei) feathers were so highly sought after weavers dismantled dusters and apparel to procure the feathers. The Māori term roro heihei once denoted the important role of chickens to announce the dawn, te ao mārama, which had an association to higher forms of being and knowledge (Orbell, 2003). It then became a derogatory term directed at a person who boasted to have more intelligence than they have, perhaps observed from the behaviour of an overconfident rooster (Haupuru Harwood, personal communication, September 17, 2019).

***Figure 7.27*. Kahu huruhuru (Māori feather cloak). Candlewick, wool, pheasant, and peacock feathers; spaced double pair twining, plaiting. Produced 19th century(?). Bequeathed by William Leonard Stevenson Loat. Acquisition 1933. ©The Trustees of the British Museum Oc1933,0315.31.**

The various feather types from male common pheasants were identified in 15 (of 110) of Te Papa's Māori cloaks (Harwood, 2011a). According to a provisional analysis of the International Register, at least 75 feather cloaks in museum collections around the world featured pheasant feathers (Table 7.2). A fully feathered pheasant cloak located in the British Museum, London (Oc1933,0315.31) contained most of the different body feathers of a male common pheasant arranged in rows according to feather type (Figs. 7.27 & 7.28) (Starzecka et al., 2010, p. 125). The male of the species weighs up to 3kg and is more colourful than the female, with numerous iridescent feather types including 18 impressive sword-like banded tail feathers that can reach 60cm (Long, 1981, p. 167; Marchant & Higgins, 1993).

***Figure 7.28*. Male common pheasant (peihana: *Phasianus colchicus*). Centre and right: detail of front-side and upperback feathers. Images by Hokimate Harwood, Staglands Wildlife Reserve and Café, Akatarawa, Upper Hutt, 2018.**

With original distribution in Asia, the contemporary New Zealand common pheasants (*Phasianus colchicus*) are likely a mix of the ring-necked pheasant (*P. c. torquatus*) from Asia, and black-necked (*P. c. colchicus*) birds from England (Long, 1981, p. 173; Scofield & Worthy, 2010, p. 28; Thomson, 1922, p. 11). First imported to Wellington from England in 1842, they were subsequently introduced and liberated well into the 20th century in both islands probably as game birds, and were abundant especially in the North Island by 1871 (Hutton, 1869; Long, 1981; Scofield & Worthy, 2010, p. 28; Thomson, 1922). In 1868 the Canterbury Acclimatisation Society bred 40 birds and sold them to members for £2 a pair, with over 6,000 birds culled in a single district's annual shooting season (Long, 1981, p. 174; Thomson, 1992, p. 115). The current population is estimated to be 250,000, with over 50,000 birds shot annually (Heather & Robertson, 1996, p. 282; Marchant & Higgins, 1993, p. 378). Pheasants are distributed in small numbers towards the top of the North Island and more restricted in the South Island (Heather & Robertson, 1996; Robertson et al., 2007; Scofield & Worthy, 2010). Despite their desirability as a game bird, they have been recorded destroying crops, and eating insects and fruits (Thomson, 1922, p. 116).

***Figure 7.29*. European feather cape (Hawai'ian influenced). Pheasant and peacock feather trim, silk, ribbon, burlap; sewing. Made c.1824; United Kingdom. Purchased 2010. Te Papa GH016753.**

In England, France and America, ornamental pheasant societies bred birds for exhibitions and commercial purposes in millinery, artificial fishing flies, and fashionable feather capes and cloaks (Fig. 7.29) (Doughty, 1975).

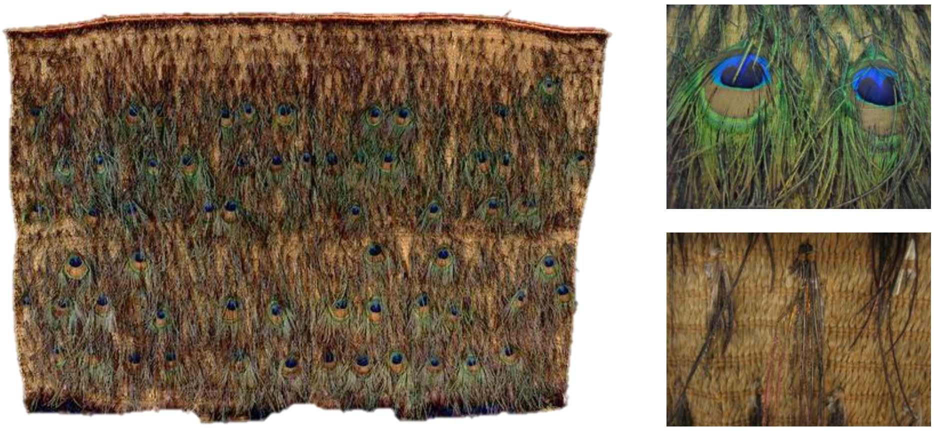

Figure 7.30**. Kahu huruhuru (Māori feather cloak). Muka (N.Z. flax), wool, peacock tail feathers; twining, plaiting. Bequest of Mrs E. H. Blair in memory of her late husband, Archibald Anderson Watt, 1918. Te Papa ME003723. Right: details of peacock feathers.**

A stunning peacock (male peafowl: *Pavo cristatus*) feather cloak covered in iridescent tail feathers and herl made for a unique example of weaving, and was the only one like it in the Te Papa collection (ME003723) (Fig. 7.30) (Harwood, 2011a). At least four other peacock feather cloaks were collated from New Zealand and overseas museums in the International Register. The rachis (shaft) in most bird tail feathers is thick, rigid, and brittle, hence the loss of feathers towards the top of the cloak (Fig. 7.30). However, the desire to have such unique colours and patterning on feathers would not have deterred many weavers. The metallic blue, iridescent green, and barred black and white peacock feathers from the neck, back, shoulders and tail were identified in 13 out of the 110 Te Papa cloaks (Fig. 7.31) (Harwood, 2011a). An initial count of peacock in cloaks in the International Register estimated that over 50 cloaks featured this species to varying degrees in public museum collections.

***Figure 7.31*. Peacocks (male peafowl, pīkake: *Pavo cristatus*). Display (left) and detail of feathers (right). Images by Hokimate Harwood, Staglands Wildlife Reserve and Café, Akatarawa, Upper Hutt, 2018.**

The more brightly coloured male peafowls (peacocks) can measure over 100cm, and weigh up to 6kg, when presenting or under threat the fanned tail of 200 plumes can reach 2m in diameter (Fig. 7.31) (Heather & Robertson, 1996; Long, 1981, p. 181; Marchant & Higgins, 1993). With origins in India and Pakistan, peafowl were known outside of Asia as late as 3,000 years ago (Doughty, 1975, p. 7; Long, 1981, p. 181). First introduced into Wellington in 1843 as an ornamental species for gardens and parks, peafowl were thereafter imported by the Acclimatisation Societies and individuals who released birds into the wild at numerous locations throughout both islands (Heather & Robertson, 1996, p. 282; Long, 1981; Marchant & Higgins, 1993, p. 373; Thomson, 1922, p. 109). Current distributions of isolated semi-feral populations are found in dry, warm or coastal areas of Northland, Hawke’s Bay, and Whānganui in the North Island, and small pockets along the coast in the South Island (Heather & Robertson, 1996; Long, 1981, p. 182; Marchant & Higgins, 1993; Robertson et al., 2007).

The presence of the tricoloured ocelli (eyes) in the tail herl fascinated and unnerved some Māori due to historical traditions pertaining to the disconcerting ‘large eyes’ perceived as an ill omen (Jackson, 2006; Marchant & Higgins, 1993, p. 372). The pūkana (protruding eyes), is used by Māori is a facial emotion to denote defiance or aggression in haka (posturing war stance) as observed in the disproportionately large eyes of the ruru (morepork: *Ninox novaeseelandiae*), which often create an ominous feeling when heard or seen at unexpected times. Peacocks can release a loud haunting call and Swedish scientist Paracelsus (c.1493-1541) asserted this lingering or mistimed cry foretold a death in the family (Jackson, 2006, p. 58). Some Māori families would not place the tail feathers on a kitchen table where eating would take place. It is difficult to now know whether Māori continued this superstition from pre-European times or whether it evolved from similar Anglo-saxon traditions pertaining to this bird, as relationships were often based on whānau (family) and personal beliefs.

***Figure 7.32*. Brisé fan. Peacock and white feathers, bone, paint; painting. Made 1800-1900; China. Bequest of Mrs Alec Tweedie, 1946. Te Papa PC000094. CC BY-NC-ND 4.0.**

The appearance and behaviour of peacocks have fascinated and captured the imagination of artists and admirers alike (Fig. 7.32). The vibrant iridescent blue-green peacock feather colouration was rare, with only kōtare (sacred kingfisher: *Todiramphus sanctus*) and pāua (*Haliotis*) shell sharing similar pigments, as seen in a Te Papa peacock brooch (2013-0009-1). Peafowls are esteemed and revered across Asia, Europe, and North America in different media, including early records of peacock feathers incorporated into pre-20th century capes in North America (Jackson, 2006, p. 120). Peacock tail feathers decorated European hats in the 1780s, particularly after Marie Antoinette placed a feather in her own hat (Jackson, 2006, p. 121). Her tragic death was another possible explanation for associating this feather with death in the 19th century (Doughty, 1975, p. 8). Māori also followed suit and fastened peacock tail feathers in their hair (see Te Papa image O.033790), suggesting a desire to replicate European fashions and experiment with new exotic plumage, or possibly to shock and impress observers.

Figure 7.33**. Kahu huruhuru (Māori feather cloak). Muka, turkey, peacock, dyed chicken feathers, wool; twining, plaiting. Made 1900-1950. Attributed to Te Ātiawa, Ngāti Toa Rangatira. Belonged to Rubi Woods. Purchased 1980. Te Papa ME014470. All Rights Reserved.**

Wild turkey (*Meleagris gallopavo*) feathers featured in at least 15 (of around 600) Māori cloaks in public museum collections (International Register). Turkey was also identified in 5 (out of 110) of Te Papa's cloaks in 2007 (Harwood, 2011a). The large, broad, iridescent dark and barred male body feathers produced a patterned scaling effect (Fig. 7.33) (Harwood, 2011a; Long, 1981). The uppertail coverts and 18 retrices (tail feathers) have a distinctive white band at the tip (Fig. 7.34) (Marchant & Higgins, 1993). The males reach 15cm, and can weigh more than 10kg, they have brighter more impressive plumage than the females, particularly when the tail is fanned during display (Long, 1981; Marchant & Higgins, 1993, p. 354).

Figure 7.34**. A male Wild Turkey (*****Meleagris gallopavo*****). Centre and Right: detail of back and tail feathers. Images by Hokimate Harwood, Staglands Wildlife Reserve and Café, Akatarawa, Upper Hutt, 2018.**

Originally from North America, wild turkeys (*Meleagris gallopavo mexicana*) were introduced to New Zealand from 1890 via England to Hawke's Bay, Nelson and Canterbury (Heather & Robertson, 1996, p. 282; Long, 1981; Marchant & Higgins, 1993; Scofield & Worthy, 2010, p. 29). The current stock originates from birds introduced to Whānganui in the 1920s, and Wellington, Hawke's Bay and Marlborough in the 1950s, then domestic farm birds became feral when released or escaped (Long, 1981; Marchant & Higgins, 1993). Numbers have fluctuated largely from cat predation and competition for food with starlings (*Sturnus vulgaris*), with scattered local populations across rough farmland in the North Island, and Nelson, Otago, and Canterbury in the South Island (Marchant & Higgins, 1993; Robertson et al., 2007; Thomson, 1922, p. 108). In 1919, a single turkey near Nelson cost *2s 6d* (2 shillings, 6 pence), but declining numbers reduced sales (Thomson, 1922, p. 109).

***Figure 7.35*. Taiaha (long Māori fighting staff). Wood, cloth, pāua (*Haliotis*) shell, turkey beard, muka. Made 1800-1850. Te Papa WE000953. All Rights Reserved.**

In North America today, hunters remove the male turkey beards, the elongated feather plumes protruding from the centre of the upperbreast, and display the beards as trophies (Fig. 7.34 (left)). Māori appeared to fashion the beards to weaponry in a cross-cultural acculturation of materials (Fig. 7.35). Taiaha kura were typically adorned with red kākā feathers and white kurī hair bound in awe (attachments) underneath using muka. Some taiaha have added red cloth or introduced materials such as goat (*Capra hircus*) hair, to replace lost (detached) materials, as an alternative to 'traditional' native materials (personal observations, 2010). It is theorised this material use signifies the prowess or mana (authority) of the animal, that in turn embodies the person wielding the weapon, in a sense a form of 'trophy'. The dark 30cm long tail feathers appeared in late 19th-early 20th century Māori portrait photography as hair adornment (Te Papa C.010186; A.005376) (Marchant & Higgins, 1993). Peacock feathers were also worn in the hair (Te Papa B.008161), as were long-tailed cuckoo, huia (Te Papa O.041634; O.041554; O.041564; O.025611), and pheasant (Te Papa B.008070; O.000794; C.010185). When the huia was listed as extinct in the early 20th century, the turkey's impressive barred and white-tipped tail feathers made ideal substitutes in Māori hair adornment in portraiture and performance art over the last century.

***Figure 7.36*. Kahu emu (Emu feather cloak). Muka, emu feathers; spaced double pair twining, plaiting. 1860s-1900. Collection of Hawke's Bay Museums Trust, Ruawharo Tā-ū-rangi No. 2628, Accession number 45/264. Right: detail of emu feathers.**

To date, four emu (*Dromaius novaehollandiae*) garments were recorded in the International Register, one stunning emu cloak in the Hawke's Bay Museum in Napier (45/264) incorporated the long body feathers into a muka backing (Fig. 7.36). The feathers had been compared to moa (Dinornithiformes) and brown kiwi, however DNA analysis confirmed the identification of emu, allocating a post-European production time (Hartnup et al., 2008). The other emu cloaks were located in the Whakatāne District Museum and Research Centre stores (MP919); and in the British Museum in London (Oc1982,Q.724) that had emu feathers and pheasant dispersed throughout and in the borders. A contemporary hieke in Te Papa (ME022088) made by Donna Waiariki (Te Arawa) accented the long emu feathers with partly scutched plant fibres and pōkinikini tags.

***Figure 7.37*. Australian emu (*Dromaius novaehollandiae*). Right: detail of side feathers. Images by Hokimate Harwood, Staglands Wildlife Reserve and Café, Akatarawa, Upper Hutt, 2018.**

Emu are large and measure 180-200cm, weighing 23-55kg and have dark to light grey-brown body feathers that are long, thin, and sometimes double-shafted (Fig. 7.37) (Long, 1981, p. 26). Other ratites, moa and kiwi can also have double shafted feathers, the likeness undoubtedly desirable for Māori weavers (see Chapter Six). Between 1814-1815 John Nicholas did not see any kiwi in Northland but did recount kiwi feather cloaks and the similarities between kiwi and other introduced ratite feathers (Nicholas, 1817, p. 255).

Lander (2017) shared her views on the incorporation of emu in cloaks as a replacement for moa and kiwi feathers:

> "For a while it was interesting because there was quite a trend towards using emu feathers…There is a cloak in the British museum [Oc1982,Q.724] covered with emu feathers interspersed with small orangey/ black pheasant feathers. It is beautiful. Emu are the nearest thing to moa, and if you look at our examples of moa in museum dioramas they are dressed up in emu feathers."

Emu were imported from Australia by individuals and Acclimatisation Societies between 1864-1871 with no official records as to what happened to these birds, although emu have consistently frequented New Zealand zoological gardens and parks since (Long, 1981; Thomson, 1922). Governor George Grey (1812-1898) developed an exotic wildlife sanctuary on Kawau Island in the Hauraki Gulf that housed peacocks, zebras, antelopes, gnu, deer, monkeys, kangaroos and wallabies, including emu introduced in 1868 but none survived (Checklist Committee (OSNZ), 2010; Miskelly & Powlesland, 2013; Thomson, 1922, p. 99).

***Figure 7.38*. Feather korowai. Cotton, wool, muka, and ostrich (*Struthio camelus*) feathers; tāniko. Kauri Museum, Matakohe, Northland 1995.619.**

Dark grey and black feathers from the largest living ratite, the African ostrich (*Struthio camelus*) have also been identified in a unique cloak in the Kauri Museum Northland (1995.619) included in the International Register (Fig. 7.38). According to museum staff it was made in the 1920s and presented to Prime Minister Joseph Gordon Coats in 1925. With a cotton and muka backing, the interest comes from the ostrich feathers and unique application of horizontal bands of wool and tāniko designs across the cloak. The first record of Māori contact with ostrich feathers was when Jean-François-Marie de Surville (1717-1770) the French commander of the St Jean Baptiste, and during his stay in Northland in 1769 he placed an ostrich feather on the head of a Māori chief, who did not respond positively (Salmond, 1991, p. 330). This was more likely from the contact with his head (a tapu, sacred area) rather than him disliking the feather. There were no official records of ostrich introductions into New Zealand, but they were introduced to Australia from 1869 for their feathers (Long, 1981, p. 25). Unofficially, ostriches have been farmed in New Zealand since the 1880s for meat, oil, leather, eggs, and feathers that went into hats and accessories (Fig. 7.39).[5] In the late 19th century they were farmed in Australia, Africa, Europe, and America to prevent extinction as the earlier lucrative millinery and clothing industries had overindulged in the production of hats, helmets, dresses and furniture decked with ostrich feathers (Doughty, 1975, p. 7). In fact, nineteenth century European fashions almost caused the extinction of several species including

[5] Jim Esson, 'Exotic farm animals - Ostriches and emus', Te Ara - the Encyclopedia of New Zealand, http://www.TeAra.govt.nz/en/exotic-farm-animals/page-4

the ostrich, little bittern (*Ixobrychus minutus*), and New Guinea birds of paradise (Family Paradisaeidae) (Doughty, 1975; Gillow & Sentence, 1999).

***Figure 7.39*. Hat. Straw, black and white ostrich (*Struthio camelus*) feathers, ribbon. Made 1800s. Gift of Mrs A O'Connor, 1985. Te Papa PC003316. CC BY-NC-ND 4.0.**

7.3.5 The significance of weaving techniques and other materials in Māori feather cloaks

At least 500 of approximately 600 Māori feather cloaks made after 1800 in the International Register had recorded materials, 400 of which had a foundation of flax/ muka or scutched harakeke. Harakeke has been the prominent material in Māori weaving for centuries and was the main resource for early European traders who were to become settlers (Hamilton, 1972). Most cloaks in the International Register had a muka foundation of scutched flax whenu (warps) and aho (wefts). A small number had combinations of muka, wool, or candlewick (cotton) whenu, worked with muka or cotton aho. Wool was recorded in at least 270 cloaks in the International Register, at least 50 of these had a wool foundation (whenu), with around 30 cloaks of cotton (candlewick). Fifteen cloaks had a cotton cloth backing, some of which were also sewn onto the original muka backing for structural support, or the feathers were directly sewn into the cloth. The feathers were sewn into a muka foundation in five cloaks. One contemporary cloak at Otago Museum, Dunedin (G94.38) incorporated honeycomb and huckaback weaves. Just over 300 of around 600 cloaks documented twining as the primary weaving method in the International Register when the techniques were recorded. Around 200 of these had confirmed double pair twining (whatu aho rua), and around 25 had single pair twining (whatu aho pātahi). It is assumed the twined rows were spaced, which is associated with cloaks made after 1800, and not close or compact twining observed in dog skin cloaks and several cloaks made before 1800 (see Chapter Six) (Blackman, 2011; Simmons, 1968). Most feathers were bent at the base and the lower section of the feather shaft fixed securely to the backing whenu with the aho (see Fig. 7.1).

***Figure 7.40*. Kahu huruhuru (Māori feather cloak). Coloured wool, cotton, tūī, chicken[?], kākā, and peacock feathers; spaced double pair twining; plaiting. Judge William W. Scott Estate, acquired 1959. Collection of the Illinois State Museum, 1959-0005-816903. Right: detail of kaupapa of vertical bands of wool whenu (warps). Images courtesy of Claire Martin, 2018.**

A cloak recorded in the International Register in the Collection of the Illinois State Museum in Springfield, Illinois (1959-0005-816903) was manufactured with alternating orange, red and white wool whenu (warps), and cotton aho (wefts) (Fig. 7.40). Based on museum photographs supplied in 2018, the front of the cloak had check patterns of dark tūī feathers, possibly white chicken feathers, bunches of orange kākā, and blocks and bunches of iridescent blue and 'peashell' green peacock feathers along the neckline and small bunches across two rows. The alternating coloured whenu is reminiscent of dyed muka whenu in cloaks, an example is a Te Papa kahu kiwi (ME007612), also listed in the International Register.

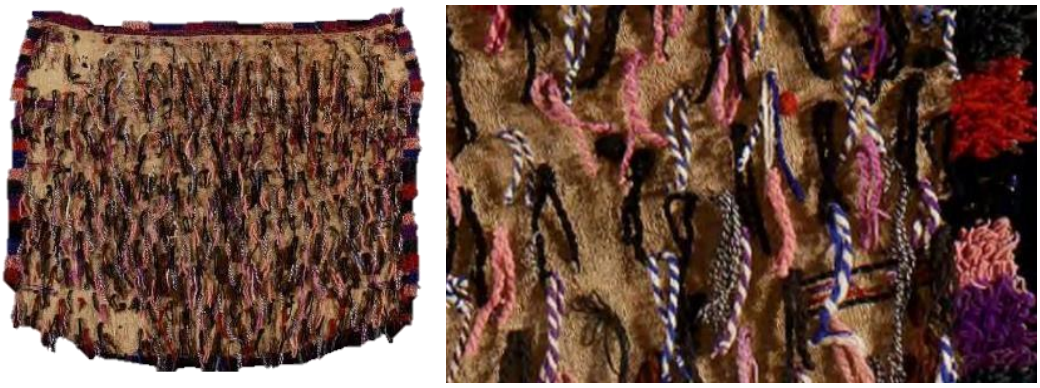

***Figure 7.41*. Korowai (Māori tag cloak). Muka, wool, chicken feathers; twining, looping. Made 1880/1900. Te Papa ME004154. All Rights Reserved.**

After 1800, coloured wool, particularly red and blue, were woven or sewn into cloaks as plain, looped, or interlaced strands (pāheke), rolled tags, trimmed tufts, bundled pom-poms (ngore), and tassels to create a variety of surface ornamentation (Fig. 7.41) (Lander, 2011, p. 68). Weavers acquired wool and cotton from European distributors and traders, picking apart woollen hats and blankets (comforters) for 19th century cloaks (Lander, 2011, p. 66; Pendergrast, 1997, p. 13; Roth, 1923, p. 66). The International Register listed one cloak with untreated sheep wool (Te Papa ME14385), the rest appeared coloured and processed (Harwood, 2011a).

Cook attempted to introduce a breeding pair of sheep (*Ovis aries*) in March 1773 on the second voyage, but they died of scurvy (Thomson, 1922). Reverend Marsden was said to have brought over a ram and ewe from Sydney in the 1820s, a present from the King, and were some of the original sheep in New Zealand, thereafter, sheep were introduced freely from N.S.W. Australia, along with cattle (*Bos taurus*) and horses (*Equus caballus*) as domestic stock (Thomson, 1922; Wodzicki & Wright, 1984). By 1900, there were roughly 1 million people in New Zealand to the 18 million sheep, and 1 million cattle (Star, 2009, p. 61).

Figure 7.42**. Kahu huruhuru (Māori feather cloak). Muka, animal hair, turkey, chicken, and pheasant feathers; spaced double pair twining, plaiting. Made in Wellington. Purchased 1972. Te Papa ME012758. Right: detail of hair attachments in left border. All Rights Reserved.**

Several notable materials have been adapted, adopted, and replaced since European settlement. In pre-1800 Māori cloaks, dog hair (and skin) generally accompanied bird feathers in the examined surviving historical garments, including those collected on Cook's voyages, discussed in Chapter Six. Preliminary results from the International Register counted only six feather cloaks made after 1800 with animal hair, and feathers were considered the predominant element (Fig. 7.42). The hair was largely unverified dog hair and skin, originating from the kurī, introduced European breeds, or a mix of the two, and possibly some goat hair. The traditional colouring of kurī ranged from pure to off white, through to tawny yellow, brown, and black, or shades of these colours, and resembled goat hair (Long, 2003, p. 249; Thomson, 1922). Before European colonisation, the Māori dog was valued for food, in hunting birds, and the hair and skin fashioned into prized Māori clothing and weaponry (Colenso, 1877). After European settlement there was no longer the time or need to produce elaborate dog skin cloaks, replaced by cotton clothing, and kurī substituted in kākahu for European dog, goat, and sheeps' wool. An impressive kaitaka aronui in Te Papa (ME014336) illustrated the assimilation of traditional and introduced materials and techniques with the attachment of European dog hair to the base of the cloak, bound with half-hitch knots using red thread (Blackman, 2011, p. 87; Tamarapa, 2011a, p. 99).

The kurī accompanied Māori to Aotearoa, and the interbreeding of kurī with introduced European dogs generated feral hybrids diminishing its inherent value and status until its local extinction in the 1800s (Thomson, 1922). To English settlers, kurī were unwanted semi-wild dogs hunted for killing livestock (Thomson, 1922, p. 68; Wallace, 2011, p. 54). In Otago, one person killed 52 dogs between 1859-1860 and hunters were offered up to £5 payments per head (Thomson, 1922). To manage the wild dog populations, Pākehā initiated the Dog Nuisance Ordinance in 1844, and Dog Nuisance Acts, later (Thomson, 1922, p. 541). These laws declared that wandering dogs would be seized and destroyed if not claimed, or the owner fined 5 shillings (Thomson, 1922, p. 541). In the 1890s the Hokianga County Council in Northland imposed a tax of 2*s* 6*d* for the registration of each dog in the district, with non-payment of taxes resulting in large fines or imprisonment ("Country - Peninsula", 1898; Telegraph - Press Association, 1897). The reported arrests of local Waimā Māori in the 'dog tax rebellion' of 1898 made headlines (Alexander Turnbull Library, Ref: 1/2-018754-F). The law essentially undermined local Māori and their relationship to kurī, creating increased financial burden and resentment, likely resulting in Māori liberating pets and some working dogs to avoid what was considered unnecessary and unfair costs.

***Figure 7.43*. Arapawa Island goat. Image by Hokimate Harwoood, Staglands Wildlife Reserve and Café, Akatarawa, Upper Hutt, 2018.**

Cook unsuccessfully introduced goats (*Capra hircus*) in the Queen Charlotte Sound in 1773 and 1777 (Thomson, 1922, p. 57). A few were imported in the 1840s to Nelson with escapees becoming wild, with numbers reaching 30,000 at Lake Wakatipu by 1916 where culling yielded a small profit for hunters with skins sold for up to 2*s* 3*d* (2 shillings and 3 pence) each (Thomson, 1922, p. 58). Cashmere and angora goats were officially introduced into New Zealand in 1867 for the commercial value of the skins (Thomson, 1922; Wodzicki & Wright, 1984). With further importations and liberations by Acclimatisation Societies and private individuals, angora presumably interbred and hybridised with the common goat in some parts, and by 1917 numbered less than 10,000 (Thomson, 1922, p. 60). Goat hair ranged in colour from white, black, tan, and brownish red and grey, or combinations of these (Fig. 7.43) (Long, 2003, p. 501; Thomson, 1922, p. 60). The colouring, texture, and length and more importantly availability of goat products simply resulted in its replacement of dog hair as adornment in Māori cloaks after European settlement, illustrated in several kākahu in Te Papa embellished with angora goat (ME001154) and wild goat skin and hair (ME010765).

7.3.6 The significance of styles / designs in Māori feather cloaks

***Figure 7.44*. Korowai (Māori tagged cloak). Muka, dye, kererū, kākā, kākāriki, koekoeā (long-tailed cuckoo), chicken, tūī and weka feathers; spaced double pair twining, plaiting. Unknown weaver; 1800-1900. Te Papa ME004073. All Rights Reserved. Right: Detail of koekoeā feathers. Image by Hokimate Harwood, 2009.**

After European settlement, korowai partly covered by hukahuka tags were categorised as less formal attire, the fibres beaten, were soft and warm, worn for comfort rather than style compared to the fine kaitaka and full feathered cloaks (Fig. 7.44). Cook rarely recorded these types of black tagged cloaks but did document korowai stained with red ochre (kōkōwai), which would have been noteworthy (Pendergrast, 1997, pp. 14–15).

***Figure 7.45*. Korowai (Māori tagged cloak). Candlewick, Wool, cotton, and dyed chicken feathers; spaced double pair twining, plaiting, rolling. Made 1900-1950. Gift of the Right Honourable the Lady Rowley, 1980. Te Papa ME014371. Right: detail of dyed chicken feathers, wool hukahuka. All Rights Reserved.**

In the more modern korowai, weavers continued to explore with various decorative elements and the korowai evolved more rapidly than the prestigious kaitaka (Fig. 7.45) (Lander, 2011, pp. 66–67; Tamarapa, 2011a, pp. 144–145). At least 80 cloaks were categorised as korowai in the International Register. After kahu kiwi, and full feathered cloaks (kahu huruhuru) which numbered over 200 in the International Register, korowai were one of the more common types of cloaks, with varying degrees of feather adornment they were quicker and easier to produce.

***Figure 7.46*. Kaitaka aronui/ pātea (Fine cloak with wide tāniko). Muka, wool, chicken, pheasant, kākā and weka feathers; spaced double pair twining; tāniko. Made 1850-1900. Purchased 1974. Te Papa ME012933. All Rights Reserved.**

A rare form of the pekerangi style of feather cloak that is reminiscent of Cook-collected cloaks has continued since the 19th century, and feature tāniko bands and small bunches (quillets) of feathers across the foundation (Simmons, 1981). Two such cloaks recorded as Cook collections were examined for this research in Chapter Six. A small 19th century Te Papa kaitaka aronui had rows of small bunches of brown weka (*Gallirallus* spp.), orange underwing kākā feathers, multi-coloured chicken, and male pheasant feathers (Fig. 7.46). Less than 10 Māori cloaks with these combined features were recorded in the International Register.

***Figure 7.47*. Kahu kiwi (kiwi feather cloak). Muka, brown kiwi feathers, wool; tāniko, twining, plaiting. Te Papa ME006598. Right: detail of triangular designs in tāniko border. All Rights Reserved.**

Ornate kaitaka cloaks with tāniko (patterned) borders were highly esteemed and made by skilled weavers who were respected in their communities and their knowledge and abilities in demand (Fig. 7.47) (Firth, 1959). In the International Register, around 40 feather cloaks in museums contained tāniko, and most of the kiwi feather cloaks featured tāniko borders, both signifiers of prestige (Hīroa, 1966; Mead, 1969). The processing of harakeke, and preparing and dyeing the muka, and then weaving the garment took months, sometimes years. Weavers developed common designs including triangles, chevrons, diamonds, and stripes, incorporating more intricate designs for each kākahu, and each time considering all the aspects of the cloak including the tāniko design before starting (Blackman, 2011, p. 81).

Figure 7.48. **Kahu kiwi (kiwi feather cloak). Muka, wool, brown kiwi, kererū, kākā and tūī feathers; spaced double pair twining, plaiting. Made 1850-1900; Hawke's Bay. Attributed to Ngāti Kahungunu. Te Papa ME010764. Right: detail of geometric feather border. All Rights Reserved.**

A preliminary evaluation of feather cloak designs in the International Register counted around 40 cloaks with check patterns, more than 20 with triangles, and over 10 with diamonds. From this research, it has been theorised that some of the patterns potentially originated from designs in Polynesian weaving and tapa (bark cloth) clothing, as discussed in Chapter Five. It is argued that in the timeline for this research that when the production of kaitaka decreased in the 19th century, the geometric designs in tāniko borders transferred to the designs in feather cloaks (Figs. 7.47, 7.48, 7.49 & Table 7.3). The pātikitiki pattern where the diamond is the dominant motif is common in kaitaka tāniko (Fig. 7.49) (Mead, 1969). Diamond patterning recorded in two Te Papa kahu huruhuru (ME004275 and ME015604) resembled the aspects of the diamond designs in tāniko (Table 7.3).

***Figure 7.49*. Kaitaka (Fine cloak with tāniko). Muka, wool; twining, tāniko. Te Papa ME002061. Right: detail of tāniko designs. All Rights Reserved.**

***Table 7.3*. Variations of diamond designs in feather cloaks derived from tāniko patterns**

	
Kahu huruhuru (Māori feather cloak). Muka (N.Z. flax), kererū, tūī, kākā, kākāriki feathers; double pair twining, plaiting. 1850-1900. Te Papa ME004275. All Rights Reserved.	**Kahu huruhuru (Māori feather cloak). Muka, wool, kererū, kākā, tūī, kākāriki and chicken feathers; double pair twining, plaiting. c.1900; North Island. Purchased 1993. Te Papa ME015604. All Rights Reserved.**

A tātara can be described as a thick warm muka cape covered with short dried and undressed flax tags sometimes dyed (Best, 1898, pp. 641–642; Hamilton, 1972, p. 288; Mead, 1969, p. 224). The International Register included a tātara rain cape in the Pitt Rivers Museum, University of Oxford in Oxford, England (1909.31.1) (Fig. 7.50). It had a muka foundation with lightly scutched flax tags, attached by spaced double pair twining to the backing, red and blue wool adornment along the base, and remnants of possibly brown kiwi feathers twined into the backing amongst the tags along the base (Roth, 1923, p. 102; Simmons, 1996b).[6] It is one of only four types of rain capes made after 1800 catalogued with feathers in the International Register. An older cape, a pākē of harakeke and split tail and wing feathers from a kererū was identified in Te Papa (ME01170) (see Chapter Five, Fig. 5.34). Two contemporary examples included a woven hieke with a row of blue pūkeko (swamphen: *Porphyrio melanotus*) feathers

[6] http://objects.prm.ox.ac.uk/pages/PRMUID45299.html

near the collar, now housed in the Dowse Art Museum, Petone Settlers Museum in Lower Hutt and made in 1994 by weaver Pip Devonshire (Ngāti Raukawa, Ngāti Manomano, Ngāti Te Au) (1995.14.1) and named ‘Ki a Hinemoana’ (see International Register). The other, a hieke made by Donna Waiariki had emu feathers (Te Papa ME022088).

***Figure 7.50*. Tātara (Māori rain cape). Muka, harakeke, kiwi (?) feather remnants, dye, wool; scutching, spaced double pair twining, plaiting. Mrs Melville Lee. Donated 1909. Pitt Rivers Museum, University of Oxford, Oxford, England 1909.31.1. Right: back view of cape.**

Rain capes were common attire, with shorter versions worn around the shoulder and waist, and were made well into the 20th century with decorative trimmings of wool and feathers (Pendergrast, 1997). Māori artforms often served a functional and artistic purpose, and clothing often exemplified personal creative expression in weavers, and wealth, style, and status in the wearer. In the late 19th - early 20th century, some of the finer rain capes appeared as prestige wear in portraits and photography (Te Papa O.025628, O.025634). One remarkable black kahu tōī (cabbage tree cloak) made of dyed leaves from the mountain cabbage (*Cordyline indivisa*) in Te Papa (ME001156) is one such example (Tamarapa, 2011a, pp. 162–163).

***Table 7.4*. Similar coloured check patterning rain cape and feather cloak.**

	
Pākē (Māori rain cape). Plant fibre, dye, wool; spaced double pair twining. Te Papa ME002078. All Rights Reserved.	**Kahu huruhuru (Māori feather cloak). Muka, kākā and tūī feathers; spaced double pair twining, plaiting. Made 1850-1900. Te Papa ME001773. All Rights Reserved.**

Early tagged rain capes were conceivably mistaken for feather and dog skin cloaks (see Chapter Six, Fig. 6.5). Auckland War Memorial Museum, Tāmaki Paenga Hira has a rare example of a tūī tail feather cape resembling a rain cape (Ethnology No. 1491) (see Chapter Five, Fig. 5.41). On occasion coloured check patterned rain capes resembled post-European feather cloaks, as observed in a dyed pākē rain cape (ME002078) and kahu huruhuru (ME001773) in the Te Papa collections (Table 7.4). Dog skin cloaks with check patterns were also witnessed by Cooks crew on the first voyage (1769-1770), including naturalist Hermann Sporing on White Island in November 1769 (Mead, 1969, p. 50). Thatched rain capes and feather cloaks shared the same technique, in that the tags of stripped flax were twined into the garment as it was made (see Chapter One, Fig. 1.8) (Hīroa, 1926).

***Figure 7.51*. Pihepihe (cloak with pōkinikini strands). Muka, dye, duck feathers, pōkinikini; scraping, dyeing, spaced double pair twining. North Island. Gift of Robert Coddington, 1977. Te Papa ME013936. All Rights Reserved.**

It is unusual to find pōkinikini (dyed strands of partly scutched harakeke) in feather cloaks. The International Register catalogued around eight cloaks with this feature, including three at Te Papa (ME013936, ME014387, ME022088) (Fig. 7.51). Others were found in Scotland, in the National Museum of Scotland in Edinburgh (A.1910.129), and the rare kahu kākāpō in Perth Museum and Art Gallery (Perth and Kinross Council), in Perth (1978.73) (Fig. 7.20). With additional examples in the World Museum, National Museums Liverpool, in Liverpool, England (54.160.101, 56.25.722), and the American Museum of Natural History, in New York City (80.1/5575).


***Figure 7.52*. Korirangi (Māori cloak with cylindrical tags). Muka, natural dye, harakeke, wool; plaiting, twining, scraping, dyeing. Made 1820-1900. Gift of W. Leo Buller, 1911. Te Papa ME002076. Right: detail of pōkinikini and ara (rows).**

A korirangi or pihepihe cloak with pōkinikini in the Te Papa collection (ME002076) was acquired through Walter Buller, a well-known ornithologist of the late 19th century (Tamarapa, 2011a, pp. 122–123) (Fig. 7.52). Nineteenth century pihepihe (shoulder garments), were worn by females, and had pōkinikini strands of short rolled and dyed tags, twined into a muka cloak backing (Hamilton, 1972, p. 290). The korirangi (pihepihe) was so named from the plumage of the shining cuckoo (pīpīwharauroa: *Chrysococcyx lucidus*) where the contrasting barred light and dark flax strands resembled the barring of the cuckoo's front, and tail feathers (Fig. 7.53) (Hamilton, 1972, p. 285; Mead, 1969, pp. 97–98; Tamarapa, 2011a, p. 123).

***Figure 7.53*. Shining cuckoo (pīpīwharauroa: *Chrysococcyx lucidus*). Te Papa OR.000410.**

Both the migrating shining cuckoo and long-tailed cuckoo (*Eudynamys taitensis*) breed on both main islands and some offshore islands over spring, yet fossils of both species are rare, suggesting their movement is largely transitory (Gill, 2010; Heather & Robertson, 1996;

Higgins, 1999; Holdaway et al., 2001; Robertson et al., 2007). As brood parasites, they leave their young in the nests of other birds to be raised, Māori compared this behaviour to neglectful human parents (Best, 1977; Orbell, 2003). Shining cuckoo feathers were identified in one Te Papa kahu kiwi (ME014499), discussed later, and despite or possibly because of their rarity the cuckoos continue to inspire Māori artists (Harwood, 2011a).

7.3.7 The significance of the function of Māori feather cloaks

Mead (1969) navigated the facets of European influences by classifying the responses to these influences in Māori clothing. Pre-European hierarchies in cloak attire dictated that prestigious Māori cloaks be adorned with kurī, tāniko, or red kākā feathers, and were worn on important occasions. It was from the initial meetings with early Europeans that important trading relationships were created. Cloaks became important trading items and functioned as valuable exchanges, gifts, or forms of payment from the 19th century on, in which presenting a cloak to a person of high rank or mana, reflected well on the weaver and people offering the gift (Mead, 1969). With the introduction of European clothing, there was a transition of cloak use from traditional daily attire to costume wear, with cloaks generally worn on special public occasions to marae or political events, such as kapa haka, openings, graduations, and used at tangihanga, and sometimes a combination of these (Mead, 1969; Stevens, 2015).

Figure 7.54. **Korowai whakahekeheke (cloak with vertical lines of decorative elements). Muka, brown kiwi and kererū feathers; dyeing, double pair twining, plaiting. Made 20th century. Gift of Miss Jean Gilmer, 2006. Te Papa ME023834. Right: detail of green and white kererū feathers. All Rights Reserved.**

After European settlement, Māori feather cloaks were often associated with dignitaries in which cloaks were often gifted to and worn by heads of state, prime ministers, governor generals, including members of the British royal family. Richard John Seddon was New Zealand's longest serving Prime Minister from 1893-1906. From research collated in the International Register, Seddon was gifted several feather cloaks in his term, and some were also placed on his coffin at his funeral to reflect his position. One of the eight korowai whakahekeheke with feathers listed in the International Register was gifted to Te Papa (ME023834) in 2006 by a member of Seddon's family (Fig. 7.54) (Tamarapa, 2011a, pp. 128–129). It had a muka backing with dyed black hukahuka (tassels) in alternating vertical bands adjacent to brown kiwi feathers, where a single kiwi feather was woven in backwards using the feather tip. The bottom border had alternating green and white kererū feathers.

Another kiwi feather cloak in Queensland Museum in Brisbane, Australia (E1777) was also given to Seddon by Māori. A Te Papa korowai (ME007874) without feathers made in the 19th century in Wairoa and influenced by Ngāti Rongomaiwahine was said to have been owned by Richard Seddon, James Carroll, and Captain Christian W. Ostenfeld who gifted it to the Museum in 1955.[7] A British Museum feather cloak with kākāpō and fowl feathers (Oc1936,0607.1), and a kahu kiwi (Te Papa ME023833) were both presented at Richard Seddon's funeral in 1906 (Tamarapa, 2011a, pp. 126–127). The Te Papa kahu kiwi was placed on the casket of Dr. Seddon Bennington, Te Papa Chief Executive (2003-2009) who was named after the Prime Minister.

Māori illustrated their generosity and goodwill towards the crown during the New Zealand Royal tour in 1901 by gifting valuable taonga (treasures) of carved wooden and pounamu (greenstone) ornaments and weaponry; weaving including cloaks of fur from the extinct kurī and feathers from weka, pigeon and kākā ("1901 The Maori gave his best", 1953, p. 23). The International Register documented several cloaks in The British Museum in London possibly accessioned as Royal Loans in 1902 (QRL 1, 2, 3, 9, 10 & 11) (Lander, 2011, p. 69). A kahu kiwi in the Royal Collection Trust in London, England (RCIN 746301) was later worn by Queen Elizabeth II in Rotorua during the 1953 New Zealand Royal tour (Alexander Turnbull Library, Ref: EP/1986/0899/37).

[7] https://collections.tepapa.govt.nz/object/65040

***Figure 7.55*. Kahu kiwi (kiwi feather cloak). Muka, dye, brown kiwi, tūī, kākāpō, kākā and shining cuckoo feathers; twining, plaiting. Made 1850-1900. Gifted to Thomas Holden. Purchased 1985. Te Papa ME014499. All Rights Reserved.**

A rare kahu kiwi in the Te Papa collection (ME014499) is the only cloak in which kākāpō feathers were identified in 2007 (Fig. 7.55) (Harwood, 2011a). It is also the only Te Papa cloak to contain shining cuckoo feathers and tūī throat feathers (Figs. 7.56, 7.14 & 7.53) (Harwood, 2011a). A Māori (chief) from Te Aroha gifted this exceptional Te Papa cloak to Thomas Holden (1849-1920), a fluent reo Māori speaker for assisting with the payment and administration of the chief's taxes for around 10 years (Tamarapa, 2011a, pp. 146–147).

***Figure 7.56*. Kahu kiwi (kiwi feather cloak). Te Papa ME014499. Left to right: detail of pīpīwharauroa feathers; tūī throat feathers (pōhoi); and kākāpō feathers. Images by Hokimate Harwood, 2010.**

At 19th and 20th century tangihanga (funerals), gestures of kōpaki (a wrapping or shroud) were sometimes made by visiting tribes, where an appropriate gift was offered to the grieving family (whānau pani) in the form of a jade or whalebone club or fine dress cloak (Hīroa, 1966, p. 420). In response, the whānau pani matched this custom with the tahua roa, the gifting of taonga to visitors sometimes with Māori cloaks of various kinds, particularly when the local tribe was noted for their skill in weaving (Hīroa, 1966, p. 428). Historically, the concept of tahua roa (heaped food) was to exhibit the wealth, appreciation, and hospitality of the hosting whānau and iwi, in the 20th century, cloaks were a major component of this gesture also, and it was practised into the 1920s (Fig. 7.57) (Maihi, 2011, p. 41).

***Figure 7.57*. Otago Witness on 5 August 1914, p.43. 'In memory of the late chief, Takarangi Mete-Kīngi (1845? – 1914): A collection of valuable Māori mats and other mementos distributed to relatives and friends.' Pūtiki pā, in Whānganui. Photograph by Toska Studios. Image courtesy of Hocken Collections, Uare Taoka o Hākena, University of Otago.**

Valuable kākahu were not necessarily only produced for an event or person but remembered for an event or person. Elsdon Best made note of a fine cloak in his possession, worked in small alternating triangles of black tūī and white kererū feathers, and edges lined with rows of orange kākā feathers (Te Papa ME000739), and presented to him as an oha by the Tama-kai-moana hapū of Maungapōhatu (Fig. 7.58) (Best, 1898, p. 640; Tamarapa, 2011a, p. 171; Wallace, 2011). This likely occurred around 1899 during the tahua roa at the tangihanga of 9 year old Marewa-i-te-rangi, the daughter of Pinohi Tukua-i-te-rangi, and granddaughter of Tūtakangahau who left her in Elsdon Best's charge to attend the school in Te Whāiti (Malcom-Buchanan, 2014; Tamarapa, 2011a, p. 171; Wallace, 2011). Tūtakangahau was Best's main contributor to his memoirs of Tūhoe customs (Holman, 2010). The premise of the oha, ohaki, or oha-a-kī (oha- greeting, ki-speech), or koha (in remembrance), granted a person's last or dying wish in the gifting of a taonga or keepsake (Hīroa, 1966, p. 415; Williams, 1957). Best later deposited this cloak and several other gifted cloaks from the Bay of Plenty area into the Dominion Museum (now Te Papa) in Wellington in the late 19th century (Holman, 2010; Tamarapa, 2011a, p. 171; Wallace, 2011).

***Figure 7.58*. Kahu huruhuru (Māori feather cloak). Muka, tūī, kererū and kākā feathers; plaiting, spaced double pair twining. Made c.1890; Ngāi Tūhoe. Deposited by Elsdon Best, 1899. Te Papa ME000739. All Rights Reserved.**

7.3.8 Māori weaver innovation, identity, and religious and political responses

The concept of conspicuous 'colour lifts' in which contrasting coloured feathers have been added to a cloak to draw the eye of the observer, were recorded in Te Papa's Māori cloaks made after 1800 (see Fig. 7.13) (Harwood, 2011a, 2011b; Te Kanawa, 1992). The premise behind this use was that the feathers or birds have little meaning or significance for the weaver other than an aesthetic value. In contrast, potential weaver 'signatures' were also recorded and interpreted from the feather identification of Te Papa's Māori cloaks where weaver markers were defined as inconspicuous or subtle elements in a cloak, differentiated from conspicuous colour 'lifts' in that the feathers or birds were of importance to the weaver, or wearer whereby acting as a personal identifier (Harwood, 2011a, 2011b).

Figure 7.59**. Korowai kārure (Māori cloak with unravelling tags); Muka, brown kiwi and kākā feathers, dye; spaced double pair twining, rolling, dyeing, plaiting, miro. 1900-1930. Attributed to Te Arawa. Bequest from Sir George Monckton-Arundell estate, 1980. Te Papa ME014383. All Rights Reserved. Right: detail of concealed kākā belly (top) and underwing feathers. Images by Hokimate Harwood, 2007.**

One such cloak with Te Arawa affiliations in the Te Papa collection (ME014383), a korowai kārure had kākā feathers discovered in 2007 hidden amongst the brown kiwi in the lower border (Fig. 7.59) (Tamarapa, 2011a, pp. 120–121). Most feather cloaks in world museums in the International Register were made after 1800 and based on a provisional analysis of the approximately 600 feather cloaks recorded with detailed descriptions, at least 25 cloaks had single feathers added that potentially indicated a type of weaver signature.

Figure 7.60**. Kahu kiwi (kiwi feather cloak). Muka, green wool, brown kiwi, chicken, and pheasant feathers; spaced double pair twining, plaiting. Attributed to Ngāi Tūhoe. Te Papa ME007904. All Rights Reserved. Right: detail of green wool. Image by Hokimate Harwood, 2010.**

Kahu kiwi are highly regarded because the birds are rare and the feathers large and lustrous. Each cloak was made with slight yet specific differences, but they can look similar from afar. Close inspection of a Te Papa kahu kiwi (ME007904) in the International Register revealed concealed chicken and pheasant feathers in the middle and right-hand side, and a loop of green wool in the bottom right corner (Figs. 7.60 & 7.61). The International Register also listed a kahu kiwi in Canterbury Museum in Christchurch (E161.51), that had two strands of inserted green wool into the lower right-hand corner, and one strand of red wool in the lower left edge. Te Hemo Ata Henare (2017) relayed that she knew of late Bay of Plenty master weaver Eddie Maxwell inserting a signature in his work, "he used to put ... green thread in, that's … his tohu".

***Figure 7.61*. Detail of kahu kiwi. Te Papa ME007904. Showing a single cream & brown chicken hackle feather in the centre of the kahu kiwi (left); and single male pheasant feathers in the cloak centre and right-hand side border (right). Images by Hokimate Harwood, 2010.**

Traditional Māori knowledge was communicated in oral language and higher artforms such as raranga (weaving), whakairo (carving), and tā moko (tattoo) (Harwood, 2011b). However, by the late 1800s, many carved structures were destroyed, buried, or dismantled, illegitimately confiscated, and sold (Awatere, 1984; Brown, 1996). Numerous mana taonga of Ngāi Tūhoe were stolen in the 1916 police raid at Maungapōhatu (Te Awekōtuku & Nikora, 2003). Weaving was time intensive and had diminished by the mid-1900s until it was revitalised by weaving groups. Cloak weavers experimented with more conspicuous forms of communication in alignment with the spoken and written language introduced to Māori communities in the early 1800s. The Native Schools Act of 1867 introduced native (Māori) schools and supported mission schools, where English was to be the language of instruction (Mead, 1969). According to one missionary, by 1860 three quarters of the Māori population could already read and two thirds could write in their own language, the outcome of thirty years work by the missionaries (Hohepa, 1964). Writing in cloaks typically related to the weaver, wearer, or a place or event that referenced the weaver's individual memory and social recollection of the community (Binney, 2009b).

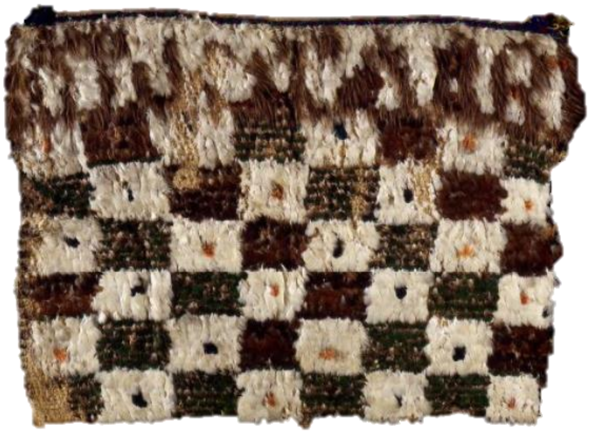

***Figure 7.62*. Kahu huruhuru (Māori feather cloak). Muka, wool, brown kiwi, kererū, tūī, kākā feathers; twining, plaiting. Te Papa ME010762. All Rights Reserved.**

A Te Papa kahu huruhuru (ME010762) with writing in the International Register featured brown kiwi feathers that formulated a word with the letters "T", "U", and possibly two "A"'s (Fig. 7.62). Another novel kahu huruhuru in the International Register, identified in the Te Papa collection (ME010936) incorporated the name KAARI along the top (Binney, 2009a). Timi Kaara or Timi Kaari was a transliteration of Sir James Carroll (1857-1926), of Ngāti Kahungunu and Irish descent, Carroll was a well-known Māori politician of the late 19th and early 20th centuries (Mitira, 1972). The kahu huruhuru was made by Ngāi Tūhoe weavers at Mataatua, Ruatāhuna around 1900 (Binney, 2009a, p. 513). Carroll worked in the Native Affairs Department, as an interpreter for the House of Representatives in 1879 and as Native Affairs Minister in 1899 (King, 2003; Mitira, 1972). In the late 19th and early 20th century a group of young European-educated Māori men tried to broker Māori-Pākehā relations juxta-posed between the two worlds. Sir Āpirana Ngata (1874-1950) (Ngāti Porou), James Carroll, Te Rangi Hīroa (Sir Peter Buck) (1877-1951) (Ngāti Mutunga), and Sir Māui Pōmare (1876-1930) (Ngāti Mutunga, Ngāti Toa Rangatira) were accredited with working for Māori rights and uplifting iwi aspirations in the New Zealand legal, military, political, medical, academic, and financial systems.

The initials "H" and "A" were also discovered in a Te Papa cloak (ME014386) in the tāniko orientated upside down at the base of the cloak (Harwood, 2011b). A Te Papa cloak without feathers had the name "Ngapera" then a "H" or "K" or "R" threaded in red wool near the neckline (Te Papa ME003719). As discussed previously, the Auckland War Memorial Museum holds the treasured kahu kura (Ethnology No. 5975) by Makurata Paitini with her name “MA” “KU” in the tāniko. Makurata also incorporated her own designs into kākahu as a form of communicating her identity (see Fig. 7.9). A Field Museum kahu kiwi (88524) in Chicago had “WERE TAIAPA” and “WI” partially obscured in the tāniko facing the cloak base. An exceptional kahu kiwi with tāniko in the Waikato Museum (Accession No. 1981/81/1) named Te Komuhumuhu had “TE AKAUROA” and “TAUPONUI” in the side borders. Museum records indicated connections to Te Arawa. Another kahu kiwi (273649) in the Field Museum in Chicago, also had “TAUPONUI” in the bottom corner, indicating a connection. A Fowler Museum kahu kiwi (X65.10284) in Los Angeles, California had ‘Harete Taupo’ worked in the tāniko. Te Manawa Museum in Palmerston North listed a small korowai with feathers (2008/195/3) and the initials “P.E.N.”, embroidered in red wool on the back, which did not appear to be associated with the former owners. A kahu kiwi (D92/146/1) temporarily at Te Manawa Museum, was not included in the International Register as it was not a permanent museum collection item, was woven by Mere Ngareta (Ngāti Huru Te Rā, Ngāti Houmāhanga of Ngāti Apa, and Marukohana of Whānganui) in the late 19th century, and had the letter “M” stitched into the back using red cotton thread (Tamarapa, 2011b, p. 158). The letter “M” was discovered in the waistbands of eight Te Papa piupiu in 2010, stitched into the backing with yellow plant fibres.[8]

***Figure 7.63*. Kahu huruhuru (Māori feather cloak). Fibre, mammal hair and skin, wool and peacock, chicken, and pheasant feathers; spaced double pair twining, tāniko, knotting, plaiting, sewing. Image courtesy of the Royal Ontario Museum, Toronto, Ontario, Canada HB1357.**

[8] https://blog.tepapa.govt.nz/2012/12/05/m-is-for-mystery-m-initial-in-the-waistband-of-te-papas-piupiu-maori/

An extraordinary kākahu in the Royal Ontario Museum in Toronto, Canada (HB1357) was listed in the International Register of Māori feather cloaks (Fig. 7.63). According to museum collection records, it was constructed of a fibre kaupapa (foundation) and decorated with coloured wool in the tāniko borders, and untreated wool and skin strips along the sides and neckline. Based on the images provided by the Royal Ontario Museum in 2018, this distinctive kākahu consisted of (male) peacock, chicken, and multi-coloured male common pheasant feathers. Fashioned out of feathers, the central figure appeared to be a male dressed in a British naval or soldier's uniform, his head directed up, mouth open, and holding his right arm, or object, possibly a gun, up in the air (Fig. 7.64).

***Figure 7.64*. Kahu huruhuru (Māori feather cloak). Detail of head of figure. Image courtesy of the Royal Ontario Museum, Toronto, Ontario, Canada HB1357.**

This unusual kākahu contained striking iridescent peacock feathers from the neck and breast; green peashell feathers from the upperback; black and white scapular feathers, and iridescent green tail herl (Fig. 7.31). Most of the white feathers were identified as chicken from images, and there are also multi-coloured chicken feathers along the neckline. The rest of the white feathers appeared to originate from waterfowl, with some feathers cut to shape the figures outline. Multicoloured male common pheasant from the breast, nape, back, and sides created a background. Some of the mammalian skin strips were sewn together before being tied to a running cord along the sides and top (neckline).

No provenance had been recorded connecting this cloak to a person, people, location, or event. However, the stance of the figure with arm raised and mouth open is comparable to that of representations of Te Kooti Rikirangi Te Tūruki (Rongowhakaata, Ngāti Maru) (c. 1832-1893). A prophet and fighter, Te Kooti was credited with founding the hāhi Ringatū (Ringatū faith), devising the symbolism for the raised (tū) hand (ringa), which has biblical associations and many Tūhoe followers (Binney, 2009a; Greenwood, 1942). Te Kooti was named a traitor by some Māori and British, after fighting on and against both sides. He was arrested and imprisoned on the Chatham Islands (Wharekauri) in 1867, and there a disillusioned Te Kooti envisioned the beginnings of the Ringatū faith. During the New Zealand fighting campaigns of 1860-1866 the British Army wore dark blue jackets and frocks similar in design to the standard British red uniforms (Taylor, 2004, p. 34). Captain Gilbert Mair (1843-1923) who fought Te Kooti and his men in 1870 in the Bay of Plenty and east coast, wore a uniform of a woollen shirt, blue tunic, knickerbockers, long stockings and a short-waist shawl (Cowan, 1956, p. 395). The other soldiers wore the shawl and blue jackets, so the cloak could depict a British soldier holding a musket or bayonet (Cowan, 1956, p. 447). Other depictions of Māori in British uniform were portrayed in whare, carvings, and paintings (Fig. 7.65).

Figure 7.65. **Te Rauparaha (Ngāti Toa Rangatira, Ngāti Raukawa) in naval uniform. Watercolour, pencil graphite, ink, gouache, paper. Unknown; artist; 1847/1860, William Bambridge; after. Gift of Amy Wallace, 1962. Te Papa 1992-0035-1710. All Rights Reserved.**

Textiles, flags, sails, cloaks, blankets and clothing were somewhat interchangeable canvasses for articulating Māori social concerns in the 19th century. Sections of wool and cotton were re-fashioned into clothing as trophies or tokens of victory, as defeated British soldiers' uniforms were incorporated into taiaha or Māori fighting staffs (personal observations, 2010; See Te Papa taiaha ME001310 and WE000218 as possible examples). The prominent union jack in the English flag was an icon of the British constitution, and Māori flags were formulated, yet measured acts of Māori defiance against them. A flag was made for the union of the Urewera tribes and is most likely the Te Whāiti version of the flag of Te Whitu Tekau, c.1874 (Fig. 7.66) (Binney, 2009a, p. 241). Te Whitu Tekau, the seventy, or union of Mataatua, was a chiefly council installed in 1872 as a magisterial court to oversee local matters (Binney, 2009a). A version of this flag was flown at the second Te Whitu Tekau meeting in March 1874 at Ruatāhuna in the Bay of Plenty, and it is speculated the profile image is the Archangel Mikaere (Michael), or Te Kooti Rikirangi himself, representing the renewed commitment of Tūhoe to the Ringatū leader (Binney, 2009a, p. 241). The figure has a blue collar like the depictions painted by Te Kooti in the wharenui Tūwhare at Galatea in the Bay of Plenty, where blue represents the colour of life for Tūhoe (Binney, 2012, p. 438). Figurative patterns and paintings appeared in the 19th century on wharenui (meeting house) rafters, including some depicting Te Kooti Rikirangi (Neich, 1993). Whakapapa Māori, life, and traditions were portrayed in traditional figurative artforms in whakairo (carvings), in painted hoe (paddles), and Māori rock art (Duff, 1950; Gibbs, Lythberg, & Salmond, 2018; Neich, 1993; Teviotdale, 1932). Nick Tupara of Ngāti Oneone, described the significance of the characters in some of the known Te Kooti flags, and affirmed they were a symbol of power and allegiance (Peters, 2017, p. 23). Tupara understood that the red cross + likely embodied the fighting cross of the Archangel Michael who featured in the Bible's final chapter, the book of Revelations (Peters, 2017, p. 23). It was believed the other symbols represented Te Kooti's Hahi Ringatū (Ringatū faith) and according to Tupara the silhouetted figure's waha (mouth) was open, as if "articulating a conversation. It's looking to address something - the loss of land, the death and the suffering of his people" (Peters, 2017, p. 23). Te Kooti saw a parallel between Māori and the Israelites in Egypt, where Michael was the saviour of the Jews, believing he like Michael, would also protect Māori where as Tupara stated "The Archangel Michael spoke of the light in the moon in the darkness that would bring hope and save them from their suffering" (Peters, 2017). Saint Michael the Archangel is often depicted holding a spear or sword with which he defeats evil.

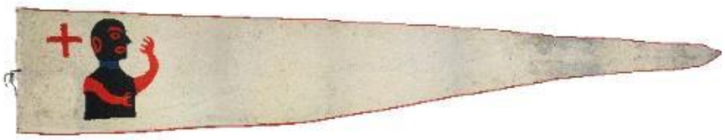

***Figure 7.66*. Pennant. Cotton, Wool; sewing. Most likely the Te Whāiti version of the flag of Te Whitu Tekau, c.1874 (Binney, 2009a, p. 241). 106.3cm x 576.5cm. Unknown maker/ artist, 1800-1900. Deposited by Sir George Grey 1879. Te Papa ME000796. All Rights Reserved.**

There are very few cloaks, particularly feather cloaks, that depict figures and lettering. The reason for this lies in the techniques of twined weaving in that rectilinear patterns can be easily created by adding or skipping a whatu (twining in this case with feathers) on the next row for triangular or diagonal designs. However curvilinear patterns as seen in the Royal Ontario Museum cloak (HB1357) required some skill and creative innovation. Incorporating introduced materials and retaining traditional weaving techniques was also an indirect response to Pākehā influence. Whereby, superficially iwi Māori endured forced changes in most aspects of life. Yet internally, while some weavers possibly enjoyed various material options, others likely struggled to retain pre-European customs such as personal and societal autonomy. After consultation with the descendants of Te Kooti Rikirangi (Ngā uri o Te Kooti) in 2019, no definitive evidence was found to suggest the figure or cloak was connected to him. Despite the lack of provenance or history recorded for this intriguing cloak, shared knowledge from future research could benefit iwi, weavers, and museums and conceivably recover its true origins, meaning, and purpose.

Figure 7.67. **Kākahu (Māori cloak). Māori cloak with symbolism and writing. Wool, muka, male common pheasant feathers, pūkeko feathers; spaced double pair twining, hand sewing. Made 1860-1900. Te Papa ME015747. All Rights Reserved.**

A Te Papa cloak (ME015747) listed in the International Register with an unrecorded history could also have links to Māori religious or political symbolism (Fig. 7.67). Across the cloak and identified in all four borders were bluish-black pūkeko feathers and various multi-coloured male common pheasant feathers. A fascinating aspect of this cloak was the writing in wool, and remnants of a word resembling POIHANA. The letters appeared upside down when the cloak was orientated correctly, and some of the wool on the first **A** and **N** had been unpicked, possibly because the **N** faced the wrong direction. Proposed translations for Poihana include variations on the names used to describe the movement of the cloak in the wind when tied to a flagstaff (Te Manakura, 2007, p.138). Of the four card symbols across the middle of the cloak, ♠ ♥ ♣ ♦ only the heart and possibly diamond symbols were orientated correctly, pointing toward the neckline. The four original French suits of clubs, spades, diamonds, and hearts were known as pips, and the coat cards of Kings, Queens, Jacks (Knaves) known as tétes and Aces (Chatto, 1848).

Figure 7.68**. Maori rebel flags. Produced by William Francis Gordon (artist); 1860s. Watercolour, ink, paper. Gift of W.F. Gordon, 1916. Te Papa 1992-0035-1631/8.**

For different iwi Māori, playing card emblems were represented in various artforms such as religious and political imagery in response to British symbolism and empirialism (Tamarapa, 2011a, pp. 106–107; Te Manakura, 2007; Wallace, 2009). Diamond patterning was already prevalent in the tāniko patterns of kaitaka cloaks in the first half of the 19th century before they appeared in feather cloak designs in the second half (see Fig. 7.49, Table 7.3). The terminology and symbology from European monarch societies were incorporated into Māori society, and these motifs were possibly introduced via European playing cards from sailors, sealers, and traders from the early 1800s (Fig. 7.68).

One of the more established theories is that this kākahu was associated with the prophet Rua Tapunui Kēnana Hepetipa (Ngāi Tūhoe) (1869-1937), who utilised these symbols in his teachings. Rua referred to himself as the ‘Mihaia hou’, or ‘new Messiah’ and wanted total autonomy for his 600 followers at Maungapōhatu in 1907 (Belich, 1996; Binney et al., 1979).

Rua adopted iconography forged from European biblical histories, believing he was the true successor of Te Kooti Rikirangi, as King Solomon had succeeded his father, King David. In 1908, photographer George Bourne (1875-1924) obtained rare images of Rua Kēnana with his wives and children at Maungapōhatu at the distinctive circular hall Hiona (Zion) modelled off Solomons court-house, painted with yellow diamonds and blue clubs (Alexander Turnbull Library, Ref: APG-1679-1/2-G); and with Rua standing near the entrance gate to the complex (Auckland War Memorial Museum Tāmaki Paenga Hira, Ref: PH-1976-6-30) (Binney et al., 1979, pp. 47–48). The gate decorated with the name MIHAIA (The Messiah) featured emblems of the star and clubs, interpreted as the two moving stars of Kopu, or Venus, the morning star; and Halley's comet, or the two sons of God, Christ and Rua; while the four-pointed star above the gateway referenced the prophecy of Te Kooti, telling of the advent of his greater successor from the east (Binney et al., 1979). The other icons are open to interpretation, in that the spades embodied Pākehā dominance, while the standing clubs, and 'diamonds' of Maungapōhatu (the holy ghost), were both emblems for Rua as the predicted King (Binney et al., 1979). On the Hiona structure, a white background decorated with blue clubs and a crown of gold diamonds served as mnemonic devices for Māori unable to read the English scriptures (Binney et al., 1979).

Examples of Māori use of card symbolism was captured in the Waikato and Rotorua (Wallace, 2009). Reischek was given ease of access to land, birds, taonga and most importantly Rangatira including the Māori King in the Waikato area in the late 19th century. Māori were initially reluctant to conform to the European constitution of Royalty, preferring Rangatira status that adhered to autonomous sovereignty and guardianship of kindred lands and resources. Waikato Māori tried to elect numerous Tainui leaders, and finally Te Wherowhero was appointed the first Māori King (taking the name Pōtatau) in 1858 and succeeded by his son Tāwhiao in 1860. When Reischek met Tāwhiao around February 1882, he described him as a "powerful energetic man with a richly tattooed face (tā moko) … wearing a mantle of kiwi feathers over his shoulders, …his hair was adorned with huia feathers, …ears were hung with ornaments of sharks' teeth and greenstone pendants; .. and carrying a large and beautifully formed greenstone club [mere]" (Reischek, 1930, p. 151). The first wife of Tāwhiao, Hera (Poihire) Ngāpora, followed, and Reischek (1930) noted that she had tattooed lips and chin (moko kauae), and top hat, and was wrapped in a calico dress on which all kinds of card games were printed in a strange manner. This dress was possibly a notion to undermine or mock British rule.

Feather cloaks were usually woven from the bottom up, with the weaver commencing in the bottom left hand corner, working her way across from left to right, then down onto the next row, and finishing at the collar in the top right corner, so that the feathers can be added in each row layered as they are on a bird. One might assume that the weaver unintentionally did not realise the writing was the wrong way up, but as the heart and possibly diamond shaped card symbols were correctly aligned, it creates some doubt.

***Figure 7.69*. Kākahu (Māori cloak) with cross and branched figures. Muka, dye, wool, and tūī feathers; spaced double pair twining, tāniko, sewing. Sir George Grey Collection. British Museum Oc1854,1229.133. ©The Trustees of the British Museum. Right: detail of downy tūī feathers. Image by Hokimate Harwood, 2019.**

A British Museum kākahu (Oc1854,1229.133) listed in the International Register had distinct branched designs on either side of the garment, and two crosses down the centre (Fig. 7.69) (Roth, 1923, p. 72). It was classified as a pātea, or pekerangi, due to the fine tāniko and tufts of scattered feathers across the kaupapa (Mead, 1969, p. 113; Starzecka et al., 2010, p. 116). Pendergrast suggested a production date of early 19th century and detailed the spaced double pair twining with narrow side tāniko bands, and deeper tāniko bottom border, with red wool pompoms and feathers facing upward (Starzecka et al., 2010, p. 116).

***Figure 7.70*. Tūī (*Prosthemadera novaeseelandiae*). ♂ Tūī front, and detail of lower belly feathers (right). Collected by E. Thompson, October 1965, Hutt Valley. Te Papa OR.012225. Images by Hokimate Harwood, 2018.**

This kākahu (Oc1854,1229.133) was personally examined and imaged in 2019. The observed dark feathers were attached with red wool adornment, possibly depicting leaves on the 'tree-like' structures on the sides and at the tips of the crosses. The cloak feathers were described as downy, lacking pennaceous barbs at the tips as in typical contour feathers, and prominent dark brown-grey or black down (Fig. 7.69). The longer cloak feathers measured over 6cm long and had grey down, dark grey-brown shafts on the dorsal side and light grey-white shafts on the ventral side. Microscopic down analysis in 2019 of several dark detached cloak feathers indicated the feathers originated from a passerine (see Chapter Two, Harwood, 2011a). The downy barbules were medium-long with uniformly spaced dark triangular nodes, and comparisons of node size, shape, and distribution to a microscopic reference image database confirmed the species as tūī (see Chapter Two). Reference image comparisons of the cloak feathers to museum bird skins determined the feather types as the lower (downy) belly feathers from tūī (Fig. 7.70). Most of the cloak feathers faced towards the top of the cloak, others were orientated sideways and attached via twining, or threaded into the wool adornment (Fig. 7.69).

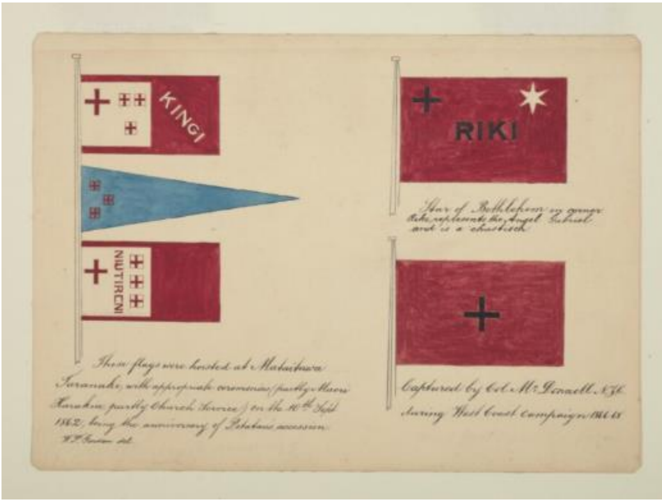

***Figure 7.71*. Māori rebel flags. Produced by William Francis Gordon. Watercolours, ink, paper. Gift of W. F. Gordon, 1916. Te Papa 1992-0035-1631/4. All Rights Reserved.**

The most intriguing aspect of this cloak comes in the fascinating use of religious symbolism, as the crosses and two 'trees' can be interpreted in many ways. For example, Māori religions and political agendas responded to Christianity with crosses in 19th century flags (Fig. 7.71). Christianity is synonymous with crosses and is also known to integrate trees in biblical traditions. In Catholic imagery, two trees were present in the garden of Eden, one the Tree of Life, the other the Tree of the Knowledge of good and evil (Genesis 2:9). It is thought the two trees represented the bringing together of two traditions, two peoples (Porter, 1998, p. 28). The feathers repurposed as leaves on the trees, could be for the healing of nations (Revelation 22:2), or could denote fruit on the trees, that sustained the righteous, but also tempted us, like Adam and Eve. The cross was also said to have originated from and thereby become the tree of life (Dreyer, 2000, p. 226). The cross also represented Jesus Christ's death on a tree (Williams, 1930). Another train of thought is that the cross or true Tree of Life holds this central position, and the two trees correspond to the duality of the good and evil of the tree of knowledge (Guénon, 2001, p. 58). Guénon (2001) explained that the concept of a centralised cross, or 'tree in the midst', is that it is the 'world axis' in which the vertical line is the trunk of the tree and the horizontal lines are the branches, standing in the middle of a world in which the state of human existence is developed (p. 54). In the context of 'world axis' this central cross implied unity of good and bad (Guénon, 2001, p. 55). Figurative trees are portrayed in paintings inside 19th century Tūhoe wharenui in the Bay of Plenty, at times depicting human figures preaching, or alongside other religious symbolism such as birds, leaves, crescent moons and suns (Neich, 1993, pp. 282–283).

7.4 Discussion

Some of the aspects in this chapter discussed are clearly a direct response to European influences to demonstrate the numerous effects of colonisation. Other elements have naturally progressed to incorporate European influences through the adoption or adaptation of materials, techniques, and customs over the last 200 years.

Flax was valuable to Māori and Europeans, a lucrative trade item for early settlers and exported to England and Australia, it was plentiful and widespread, with the blade reaching 12 ft long, it was strong, flexible and versatile (Hay, 1882). Unfortunately processing was laborious, and the trade fluctuated, with dressed flax export values at £143,799 in 1873 dropping to £11,742 in 1875 (Hay, 1882, p. 207). The replacement of European clothing with flax clothing coincided with this downward trend in muka production by the 20th century. However, its renewed use in kākahu in the last 50 years reflects its ancestral significance in Māori society.

Within the parameters of this study, muka and brown kiwi feathers proved to be the two most prolific materials identified in Māori feather cloaks made after European settlement, and both were fundamental in showcasing a weavers' aptitude for traditional cloak manufacture.

Weavers employed different flax varieties for whatu kākahu and raranga, preferring locally sourced plants cultivated and harvested for their specific purposes (Te Kanawa, 1992). While kiwi feather cloaks were not specifically mentioned from Cooks voyages, we do know that kiwi skins and feathers were present in pre-1800 cloaks. Detailed in Chapter Six, the first known example was produced in the 16th-17th century, a cloak fragment in Southland Museum and Art Gallery (88.258.57(a)), found on Lee Island, Fiordland that incorporated twined strips of brown kiwi, and dog skin and hair. Two Cook-collected cloaks had bunches of brown kiwi feathers twined into the backing with the feather tips pointing towards the neckline. One located in the Hunterian Museum, University of Glasgow, in Glasgow, Scotland (GLAHM E.422), the other in the World Museum Vienna, Austria (Inv. No. 25), described in Chapter Six. There was also a confirmed account of a kiwi skin cloak, and kiwi feather cloaks observed in Northland in the early 19th century (Nicholas, 1817, p. 255; Yate, 1835, p. 59). The International Register is still only a preliminary list of feather cloaks in world museums, yet the current number of cloaks with kiwi feathers is substantial, numbering over half the cloaks with verified species. However, it cannot be assumed that kahu kiwi, fully feathered twined kiwi feather cloaks, were a direct result of Pākehā settlement as kiwi feathers have a unique quality that weavers have favoured for centuries, and twined, and kiwi in cloaks were already observed and evolving up to European settlement. As prestigious twined kahu kiwi appeared uniform in colour incorporating the back feathers, they required more birds, sometimes up to 40 kiwi birds in a cloak (Buller, 1888, p. 105; Henare, 2017; Hīroa, 1911, p. 84).

Kākā are another important bird species due to its red feathers. A tradition originating from Polynesia in the use of variations of the term kura (red), and in describing items of prestige and value as discussed in Chapter Five. Although the unique feathers of huia and kākāpō have been recorded in limited kākahu Māori to date, their significance in a cloak would also elevate the status of the cloak and wearer. Other commonly recorded native cloak species such as tūī, kererū, weka and pūkeko and were also numerous and widespread in both islands until the late 19th century, however it is difficult to ascertain whether frequent use of a species equates to preference. Their availability probability did make them more desirable, and material evidence featuring most of these species in pre-European times validate their worth in kākahu for at least the last 250 years, as discussed in Chapter Six.

***Figure 7.72*. The birds. Peacock, chickens, ducks, and pigeons for hunting. Oil paint, canvas. Melchior d'Hondecoeter; follower of; 17th century; Netherlands. Bequest of Mrs E.G. Elgar, 1945. Te Papa 1992-0035-2276.**

A total of 144 bird species have been introduced into New Zealand since 1840 via anthropogenic means, less than a quarter of the introductions were successful (Wodzicki & Wright, 1984). The majority of introduced birds in cloaks were imported around the mid to late 1800s. Although, there are indications that along with chickens, missionaries also unofficially introduced turkeys, geese, ducks, and common fowl in Northland, earlier than the official acclimatisation records (Nicholas, 1817, p. 256). The larger birds were introduced for hunting and so were valuable to European settlers, in that the Animals Protection Act 1907 restricted the seasonal hunting of imported wild duck, pheasant, and quail (Thomson, 1922, p. 546). Exotic birds were introduced from America, Australia, Africa, England, and Europe by the New Zealand Acclimatisation Society, specifically to help early settlers 'acclimatise' and settle into New Zealand life (Long, 1981; Thomson, 1922). Māori utilised chickens, pheasants, peafowl, ducks, and quail for food and feathers, the new colours and patterns would have been a novelty for weavers and are incorporated into most cloaks today in place of native feathers, not necessarily because they are preferred but because they are more accessible (Fig. 7.72).

Processed wool was first recorded in Cook-collected cloaks dating from the 1770s. Two examples in Chapter Six include a feather cloak in the Hunterian Museum, University of Glasgow, in Glasgow, Scotland (GLAHM E.422) with short strands of green wool, and a plain cloak in Pitt Rivers Museum, University of Oxford, in Oxford England (1886.1.1132) with long red wool strands added to the muka backing during construction (Lander, 2011, p. 66). In post-European cloaks, wool was incorporated by weaving or sewing, and was the most common introduced material (Lander, 2011). Early 19th century European wool blankets with identifiable bright colours and linear tartan designs proved a practical, warmer replacement for kākahu. In the 1850s Māori dressed in cloaks and blankets, and by the 1860s European clothing was widespread replacing both (Firth, 1959; Mead, 1969, p. 107). Images of this time captured Māori wearing blankets around the shoulders, like kākahu (Te Papa O.041153, A.004708, A.004683). A kaitaka huaki (cloak with double layered tāniko borders) in Te Papa (WE000471) had shortened vertical bands of tāniko part way up the cloak, and according to Maureen Lander, resembled the Hudson Bay Point Blanket designs from North America in the 18th and 19th centuries (Tamarapa, 2011a, pp. 138–139). A contemporary textile titled "Bicultural rap" in Te Papa (ME023143) made by artist Suzanne Tamaki (Te Arawa, Ngāti Maniapoto, Ngāi Tūhoe) in 2001, fused traditional Māori and colonial fashions. Constructed in six parts of sections of wool blankets (ME023143/1-5) and aspects of Māori attire like a collar of dyed feathers, bone, and shell (ME023143/6). According to the artist she was inspired by the 'korowai', and references Māori trade and blanket-wear during colonisation in this piece (S. Tamaki, personal communication, August 20 2018). It is an expressive social commentary on Māori adaptations to European influences in the 19th century still remembered today.

In Māori cloaks, twining was used as early as the 16th-17th century, and was the principal cloak weaving technique by the end of the 18th century when Cook visited New Zealand (see Chapter Six). By this stage elaborate coloured close and spaced, single and double pair twined cloaks were collected. In fact, tāniko and bent twined feathers that were associated with 19th century weaving first appeared in cloaks collected by Cook. By the end of the 19th century the majority of public museum cloaks demonstrated spaced double pair twining to secure bird feathers, so Māori weavers developed and mastered this technique in a short time. Cloaks with scattered feathers, transitioned into a wide array of simple then elaborate variations of kākahu, korowai, kaitaka, and kahu huruhuru incorporating a single species, to small bunches (quillets), to lined feather borders and strips, and fully covered cloaks featuring multiple species, and with elaborate geometric designs, figures and writing.

Some tāniko designs can be associated with a specific weaver, whānau (family), or rohe (area) with some patterns handed down for generations, while other more generic cloak patterns such as aronui (aonui) and aramoana which incorporate triangular patterns and diamond patterns, were used and shared by different iwi when cloaks were traded and gifted (Maihi, 2011, p. 41). The skill and time required to prepare and weave the different woven tāniko elements reinforces this. In kaitaka, the muka whenu (warps) were not beaten, soaked, or rolled to the same degree as korowai or kahu huruhuru, producing muka with a golden stately lustre (Maihi, 2011, p. 40). Tāniko is made using coloured fibres in which instead of interlocking pair wefts in the twined kaupapa, the wefts are alternately given full and half twists where a full twist brings the colour of the same aho to the front again, referred to as wrapped twining (Blackman, 2011, p. 81; Hīroa, 1926). The other historical techniques not directly involved in feather attachment, but were possibly precursors to tāniko construction were recorded in pre- and post-European cloaks and included close single pair twining in which the coloured weft strands appeared at alternate warps; and a version of twilling where the dyed aho threads were passed over and under more than one whenu at a time (Hīroa, 1926). As versions of these techniques were recorded in at least one pre-European Cook-collected cloak, and observed in early dogskin cloaks, they were also not necessarily associated with European influences, discussed in Chapter Six (Hīroa, 1926, p. 101). These methods were also recorded in post-European museum cloaks listed in the International Register, and in private marae cloaks reviewed in more detail in Chapter Eight.

Shaping in cloaks was practised in pre-1800 cloaks, although it was previously only associated with post-European clothing (see Chapter Six) (Simmons, 1968). Shaping is achieved by adding shortened weft rows of aho (poka) extending only partly across the kaupapa to fit the wearers shoulders and buttocks (Blackman, 2011, p. 86). Other methods included additional whenu (warps), or wedge-shaped forms for kaitaka paepaeroa in which the kaupapa is turned 90 degrees so the whenu lie horizontally and aho vertically (Blackman, 2011). The development of specialised skills and techniques in kākahu reiterated the exponential development in most aspects of cloak production in a short time.

Evidence of sewing in Māori clothing can be dated to the 16th-17th century (see Chapter Six). Cloth backing and sewing were natural progressions in increasing the efficiency of cloak making from the 19th century. With cloth from linen, and English needlework traced as early as the 1810s, sewing taught through missionaries allowed learners and non-weavers to participate in the artform through to today where modern cloaks have feathers sewn on for marae events (Corey-Pearce, 2005, p. 76; Lander, 2011). As feathers were originally twined into the backing during construction, it is not possible to re-attach feathers in the same manner, so cloaks damaged or suffering feather loss were repaired by hand using glue, hand sewing, or by machine sewing feathers (back) on to the garment.

Colour preference is difficult to ascertain without eliminating possible bird or feather selection. Based on the International Register, the most common colours were brown, red, white, green (forest and light), black (iridescent), blue, and multi-coloured feathers. Pure white feathers had divine associations. In pre-European cloaks light coloured moa (Dinornithiformes) and white albatross (Diomedeidae) feathers were incorporated into South Island burial cloaks (see Chapter Six). This reverence towards white and rare birds and feathers, has filtered into Māori artforms from Polynesia (Chapter Five). Māori cloaks with striking red coloured kākā feathers were probably recognised as the most culturally significant. Exotic coloured feathers in European fashions increased markedly in the 19th century, and Māori cloaks were not exempt (Doughty, 1975; Hunter, 2011). This trend showcased iridescence in feathers from kererū, tūī, peacock, chicken, and pheasant. Feather iridescence is produced from optical inference where the barbules (branching off the barbs) are covered by transparent keratin membranes, sometimes arranged in several layers (Voitkevich, 1966, p. 31). When light hits the outer/inner vane of the feather it reflects off the outer/ inner membrane surfaces, and the resulting iridescent colour varies depending on the number and thickness of membranes, the angle of light incidence, and the optical refraction of the keratin in the membranes (Voitkevich, 1966). Much of the visual appeal of cloaks occurs from the layering of uniformly sized, shaped and coloured feathers together, and placing the feathers flat with the dorsal side facing out, and tips pointing towards the cloak base, as they appear on a bird (Te Kanawa, 1992).

Mead's (1969) classifications of Māori cloaks in the 20th century assisted in the standardisation of the thousands of kākahu in museum collections around the world. The designation of Māori cloaks into classes were likely a result of the larger volume and variety of cloaks in the 19th century. One of the difficulties arising from allocating cloak titles was that as Mead (1969) admitted, materials and techniques were often 'thrown together in a grand mixture in one cloak', making classification challenging (p. 36). Best (1898) recorded cloak and bird names specific to Tūhoe but confused the terminologies of some Māori verbs with nouns or techniques with objects. Roth (1923) also lacked experience with the Māori language, and omitted Māori cloak titles in his study, as intended meanings for cloaks were not always clear, maintaining also that the dialectical distinctions could not be addressed (p. 14). It was more likely that Roth simply did not know what the terms meant as it was before Mead (1969) published in this area. In the International Register, the term korowai regularly described any kākahu, which is often the case for private collections, as Ngāti Pikiao of Te Arawa refer to any cloak as a korowai (Malcolm-Buchanan, 2014).

New Zealand bird abundance and distribution over time can dictate what is environmentally available for weavers over what was socially or personally preferred. In some cases, it was possibly all three. Nineteenth century Māori populations were concentrated in warm climates, near large forested areas and the coasts, which had an abundance of taonga species including harakeke and tōtara (*Podocarpus* spp.), and brown kiwi, kererū and kākā. Even though native bird numbers and distributions had reduced over the hundreds of years of Māori occupation before European settlement, an accumulation of rapidly introduced environmental impacts in the 19th century contributed to the critical conservation status of the most vulnerable native species. To where, distributions of brown kiwi, kākā, kererū, weka, kākāriki have continued to decrease in the last 40 years (Innes et al., 2010). Today there is reduced access to native New Zealand birds which are legally protected, and weavers are required to register with the Department of Conservation for feathers (Beverley, 1998; Chanwai & Richardson, 1998). Native birds are skinned, and feathers plucked for when needed, even taxidermied skins, road-kill, feather dusters, pillows and mattresses are collected when available. Master weaver, Digger Te Kanawa (Ngāti Maniapoto) even repurposed feathers from old disintegrating kākahu (Te Kanawa, 1992, p. 25). Varieties of exotic bird feathers are also available from local and overseas breeders and novelty feather retailers.

Currently in Otago museum, Dunedin an old waka huia (treasured feather box) (D33.1892) made of Hall's tōtara (*Podocarpus* sp.) and lined with tapa (bark cloth) was found containing 70 huia feathers and bunches of red kākā feathers (D33.1892a) (Otago Museum, 2006; Phillips, 1963; Simmons, 1968). It was collected from Miller's Flat, where the Clutha River and Talla Burn meet in Otago, however huia were naturally distributed in the North Island, and the traditional Polynesian trees to make tapa such as paper mulberry (aute: *Broussonetia papyrifera*) failed to thrive in colder southern climates but grew in the north, west, and east coasts of the North Island (Beaglehole, 1962, p. 444; "Gift of huia feather box", 1933, p. 2; Parkinson, 1984, p. 110; Rowley & Simmons, 1966, p. 108; Salmond, 1991). Lander (2017), expected that "the kākā [feathers] were worn with the huia feathers on the head. In the north it was gannet [tākapu: *Morus serrator*] as can be seen in the 1820 portrait of Hongi Hika (by James Barry) [Alexander Turnbull Library, Ref: G-618] in which he has several gannet feathers with kākā feathers at the base. As you go south its huia. Feathers on the head were really important." The large number of feathers and tapa were potentially important gift or trade items; however, it was more likely the deliberate movement of these items south that occurred, rather than trade.

Traditionally Māori relied on trade between iwi (tribal groups) to exchange resources but to also create and manage long-term reciprocal relationships. One famous instance in the 19th century involved the great Ngāti Kahungunu waka taua Te toki-a-Tāpiri, now in Auckland War Memorial Museum (Ethnology No. 290, 13663, 150) that was exchanged for the prestigious kahu kurī 'Karamaene' of Rongowhakaata (Maihi, 2011, p. 41). There have been occasions where feathers from rare birds have been exchanged for cloaks, in that the red-tail (streamer) from the amokura (red-tailed tropic bird: *Phaethon rubricauda*) was exchanged for a kaitaka (Maihi, 2011). Northern Māori were also recorded trading precious gannet feathers for cloaks (Lander, 2017; Salmond, 1997, p. 485). After European arrival, North and South Island Māori continued to produce, trade and gift feather cloaks for cotton and canvas and wool fabric and clothing; stone for steel axes; bone hooks, and spear tips for nails; as well as pounamu (greenstone), fish, birds and precious feathers (Belich, 1996; Mitchell & Mitchell, 2004, p. 155; Salmond, 1997). New Māori-Pākehā trading relationships were particularly important as a means of co-existing in the new environment, and regime of British currencies, taxes, and laws. Most tribes had iron tools, imported blankets, and garments, pigs, potatoes, and guns by 1830 from large scale trade in which cash replaced bartering with ships and stations (Belich, 1996, p. 148; Coutts, 1969). Items of interest were highly desired for Māori artforms, red sealing wax for example was incorporated into pendants and weaponry (Te Papa ME005186/4, ME002971, WE000259). The European economy influenced a marked increase in taonga Māori and cloak production. In pre-European times, iwi Māori owned the land they inhabited, they were largely self-governed and acquired and produced food, shelter, and clothing when required. After settlement, many Māori lost or sold their land, instead working in family groups for cash money, and moving around in short term and seasonal jobs like shearing, harvesting, bush felling, track making, flax cutting, and gum digging (Stenson & Olssen, 1997, p. 167). Fewer New Zealand women worked in paid employment than men, in 1874, 11%, versus men 63% (Stenson & Olssen, 1997, p. 224). This figure would have been lower still for Māori women. In 1891, women who worked in domestic services, or clothing, textile or food processing, health (nurses) or teaching, were paid less than men (Stenson & Olssen, 1997, p. 225).

European textiles and crafts also dictated New Zealand fashions that incorporated processed and machine-made, natural, and dyed wool, cotton fabric and thread, candlewick (cotton), macramé thread, and silk embroidery thread. They were colourful, varied, fast, and efficient replacements for time-consuming muka production. Digger Te Kanawa took approximately eight months to complete a traditional kākahu, three of these were spent preparing the materials (Te Kanawa, 1992, p. 5). Records from Northland as early 1815, and in the second half of the 19th century, showed that fine cloaks were rarely traded with Europeans as some could take 2-3 years to manufacture (Hay, 1882, p. 149; Salmond, 1997, p. 486). These factors have had ongoing effects for Māori artforms such as carving and weaving. Design and construction of whare whakairo (carved houses) developed from using traditional materials and methods, to introduced timber, nails and machinery, with ancestral designs, and figures and writing painted on (McEwen, 1947; Neich, 1993; Stenson & Olssen, 1997, p. 295). Taonga had an inherent cultural value, which translated to economic value, and were sometimes sold or exchanged below their true monetary or intrinsic value (Firth, 1959). Māori carvings were revered as too 'traditional' and inappropriate, or collected as profit-making curios (Day, 2005; Witehira, 2013). Some structures were burnt, defiled, destroyed, buried, stolen, or confiscated by individuals on behalf of the Government and religious organisations at the time (Awatere, 1984; Brown, 1996; Te Awekotuku & Nikora, 2003; Tewhata, 2013; Walker, 2008). From the 1870s, Rotorua Māori generated a successful tourism industry for visiting Europeans and Americans to experience the geothermal activities, entertainment, food and collectible Māori arts and crafts, as well as photography that has served as a permanent archive of historical clothing from pre-contact times (Corey-Pearce, 2005).

Fine kākahu were traditionally made to honour high ranking Māori. Later this custom was afforded to Pākehā and cloaks given to international dignitaries in New Zealand such as Governor generals and Prime Ministers and visiting British Royals as a mark of respect. The cloak increased the mana of the authoritative wearer, and vice versa. One example is a striking kahu kiwi in the Te Papa collection (Te Papa ME011807) with Ngāti Kahungunu affiliations, called 'Piata' with vibrant scarlet red kākā and iridescent black tūī feathers in the side borders (see International Register). It was presented by Rāwinia Ngāwaka Tūkeke a female Rangatira (chief) of Ngāti Kere and Ngāti Hinetewai of Pōrangahau to the Honourable James Henry St Hill (a Wellington magistrate) in the 1850s (Tamarapa, 2011a, pp. 130–131). His widow then gave the cloak to the great-aunt of a Mrs D. S. Carmichael who went on to sell it for £100 to Miss J. LaMarsh (Canadian Secretary of State) who presented this and another cloak to the New Zealand Government who then passed them on to the Dominion museum (now Te Papa) (Tamarapa, 2011a).

European collecting of indigenous artefacts around the world certainly influenced increased production, or at least how and why they were collected. Objects were at times acquired under questionable circumstances and then sent permanently away from the tribal area and overseas with little information connected to them. The provenance of some of the cloaks in the International Register were over-embellished either by the donor or recipient, with some cloaks described as belonging to a "Māori chief" or in being associated with the "Māori King" which with further research could be substantiated. Much of this idealism and fascination with collecting 'all things Māori' comes from the European rationale that Māori would soon die out (Belich, 1996; Smith, 2012). Hence an increase in demand for Māori trinkets and curios of a dying race was countered by an increase in production to meet the demand. Ethnologists Walter Mantell (1820-1895), Augustus Hamilton (1853-1913), Elsdon Best (1856-1931), Walter Buller (1838-1906), Alexander Turnbull (1868-1918), Kenneth Webster (1906-1967), George Grey (1812-1898) and William Oldman (1879-1949) had close relationships with iwi and hapū Māori, and were some of the major cloak collectors and contributors to New Zealand and British museum collections (Tamarapa, 2011a, pp. 12–13). Legitimately, many kākahu were gifted, exchanged, and sold and used as payment instead of European monies. Numerous cloaks in the International Register were acquired by collectors who returned to England, Europe, or America and then generations later, the cloaks are found with no information and given to a local museum to be looked after. Others were purchased specifically for museum collections, with kiwi cloaks probably being one of the more preferred items, producing a skewed representation of production and collecting behaviours (Huster, 2013). European collectors also often disseminated ethnographic acquisitions across multiple museums (Waterfield & King, 2006). Mead (1969) stated that most of the Auckland museum garments were acquired between 1920-1949, and issued that museum money was a factor, and a time lag between production and value increased when the collector died, and the collection put on the market or bequeathed to a museum (pp. 132–133). Traditionally upon the death of the recipient of such a taonga, a 'gift' would have been repatriated back to the family of the donor, to acknowledge the relationship in which the cloak was presented (Maihi, 2011, p. 41). Hori Parata (2017) understood this still happens today in which giving or officially gifting taonga usually represents a sign of respect on the part of the giver, and when the gift is mis-used or no longer wanted then it should be returned to iwi where possible:

> "that was the gifting thing…, we don't gift you something so you can go and sell it to somebody else or give it to somebody else. You give it back.".

Ngāi Tūhoe exhibited their generosity and appreciation by gifting beautiful kākahu to Missionaries, nurses, doctors, politicians, and teachers in Te Urewera in the 19th and 20th centuries. Maungapōhatu teacher Irene Paulger (1899-1966) was apparently given a kahu huruhuru by one of Rua Kēnana's wives, currently in the Puke Ariki Museum (A79.996) in New Plymouth (Reid, 1987). Missionaries, Hihita known as sister Annie Henry (1879-1971) and Hoani or Reverend John George Laughton (1891-1965) received kākahu from Tūhoe Māori, and both have been imaged wearing feather cloaks (Te Awekotuku, & Nikora, 2003; Te Kaawa, 2008). Listed in the International Register in the Whakatāne District Museum and Research Centre, Te Whare Taonga Ō Taketake, a korowai (MP925) was given to the Reverend J. G. Laughton in 1918 by Tawhakirangi, the wife of Toko, son of Rua Kēnana. Annie Henry was photographed wearing a beautifully designed kahu huruhuru (MP356) also in the collection around 1949 in Ruatāhuna (Alexander Turnbull Library, Ref: 1/2-030853-F). In the Register, Auckland War Memorial Museum listed a kahu huruhuru (Ethnology No. 16110) given to Major Gilbert Mair by one of Rua's wives in 1890. In Otago Museum, Dunedin, a kākahu (D62.965) and kahu kiwi (D62.966) were both gifted to a Mrs E. H. McGregor by Rua Kēnana.

Kākahu have a pivotal role in Māori burial customs traced to Polynesia and historical burial cloaks dating from the 17th century (see Chapters Five & Six). In these times, the tūpāpaku (deceased) were dressed in their finest cloaks to reflect their mana (authority) and following the interment they were again wrapped in a cloak (Mead, 1969, p. 179). In Rotorua, after Christianity arrived in New Zealand, kākahu whakamahana were laid on the deceased at a tangi and certain taonga buried with them (Mead, 1969, p. 196; Tapsell, 1998). The term kahu, denotes the symbolism of cloaks providing warmth and protection, and love for people (Williams, 1957). In the north, kahu tukutuku, made specifically for tangihanga, are circulated around members of the whānau, for repeated use (Mead, 1969, p. 196). The continuation of kākahu in this important role has only been changed by the mechanisms in how they are used, not why. It is therefore not necessarily a strictly European influence, and practicality dictates that not everyone owns a cloak today.

Historically the gifting of kākahu was enacted in the form of a tono (offering), sometimes for marriage, to build relationships between iwi or kin groups, and was still relevant in the 19th century but not common today (Mead, 1969; Parata, 2017; Tapsell, 1998). Clothing transitioned from functional to costume-wear in the 1800s, and with this development gender and status roles shifted too (Mead, 1969). Prestigious attire of feather cloaks, adornment, and pounamu were once reserved for high ranking Māori in the 18th century, from the 19th century the strict rules of tapu and mana gradually dissolved and lay people, male and female, Māori and Pākehā wore this attire (Mead, 1969, p. 214; Wallace, 2002). Ethnological research of the 19th and 20th centuries implied Māori cloak weaving was a women's responsibility (Best, 1898), however even Hamilton acknowledged men had to learn to weave and prominent male weavers were recorded into the 20th century and today as discussed in Chapter Five (Hamilton, 1972, p. 280).

Based on the literature, it is difficult to surmise to what degree what feathered shoulder and waist garments changed after European arrival, due to the ambiguous and versatile classifications and functions. There were limited feathered textiles acquired by Cook, but it is known that both parrot feather cloaks and maro (aprons) were recorded pre-1800, as they appeared in European records and kōrero Māori (histories) (see Chapter Six). In 19th century photographs, cloaks were worn over European clothing, either around both shoulders with the gap in the middle; to the side to allow movement in one arm; or worn under one shoulder to keep one arm free. When staged in photographs or portraits, models also wore the cloaks upside down so dramatic views of the tāniko could be seen at the neckline (Te Papa B.000591), which is incorrect, or worn under the arms or around the waist (Te Papa O.025004) (Blackman, 2011, p. 83).

The orientation of cloaks could also have some relevance in the evolution of production and use. Two 18th century Cook-collected kaitaka have the feathers pointing towards both the neckline and the baseline, in the Hunterian Museum, University of Glasgow, in Glasgow, Scotland (GLAHM E.422) and World Museum in Vienna, Austria (Inv. No. 25) (see Chapter Six). In the 19th century when writing was introduced into the artform, the letters or wording in some cloaks were orientated the wrong way, directed towards the baseline, when the cloak was worn 'correctly' (Te Papa ME014386, ME015747). This like the feather attachment in the Cook cloaks, may have resulted in this disorientation from the weaver's perspective, from developing a new technique such as twining feathers into 18th century cloaks, and incorporating English letters into 19th century cloaks. However, as the two Cook cloaks have similar bird species and feather use, they were possibly associated, and the disorientation intentional. If they were unintentional miscalculations, the cloaks were probably readily gifted, traded, or sold because of these errors.

Māori protest of British rule was amplified after the Treaty signing in 1840. From this time, issues of Governance over land dictated struggles for iwi Māori and resulted in aggressive and passive forms of resistance. Infamous Ngāpuhi Rangatira Hōne Heke Pōkai was one of the first chiefs to sign the Treaty, but cut down the flagpole that flew the British flag numerous times during the Heke rebellion from 1844-1846 at Kororāreka (Russell) in Northland (Hohepa, 1964). The flag was a symbol of oppression and mistrust, and Heke's reaction was a statement of his anger and resentment for the Crown's misrepresentation of the Treaty (Cowan, 1955). With the creation of movements that combined Māori and Anglo-Saxon religious principles, the conflicting doctrines confounded missionaries by utilising European imagery, as the cryptic and somewhat rebellious nature of writing and symbolism in turn undermined British authority. A rare twined muka pennant or flag in the British Museum (Oc1982,Q.705) depicts an outlined male figure with red kākā feathers in his hair, white feathers in his ear, and a lizard near his head (Te Manakura, 2007). Te Whiti-o-Rongomai of Taranaki was originally a follower of the Hauhau movement and adopted the white feathers of the toroa (albatross) and later goose (Anatidae) as his raukura (precious feather), and the poi (ball) worn in the hair or hats as emblems that symbolised peace and hospitality (Cowan, 1935). Te Manakura (2007) established that cloaks like flags communicated the most contentious issues of the time, such as land confiscations in the form of abstract figurative portraiture symbolising Rangatiratanga, or sovereignty over ancestral Māori lands. Aperahama Taonui was noted for his 1863 declaration "E ngā Rangatira o Ngāpuhi whakarongo mai. Kaua e uhia te Tiriti O Waitangi ki te kara o Ingarangi, engari me uhi anō ko tōu kara Māori, ki te kahu o tenei motu." Translated as "Ngāpuhi chiefs, listen to me. Don't cover the Treaty of Waitangi with the English flag, but cover it with your own flag, with the cloak of this island" (Kawharu, 2008). In that the flag of a nation represents the mana of the people, and kahu (kākahu) reflect the mana of the person.

Māori weavers that were once governed by strict rules of conformity and taste probably revelled in exploring subtle or hidden elements in their kākahu. Pre-European cloaks documented in Chapter Six showed elements of contrasting feather colours and patterning. These 'colour lifts' were present throughout Te Papa's collection and in the International Register cloaks made after the 19th century (Harwood, 2011a, 2011b). An 18th century kaitaka collected by Cook at the Hunterian Museum, University of Glasgow, in Glasgow, Scotland (GLAHM E.422) had a small bunch of blue kōtare feathers towards the cloak's centre. Similarly, another Cook collected cloak in the Hunterian Museum (GLAHM E.453) had two bunches of red kākā feathers in the middle of an unfinished cloak, as discussed in more detail in Chapter Six. For even though the recorded feathers contrasted against the other cloak feathers and background, the birds and feathers themselves more likely represented something to the weaver at the time of production, rather than a simple insert of contrast or flash of colour. Māori weavers were known to intentionally add or remove elements into their work as a possible message or signature (Harwood, 2011a, 2011b; Hīroa, 1923, p. 735; McKendry, 2017, p. 68; Smith, 2013, p. 241). For example, a Te Papa kahu huruhuru (ME024139) had a sewn pouch of embroidered cotton on the back. Bonica (2017) recalled a kete whakairo with a single white feather on one side as a possible 'tohu' made by the late master weaver Rangi Kiu (Ngāti Kahungunu ki Wairoa), housed in the Auckland War Memorial Museum Tāmaki Paenga Hira collection (Ethnology No. 55222). Polynesian bark cloth garments have figurative patterns depicting the makers memories and surroundings in Tongan Ngatu (Te Papa FE008723) and Siapo from Futuna (Te Papa FE012568). Some of the Sāmoan 'ie toga (finemats) also featured written names and places (Te Papa FE010344, FE010379). North American Navajo weavers insert 'spirit pathways' or ch'ihónít'i, a purposeful line woven into textiles that can offer a potential entrance into the Navajo spirit world (Yohe, 2012). The weft rows in Māori cloak weaving are termed ara, translated as path or pathway.

7.5 Conclusions

A comparative analysis of selected research themes for Māori feather cloak production and use was undertaken to determine what changes or influences could be attributed to European settlement. The parameters dedicated to measuring the degrees of change in Māori cloaks before and after European settlement confirm that such a study be multi-disciplinary and broaches Polynesian influences, aspects of historical cloaks made before European arrival, and cloaks made after European colonisation particularly in the 19th century.

Twining is a major component of Māori (feathered) clothing, employed for hundreds of years, its continuation through to today substantiates its historical importance, and practical application representing this higher artform. The implementation of spaced double pair twining was forecast from the development of close and spaced, and single and double pair twined cloaks collected by Cook in the 18th century.

Preferences for birds and feathers after European settlement can be determined from the relatively large number of Māori cloaks with specific species, namely brown kiwi and kākā. The prevalence of species in cloaks however does not always equate to preference, as is the case for introduced species today. In general, incredibly rare, and therefore significant birds and feathers were not, and could not be used to cover full cloaks, nor were they incorporated into many cloaks. If they were, the birds would decline or disappear, or their distinctiveness and value would decrease.

Weaver identifiers in the form of hidden, or single feathers, or birds that have some cultural or personal significance may not necessarily be aligned solely with European influences. Initially documented in 19th century cloaks in 2007, the occurrence could have been in response to the higher volume of cloaks and a desire for weavers to insert an identifier or mnemonic tool in their many works (Harwood, 2011a, 2011b). However, a study of pre-1800 cloaks confirmed the inclusion of specific species or feathers in cloaks. In fact, whether intentional or not, weavers consciously and subconsciously always leave an individual imprint in their kākahu. A closer study of material and technical aspects of the cloaks, particularly kahu kiwi in the International Register to identify and interpret what these markers communicated to further understand and reconnect the relationship between weavers and their kākahu could have numerous benefits for iwi Māori and collections around the world.

Writing and symbolism in cloaks signified a retaining of old customs to represent people of rank or importance in an artform in the materials and techniques, colours, and designs. This new bicultural application reflected a change in the mechanism of achieving this communication, but not necessarily the concept behind it. Binney (2009b) felt literacy was from a desire to communicate issues and effectively encouraged memories and protests to be communicated over great distances, and that reference points or motifs occurred in most oral stories, that concentrated on ‘key symbols’ with recurring narrative themes, such as the bible. Therefore continued research into recorded individual, community, and iwi designs and symbology could also help to recover cloak histories.

Rather than Māori follow or simply respond to forced changes from European settlement, weavers developed an innovative method of creatively articulating these changes in this public forum sometimes using satire and irony. Cloaks became the embodiment of self-expression for weavers, a focus of pride and prosperity, and was still the central aspiration of many Māori. The appropriation of writing and symbols in cloaks reflected a renewed Māori authority and autonomy. The continuation of this past time is a means of carrying on a tradition that has changed but not lost, as Hori Parata (2017) worded it:

> "We're trying to heal ourselves, we're trying to retrieve ourselves. We're trying to give each other confidence in each other again. We gave so much over, ..to try and fit into this paradigm that came upon us, it didn't work right. And it was the survival from the old Māori village .. to the new world, of living in town, going and buying your kai [food] rather than going and getting it during the day. And it did put a lot of stress on our people."

The Māori feather cloaks collected by Cook featured twined weaving to secure small bunches of scattered feathers. So, while it is difficult to ascertain whether Māori weaving would have naturally progressed to the fully feathered twined cloaks, it is probable they would have eventually, as refinement of weaving was already apparent. So that European contact accelerated this type of cloak production and collection, and cloaks were then given or sold to collectors and museums throughout the world starting from Cook.

Most artists naturally progress from changes to various internal and external influences. The ease and speed at which Māori acquired and assimilated to introduced materials and techniques speaks to their willingness to evolve the artform to better suit the functional and artistic needs of iwi Māori at the time. Weavers capitalised on this freedom to create new designs in their work without the strict cultural or social adherence to 'traditional' materials, techniques, and designs, colours, and practices. By the mid-1800s certain types of cloaks had declined, while others were replaced with different materials and techniques to reflect change in societal expectations, and various aspects of cloaks were incorporated together. Some weavers today incorporate a mix of traditional and European elements, partly for convenience and partly to retain aspects of the past (Lander, 2011).

Standard cloak classifications are based on and associated with time periods, and hence museums have adopted this nomenclature. However, it does not consider the revolution of cloak production cycles in which modern weavers are often inspired by old works and styles, as well as desiring to create something new and unique. Even Cook-collected cloaks had aspects of weaving techniques and styles that appeared in historical cloaks and 19th century clothing, including strips of animal skins and wool.

The fundamentals of kākahu Māori are Māori inspired. Iwi Māori still have strong connections to certain birds, and kākahu whether in museums or private collections. Whānau and marae still weave, share, gift, and use kākahu for important events including tangihanga today. These behaviours have not changed since European settlement, however the volume of cloaks made and collected, and how iwi Māori can access birds and kākahu have.

From this research, at least 600 Māori feather cloaks that were made between 1850-1950 can now be found in New Zealand and world museums. Less than 30% of these cloaks have provenance to an iwi (people) or area. Te Papa Museum currently houses over 352 kākahu (124 have feathers) as permanent collection items, and only 64 cloaks have an iwi affiliation with limited information recorded by the collector or donor (Tamarapa, 2011a, p. 15). Cloaks gifted were less likely to have provenance information, compared to cloaks formally purchased or acquired for museums, which are generally audited with official financial records. The majority of cloaks have recorded affiliations with the Bay of Plenty (Te Arawa, Ngāi Tūhoe), Waikato, Taranaki, and Whānganui. With regional museum collections strongly connected to locally known iwi and whānau weavers. David Simmons, who initiated a catalogue of 'Māori artefacts' in the United Kingdom, European, Australian and American museums, made some attributions such as production dates and localities that are yet to be substantiated.

Unfortunately, due to time and resource constraints, for many of the museums contacted for the International Register, imaging and material and technical information could not be obtained, resulting in a substantial number of cloaks unobserved, and species unverified. While the results are preliminary until further research can be undertaken, the knowledge and information already gleaned from this feather cloak inventory has benefits for iwi-led taonga research and databases, for weavers and families tracking individual cloaks, and museums wanting assistance in documenting the materials and techniques in the collections.

The cloaks collated in International Register offer an important opportunity to continue this research. Feather identification of the cloak register could confirm and better interpret Māori feather cloak production and use over time. Sharing knowledge between Museums is crucial to recover these connections and origins. While it is important to respect iwi relationships and the principles of mana taonga in the sharing of this knowledge, better understanding of our kākahu comes from appropriately learning and sharing this information. The acquisition of new knowledge can develop from the ongoing cultural, intellectual, and physical care of collections. The preservation of cloaks for future generations includes recording the materials and techniques, designs, provenance, and collection histories that incorporate input or initiation from iwi or source communities, weavers, researchers, museum staff, and conservators.

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CHAPTER EIGHT: CURRENT RELATIONSHIPS AND FUTURE TRENDS REGARDING IWI MĀORI, MUSEUMS AND MĀORI FEATHER CLOAKS

E hara ma te miro koura anō, e whai te kākahu aroha

It is not only with golden thread that a garment of love can be made
(Rahera Shortland, Ngāpuhi, 1990)

8.0 Abstract

The 1984 Te Māori exhibition opened museum doors across the world and facilitated the rekindling of ancestral iwi Māori (tribal) relationships with taonga Māori (treasures) in museum collections (Tapsell, 2006). Today there is some progressive movement towards Māori autonomy in how Māori make and relate to taonga in private and marae (Māori meeting grounds) collections, with an expectation of input and dialogue between iwi and museums in the physical and spiritual use, and care and display of taonga. This chapter related the rarely recorded voices of northern iwi Māori and contemporary weavers pertaining to how and why certain birds and feathers were accessed and handled for cloak weaving in Northland. It detailed the production and use of unique and historical Māori feather cloaks at a Hokianga marae that reaffirmed whakapapa (genealogical) connections and tikanga (customs) in their continued use at marae and whānau (family) events. This knowledge translated to how iwi, hapū (subtribes) and whānau (family) related to taonga Māori in public museum collections and what measures could be implemented to improve access and shared knowledge. Current research trends relating to kākahu Māori in museums that could impact on future relationships with iwi were discussed, such as the creation of iwi led taonga databases, and the recording of weaver and practitioner information to better understand cloak materials, techniques, and weaver histories was recommended (Christidis, Daniel, Monaghan, Carrillo-Huffman, & Huffman, 2008). Finally, scientific research to identify and provenance kākahu through animal and plant materials using microscopy, image reference databases, and genetic (DNA) and isotopic (forms of elements) analyses in kākahu, were also reviewed and potential concerns addressed.

8.1 Introduction

Northland covers the narrow peninsula from the Auckland region to the northern tip of the North Island, with the Tasman Sea and Pacific Ocean on either side it has a total land area of 12,600km^2, and coastline 1,700km long (Lightner, 2017). Te Tai Tokerau or Ngāpuhi-nui-tonu land boundaries extend from west to east from Hokianga Harbour to the Bay of Islands, and southward to Maunganui Bluff and Whāngārei (Fig. 8.1). Today Māori constitute around a quarter of Northland's population (44,928 people), which equates to 7.5% of New Zealand's total Māori population (Statistics New Zealand, 2016). Northland's largest iwi, Ngāpuhi are yet to complete Treaty settlements (Office of Treaty Settlements, 2017). By 1965, only 6% of land in New Zealand was Māori owned, of which less than 13% had forests, and a third was leased (Asher & Naull, 1987).

***Figure 8.1*. Traditional lands of Ngāpuhi. Map produced from information by Dr Rāwiri Taonui (Ngāpuhi, Ngāti Maniapoto), courtesy of Te Ara - Encyclopedia of New Zealand, Manatū Taonga Ministry for Culture and Heritage, c.2005.**

8.1.1 Ngāpuhi relationships with kākahu

Northern Māori were one of the first iwi (peoples) to encounter Europeans and assimilate to British influences such as language, economy, food, religion, clothing, and weapons (Angas, 1847a, 1847b; Campbell, 1881; Maning, 1970; Savage, 1973). Yet limited studies have detailed pre- or post-European influences on Northern Māori pertaining to feather cloaks

(White, n.d.). Sydney Parkinson (c.1745-1771), an artist from the first voyage of Captain James Cook recorded in December 1769 in the Bay of Islands (near Doubtless Bay) a waka of 80 Māori men of which the heavily tattooed chiefs wore garments of dog skins, he also noted many 'koomarra' (kūmara: *Ipomoea batatas*) plantations and 'eaowte' (e aute) (aute, paper mulberry: *Broussonetia papyrifera*) trees or cloth trees (Parkinson, 1984, p. 110). Few records came from the French explorers, Jean-François-Marie de Surville (1717-1770), a merchant captain with the French East India Company, commanded a voyage of exploration to the Pacific in 1769-1770 on the St Jean Baptiste. Marc-Joseph Marion du Fresne (1724-1772), a Breton-born French explorer of the south Indian Ocean, Australia, and New Zealand, was famously killed by northern Māori in 1772 (Dunmore, 1965; Kelly, 1951; Salmond, 1991). In April-July 1772 Julien Crozet, du Fresne's 2nd in command, described the clothing in the Bay of Islands as fine cloaks possibly 'woven in each corner with threads of various colours in the manner of our stitchwork', or in the case of chiefs, decorated with fringes or well matched strips of dogskin, or feathers (Salmond, 1991, pp. 409–410). In cold weather the chiefs often wore their dogskin cloaks reversed, with the fur turned in to keep them warm (Salmond, 1991, p. 410).

The next notable records occurred after settlement, when the first Christian mission station was built at Rangihoua in the Bay of Islands in 1814 by Reverend Samuel Marsden (1765-1838), an English-born priest of the Church of England and prominent member of the Church Missionary Society (Belich, 1996; Salmond, 1997). John Nicholas (1784-1868) a ship companion of Reverend Marsden, met Whiria, other Rangatira (chiefs/ leaders) and toa (warriors) on 5th February 1815, who were dressed in impressive cloth garments, described as dog skin cloaks in squares or strips, and feather waist garments (Nicholas, 1817b; Salmond, 1997). Between 1814-1815 Nicholas did not see any kiwi in Northland but did recount kiwi feather cloaks and the similarities between kiwi and other introduced ratite feathers (Nicholas, 1817b, p. 255). There were also records of kiwi skin cloaks in Northland in the early 19th century (Yate, 1835, p. 59).

New Zealand had 115 ports in the 19th century that were turned into towns for business (Belich, 1996, p. 372). Māori embraced Christianity because of the introduced illnesses that affected many Māori living near ports such as the Bay of Islands and Hokianga, where Europeans arrived and where missionaries had the biggest impact (King, 2003, p. 148). By 1838 the centre of Methodism had arrived in the Hokianga where missionaries were credited with putting an end to warfare, cannibalism, bloodshed, and slavery (Hohepa, 1964). Missionaries would have also encouraged northern Māori to dress in 'appropriate' European clothing (Corey-Pearce, 2005). By the 1830s, Hokianga Māori of rank wore a fusion of esteemed English top hats, overcoats, and umbrellas augmented with fine Māori cloaks; however most Māori clothed in blankets, cloaks, and limited forms of generic European cloth dresses (Hohepa, 1964).

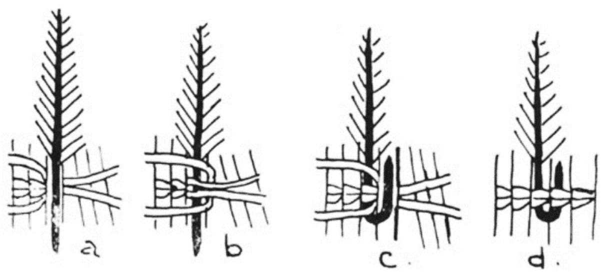

Figure 8.2. **Orthodox Māori feather attachment, using two pair-interlocking weft twining. From Hīroa (1925b); [Fig. 78.].**

Māori feather cloaks produced from the 19th century on generally comprised of a muka backing of scutched (scraped) flax (*Phormium tenax*) (see Chapter One, Fig. 1.6). The standard 'traditional' technique of Māori cloaks after 1800 involved spaced double pair twining where the muka (scutched flax) fibres form two pairs of horizontal wefts (aho), that are finger twined around larger vertical warps (whenu), and the feathers secured to the backing warps via the 'two-pair interlocking' wefts (Fig. 8.2) (Hīroa, 1925b; Te Kanawa, 1992, p. 34).

In the second half of the 19th century in Northland, flax clothing was recorded with little detail, and from the perspective of European observers. Existing written records of northern cloaks indicated they were considered fine and consisted of dog skins and a choice variety of flax producing soft and silky fibres (Hay, 1882). Some had elaborate fringes, tassels, and embroidery of various colours, and into the threads of others were woven kiwi and other birds that were highly prized, much like the dog skin cloaks (Hay, 1882). It was recognised that the kaitaka (fine cloak with tāniko border) with a 'silky gloss and texture, was very highly esteemed' but that the 'rarer and most valuable garment was the weweru mo te huru kiwi', a cloak of kiwi feathers (Hay, 1882, p. 148). As discussed in Chapter Five, the term weweru is an old Polynesian term, that Māori generically described as plaited or woven cloaks. A weru or weruweru is described as a finely woven flax mat with an ornamental border (Williams, 1957). Best (1898) also described a puweru as a common garment, worn daily (p. 656). In Rapa (French Polynesia), raincapes are 'taveru', where 'veru' or 'weru' are ancient names for capes or clothing (Hīroa, 1926, p. 204). Hay (1882) recorded that the coarse more common garments took 6 months, whereas kiwi cloaks made by adding single feathers into garments required 2-3 years to complete, and that they were light yet sturdy and handed down to the next generation (p. 149). A closely twined cloak was described as *te pūkaha*, that defended the wearer against blows in battle (Hay, 1882, p. 149). A pūkaha (pūreke) can also be a very rough cape of inferior flax (Best, 1898, p. 641).

Historically, kauri (*Agathis australis*) dominated Northland's forests, and kōrari (the northern vernacular for flax) was widespread in bush and open land areas, yet flax milling had never been a profitable industry in the north (Hay, 1882; Maihi, 2011). Today, there are over twenty-three wetlands in the Kaikohe district with flax recorded as the dominant species in some sites (Conning & Miller, 2000, p. 24). Ngāpuhi continue to have strong histories and traditions with birds, particularly North Island brown kiwi (*Apteryx mantelli*), kukupā (kererū, N.Z. pigeon: *Hemiphaga novaeseelandiae*), North Island kākā (*Nestor meridionalis septentrionalis*), the kuaka (bar-tailed godwit: *Limosa lapponica*), gannet (tākapu: *Morus serrator*) and ōi (tītī, grey-faced petrel: *Pterodroma macroptera gouldi*). Recent ecological surveys in Northland demonstrated a steady decline in ground-dwelling and low flying forest birds like brown kiwi (Miller & Pierce, 1995; Pierce & Montgomery, 1992; Robertson, Colbourne, Graham, & Miller, 2011) and kererū (Pierce, 1993; Pierce, Atkinson, & Smith, 1993; Pierce & Graham, 1995). There was a marked reduction in native birds by the second half of the 19th century, with most birds reclining into remote forested areas (Hay, 1882). The harvesting of native birds has been an ongoing contentious issue between Governmental agencies and iwi Māori (Barber, 1995; Beverley, 1998; Galbreath, 2002; New Zealand Conservation Authority, 1997). Currently, due to deforestation, overhunting, and predation and competition from rats (*Rattus* spp.), mustelids (*Mustela* spp.), and the Australian brush-tailed possum (*Trichosurus Vulpecula*), the most commonly observed native birds in northland are predatory and opportunistic swamp harriers (*Circus approximans*); ruru (*Ninox novaeseelandiae*) and kōtare (kingfisher: *Todiramphus sanctus vagans*) (Holdaway, 1999; Innes, Kelly, Overton, & Gillies, 2010; Robertson, Hyvönen, Fraser, & Pickard, 2007; Wodzicki & Wright, 1984). After game birds and fowl were introduced by the Acclimatisation Societies from the 1800s, many have now established wild populations and are prolific throughout Northland including peafowl (*Pavo cristatus*), common pheasant (*Phasianus colchicus*), and California quail (*Callipepla californicus*) (Hay, 1882; Long, 1981).

8.1.2 Iwi relationships with museum kākahu and taonga

Pākehā statistics in 1891 registered 20 principal tribes in the North Island, the top five largest were Ngāti Porou, Te Arawa, Ngāti Kahungunu, Whānganui and Ngāpuhi, which together made up 20,663 or 53% of all North Island Maori (Belich, 1996). The material identification of museum cloaks could determine geographic provenance and contribute to reconnecting kākahu with iwi. Of the 124 feather cloaks currently in the Museum of New Zealand Te Papa Tongarewa (Te Papa) collection, over 60% of these kākahu had no recorded provenance, in that they have little or no recorded connections to a maker, owner, iwi, or geographic region (Harwood, 2011a, Tamarapa, 2011). What is known is that Te Papa's Māori feather cloak collection is comprised primarily of examples from 1850-1950, and from the North Island, as several collectors deposited their collections in the museum in Wellington (Tamarapa, 2011).

8.1.3 Current research relevant to ethnological collections in museums

This chapter investigated the current and future implications of research relevant to kākahu Māori in museum collections. It addressed access to collections, and the importance of material identification and determination of provenance (geographic origins) of taonga Māori, particularly kākahu in museum collections using scientific analyses. It was previously suggested that this type of research required multi-disciplinary methods with various forms of analyses on bird and plant materials (Harwood, 2011a).

A digital format has been deemed the most accessible means for the dissemination of knowledge pertaining to museum collections globally for iwi, hapū (subtribes), weavers, and museums and researchers (Brown, 2008; Ngata, Ngata-Gibson & Salmond, 2012). Addressing physical and digital access to ethnological collections that have connections to indigenous communities is at the forefront of the debate over who gets to access, research, and use taonga Māori, how and why.

The British Museum employs a range of analytical techniques to ascertain material and technical collection information to date and provenance objects which in turn inform staff where collections sit in a social or historical context, and importantly the best conservation practices. The museum routinely utilises scientific techniques to determine when, how, and where collection items are made using optical microscopy, chemical analyses (Spataro & Craddock, 2015); GC/ MS (gas chromatography/ mass spectrometry); atomic absorption spectrophotometry; and radiocarbon dating (Ambers & Housley, 1999). As well as X-ray diffraction, Infrared and Raman spectroscopy (Alabi et al., 2015), inductively coupled plasma atomic emission spectrometry, scanning electron microscopy, radiography, and X-ray fluorescence (Heginbotham et al., 2015). The 2017 British Museum Good Research Practice Policy outlined ethical and practical standards of research methods, co-operation, and shared knowledge with stakeholders, and dissemination of results and storage of data.[9]

In the United States, the Metropolitan Museum of Art in the Department of Scientific Research of New York City is responsible for investigating the material aspects of museum art works. Scientists co-ordinate the research with conservators and curators in the study and conservation of art works, and pursue innovative research in analytical techniques, preventive conservation, and treatment methods. Recent studies have captured relevant collection information from elemental and molecular analyses (Chen-Wiegart et al., 2017), and raman spectroscopy (Cesaratto, Centeno, Lombardi, Shibayama, & Leona, 2017), where examples of identification of materials (Granzotto, Arslanoglu, Rolando, & Tokarski, 2017), and techniques (Duvernois, Arslanoglu, & Centeno, 2017; Granzotto & Arslanoglu, 2017) restored the knowledge surrounding historically important objects (Hale & Centeno, 2017).

The Smithsonian Institution National Museum of Natural History in Washington D.C. has a dedicated feather identification lab that was initially established in the 1990s in order to verify the remains of United States Airforce birdstrike remains (Laybourne & Dove, 1994; Laybourne, Sabo, & Morningstar, 1992). The premise of feather identifications from light microscopy is based on the structural differences in feather down between bird groups and species (see Chapter Two). The feather identifications carried out through the Smithsonian Institution lab have made considerable contributions in the fields of forensics (Dove & Koch, 2010), ecology (Dove, 1997, 2000), archaeology (Dove et al., 2005; Dove & Peurach, 2002), and in ethnological museum collections (Dove, 1998; Pearlstein, 2010).

Questions surrounding the potential of developing further scientific techniques in material and technical identifications, and then provenance of ethnological collections are new for New Zealand and need to consider not just scientific, but historical, ethical and ethnological factors

[9] https://www.britishmuseum.org/research/research-strategy-and-governance

that many other countries do not necessarily need to adhere to or consider. Carbon dating has been a breakthrough in aging historic museum collections in the last 50 years, yet little has been done on New Zealand ethnological collections due to the short time frame of human settlement. Most of the carbon dating conducted on archaeological artefacts and paleontological specimens answered anthropological, ecological, or taxonomic (evolutionary) questions. For instance, radio-carbon dating has traced human movement throughout Polynesia by studying the Māori rat (kiore: *Rattus exulans*) that has accompanied human populations across the Pacific (Wilmhurst, Anderson, Higham, & Worthy, 2008).

At the centre of New Zealand scientific studies pertaining to Māori feather cloaks, are museum bird collections used for species identifications in ecological and ethnological studies (Gill, 2006; Gillette & Bartle, 1982), bird distributions, species diversity (Guralnick & Cleve, 2005), and genetic research (Leeton, Christidis & Westerman, 1993; Payne & Sorenson, 2003). Museum bird skins have contributed to Māori cloak material identifications using micro - and macroscopic feather analyses since 2007 (Harwood, 2011a), and DNA analysis of the museum's Natural Environment bird specimens (Shepherd et al., 2012). Massey University's bird DNA lab has facilitated genetic analysis and the identification of Māori feather cloaks and kete (bags) (Hartnup, 2012; Hartnup et al., 2008; Hartnup et al., 2011). One study analysed the unique genetic sequences in the feathers of brown kiwi in cloaks to recover the geographical origins of feathers in kākahu Māori (Hartnup et al., 2011). Recent isotopic analyses of reference museum feathers aimed to allocate geographic-locations through a feather-precipitation isoscape model for New Zealand with potential for future provenance studies (Rogers, Wassenaar, Soto, & Bartle, 2012). The Te Papa Museum conservation department has undertaken X-Ray Fluorescence (pXRF) analyses on the taonga Māori collections to measure the chemical elements present (Rogers, 2019). While the application for textiles is limited, this tool can potentially determine the type of wood in whakairo (carvings) and identify the elemental makeup of paint, oil, or kōkōwai (red ochre) on the surface. International (XRF) studies have also been applied to ancient ceramics (Ownby, 2012). Harakeke was analysed to gauge its effectiveness as a tool in identifying plant cultivars and tracing the origins of pā harakeke (plantations) to reconnect the muka (processed harakeke) in cloaks to a specific geographic region (Scheele & Smissen, 2010). How these research tools and results can be made available to New Zealand museum cloak collections is of relevance to iwi Māori, particularly those studies aiming to provenance cloaks to a specific region. As this could create several potentially problematic issues, and it is integral to highlight and scrutinize these future trends in science. As scientific methodologies that are not complemented by iwi Māori knowledge and input, can lead to a misrepresentation and misinterpretation of the origins of ethnological collections and Māori practices (Wehi, Whaanga, & Trewick, 2012).

8.2 Methods and Methodologies

The premise of this chapter was the collation, categorisation and analysis of literature, oral histories and material evidence pertaining to Northern iwi feather cloaks; the current relationships of iwi Māori with taonga in marae and in museums; and implications for scientific research pertaining to museum kākahu. Selected kākahu from a Northern marae were analysed based on the research themes of language, materials and techniques in production, functional use, and significance of birds and feathers. Additional information such as weaver and wearer influences; like who made it, who wore it, and what this communicated, namely its inherent value were documented where possible. The themes related to when the clothing was made, where it was made, what birds and plants were available to the weaver, and what kinds of religious and social factors may have influenced the production or use of the cloak.

The methods of obtaining what aspects of iwi knowledge have been adopted or adapted over time combined Western (Pākehā) scientific and Māori frameworks. Comparative matrix models have capabilities in comparing data in mathematical and sociological studies (Vallier, 1973). The matrix model conducts thematic analysis in qualitative research allowing for simple visual comparisons and contrasts in data, particularly interview data and interdisciplinary projects such as this (Gale, Heath, Cameron, Rashid, & Redwood, 2013). The matrix framework incorporated the material and technical composition of cloaks and acknowledged the tangible, in the physical world, and the intangible, the intellectual and spiritual realms. These aspects are inherently interwoven and produce layers of knowledge that can be unlocked with multiple disciplines in the fields of te pūtaiao (the natural world) and Mātauranga Māori (Māori knowledge). For each cloak or reference the following matrix was tabulated to record important aspects of knowledge associated with the production and use of each kākahu (Table 8.1).

***Table 8.1*. Matrix method of data collection for each cloak relating to the main research themes and where they are placed in the temporal space, and physical and social environment.**

	Time period the cloak was made	*Where the cloak was made, climate*	*Birds & Plants available*	*Social & religious factors*
Who made/ wore the cloak				
The birds & plants used				
How were the feathers attached				
Why were the materials & techniques used				
What was the cloak called				
What did the cloak communicate				

The themes identified in Table 8.1 were cross-referenced against factors such as the time and place in which the clothing was made, the climate including temperature and rainfall, the plants and birds available to the weaver, and the social and religious factors placed on the production and use of the cloak. The primary methods of investigating bird and feather use in Northern Māori feather cloaks, and scientific studies regarding cloak provenance involved:

1. A search and review of major literature covering ethnological studies of northern cloaks and feather use, iwi relationships with feather cloaks, and iwi bird use and access, feather and material identification, and scientific analyses in the provenance of ethnological museum collections.
2. Conducting oral history interviews with well-known national and northern iwi (peoples/ tribe), weavers, and experts in Māori bird and resource management.
3. The creation of an International Register of Māori feather cloaks held in museums around the world, that recorded materials, techniques, images, museum numbers, cloak descriptions, provenance, and collection histories.
4. Recording the materials and techniques of northern marae cloaks from personal observations. Identifications were made from comparisons of reference image databases of museum bird skins initially created in 2007 (Harwood, 2011a). Additional feather images were created for this research 2017-2018.

Primary sources of evidence were previously lacking regarding northern Māori and their relationship with birds. Small pieces of information were gleaned from archival manuscripts, ethnological journals, and documents that incorporated observations of early Māori-European encounters in the late 18th to the 20th century. Contemporary, oral, and indigenous narratives substantiated evidence and triangulated forms of data (information) in conjunction with other historical accounts that reinforced theories and contributed to a modern written record of northern relationships of kākahu and birds.

Recording oral narratives on the relationship between Ngāpuhi Māori with birds today is imperative in terms of preserving historical and current knowledge for future generations, especially as so few resources are accessible for iwi researchers. Oral history narratives of northern iwi were limited, and few have recorded this specific field of study (Barnes, 2010; Howearth, 2003; Piripi, 1962). Literature on how to conduct oral history research was reviewed regarding appropriate discussion points for weavers and iwi kaumātua on kākahu and birds (Clayworth, 2010; Eni & Rowe, 2010; Fyfe & Mason, 1989; Royal, 1992). Oral history interviews were conducted in 2017 with seven prominent Māori weavers, artists, and northern iwi conservationists from the Bay of Islands (Ngāti Wai), Ngāti Hine, and Ngāpuhi weavers based in the Hokianga, Kaikohe, and Whāngārei in Northland. One non-Māori artist and weaver was interviewed in Auckland. These testimonies were recorded using semi-structured conversational questions pertaining to historical and contemporary cloaks; traditional and modern cloak materials and techniques; family cloaks, and cloaks and taonga located in museums; as well as feather and bird use and management were included in the interview process. The interviews supplemented gaps in the literature and research and have been cited in the text (e.g. Prime (2017)) to recognise the knowledge of each participant and the importance of the information imparted for this research (See Appendix One for ethics approval and Appendix Two for an example of an interview schedule). After each interview, the responses were analysed according to the corresponding theme, location, and time-period it was associated with.

Between 2015-2017, analyses of current iwi relationships with taonga in Museums, and future trends in scientific research to provenance kākahu in museum collections were conducted. This involved a review of literature and projects for current iwi involvement in taonga inventories in public national and international museum collections, as well as iwi-led and rohe-based taonga and cultural centres. Primary and secondary sources were examined covering microscopic feather and plant identification techniques in textiles; in conjunction with reference image and specimen databases in museum collections. The identification and analyses of geographic origins of plants and feathers using genetic sequencing (DNA) and isotopic analyses that compared textile samples to elements or markers in populations specific to an area were also discussed in terms of the implications of these studies and how they were conducted.

Determining Northland bird abundance and distribution allowed for some understanding and interpretation of whether northern iwi weavers were using what was environmentally available over what was socially or personally preferred. In some cases, it was possibly all three. References for taxonomic classifications and nomenclature have used the *Checklist Of The Birds Of New Zealand* (OSNZ Checklist Committee, 2010). Descriptions of New Zealand bird feather morphology followed Harwood (2011a), the *The Field Guide To The Birds Of New Zealand* (Heather & Robertson, 1996), and the *Handbook of Australian, New Zealand & Antarctic Birds* (1990-2007). Historic and current bird distributions and abundance also referred to Atkinson and Millener (1991), Holdaway, Worthy and Tennyson (2001), and Robertson et al. (2007). Anecdotal evidence from 19th century writers and scholars derived from Hay (1882) and Pycroft (1898) in Northland; Elsdon Best (1856-1931) and his work in recording Tūhoe in *Forest Lore Of The Māori* (Best, 1908, 1977); and Walter Buller (1838-1906) and his volumes on *A History Of The Birds Of New Zealand* (Buller, 1888). The histories of introduced birds and mammals referred to *Introduced Birds Of The World* (Long, 1981), and *The Naturalisation Of Animals And Plants In New Zealand* (Thomson, 1922). Literature that focussed specifically on Māori relationships with birds were unfortunately rare, particularly those published by Māori. Both Riley (2001) and Orbell (2003) have recorded similar Māori customs and traditions pertaining to birds and served as useful supporting secondary sources of recorded knowledge, despite lacking the origins of some evidence.

Data collection between 2015-2019 involved creating an International Register of Māori feather cloaks held in museums around the world. National and international museums were contacted to collate the first publicly accessible inventory of kākahu based on Simmons' unpublished 1978 catalogues of Māori artefacts in international museum collections (1996-1997). Participating museums were asked to provide production and provenance histories for each cloak. The majority of cloaks with potential associations with northern iwi listed in the register were located in Northland museums, and most had unconfirmed provenance, so further information or images were sought from these museums in 2017-2018 for detailed examination of materials and techniques, and production history and locations.

A selection of unique kākahu with feathers at Pukerātā Marae in Ōtaua, near Kaikohe in Northland were identified for this research in 2017 (Fig. 8.1). Contact was made with the marae members associated with these significant kākahu. The Pukerātā Marae kākahu were examined individually after marae protocols of karakia and a mihi whakatau were performed. Members of the marae issued short statements regarding the materials, techniques, and history of selected kākahu and the weavers. For this study, the selected Pukerātā Marae kākahu were imaged and the materials, designs and techniques described for each kākahu. Birds and feathers were identified from personal observations according to previous comparative analyses of reference image databases of museum bird skins (Harwood, 2011a). Technical information observed descriptions and diagrams provided by Hīroa (1926).

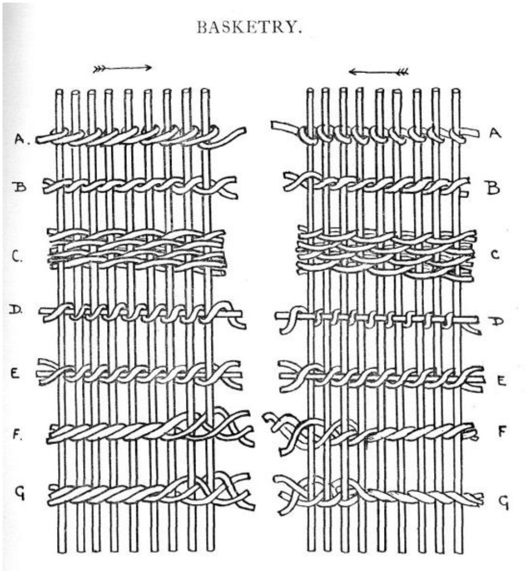

***Figure 8.3*. Basketry weaving techniques [from Hīroa (1924a); Left - front, Right - back]: (A) Wrapped work; (B) Plain twined weaving; (C) Twill and diagonal twined weaving; (D) Wrapped twining weaving; (E) Lattice twined weaving; (F) Three-strand twine; (G) Three-strand braid.**

The less common techniques incorporated close single paired twining in which dyed muka fibres appeared at alternate warps, and were observed and identified in the borders and kaupapa (foundation) of several Pukerātā Marae cloaks (Fig. 8.3) (Hīroa, 1926, p. 75). Some of the patterns in the marae kākahu had been likened to tāniko designs, in which geometric motifs were typically created using wrapped twining. Therefore, this unique technical difference in the skipping of warps in some of these designs also showed similarities with possibly earlier forms of tāniko in twilled and diagonal twining in basketry (Fig. 8.3).

The Waka Mātauranga framework introduced by Black (2014) engaged in the various aspects of the research in that it fostered the essence of 'Te Reo o Te Kākahu', and the relationship between language and knowledge in cloak making that has transferred from Polynesian cloaks through to historical and present day Māori feather cloaks. This framework also acknowledged that northern iwi Māori were independent and maintained unique identities, authorities, and language (Black, 2014). Further to this, the research facilitated new knowledge of how we can better understand Māori feather cloaks today to appropriately contribute to this continued connection.

The Scientific framework incorporated the feather identification and verification of material evidence in the Pukerātā Marae cloak collection in Northland. This enabled the confirmation of bird species and contributed to a body of knowledge concerning Northern cloaks obtained from literature, and oral narratives of northern iwi members and weavers. The framework also allowed for an analysis of bird distributions and abundance to be compared to identified species in the Pukerātā Marae cloaks of known provenance. This could establish if weavers in the area preferred specific birds for their cloaks, and whether these birds were common, widespread, and regularly featured in the diet and kākahu of Northern Māori. Within the parameters of the scientific framework, the viability of current and future scientific research in the identification and determination of provenance of cloak materials was also tested.

Language and forms of communication were interwoven throughout the research. Iwi Māori evolved language and knowledge bases for their surroundings and endeavours. Most Māori bird names had a whakapapa (taxonomy), often based on onomatopoeic naming that formed mnemonic devices transmitted generationally. Kūkupa or kukupā, the northern Māori names for the kererū, are known as fruit doves in the Cook Islands (*Ptilinopus rarotongensis*), Tuāmotu (*Ptilinopus coralensis*) and Tahiti ('u'upa: *Ptilinopus purpuratus*) (Holyoak, 1980; Thibault & Rives, 1975). Cloak terminologies specific to iwi, particularly Ngāpuhi, were rarely recorded in the literature. Best (1898) recorded generic names and terms for weaving and kākahu specific to Ngāi Tūhoe in the Bay of Plenty. The term korowai for example, is used by many iwi and marae including the Pukerātā Marae and Ngāti Pikiao of Te Arawa to denote most cloaks (Malcolm-Buchanan, 2014). A modern classification of korowai describes a cloak with decorative elements like feathers and tassels or combination of these (Mead, 1969). While whītau is the southern name for muka, kōrari (the flowering stalk) is the northern vernacular for the flax plant (Beattie, 1920; Maihi, 2011, p. 35).

8.3 Current Northern Iwi Māori relationships with kākahu

> "We're always recognised as being rough weavers up here in the North. I have to say my tūpuna from Waikare, I only have a kete ….but she used to make pōtae out of kiekie [*Freycinetia banksii*] and kākahu out of kiekie…and they were beautiful, her kete are just exquisite… I think that a lot of weavers like Edna [Pahewa] and Aunty Emily [Schuster],… Digger [Te Kanawa], they actually acknowledged that there was a lot more in Ngāpuhi than people know, in the Tai Tokerau" (Te Hemo Ata Henare (Ngāpuhi weaver), 2017).

8.3.1 Kahu kukupā (pigeon feather cloak) - He korowai tāwhito

Figure 8.4. **Kahu kukupā (pigeon feather cloak). Muka, cotton thread, kukupā and pheasant feathers, dye; spaced double pair twining, plaiting, and sewing. Made c.19th century. Unknown weaver/ owners. Pukerātā Marae, Ōtaua, Northland. Image by Hokimate Harwood, 2017.**

The 2012 Pukerātā Marae cloak catalogue referred to one striking kākahu as *He korowai tāwhito* (an old cloak), featuring kukupā (New Zealand pigeon: *Hemiphaga novaeseelandiae*) feathers with a Matariki star adornment (Figs. 8.4 & 8.6). Personal observations conducted in 2017 confirmed this unique feather cloak had a kaupapa predominantly comprised of green kukupā, and white kukupā feathers creating two white (8-point) stars, one in the top left and middle right, and white triangular pattern along the bottom and side borders (Figs. 8.4 & 8.5). White kukupā and common pheasant (*Phasianus colchicus*) feathers were identified along the top border underneath an attractive multi-coloured three-ply plaited neckline (Fig. 8.7).

***Figure 8.5*. Kahu kukupā (pigeon feather cloak). Detail of white star (Matariki) of kukupā feathers. Made c.19th century. Unknown weaver/ owners. Pukerātā Marae, Ōtaua, Northland. Image by Hokimate Harwood, 2017.**

The foundation was of muka (scutched kōrari, New Zealand flax: *Phormium tenax*) and the primary weaving technique was spaced whatu aho rua (double pair twining) to which mainly green and teal kukupā feathers from the neck, and upperwings adorned most of the kaupapa, with some maroon feathers from the back sewn into the foundation using light coloured cotton thread (Figs. 8.4 & 8.6). The white kukupā feathers originated from the breast and belly (Figs. 8.5 & 8.6). Based on the International Register, wing, and tail feathers were rarely recorded in twined cloaks made after 1800. The rigidity of the shafts in flight feathers make them difficult to bend and twine into the foundation without breakage, as opposed to breast and belly contour feathers, that have thinner more pliable shafts.

***Figure 8.6*. Pair of kererū (New Zealand pigeon: *Hemiphaga novaeseelandiae*). ©Peter Reese, Te Pākeka/ Maud Island, Marlborough Sounds, 2008.**

Green neck and white breast feathers were the most common type of pigeon feather observed in Māori cloaks from the 19th century onwards (Harwood, 2011a). The neck and upper chest feathers measured between 2-3 cm long and 2cm wide and were fan shaped. Feather research conducted in 2006, counted 300 of the preferred green neck feathers, and 500 of the white lower chest and upper belly feathers on a bird (H. Harwood, unpub. data).

***Figure 8.7*. Kahu kukupā (pigeon feather cloak). Detail of plaited neckline and kukupā and multi-coloured pheasant feathers. Made c.19th century. Unknown weaver/ owners. Pukerātā Marae, Ōtaua, Northland. Images by Hokimate Harwood, 2017.**

Observations in 2017 noted multi-coloured common pheasant feathers hand sewn with dark cotton thread along the top border (Fig. 8.7). The male pheasant feathers derived from the breast, belly, side, flank, and upper and mid-back area (Fig. 8.8). The production date was unknown, but Pukerātā Marae members suggested the kākahu was potentially over one hundred years old, hence the title. The sewn feathers indicated more recent repairs or additions.

***Figure 8.8*. Male common pheasant, peihana (*Phasianus colchicus*). Centre and right: detail of side and back feathers. Images by Hokimate Harwood, Staglands Wildlife Reserve and Café, Akatarawa, Upper Hutt, 2018.**

Suzie Kire, a local korowai weaver made a copy of this kākahu for her whānau, who do not know the original owner but believed it was old (L. Ashby, personal communication, December 1, 2019). Only 20 (from around 600) feather cloaks in the International Register had pigeon as the predominant species, with only three catalogued as pigeon feather cloaks (kahu kererū). Te Papa listed one (ME000738), with others located in Auckland War Memorial Museum Tāmaki Paenga Hira (Ethnology No. 4371), and the Reiss-Engelhorn-Museen (Reiss Engelhorn Museum) in Mannheim, Germany (52313).

The pepeha "kua kitea a Matariki, ā, kua maoka te hinu" translated as when the Pleiades are first seen at the time of sunrise the fat is cooked, refers to the many birds and rats such as kukupā, that were cooked and stored in their fat at this time for the winter months (Best, 1977, p. 273; Mead & Grove, 2001, p. 272). Māori adopted European symbolism including stars and crosses in artforms from the 1800s onwards, including in tukutuku and tāniko designs (Mead, 1968). This star motif was a unique response to the changing social and religious culture using European icons to illustrate important Māori traditions, as discussed in Chapter Seven. The star motif was also observed in the following Pukerātā Marae cloak, a korowai with kiwi feathers and white star pattern (Section 8.3.2).

8.3.2 Korowai kiwi feathers and white star. No 6.

Figure 8.9**. Kahu kiwi (kiwi feather cloak). (No. 6). Muka, dye, brown kiwi, and white chicken feathers; spaced double pair twining, diagonal twined weaving. Weaver/ owner Anitanaha Piripi (Waikato), made c.19th century. Pukerātā Marae, Ōtaua, Northland. Image by Hokimate Harwood, 2017.**

The 2012 Pukerātā Marae catalogue listed a unique cloak, a korowai kiwi with star - No. 6 (Fig. 8.9). According to northern kaumātua Telly Warren, the weaver and owner was his whāea tūpuna Anitanaha Piripi (Waikato) who married Tāmati Thomas Hare in the 19th century (L. Ashby, personal communication, December 1, 2019). When examined for this study in 2017, the kahu kiwi (kiwi feather cloak) had predominantly brown kiwi (*Apteryx mantelli*) feathers placed across the cloak in the tāmoe (flat) position with the dorsal side facing out (Figs. 8.9 & 8.10). This kākahu showed similarities with the previous kahu kukupā (pigeon cloak) with the adornment of a white star design (see Section 8.3.1). Brown kiwi feathers decorated the cloak, with a prominent white (5-point) star of domestic chicken (*Gallus domesticus*) feathers in the top centre with white feathers radiating off the top of the star (Fig. 8.10). The star and lines were thought to represent a heron (kōtuku: *Ardea modesta*) in flight (L. Ashby, personal communication, May 20, 2017).

***Figure 8.10*. Kahu kiwi (kiwi feather cloak). (No. 6). Left: detail of white star. Centre: detail of white chicken feathers, and backwards kiwi feather in centre. Right: detail of backwards brown kiwi feather. Weaver/ owner Anitanaha Piripi (Waikato), made c.19th century. Pukerātā Marae, Ōtaua, Northland. Images by Hokimate Harwood, 2017.**

The muka is gold and lustrous which possibly indicated a different amount of pressure was used during the scutching (hāro) technique, or beating process (using a patu muka) typically seen in other kākahu. Ngāpuhi weaver, Te Hemo Ata Henare (2017) maintained this was specifically a northern technique of muka extraction. A weaving practice in kaitaka (fine Māori cloaks with tāniko borders) was to not beat or soak the muka, so that the muka retained a golden lustrous sheen (Maihi, 2011). The weaving technique for feather attachment in this kahu kiwi (No. 6) was whatu aho rua (spaced double pair twining) using muka whenu and aho. At least three feathers located to the left of the star and in the white feathers radiating from the star were woven in backwards with the base facing outwards (Fig. 8.10 (centre & right)).

***Figure 8.11*. North Island brown kiwi (*Apteryx mantelli*). Collected by Richard Anderson, Northland, New Zealand. Right: detail of brown kiwi back feathers. Te Papa OR.023841. CC BY-NC-ND 4.0.**

As the cloak has a Northland provenance, the brown kiwi feathers were likely North Island brown kiwi (*Apteryx mantelli*), and the feathers derived from most of the body including the underside or belly (Figs. 8.10 & 8.11). Image comparisons of the cloak feathers to museum bird skin images of jungle fowl (*Gallus gallus*) indicated the white chicken feathers originated from the neck (nape), back, and body feathers (Figs. 8.10 & 8.12).

***Figure 8.12*. Rooster (tame heihei, male domestic chicken: *Gallus domesticus*). Image by Hokimate Harwood, Staglands Wildlife Reserve and Café, Akatarawa, Upper Hutt, 2018.**

The top of the cloak had black cloth, and black dyed (paru) muka woven in using close single pair twining to create diagonal and triangular patterns along the top and base of the cloak (Fig. 8.13). The border designs along the neckline and base were similar in construction and design with other Pukerātā Marae cloaks, suggesting they had the same weaver or group of weavers.

***Figure 8.13*. Kahu kiwi (kiwi feather cloak). (No. 6). Left: detail of neckline showing close single pair twining and brown kiwi feather attachment. Right: detail of close twined adornment along base of cloak. Weaver/ owner Anitanaha Piripi (Waikato), made c.19th century. Pukerātā Marae, Ōtaua, Northland. Images by Hokimate Harwood, 2017.**

8.3.3 Korowai with feathers in the borders.

***Figure 8.14*. Korowai (Māori feather cloak with tassels). Muka, chicken, kukupā, pheasant, pūtangitangi, and peacock feathers, cotton thread, nylon/ polyester ties; spaced double pair twining, sewing, plaiting. Made before 1940. Pukerātā Marae, Ōtaua, Northland. Image by Hokimate Harwood, 2017.**

According to the 2012 Pukerātā Marae catalogue a listed korowai was worn in the 1940s Waitangi centennial celebrations. Examined in 2017, this decorative cloak was initially constructed of muka using spaced whatu aho rua (double pair twining) (Fig. 8.14). Later multicoloured chicken, green and white kukupā, multi-coloured pheasant, pūtangitangi (paradise shelduck*: Tadorna variegata*), and peacock (male peafowl: *Pavo cristatus*) feathers were sewn into the cloak (Fig. 8.15). There was peacock feathers along the neckline; peacock, chicken, kukupā, and pheasant along the base; and paradise duck feathers also in the side borders. Green & black nylon/ polyester curtain ties were added as hukahuka (tassels), which were recently sewn on across the cloak using cream cotton thread.

***Figure 8.15*. Korowai (Māori feather cloak with tassels). Detail of side border with dark and white speckled pūtangitangi, brown pheasant, green and white kukupā, and light iridescent green peacock feathers. Pukerātā Marae, Ōtaua, Northland. Images by Hokimate Harwood, 2017.**

The black and white speckled pūtangitangi feathers originated from around the midsection of the male of the species, including the belly, side, and mid back (Figs. 8.15 & 8.16). Both males and females have dark speckled bodies, but the colouring is less distinct in the white-headed females (Heather & Robertson, 1996; Marchant & Higgins, 1990b). Hay (1882) noted the Hokianga and Kaipara regions had plenty of native duck and cross-bred species in rivers, including paradise ducks in the second half of the 19th century, they were easily shot and eaten, and had fine plumage (p. 225). Towards the end of the 19th century in the Bay of Islands, some of the native ducks were less common (Pycroft, 1898). Historically pūtangitangi were widely distributed in the North and South Islands with fluctuating numbers over the last 200 years, and in 1981 the North Island population was around 70,000, currently there is a relatively large population in Northland from translocations (Heather & Robertson, 1996; Holdaway et al., 2001; Marchant & Higgins, 1990b; Robertson et al., 2007; Worthy, 2010a). Reduced numbers reported in the late 19th century from European settlement resulted from shooting, accidental poisoning, and introduced predators (Marchant & Higgins, 1990b). Bundles of paradise duck feathers were also found along with other species like kākāpō (*Strigops habroptilus*), and kākā (*Nestor meridionalis*) in rock shelters on Lee Island, Lake Te Anau in Fiordland presumably left by fowlers (Holdaway, 1991). The feathers were located near an historical brown kiwi skin cloak dating from 16th -17th century currently in the Southland Museum and Art Gallery Niho o te Taniwha, Invercargill (88.258.57(a) & (b)), discussed in Chapter Six. The onomatopoeic naming of this species, pūtangitangi, derived from the loud alarm call the birds make when they are distressed (Orbell, 2003).

***Figure 8.16*. Pūtangitangi (Paradise shelduck: *Tadorna variegata*). ♂. Collected by H Fraser, 3 July 1937, Fielding New Zealand. Right: detail of back feathers. Te Papa OR.014008. CC BY-NC-ND 4.0.**

The male common pheasant feathers originated from the breast, side, and upper and lower back (Figs. 8.15, 8.17 & 8.8). Iridescent peacock feathers from the neck, breast, belly, and upperback appeared in all four cloak borders (Figs. 8.17 & 8.18). Green neck and white breast feathers from the kukupā were recorded in the side and bottom borders (Figs. 8.6 & 8.17).

***Figure 8.17*. Korowai (Māori feather cloak with tassels). Left: detail of neckline with multi-plaited collar using whenu (warps), and hand sewn peacock feathers. Right: detail of cloak base with sewn peacock, kukupā and pheasant feathers, curtain ties and decorative muka element across cloak base. Pukerātā Marae, Ōtaua, Northland. Images by Hokimate Harwood, 2017.**

Natural muka decorations like pāheke (flowing or trickling) patterns also featured towards the cloak base in which a second decorative weft element was loosely twined into the backing (Fig. 8.17). Possible remnants of the original naturally dyed muka hukahuka were observed towards the cloak neck and baseline. The feathers and cloak had been sewn over with light and dark coloured cotton thread at different times. This old cloak has had new repairs and additions with sewn synthetic tassels and peacock feathers along the top border. It also demonstrated similar adornment to the next korowai with full tassels, cloak No. 3 (Section 8.3.4).

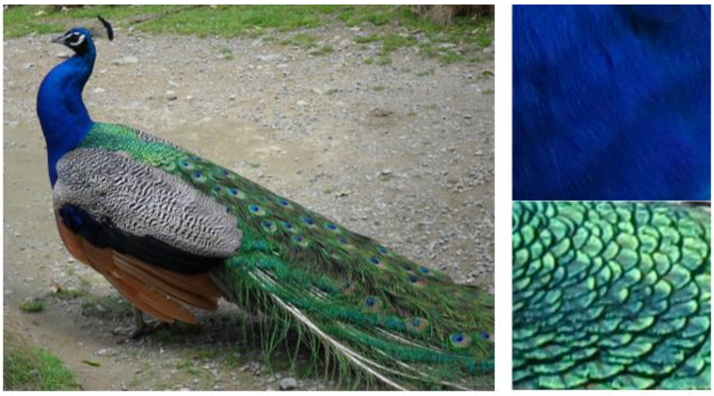

***Figure 8.18*. A Peacock (male peafowl) (*Pavo cristatus*). Right: detail of blue neck and back peashell feathers (bottom). Images by Hokimate Harwood, Staglands Wildlife Reserve and Café, Akatarawa, Upper Hutt, 2018.**

8.3.4 Korowai full tassels No.3.

***Figure 8.19*. Korowai (Māori cloak with tassels). (No. 3). Muka, chicken feathers, cotton thread, polyester/ nylon curtain ties, dye; spaced double pair twining, sewing. Donor unknown. Made before 1940. Pukerātā Marae, Ōtaua, Northland. Image by Hokimate Harwood, 2017.**

A Pukerātā Marae kākahu was catalogued in 2012 as a korowai tāwhito (old cloak) and worn in the 1940s Waitangi centennial celebrations according to the Rountree (Raunatiri) whānau (Fig. 8.19). Originally made of muka, it had remnants of the original naturally dyed (paru, mud) whenu tāpiri (warp ends) when examined in 2017. The main technique involved spaced double pair twining (whatu aho rua), with recent work that featured sewing across the cloak along most rows in line with the weft row (ara). Sewn dark peacock and multicoloured chicken feathers adorned the neckline, and black nylon/ polyester curtain ties and tassels decorated the main kaupapa of the cloak (Fig. 8.20).

***Figure 8.20*. Korowai (Māori cloak with tassels). Left: detail of chicken feathers, sewing and dark curtain ties. Right: detail of green peacock and dark chicken feathers. Donor unknown. Made before 1940. Pukerātā Marae, Ōtaua, Northland. Images by Hokimate Harwood, 2017.**

Multi-coloured chicken feathers from different breeds including hackle (neck), saddle (side-back), and body feathers adorned the top border (Figs. 8.12 & 8.20). The top border or neckline was finished with the whenu (warps) bent back and secured. The cloak could have been around 100 years old, with repairs and additions over time using machine and hand sewing, and synthetic tassels and chicken feathers added along the top to replace previous feather loss and adornment.

8.3.5 Korowai whakahekeheke with kiwi feathers and geometric designs in cloak. No. 4

***Figure 8.21*. Korowai whakahekeheke (cloak with vertical decorative strips). (No. 4). Muka, brown kiwi feathers, nylon/ polyester curtain ties, dye; spaced double & close single pair twining, rolling. Made 19th century. Rountree (Raunatiri) whānau korowai. Pukerātā Marae, Ōtaua, Northland. Image by Hokimate Harwood, 2017.**

The 2012 Pukerātā Marae catalogue and whānau members referred to a remarkable cloak as the Raunatiri Korowai with kiwi strips (No. 4) (Fig. 8.21). When examined in 2017 this stunning korowai whakahekeheke (meaning to descend), was described as a cloak manufactured from fine muka and spaced whatu aho rua (spaced double pair twining), with borders and vertical bands of tāniko-like decorative elements, and parallel brown kiwi feathers (Fig. 8.21). Estimated to be over 100 years old, and worn in the 1940s Waitangi centenary celebrations, it was acknowledged that it was unique and fascinating in the use of geometric designs in the kaupapa. The weaver of the Raunatiri korowai was unrecorded.

Four vertical strips or columns were recorded in 2017 of mainly tāmoe (flat) brown kiwi feathers, so they were placed as they are on a bird. This feather use resembled the kahu kiwi in Section 8.3.2. Brown kiwi feathers were also located along the top under the decorative border. Three expertly made columns of 11 sets of matching and adjacent black (paru dyed) diamond-shaped geometric patterns adorned the kaupapa of the cloak (Figs. 8.21 & 8.22).

***Figure 8.22*. Korowai whakahekeheke (cloak with vertical decorative strips). (No. 4). Left: brown kiwi feathers and close single pair twining in geometric designs on the kaupapa. Right: detail of twined weaving design. Made 19th century. Rountree (Raunatiri) whānau korowai. Pukerātā Marae, Ōtaua, Northland. Images by Hokimate Harwood, 2017.**

It appeared that close single pair twining formed some of the diagonal and triangular weaving patterns in the decorative cloak borders and centre of the kaupapa, which were unique and intriguing (Figs. 8.22 & 8.23). The designs were consistent with transitional Māori clothing from 1800-1900 (Mead, 1968). It appeared the motifs in the centre were incorporated as the cloak was made. Tāniko (coloured wrapped twined) borders were often pre-made in strips, and rarely observed in separate small designs as in this cloak.

***Figure 8.23*. Korowai whakahekeheke (cloak with vertical decorative strips). (No. 4). Detail of neck and side borders with close single pair twining, and cloak tie. Made 19th century. Rountree (Raunatiri) whānau korowai. Pukerātā Marae, Ōtaua, Northland. Right: detail of twined designs in neck border and skipped whenu. Images by Hokimate Harwood, 2017.**

This cloak is similar in style and patterning to another Pukerātā Marae kākahu, a korowai tāwhito (old cloak) referred to as No. 5, that did not contain feathers but had similar patterned borders and designs across the kaupapa (Fig. 8.24). That it had different designs, yet similar techniques suggested it was possibly made around the same time by the same weaver(s). The kaupapa of the korowai tāwhito (No. 5) was produced using muka whenu and aho, and spaced double pair twining, with 2-ply paru-dyed kārure (unravelling) tassels. It appeared the three columns of three sets of alternating diamond and triangular patterns were constructed using close single pair twining with dyed aho strands to produce the diagonal weaving (Fig. 8.24).

***Figure 8.24*. Korowai tāwhito (old cloak). (No. 5). Muka, dye; spaced double & close single pair twining. Made 19th century. Pukerātā Marae, Ōtaua, Northland. Right: detail of bottom border. Images by Hokimate Harwood, 2017.**

This korowai kārure was also expertly and beautifully made. All four borders had black and brown naturally dyed close single pair twined borders with variations of diagonal weaving in triangular patterns. The side borders were added separately, and the top and bottom borders seemed to be woven in as the cloak was made. For two cloaks to have such similar yet rare adornment, indicated that the same weaver(s) produced both cloaks around the same time demonstrating their creativity and innovation. The weaving techniques, designs, and positioning was unique and specific to the Hokianga according to prominent weaver Toi Te Rito Maihi (2017).

8.3.6 Kākahu (feather cloak) for marae events

***Figure 8.25*. Rangiheketini (Kākahu with feathers). Pheasant and chicken feathers, cotton embroidery thread, macramé twine, mason line, wool; spaced double pair twining, tāniko. 20th century. Weaver Hana Harssen. Pukerātā Marae, Ōtaua, Northland. Image by Hokimate Harwood, 2017.**

A striking feather cloak used for Pukerātā Marae events was examined in 2017 (Fig. 8.25). The 2012 Pukerātā Marae catalogue stated this kākahu was made by Hana Harssen in the 20th century and called 'Rangiheketini' - a prodigious ancestral Ngāpuhi name. Various coloured male common pheasant feathers from the side, upper, and lower back of the bird were positioned in horizontal blocks creating four vertical columns (Figs. 8.8 & 8.26). The columns of feathers and black tassels of satin nylon threads decorated the space in between columns resembling the korowai whakahekeheke, the kākahu with kiwi feathers (Cloak No. 4) (Fig. 8.21). Male common pheasant feathers decorated the bottom border, and red chicken feathers adorned the top border under tāniko patterning. The whenu (warps) were consistent with macramé twine and the aho (wefts) possibly comprised of mason fishing line, both were popular cloak weaving materials in the early-mid 20th century (Mead, 1968, p. 52). The technique for the foundation and feather attachment consisted of whatu aho rua (spaced double pair twining).

Figure 8.26. **Rangiheketini (Kākahu with feathers). Detail of black tassels and pheasant feathers along bottom border (right). Weaver Hana Harssen. Made 20th century. Pukerātā Marae, Ōtaua, Northland. Images by Hokimate Harwood, 2017.**

The natural red chicken feathers along the top were identified as hackle (neck) and possibly saddle (back) feathers in 2017 (Figs. 8.27 & 8.28). A decorative tāniko design of red, black, white, and yellow cotton embroidery thread ran alongside a blue-grey woollen tāniko border along the neckline. The dominant designs in this tāniko were the flower/ star, pātikitiki (diamond), and triangular patterns used from the 20th century on and described as modern Māori decorative motifs worked into classical or traditional designs (Mead, 1968, p. 56).

Figure 8.27. **Rangiheketini (Kākahu with feathers). Detail of red chicken feathers underneath tāniko border along neckline. Weaver Hana Harssen. 20th century. Pukerātā Marae, Ōtaua, Northland. Image by Hokimate Harwood, 2017.**

Most whānau or marae that have kākahu, will use one or two kākahu for marae or important events such as weddings, graduations, etc. These kākahu may have been made specifically for these occasions or over time have been used for this purpose. They were generally contemporary robust cloaks of modern materials, so they could be worn or handled, and therefore quickly and easily repaired or replaced when required.

***Figure 8.28*. Rooster (heihei, domestic chicken: *Gallus domesticus*). Centre and Right: detail of saddle (back) and hackle (neck) chicken feathers. Images by Hokimate Harwood, Staglands Wildlife Reserve and Café, Akatarawa, Upper Hutt, 2018.**

8.4 Significance of materials, birds, and feathers for northern iwi

With such a small sample it was not possible to draw any major conclusions about Northland in general, however the collection of Pukerātā Marae cloaks provided an accurate representation in what was recorded in oral narratives of Ngāpuhi weaving. In that muka was the prominent base material in the older marae kākahu, and cotton, embroidery, and nylon thread and macramé twine were used for recent repairs, and replacement of traditional muka and hukahuka (tassels) in more modern cloaks (Fig. 8.25). Native birds such as kukupā and brown kiwi and kākā were probably the preferred native species, had numbers been higher in the area. Birds introduced in the mid-late 1800s such as multi-coloured chicken, pheasant, and peacock replaced native bird feathers as they were more readily available. While Northern iwi do consider all plants and animals as having significance, some birds and colours were possibly preferred for kākahu, and other birds were certainly historically favoured by some weavers for reasons that reflected a personal or familial association. These behaviours and patterns were also reflected in the museum collections in the International Register.

Introduced game birds had successfully acclimatised in Northland by the late 1800s, some were recorded as disproportionate and were already supplanting native bird species, namely the

European passerines and songbirds, English (common) pheasant (*P. colchicus*), Chinese pheasant (*P. torquatus*), California quail (*Callipepla californica brunnescens*), and Australian quail (*Coturnix ypsilophora australis*) (Hay, 1882). Henare (2017) confirmed the preference for some whānau in the north to use contemporary materials over traditional:

> "I've helped or assisted others with kākahu, maybe three or four that are traditionally made... I first made a kākahu out of candlewick for an unveiling for my tūpuna (ancestor) one day. I was asked to make one but not out of natural fibre because they wanted it to last."

The convenience of using readily available, introduced materials such as wool, cotton and exotic bird feathers required less time and energy in the weaving process, as they have already been treated they are less susceptible to moisture, mildew, and insect damage, as some insects feed on the keratin (protein) in feathers. Most traditional cloaks were never made to last forever they were only expected to last for the person or purpose for which they were intended and then another would be made.

Hori Parata of Ngāti Wai described his experience with collecting birds for weavers in that they didn't ask for specific birds if they already knew that the bird collectors would be going after a particular species, and that all bird feathers were used in some way (Parata, 2017). Parata (2017) when talking of collecting feathers and harakeke for kākahu with his uncle in the bush, recalled:

> "Of course that's one of the things that I can very much remember…that's when we weren't collecting the feathers and bringing them home, was that our kaumātua (elders) told us that you pluck the bird straight away because they're still warm and easier to pluck and then you make sure you cover those feathers over…so it doesn't upset all the other birds….so…there was a tikanga (custom) for us".

Brown kiwi are synonymous with Northland and were still 'very plentiful' in the north in the second half of the 19^{th} century, despite Māori regularly acquiring the birds for food, the skin for leather and feathers for cloaks (Hay, 1882). Towards the end of the 19^{th} century in the Bay of Islands, brown kiwi were still common in remote bush areas, with numbers impacted by hunting and from predation from dogs, stoats (*Mustela erminea*), and weasels (*Mustela* spp.) (Pycroft, 1898). Currently Northland has one of the few remaining larger populations of brown kiwi. North Island brown kiwi have reduced in number and distribution since European settlement, yet are still present in local but declining populations particularly in Northland's

Waitangi State Forest; Waipoua State Forest; between Tauroa Pt. and Doubtless Bay, and Bream Bay and Ruawai; and Tangiteroria (Marchant & Higgins, 1990a, p. 73; Worthy, 2010b). Captive breeding and translocations have assisted in re-populating areas though (Marchant & Higgins, 1990a, p. 73). North Island brown kiwi are still listed as at risk and can be found throughout the district of Kaikohe in forest and shrubland including remnants in farmland, where current threats continue from dogs, small predators, and habitat loss (Conning & Miller, 2000, p. 27; Robertson et al., 2017).

A prominent 20th century weaver from Motatau, Te Para Mabel Waititi (1915-2009) of Ngāti Hine, was a member of the New Zealand Weavers' Association and grew up weaving with her great grandmother Mihiwera Tipene (neé Shortland), and her mother Riuroa Tipene who were kairaranga and produced a wide range of fibre arts. Te Para Waititi was well known for her raranga and whatu raranga including kākahu using local materials for Ngāti Hine buildings, events, and as gifts throughout the 20th and into the 21st century, as well as contributing to making the tukutuku panels in the Waitangi Treaty meeting house Te Whare Rūnanga. According to her daughter, Waina Albert, Te Para did not have a preference for any specific birds, but that she loved any feathers and was making kākahu when the birds used to be plentiful, and that wherever she could get the feathers from, she appreciated (W. Albert, personal communication, August 2018). Kevin Prime of Ngāti Hine in Motatau worked with Te Para on different kaupapa (projects), and having a whānau relationship, would try to collect and prepare the feathers of dead native birds for the kuia (female elder). Prime (2017) remembered that in the 1980s weavers could easily access feathers from kukupā; and pūkeko (swamphen: *Porphyrio melanotus*) - which were considered pests, but that kiwi were rare in most areas of the forest. Te Para would sometimes ask Kevin "pena kua kite ki a nei kiwi?", asking if any kiwi had been seen (Prime, 2017). Near Kevin's Motatau homestead in the 1980s, kiwi were regularly found dead, so the meat was cooked and eaten, and the feathers kept aside for weavers like Te Para. Due to their rarity, Prime (2017) attested that Te Para took great care in washing, drying, separating, and preparing the kiwi feathers for weaving, stating "there's not many people around that even do that now… because of the scarcity now, [of] kiwi". Prime (2017) felt that kiwi were not necessarily explicitly hunted for just kākahu, "in a sense if they were around they [Māori hunters] caught them". The International Register listed at least one kahu kiwi (kiwi feather cloak) in the Te Papa collection (ME014382) with possible Northland provenance, as the museum mostly acquired collections from the mid-lower North Island additional research on the history of this cloak would be required to confirm and link provenance to northern iwi.

Maihi (2017) in her research found evidence that kiwi were caught and kept by some whānau for the purpose of using the feathers for kākahu. Māori were known for keeping kākā and tūī as decoys and pets to attract other birds (Best, 1977). Great care was taken to hunt for kiwi and after plucking the birds to preserve the feathers, they were tied up in bundles and kept for future use in cloaks and head bands for mourning women (Best, 1977, p. 168). According to Best (1977) Northern Māori collected and offered the heart of the first kiwi caught to the tūpuna with the following karakia (chant) (p. 169):

> *Haere e runga, haere i raro*
> *Haere i runga o Puhikura*
> *E takoto nei koe, e Tangaroa*
> *Autu Tangaroa, Kahukura rangi*
> *Ka whiwhi ai koe ki ngā kurī*
> *E marie auta marie*
> *E whakatangi ai koe*
> *E tu nei Tangaroa*
> *Mau e whakaruru ai e.*

The heart was then given to the dogs, and the rest of the bird cooked and eaten by the hunters (Best, 1977). Puhi can be translated as a young female, or feathers, and kura described something red, treasured, feathered, or a chief (Williams, 1957).

Prime (2017) acknowledged that historically kiwi and kukupā were important for northern Māori for "food and the materials…the feathers ..that was the main thing for the kiwi and the pigeon maybe because they are bigger but they also ate the tūī as well. They were cooked the same way, boiled ..[with]..a bit of salt, if they were fat they were a really good feed". Anecdotal evidence suggested that kiwi and kukupā numbers in the North have been fluctuating in the 20-30 years due to possum, mustelid, and hunting pressures despite being historically abundant and widespread (Prime, 2017). Kukupā have declined considerably in Northland, now listed as a threatened endemic, they are found throughout the Kaikohe area and sparsely scattered north of Kaitaia in local populations, they still thrive in broadleaf-podocarp forests despite continued predation from possums, rats, and hunting (Checklist Committee (OSNZ), 2010; Conning & Miller, 2000; Higgins & Davies, 1996).

In the second half of the 19th century, Northland kukupā were recorded in flocks of hundreds or thousands moving seasonally for fruiting tree species, where they were easily shot and eaten in large numbers (Hay, 1882, p. 218). Towards the end of the 19th century in the Bay of Islands, pigeons were still numerous, however it was predicted that they would be rare in the North in the 20th century due to the gradual disappearance of bush, and insufficient legal protection (Pycroft, 1898). Preferring native forest, kukupā have adapted to exotic food species and suburban areas, where predation is reduced (Harwood, 2002; Worthy, 2010c). Predator control programmes undertaken by some landowners have reportedly also produced a positive recruitment response for kukupā populations near Kaikohe (Conning & Miller, 2000). Recent programmes run by Northland Māori land-owners and farmers with the assistance from the Department of Conservation (Te Papa Atawhai) and Landcare Research (Manaaki Whenua) contributed to the kukupā health status, bird counting, foliage research, sampling, and monitoring and controlling rat and possum numbers (Prime, 2017). Prime (2017) who is associated with the kukupā restoration programme in Motatau, acknowledged that the old ways of using pigeon may not be as sustainable with constant predation and hunting pressures.

As stated in Chapter Five, Northern elders still request pigeon when ill, as was done in years past. Prime (2017) thought this was a way of wanting to relive this experience again, or "to have a last taste of a food of which they have been deprived of all their lives". Mita Harris (2017), also recalled this tradition of requesting kukupā as a last meal, and kiwi "not everyone could eat it, only certain [people], it had to be, when they ate it they ate the whole thing, they didn't throw it away.. it was a tapu [sacred] bird to eat apparently… every bit was eaten". As discussed in Chapter Five, the association of pigeons with death could have stemmed from the relationship of Māui the trickster visiting the underworld to visit his father (Prime, 2017).

***Figure 8.29*. *Hemiphaga novaeseelandiae* (Columbidae), Miss Anna Elizabeth (Bessie) Jerome Spencer, New Zealand Pigeon. Photographic gelatin, sheet glass, silver, photographic plates. Photograph by Herbert Guthrie-Smith; circa 1910; Hawke's Bay. Te Papa B.003954.**

Like many native birds, kukupā are very tame and docile due to the lack of hunting and predation in New Zealand before humans and mammals arrived (Fig. 8.29). According to Kevin Prime (2017), Ngāti Hine kaumātua (elder) Percy Tipene (1952-2017) investigated raising domestic kukupā and feeding chickens a similar diet to kukupā to reproduce the taste of the birds eating native fruits. Prime (2017) reiterated that "what these birds ate … permeated through. So, what the bird was eating, like taraire [*Beilschmiedia tarairi*], pūriri [*Vitex lucens*], … miro [*Prumnopitys ferruginea*], kahikatea [*Dacrycarpus dacrydioides*], tōtara [*Podocarpus tōtara*], it depended on what they were eating…and even kohekohe [*Dysoxylum spectabile*], how the fruit breaks open and they pull the seeds out". The long-established relationship northern Māori have with kukupā only drives the need for increased pressure for protection.

For some Māori, kākā (*Nestor meridionalis*) and kukupā were considered two of the most important forest birds forming the main sources in the diet (Best, 1908, p. 257). Kākā were not recorded in the Pukerātā Marae cloaks, however they were recorded in northern oral narratives as a culturally significant species used in kākahu. In the second half of the 1800s, northern kākā were considered common and good eating, with variations in plumage colour (Hay, 1882, p. 219). Towards the end of the 19th century in the Bay of Islands, kākā were still recorded as 'fairly' numerous (Pycroft, 1898). North Island kākā (*Nestor meridionalis septentrionalis*) were previously widespread and are now currently isolated in scattered locally common populations in the upper and lower regions of the North Island (Chambers, 2010; Robertson et al., 2007). Preferring native or unmodified forest, current distribution is marked by a severe reduction from habitat loss, predation, and overhunting with scattered records in Northland forests, from between South Rangaunu Harbour and Maungataniwha Ranges, South to near Dargaville, with many records round Whāngārei and Hen & Chicken Islands (Higgins, 1999, p. 624). Listed as a threatened endemic, Northland kākā were thought to have been vagrants, in non-resident populations, mainly attributed to predation from mustelids, the biggest threat on the mainland (Conning & Miller, 2000; Powlesland, Wills, August, & August, 2003). Bird surveys in six forests in the Far North in 1979 counted several individual birds; where surveys in the same forests in 1993 found only a single kākā (Higgins, 1999, p. 625). In the International Register, only one 20th century feather cloak had recorded Northland provenance in the British Museum in London (Oc1982,Q.739) that listed kākā in the material description. The museum label named the kākahu 'Paki' and linked it to Patari Kaihau Maire, the hapū of Te Uri Taniwha, and Ngāpuhi iwi.

Mita Harris (Ngāpuhi) understood that kākā and kiwi were used in cloaks and that kukupā, kiwi, and tūī are still very significant birds for Northern Māori, recalling "kiwi and pigeon being hunted back then, … probably more for kai" (Harris, 2017). With regards to kōkako (*Callaeas wilsoni*), Harris (2017) understood they were not sought out despite there being large enough kōkako numbers in the forests in the Bay of Islands. Harris (2017) explained "I don't know about kōkako, I don't know whether they use kōkako now or not, …. I know that's one bird that wasn't touched…. when they used to go for a pigeon, they had tūī, and if kiwi was there, they'd take it. This was back in probably in the 1920s, 30s and prior to that".

According to Parata (2017) "all the birds" were used by weavers, even tūī, where "you might just put parts say of a tūī into something that you are doing", and the pūkeko, "even though I've heard some say that 'e hara te pūkeko, he manu Rangatira' [not the pūkeko, it is a chiefly bird], but no, kao, not to us". It is thought the chiefly status of the pūkeko (*Porphyrio melanotus*) derived from the birds bright red bill, a colour of status and mana (authority) dating back to Polynesia (Fig. 8.30) (Orbell, 2003). Prime (2017), Harris (2017), and Parata (2017) recalled weavers sometimes asking for specific birds, where weavers wanted a choice and number of birds to select from to get similar coloured feathers to make the cloak uniform in appearance. In the second half of the 19th century, tūī (*Prosthemadera novaeseelandiae*) were favourite song-birds and food for Northern Māori and Europeans, and kept to mimic human singing and speech (Hay, 1882, p. 218). Towards the end of the 19th century tūī were still fairly numerous in the Bay of Islands and common in most parts of Northland, admired for their plumage and eating, and tame habits (Hay, 1882, p. 219; Pycroft, 1898).

***Figure 8.30*. Pūkeko (Swamphen: *Porphyrio melanotus*). Image by Kathysg, 2019, from Pixabay.**

One of the most appealing designs of kākahu Māori is the recreation of the essence and aesthetic of a bird's plumage on a cloak. In twined weaving, most feathers are woven in with the outer edge facing out, and the weaver places the feathers on top of the whenu (warps), securing them to this backing using the aho wefts so that feathers are added on to each row and placed on top of the previous row, forming what is essentially a layering of the feathers as they appear on a bird. The mathematical skills and creative artistry of Māori weavers needed to calculate the number of birds and feather types to produce the desired design is masterful. Henare (2017) shared an account of her Aunty Alice who made a pūkeko feather cloak for a family unveiling, so that the cloak resembled the physical plumage of the bird (Fig. 8.30). Henare (2017) recounted:

> "so where the feathers came from that's where it was placed on the cloak, …it was not done deliberately, [because] I helped her make it, [it] took her two weeks, all I did was get the feathers ready to hand them to her, … I'd helped her with the muka and I just handed them [feathers] to her, …and it just seemed where she placed them … you'd swear it was like a pūkeko, looking at the bird".

Kohai Grace's 2004 'tūī cloak', held at Te Papa (ME023873), and discussed in Chapter Seven (Fig. 7.14), had a likeness to a tūī in flight, and incorporated a small tuft of white pigeon (kukupā) feathers to represent the tūī throat feathers (poi/ pōhoi), as another example of a contemporary cloak that represents the physical embodiment of a bird.

The first official record of successful chicken introductions occurred when Reverend Marsden brought fowls from Sydney, Australia to the Bay of Islands in Northland in 1814 (Long, 1981, p. 164; Thomson, 1922, p. 110). Although, there are indications that along with chickens, missionaries also unofficially introduced turkeys, geese, ducks, and common fowl, at least in Northland, earlier than the official acclimatisation records (Nicholas, 1817b, p. 256). According to the International Register, to date they are the most common introduced species identified in Māori feather cloaks in public museum collections. They were also the most common species, identified in four of the six Pukerātā Marae cloaks featuring feathers. They were incorporated to replace lost native bird feathers, probably due to the lack of native bird access for weavers in the last century.

Henare (2017) relayed the history of a kākahu made of coloured peacock (pīkake) feathers used as a kahu tūpāpaku (a cloak to cover the deceased):

> "I don't know who made the kākahu but they would use it for tūpāpaku [deceased] whenever they had tangi [funerals],..that's the kōrero that came from my grandmother to my mother and that's why my sister's name [ingoa karanga, call name] is Pīkake, it's in honour of that kākahu. Nanny said it was more about aesthetics,…there was no suspicious stuff about peacock feathers in her hapū, so I think it was more the aesthetics than anything else and it was available, they have plenty of them up there, so they used whatever they could get".

Māori beliefs pertaining to superstitions associated with peacocks probably originate from an aversion to the display of the large eyes on the male's tail feathers, like the unnerving eyes of the koukou (ruru, owl) as discussed in Chapters Five and Seven (Figs. 5.39 & 8.18). The peacock's association to death adopted by some Māori was also understood to have originated from Anglo-saxon traditions, where in some areas it is still unlucky to have peacock feathers in the house (Jackson, 2006, p. 58).

Based on the wide distribution of scattered but increasing wild peafowl populations in rural areas in Northland, the inclusion of feathers in Northern artforms and adornment is not surprising (Marchant & Higgins, 1993; Robertson et al., 2007; Scofield & Worthy, 2010). Considered an agricultural pest, landowners currently shoot peafowl, however the birds become very wary and elusive when hunted. Under the Wildlife Act 1953, Schedule 5, peafowl are listed as an unprotected species in New Zealand, and therefore it is lawful for anyone to hunt, kill, or have peafowl in their possession if it is not domesticated, this status means that landowners may carry out lethal control of feral peafowl on their property (Latham, 2011, p. 1). Wild turkeys (*Meleagris gallopavo*) may also be killed by legal methods during carefully monitored and regulated hunting seasons; however, outside of those seasons, non-harmful control options must be used (Latham, 2011, p. 6).

Pheasant was identified in half of the Pukerātā Marae cloaks and was the prominent species in a contemporary Marae cloak that was used for important events, Rangiheketini, made by Hana Harsson (Fig. 8.25). Originally from Asia, pheasants were first officially introduced into New Zealand in 1842 as game birds for Europeans to shoot and acclimatise to New Zealand (Long, 1981; Scofield & Worthy, 2010, p. 28; Thomson, 1922). Birds introduced and liberated well into the 20th century were abundant throughout the North Island by 1871, especially in the North, and up to 1869 they were released and widely distributed in the Bay of Islands (Long, 1981; Marchant & Higgins, 1993, p. 378; Robertson et al., 2007; Thomson, 1922, p. 111).

Hori Parata (2017) indicated that the matuku, or matuku-hūrepo (Australasian bittern: (*Botaurus poiciloptilus*) is a significant bird for Ngāti Wai, that weavers in the past requested feathers:

> "If they know they were doing kiwi or ..matuku [bittern] or any one of those birds.., then they'd say 'we know you fellas are going hunting today so maru mai ngā …huruhuru'- bring the feathers back. Matuku is certainly significant to us, to my hapū….. and yet he just looks like a bird .. standing out in the swamps,…looks like he's looking straight up at the stars".


***Figure 8.31*. Kahu huruhuru (feather cloak). Muka, bittern, swamp harrier, kākā and kukupā feathers, unprocessed merino wool; spaced double pair twining, plaiting. Gift of the Right Honourable the Lady Rowley, 1980. Te Papa ME014385. All Rights Reserved. Right: detail of bittern feathers. Image by Hokimate Harwood, 2007.**

Matuku belong in the Ciconiiformes order along with herons like kōtuku (*Ardea modesta*), they are known for standing straight and sticking their necks straight in the air as a defense mechanism against danger (Heather & Robertson, 1996). Matuku make booming sounds like kākāpō (*Strigops habroptilus*) at night to announce the start of the mating season and are sometimes compared to someone crying, in mourning (Best, 1977; Orbell, 2003). In the second half of the 19th century in Northland, the bittern's monotonous boom could be heard from the swamps, and were easily caught by Māori, although eating them was not that pleasant (Hay, 1882, p. 221). Bitterns are now considered threatened with records in the larger wetlands in Kaikohe, where the main concerns are habitat destruction from drainage and land development, and introduced mammals including cattle, pigs, and goats (Conning & Miller, 2000).

***Figure 8.32*. Bittern (*Botaurus poiciloptilus*). Location collected Nelson, New Zealand. Te Papa OR.009478. CC BY-NC-ND 4.0.**

Bittern feathers have been identified in at least two Māori feather cloaks in museums in the International Register. One korowai (D63.790) in Otago Museum in Dunedin, had darned wool tāniko, and chicken, bittern, and peacock feathers. The other in the Te Papa collection (ME014385) was identified in 2007 (Fig. 8.31) (Harwood, 2011a). It incorporated brown and cream bittern body feathers (Fig. 8.32); side borders and horizontal strips of orange kākā feathers from under the wing; green (neck), brown (back) and white (breast & belly) kukupā feathers in small blocks throughout the cloak; and vertical strips of brown and white body feathers from the swamp harrier (kāhu: *Circus approximans*) (Figs. 8.33 & 8.34). Merino wool was identified from microscopic hair analysis conducted in 2010 (H. Harwood, unpub. data).

***Figure 8.33*. Kahu huruhuru (feather cloak). Detail of kāhu feathers. Gift of the Right Honourable the Lady Rowley, 1980. Te Papa ME014385. Images by Hokimate Harwood, 2007.**

Harrier have been anecdotally recorded as widespread and common in Northland since the second half of the 1800s, as large opportunistic birds of prey they were recorded attacking turkeys, lambs, and rats (Hay, 1882, p. 220; Pycroft, 1898). The Acclimatisation Society organised paid bounties in the mid-20th century, and rabbit control saw some decline, today they are common in modified farmlands in Northland and scavenging carrion off roads (Heather & Robertson, 1996). Several feather cloaks featuring harrier feathers were listed in the International Register, a hawk feather cloak in the Overseas Museum, in Bremen, Germany (D.13091); a kahu kiwi in Te Manawa Museum in Palmerston North (488/15); and a candlewick cloak in the Phoebe A. Hearst Museum Of Anthropology, University Of California Berkeley, in California (11-3334). Two contemporary cloaks with swamp harrier were also collated, one kahu huruhuru (Oc1993,03.69) made by Te Rarawa weaver Mrs A. N. Lawrence located in the British Museum in London; another was made in 2000 by weaver Nigel How (Ngāti Kahungunu) named ‘Te Hemoata Kahukurī’, a Samoyed dog hair cloak in the Te Papa collection (ME024021). Other examples of harrier feathers used in taonga in the Te Papa collection included carved weapons such as tewhatewha (personal fighting staff) (WE001626); flags (G002524); and kites in Te Papa (ME016932) and in the British Museum London (Oc1843,0710.11). A Māori canoe sail in the British Museum (Oc,NZ.147) also has split feathers from kāhu and kererū (Firth, 1931). Known for their prowess, strength, and intelligence, the birds were often associated with Rangatira and the feathers likely embodied these qualities particularly in weapons (Orbell, 2003).

***Figure 8.34*. Kāhu (Swamp harrier: *Circus approximans*). Collected by S. Hornabrook, June 1940, Wairarapa, New Zealand. Te Papa OR.010596. CC BY-NC-ND 4.0.**

Te Hemo Ata Henare (2017) fondly remembered the brown quail or whē (*Coturnix ypsilophora*) at her kāinga in the Whāngāroa Harbour. The quail was introduced from Australia in the 1860s and 1870s and is now limited to the North Island, Northland in particular (Scofield & Worthy, 2010). Whēwhī, was another name for the now extinct New Zealand quail (or koreke: *Coturnix novaezelandiae*). The koreke, a bird of open grasslands was historically found in both islands including in fossil and midden sites, they were still common by 1848 when as many as 86 could be shot on one day, but by 1870 were on the verge of extinction likely from predation (Scofield & Worthy, 2010). In Northland, in the second half of the 19th century, the native koreke were thought to have always been less than common but even more so in the late 1800s with flocks of less than six birds seen at a time, they were netted in large numbers by Māori, and supplanted by more numerous introduced game birds (Hay, 1882, p. 223). The last North Island sighting was December 1869; and last reliable South Island observation was 1875, with the last specimens collected 1867-1868 (Scofield & Worthy, 2010). Quails have similar temperaments, and have trusting and timid natures, so were easy to hunt.

***Figure 8.35*. California quail (*Callipepla californica*). ♂. Image by Nel Botha, from Pixabay.**

Henare (2017) had a fondness for brown quail and recalled this bird from where her parents lived, but observed that numbers have also declined, noting "you don't see it too often now, but you see the California quail (*Callipepla californica brunnescens*)" (Fig. 8.35). This personal preference for certain birds acknowledges the relationship that some weavers may have to a species, depending on their surroundings, iwi, whānau, individual, and personal experiences. While Te Hemo Ata Henare (2017) was not aware of brown quail featuring in kākahu in Northland, California quail feathers have been identified in at least two cloaks listed in the International Register. One Te Papa Museum kākahu (ME014329), and an Auckland War Memorial Museum cloak (Ethnology No. 813).

The kuaka or bar-tailed godwit (*Limosa lapponica*) is another bird synonymous with the far north. Recently Northern iwi, Ngāti kurī made a kākahu of kuaka, kiwi, and kukupā feathers, that was worn at a graduation ceremony in the United States in 2006.[10] Parata (2017) listed these long-distance flyers as another bird that was used in kākahu for Ngāti Wai, and also by Te Aupouri (an iwi in the far north):

> "We used to do all sorts of birds .. even kuaka, …the godwit… Well you know that's how the kaumātua… had taught us, .. look you know that that month is where they're going to be, because you can see them even looking out to sea too, and they're just about ready to go, but how you study them is that you look at them in the setting sun and their breast that turns really red … because that's when they're really fat".

[10] https://www.nytimes.com/2006/06/02/nyregion/02maori.html

***Figure 8.36*. Bar-tailed godwit (kuaka: *Limosa lapponica*). Image by No-longer-here from Pixabay.**

Whakataukī (sayings) and kōrero (histories and traditions) revolve around the rare kūaka and their connection with Hawaiki (Fig. 8.36). *Kūaka mārangaranga*, re-enacts the kūaka rising (flying) up one by one when migrating to Alaska in large flocks. It is thought that Kupe followed the flock of birds from Hawaiki to the tip of the North Island, Cape Reinga, this is also why these birds are associated with this area, also known as *Te Rerenga Wairua*, where the spirits of people ascend back to this ancestral place (Orbell, 2003). In the second half of the 19th century, kuaka were common in rivers in Northland, feeding on the mudbanks in large numbers where Māori took them at night and they could be easily shot, and eaten (Hay, 1882, p. 222). By the end of the 19th century in the Bay of Islands, godwits were not common due to the absence of feeding grounds in the harbour (Pycroft, 1898). Currently they are widespread, preferring localities with broad inter-tidal areas and the large northern harbours but are seldom inland (Medway, 2010).

***Figure 8.37*. Fantail (pīwakawaka: *Rhipidura fuliginosa*). Image by LorryM from Pixabay.**

For some iwi in the north, the fantail, pīwakawaka or pīwaiwaka (*Rhipidura fuliginosa placabilis*) is associated with superstitions pertaining to death (Fig. 8.37). This likely evolved from the traditions of the trickster Māui, who was crushed by Hinenuitepō (the goddess of death) when he tried to crawl inside her to kill her to prevent death amongst men, the twittering of birds like the fantail alerted her to his presence and Māui was killed by the goddess (Orbell, 2003, p. 91). In the second half of the 19th century, local northern Māori referred to fantails (waka-waka) as 'atua nuke-nuke' (little spirits), who followed and spied on men (Hay, 1882, p. 227). There were occasions of Māori wearing whole fantails suspended in the ears (Angas, 1979, pp. 74–75). Towards the end of the 19th century in the Bay of Islands, they were still very common (Pycroft, 1898). The kōtare (sacred kingfisher: *Todiramphus sanctus*), is another bird associated with death in the North, as discussed in Chapter Five, the tapu (sacred) relationship of this bird involved in ceremonial human sacrifices in French Polynesia resulted in its generic name, sacred kingfisher. The possible use of blue kingfisher feathers in Polynesian and in a Cook-collected cloaks has been discussed in Chapters Five and Six. In the 19th century kōtare were recorded as very common throughout Northland including the Bay of Islands, sometimes with bright plumage including albino birds (Hay, 1882; Pycroft, 1898).

The beliefs associated with owls were adopted throughout Polynesia in that Hawai'ians also saw owls as guardians and omens, and having a connection to the spiritual world, indicating possible significance in the use of ruru (morepork: *Ninox novaeseelandiae*) feathers in a Te Papa Māori feather cloak (ME011987), as discussed in Chapter Five (Harwood, 2011a, 2011b). Although many people have beliefs regarding owls, they are generally unlucky tidings sometimes pertaining to death (Cielo, 1918, p. 116). As ruru were eaten by East Coast Māori, the meat was kept separate from other potted birds (Best, 1977, p. 332). For Ngāpuhi academic and weaver Maureen Lander the ruru is more of a kaitiaki, maintaining "in our family it's the ruru that might appear when someone dies... it's a messenger" (Lander, 2017). Harris (2017) remembered that the ruru, was also similarly associated with death, and considered a kind of messenger, where it would be "just flying past your path … when you're going somewhere you shouldn't be… just like a warning". The koukou is a northern name for ruru and is also another general name for the male bird, and like the name ruru is onomatopoeic in that it is named from the call of the bird (Best, 1977). Ruru were known for the mournful sounds the bird makes at night (Hay, 1882, p. 220). Most superstitions likely stem from the bird's behaviour of calling and becoming active at night, as well as its unnerving appearance of large piercing eyes that watch its prey with little body movement until its silent flight. Best (1977) retold an origin story given to him by Hori Whiu of Kaikohe, of Māori adopting the stances of the glaring eyes of the owl in the pūkana, fixed on the annoying flittering movements of the fantail in the haka dance (p. 333). Ruru were common in the 19th century in the Bay of Islands and remain so today (Pycroft, 1898; Worthy, 2010d).

***Figure 8.38*. Ōi, Muttonbird, Tītī (*Pterodroma macroptera gouldi*). Collected by Edgar Fraser Stead, 11 July 1929, Plate Island, Bay of Plenty. Gift of EF Stead, 1912-1941. Te Papa OR.002021. CC BY-NC-ND 4.0.**

Harris (2017) cited another important bird for northern Māori, ōi (tītī, muttonbird, or grey faced petrel: *Pterodroma macroptera gouldi*), "you don't see it now, it was mutton bird, you know [it] used to come right into the forest at Omahuta Forest and that's something they spoke about" (Fig. 8.38). They have been found in Late Pleistocene-Holocene North Island fossil and midden sites, and breed on islands, islets, headlands and cliff-tops throughout the north of the North Island (Tennyson, 2010b). In the second half of the 1800s ōi would breed in the furrows far inland in the thousands, where northern Māori caught them at night with nets along the shorelines and cooked and potted them in calabashes for storage in the fat for later consumption or for trade (Hay, 1882, pp. 222–223). Towards the end of the 19th century in the Bay of Islands muttonbirds were still common (Pycroft, 1898). Petrel feathers were fashioned into cloaks in Rapa in French Polynesia, as discussed in Chapter Five.

***Figure 8.39*. Australasian gannet, tākapu (*Morus serrator*). Collected Wakapuaka, Nelson, 1861. Acquisition history unknown. Te Papa OR.014145. CC BY-NC-ND 4.0.**

Lander (2017) spoke of the social importance of gannet (tākapu: *Morus serrator*) and amokura (red-tailed tropic bird: *Phaethon rubricauda*) feather adornment for northern Māori:

> "Taranaki has the toroa [albatross], Tūwharetoa has huia [tail feather]… in the north, when there weren't amokura available then it would more likely be the tail feathers of the gannet that would be used. Worn in a semicircle around the head".

In the second half of the 1800s, huia were not really recorded in Northland, however many seabirds such as albatross, seagulls, penguins, terns and skuas were numerous but not eaten by Māori who caught them for their feathers (Hay, 1882). Towards the end of the 19th century in the Bay of Islands, gannets were very common (Pycroft, 1898). White gannet feathers were characteristic of the Bay of Islands, with a record of northern gannet feathers exchanged for a fine Māori cloak near Thames in the early 19th century (Nicholas, 1817a, p. 398; Salmond, 1997, p. 485). Gannet (Fig. 8.39) and amokura (Fig. 8.40) were both of value regarding hair adornment, as the birds were rarely seen on mainland North Island coasts. Dead amokura would sometimes wash ashore in the North in Spirits Bay or North Cape and northern Māori would also hunt for them (Buller, 1877, p. 219). The red streamers of the amokura tail feathers were particularly important for northern Māori, and were highly sought after and common trade items for pounamu with southern iwi (Buller, 1877). Tropic birds also featured in Hawai'ian feather cloaks, as discussed in Chapter Five.

***Figure 8.40*. Red-tailed tropic bird, amokura (*Phaethon rubricauda roseotincta*). Image by skeeze, 2006, from Pixabay.**

Amokura breed on islands of the tropical Indian and Pacific Oceans, including Lord Howe, Norfolk and Kermadec Islands, with around 30 records from New Zealand, mainly from the north of the North Island, at Manawatāwhi/ Three Kings Islands, where it has been seen ashore, but are rarely seen further south (Tennyson, 2010a). In New Zealand gannet breed on outlying islands from Manawatāwhi/ Three Kings Islands and other outlying islands (Tennyson, 2010a).

8.5 Significance of language, techniques, function, social, and environmental influences

The Pukerātā Marae cloaks have a connection to each other in the whakapapa (genealogy) of the whānau and hapū of the area, and in the cloak materials, techniques, and design elements in their production. These kākahu are treasured taonga tuku iho that have been retained, maintained, restored, safe guarded, kept, and used to be talked about for generations to come. The naming of marae kākahu like 'Rangiheketini' and *he korowai tāwhito* expresses an inherent acknowledgement of the history and connection of these taonga with tūpuna, events, and weavers. Other cloaks in the International Register featured important names and titles such as the beautiful kahu kiwi named 'Piata' from Pōrangahau in Te Papa (ME011807); and a kahu kiwi (1981/81/1) 'Pū te kōmuhumuhu' from Te Arawa in the Waikato Museum. Weavers including Ursula Hampson, the Ashby and Rountree (Raunatiri) whānau along with other marae members had formed regular weaving groups that restored and preserved the marae kākahu, maro (waist garments) and lashings of the waka (canoe) housed at the marae. With the pā harakeke (flax plantation) located at the back of the marae, and local knowledge and skills from local weavers such as Toi Te Rito Maihi, and Te Hemo Ata Henare these traditions have continued ensuring the survival of the marae taonga.

One unique quality of these extraordinary kākahu was the golden muka derived from a unique method of hāro (scutching) of the flax and controlled softening technique that produced a lustrous muka comparable to the prestigious kaitaka cloaks of the 19th century. Henare (2017) observed that the hāro technique in the kākahu was akin to the weaving style of the late Ursula Hampson, who had continued these traditions:

> The technique is "just a hāro but she [did] it harder, she just [got] the flax, [put] it on and she [scraped]. She [scraped] it off and those [Pukerātā Marae] kākahu that are out there were made like that. That's why I really treasure the techniques that Ursula [used] because I know that once upon a time that's how it would have been done….it was about function, purpose more than anything."

The feather attachment techniques of the Pukerātā Marae cloaks reflected museum collections of kākahu made after 1800, in that spaced double pair twining was the prominent method for cloak production and repairs were implemented using hand and machine sewing techniques. The unusual designs in the kaupapa of two of the Pukerātā Marae cloaks (Nos. 4 & 5) were created using undyed and dyed muka weft elements separate from the warp foundation, and closely twined to create triangular or diagonal patterns (Figs. 8.21 & 8.24). Instead of using the standard spaced interlocking double pair twining as seen in the kaupapa; or geometric coloured wrapped twining seen in tāniko cloak borders. Instead, some threads (aho) were interlaced around several whenu (warps) in places, with the aho appearing to skip a number of whenu at a time (Fig. 8.23). When done intentionally, this technique of missing and covering several warps, was akin to twilling, a substitute for tāniko and was only achieved by the most experienced weavers (Fig. 8.41) (Blackman, 2011, p. 90).

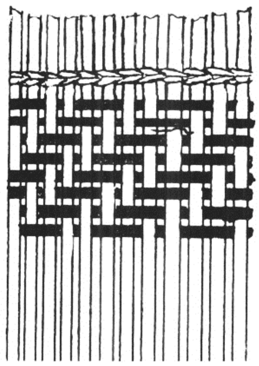

Figure 8.41**. Twilled-two weave technique. From Hīroa (1925a); [Fig. 36], After Ling Roth.**

The two Pukerātā Marae cloaks (Cloak Nos. 4 & 5) with distinct twined geometric designs in the kaupapa have inspired past and contemporary local and national weavers including Te Hemo Ata Henare, Toi Te Rito Maihi, and Maureen Lander (Figs. 8.21 & 8.24). At the time of her interview, Maihi (2017) was compiling research on these Marae cloaks, particularly the two kākahu with unique designs in the middle of the kaupapa. When Maihi (2017) first saw the korowai whakahekeheke with kiwi feathers (cloak No. 4) (Fig. 8.21) she recalled her reaction:

> [I thought] "Wow that's special, I've never seen anything like that before, and so we seem to have our own, like there seem to have been families that wove but they weren't too well known. "Like they [kākahu] weren't given to museums or anything, they were kept in the family… absolutely... You'd marry somebody and they would bring their patterns with them".

The korowai whakahekeheke (cloak No. 4) (Fig. 8.21) is well known amongst the wider New Zealand art and weaving community. Renowned master weaver Diggeress (Digger) Te Kanawa (Ngāti Maniapoto) was also fascinated by the unique technique when she visited the marae in the 1990s. According to Maihi (2017), Digger was told by her mother Rangimārie Hetet, "you will do only the raranga patterns of our hapū". Digger offered muka from Te Kūiti in exchange for the close study of this unusual weaving method (Maihi, 2017). She replicated some of the techniques in her version of the cloak *Kohikohingā Rau Manu Me Ngā Tāniko,* that she completed in 2002, it is currently held on loan in the Waikato Museum (L2004/1/1), and was made of muka, kukupā, kākā, and pūkeko feathers and dye, with small diamond shaped motifs decorating the kaupapa (Evans & Ngarimu, 2005; Lander, 2011, p. 70).

Northland born sculptor Chris Booth in turn was inspired by Digger's reproduction of the weaving designs, and created a protective woven pebble cloak called *Te Kahu o Papatūānuku*, part of Ngā Uri o Hinetuparimaunga artwork at the entrance to the Hamilton Gardens in the Waikato in 2005 and included geometric patterns of nihoniho, poutama, and tōrakaraka.[11] This kind of appropriation was acceptable in Māori Society, where reproduction was seen as a form of flattery and appreciation of skilled workmanship. While some patterns explicit to weaving whānau were fiercely guarded, others were admired and shared amongst and between communities in the form of tāniko samplers or in kākahu, and it is one reason why trying to provenance a kākahu based on tāniko or cloaks designs may be interesting but challenging.

[11] https://www.chrisbooth.co.nz/works/nga-uri-o-hinetuparimaunga-2005/

The unique twined geometric patterns in the kaupapa of two Pukerātā Marae kākahu (Nos. 4 & 5) were not recorded in any other cloaks in the International Register, to date. Mead (1968) noted that some kākahu made in the Modern Māori period (1900-present) featured tāniko designs across the body of kākahu in Rotorua (p. 42). In the International Register a cloak located in Kauri Museum Matakohe in Northland (1995.619) had ostrich feathers and tāniko bands inserted across the cloak (see Chapter Seven). Tāniko bands have been added to the kaupapa of other museum cloaks as surface decorations in the Fowler Museum Los Angeles California (X65.8014); in Te Papa (WE000471), and British Museum London (Oc,NZ.135).

***Figure 8.42*. Kahu huruhuru (feather cloak). Muka, wool, chicken, pheasant, peacock, kākā and helmeted guineafowl feathers; twining, twilling. North Island. Purchased 1979. Te Papa ME014164. All Rights Reserved. Right: detail of twilled chevron designs along baseline. Image by Hokimate Harwood, 2010.**

Twilling and close single pair twining could be earlier forms of traditional tāniko, the technique of using coloured wrapped weft twining to form geometric patterns in cloak borders (Hīroa, 1926, p. 221; Tamarapa, 2011, p. 189). Twilling is thought to be an older method of raranga (plaiting) and is defined as an interlacing of threads with progressive floats in loom weaving, where the crossing weft intersects over and under more than one warp (Hīroa, 1924a, p. 41; Hīroa, 1926, p. 101; Tamarapa, 2011, p. 119). Twilling has also been documented in historic native North American basketry (Morris, 1986; Tanner, 1982). In twilled cloak weaving each half turn of the two-strand weft encloses two or more warps, if the same pairs of warps are taken in successive rows, the ridges on the outside run vertically as in plain weaving, whereas in diagonal twined weaving, the same pairs are not taken throughout but in the next row a warp from two pairs above are combined into a different series creating angled patterning (triangles) (Hīroa, 1924a, p. 44).

The International Register listed cloaks made after 1800 with dark herring bone twill with chevron designs in the bottom borders of a Te Papa feather cloak (ME014164) (Fig. 8.42), and a kahu kiwi in Pitt Rivers Museum, University of Oxford in Oxford, England (1891.50.1) (Hīroa, 1926, p. 98; Roth, 1923, p. 87). These designs were also observed in horizontal bands across a kahu kiwi in the Museum of Archaeology and Anthropology in Cambridge (1952.375) (Blackman, 2011, p. 90). Another interesting tagged cloak (No. 28) in Cambridge (E 1907.596) also appeared to have a twilled bottom border (Roth, 1923, pp. 80–81; Hīroa, 1926, p. 98).

Other rarely recorded behaviours and techniques employed by weavers were observed in the Pukerātā Marae kākahu, in that several feathers were woven in backwards in the kahu kiwi (No. 6) (Fig. 8.9). This finding could potentially lead to further associations with other kākahu by the weaver, Anitanaha Piripi. This phenomenon was first published in the feather identification of Māori cloaks in the Te Papa collection, conducted in 2007, where at least three Te Papa cloaks showed this kind of technique, possibly as a kind a mark from the weaver (Fig. 8.10) (Harwood, 2011a, p. 135). Most cloaks have the feathers woven in at the feather base, with the tip facing out. There is no functional or aesthetic justification for this as the tip is substantially thinner and weaker than the base of the feather.


***Figure 8.43*. Kahu kiwi (kiwi feather cloak). Muka, dye, brown kiwi, pūkeko, kererū, kākā, kea takahē, weka, and spotted kiwi feather; twining, tāniko and māwhitiwhiti. Made by Erenora Puketapu-Hetet (Te Ātiawa, Ngāti Puketapu) in 1996, Wellington. Purchased 1998, with New Zealand Lottery Grants Board funds. Te Papa ME016788. All Rights Reserved. Right: detail of feather woven in at the tip. Image by Hokimate Harwood, 2010.**

Since 2007, the cloaks listed in the International Register in which this behaviour was recorded, dated from the mid to late 19th century and in contemporary cloaks, and do not appear to be associated in terms of provenance. One is a beautiful kahu kiwi made in 1996 by Erenora Puketapu Hetet (Te Ātiawa, Ngāti Puketapu) (Te Papa ME016788), where a single brown kiwi feather woven in backwards was identified in 2010 (Fig. 8.43) (Tamarapa, 2011, p. 13). A korowai whakahekeheke (Te Papa ME023834) using a single brown kiwi feather woven in backwards was identified in 2008, and had no recorded weaver or locality information, except that it was a gift from the family of Prime Minister Richard Seddon (1845-1906). Similarly, a korowai kārure (Te Papa ME015349) had numerous feathers woven in by the tip, and another kākahu identified in 2009 had at least three chicken feathers woven in backwards (Te Papa ME013119). A kahu kiwi from Rotorua in Otago Museum, Dunedin (D19.173) had one kiwi feather woven in at the tip. Much like hidden or contrasting feathers in cloaks, this was likely an intentional practice by weavers, and probably not discussed or recorded in written form. It is difficult to ascertain how long weavers have been incorporating this aspect of feather use, a closer inspection of the cloaks in the International Register, particularly those with kiwi feathers, could determine whether this practice was an anomaly or ubiquitous.

The Kaikohe Ecological District covers 62,800 ha in the north, the southern sections of Puketi Forest, with Lake Omapere located towards the centre, Waimā River in the west, Pakaraka in the east, and in the south it covers Punakitere Valley to Lake Tauanui (Conning & Miller, 2000, p. 11). The climate is mild, humid, and generally windy with an average rainfall of 1766mm per year, mostly in winter, and a mean annual temperature of 14.7°C (Conning & Miller, 2000, p. 17). Northland has some of the highest temperatures in New Zealand, one of the possible reasons for limited records of feather cloaks in Northland, much like with the Hawai'ian and Tahitian feather cloaks discussed in Chapter Five. In that in warm climates or seasons, traditional feather cloaks served as prestigious wear, rather than protective clothing against the cold. In historical South Island cloaks, they functioned as formal attire as well as protective and warm clothing, as discussed in Chapter Six.

Access to birds can impact on the number and types of feathers used in a cloak, and how the feathers are incorporated into a contemporary cloak (Taituha, 2014; Te Kanawa, 1992). Feathers of uniform shape, size, and colour were traditionally bunched together, where brown kiwi, weka, and pūkeko needed to have three feathers bunched together for the required thickness, whereas pheasant, fowl, pigeon, and duck only required two feathers bound together (Te Kanawa, 1992, p. 26). Before native bird access was restricted through law, weavers had the pick of the most desired birds and feathers, where up to 4-6 feathers would be bound together (Te Kanawa, 1992). Other factors that influenced bird and feather numbers, were the intended size of the cloak, the number and length of the whenu (warps); the number of feathers secured to each whenu (whatu); the number of feathers on each row and the number of rows with feathers; and finally the design or layout of feathers on the cloak (Taituha, 2014). Te Kanawa (1992) suggested that bands of feathers in cloaks could use up to four birds, with full feather cloaks requiring at least 12 birds. Twined full kiwi feather cloaks that appeared more uniform in colour usually incorporated the back feathers, and hence required more birds, in that up to 40 kiwi were sometimes used (Buller, 1888, p. 105; Henare, 2017; Hīroa, 1911, p. 84). Today, weavers contact the Department of Conservation to acquire native feathers for cloaks.

Kevin Prime chaired the now disestablished *Te Pātaka Kōmiti o Te Tai Tokerau*, the cultural materials committee that was a subsidiary of the Department of Conservation (DOC) for areas of Northland. They functioned as an iwi-led group from different northern rohe (regions) to monitor and disseminate materials such as wood, bones, and feathers for use in taonga, such as whales and whale bones for carving protected under the Marine Mammals Act (1978), and birds and feathers for kākahu, protected under the Wildlife Act (1953) (Miskelly, 2014). Applications to use taonga species initially came through the Pātaka, who through an interview and selection process decided whether its use was justified. Mita Harris (2017) formerly of DOC, clarified that the "Pātaka would hear them and .. would decide and give advice to DOC". The Pātaka organised wānanga (meetings) in the North to pluck kiwi killed by dogs, and dog training days in which dogs were certified as having trained for kiwi aversion (Prime, 2017). Dead native birds were usually allocated to local hapū first via the local DOC area office, where the bird comes from, then if they were not needed other applicants were considered (Prime, 2017). Te Hemo Ata Henare (2017) indicated "that was the kōrero [discussion] and so they established it so that our people could retain them [taonga species] and utilise them here. And then it was really just to be the keepers ….. until our own hapū and iwi were ready to take back ownership", it was "about giving back those taonga [species] to them for them to take responsibility". Mita Harris (2017) understood that the Pātaka finished around 2010-2011, and now it is the Māori section of the DOC that handle these applications.

Prime (2017) conceded it was not necessary to expect to use native materials in taonga, stating:

> [I wouldn't] "want a kākahu made from kiwi or pigeon and that, because I felt they are really restricted. Our mātua tūpuna [ancestors] were very adaptable… I am personally not one that believes in using a lot of the so-called cultural materials just because of that. Understandably I think if they died, done their time but I wouldn't go out of my way just to kill birds to get the feathers to make a kiwi cloak. I'd rather we got common birds. There are lots of common

> birds. If we killed birds for kākahu we wouldn't have any birds left, [it was about] making use of all the resources. I think we've got our reason for maintaining our culture but you can still adapt to the new technology, the new time, I think .. Māori learnt a good lesson when the moa [Dinornithiformes] got wiped out.….that's when more of the conservation ethic of Māori started coming through. This .. kaitiakitanga [guardianship]. Looking after the water, looking after the land. Looking after nature. It's all changed quite a bit".

Prime (2017) stated "We [the Pātaka] only gave feathers for repairs, I don't think we approved for full cloaks, you would need about 14 kiwi to make a full cloak, kahu kiwi, that's not even a full one. That's a lot of birds to provide them. We used to just approve them for repairing kākahu rather than any new ones". Kiwi feathers have unique qualities that are unlike other native and introduced birds. Te Hemo Ata Henare (2017) recalled they were preferred by northern weavers too, "the biggest feathers are here in Tai Tokerau [Northland], used to be". It would seem the three Pukerātā Marae cloaks with kukupā (kahu kukupā) and kiwi are the dominant native species (Nos. 4 & 6), were likely made in the 19th century when these species were still relatively common, and the introduced species like chicken, pheasant, and peacock incorporated when numbers had declined and the birds were protected.

Another aspect of the relationship of northern iwi with native materials came from Hori Parata (2017) who believed that each rohe of the north should have their own say in how the resources are used. That if necessary individual iwi or hapū and the Department of Conservation have their own direct discussions regarding what originates from the rohe of iwi and how, when and by whom it is used (Parata, 2017). That the Department should let Māori know as soon as the species are available, particularly birds, so they are still fresh and the feathers are in a viable condition for processing (Parata, 2017). Ngāti Wai started a kaupapa where they "were teaching .. young woman how to skin those birds, ….so that the feathers .. are still on the skins and they are .. done properly so that they can be .. stored away" (Parata, 2017). This skinning technique is used amongst weavers across New Zealand today, in the past when weavers did not immediately require certain feathers, the birds were skinned, and feathers plucked, and used later. In terms of direct local iwi access to birds, Ngāti Wai "started developing protocols, so just like our whale protocol, our kiore [Māori rat: *Rattus exulans*] one, and those sorts of things, so we developed protocols around it ourselves" (Parata, 2017). Parata (2017) recognised the last of the kuia still alive to carry on the traditions of kākahu did so out of a love for the weaving and in contributing to the community, "and they didn't do it like a protest, they did it because it was a way of life".

In Ōtākou (Otago), southern Kāi Tahu (Ngāi Tahu) have a similar body working in conjunction with the Department of Conservation in the implementation of disseminating taoka (taonga) species. *Te Kōmiti Taoka Tuku Iho* in Ōtākou consists of members of the Dunedin City Council, Department of Conservation (DOC), Te Rūnaka o Ōtākou, and Otago Museum, and an independent member. The Ōtākou group, much like *Te Pātaka o Te Tai Tokerau*, was responsible for deciding what individuals and kaupapa (projects) were supported. The exception is that under the Ngāi Tahu Claims Settlement Act, Ngāi Tahu do not require an authority under the Wildlife Act 1953 to hold dead or parts of taonga species, just that applicants prove they are registered iwi members through the Rūnaka (Rūnanga).

Iwi have different names for local birds that relate to their whakapapa (genealogy), calls, appearance, age, sex, and behaviour (Best, 1977). In that many New Zealand native bird names have whakapapa (taxonomic) links to birds in the Pacific that Māori have adapted for use in Aotearoa, as discussed in Chapter Five. The common usage of the term korowai to describe any Māori cloak possibly originated from the 18th and 19th century, when inland Māori owned or wore a korowai that was a beaten and washed comfortable cloak worn daily and sometimes adorned with tags, feathers, and wool. Like most other iwi weaving communities, pā harakeke (flax bushes) and pā paru (mud sites), were known and protected from external users. Northern dialects refer to harakeke as kōrari (the flower stalk in the centre of the plant). The northern terminologies and techniques for muka processing and weaving is also locally specific. For example, to "hāro [scutch/ scrape flax] up here is to soften, not to extract [the muka]", informed Henare (2017). Henare (2017) also relayed weaving techniques:

> "The fact that we, when we're ready to tāpiki [cast off], or tapiu we call it, the top of our kākahu we start from the centre, cross it over and then take it out. Well it makes …sense. You just carry on and make your handle or your strap…, a lot of it's common sense. I would always thank Nana Puhi Brown [Hoterene] cause you know she doesn't call takitahi, takitahi, she calls it mautahi [one over, one under twill]. Takirua is maurua [two over, two under twill]. Whakatūtū is rangatū [to pile or stand up]. So I came home and was very, very fortunate to have someone, at least one person that could talk to me about that stuff. We weren't slow in going away to learn it and then bring it back".

Based on the International Register, Ngāpuhi weaving is under-represented in museum cloak collections. Expeditions in the early 1800s recorded Māori from the Bay of islands, fifty or more together, on waka, travelling to the South Island, sometimes for war, but to also trade in ‘mats’ (cloaks) and weapons for pounamu (Hamilton, 1972, p. 15). Despite records of Ngāpuhi feather cloaks in the early 19th century, much of the first half of the century was occupied by the inter-tribal musket wars. One of the first instances of muskets in Māori warfare was observed between Ngāpuhi and Ngāti Whātua in 1807, and Ngāpuhi Rangatira Hongi Hika returned from England and Australia in 1821 with 300 muskets (Belich, 1996; King, 2003; Sissons, Wi Hongi, & Hohepa, 1987, p. 12). The second half of the 19th century dealt with European and land ownership issues. Ngāpuhi had the largest contingency of chiefs to sign the Treaty of Waitangi in 1840, with 43 signatories (Belich, 1996). After Hōne Heke’s 1844-46 rebellion, there was continued resentment towards Governmental land policies and settler attitudes, in the Hokianga European settlement increased in earnest after 1870 with Māori owned land designated and sold for European settlers (Hohepa, 1964). From the 19th century, Māori subsisted on agriculture, hunting, orchards and trade, where bacon and bully beef, mutton and goat, subsidised with fish and birds were likely important in the Northern diet going into the 20th century (Hohepa, 1964; Prime, 2017).

While it is common knowledge that Māori traded and gifted kākahu, it is rare to have such events documented for taonga, resulting in the origins of such cloaks forgotten, lost or misplaced. Henare (2017) was aware of an example of Māori trading feather cloaks in the North in the 1800s:

> One cloak belonged to a family whose ancestor was a whaler, who exchanged items with Māori from his ship at “a whaling port … called Whāngāmumu [Cape Brett] and apparently he traded a cloak, taiaha, and a tewhatewha [weapons]. [The cloak] .. has wool in its border, so it’s kiwi feather, full kiwi feather, the border is only that wild pigeon, .. kukupā, and there’s wool in the top of it. So, he traded with these Māori…whatu kākahu [woven cloaks]…. a full kiwi feather cloak”.

The Pukerātā Marae cloaks have been worn at Waitangi celebrations and used for tangi, weddings, graduations, family, and marae events. Mead (1969) addressed the use of cloaks at tangihanga (funerals) in that kahu kiwi were the most esteemed, then other feather cloaks, then korowai (p. 196). In the north, special cloaks are used, such as kahu tukutuku, a cloak which is circulated around members of the whānau and brought out whenever a death occurs (a practice followed by Te Rarawa and Ngāpuhi) (Mead, 1969, p. 196). Harris (2017) related that his whānau would use a kākahu of wool and pheasant for tangi, but that he wasn’t sure whether his area were known for weaving as such:

> "I actually don't think that we were ever weavers, ..I think that would have been the trade exchange … .. they get what's ours. It has to come as a gift from another hapū".

Old cloaks were often replicated, repaired, re-used or re-purposed to decorate other kākahu or taonga. Henare (2017) offered her thoughts on replicating older works:

> "I think that would happen quite a bit with replicating, especially if it was degrading or…if they couldn't replace it, it must have happened quite a bit. I've seen a lot of tāniko at Waimā [Hokianga] but they went right away from [digressed] making anything traditional, with traditional materials….you utilised whatever you had".

There were also accounts of how kiwi feathers would detach and fall off an old feather cloak and the feathers would be added onto other new or contemporary taonga (Henare, 2017). This serves two functions, in that it continues the mana (status) imbued in the kiwi feathers from the initial taonga, that is then transferred to the new piece, and two, that kiwi feathers are limited that being saved and re-used is sometimes the only means of working with these feathers. Digger Te Kanawa also practised this with her kākahu (Te Kanawa, 1992).

Practitioner Dante Bonica (2017) has repaired and replicated taonga in museums, "just to complete the look of a piece which, perishable parts … or detachable parts of it weren't there". Replication can preserve the original taonga, in that the techniques are learnt and relearnt, and a copy that can be used in its place, protects the integrity of the original piece. It aids in our understanding and knowledge, where we study, discuss, and rebuild it for future generations to appreciate. Hīroa (1926) stated that "when ancient craftsmen have passed, theoretical reconstruction in a museum has to be attempted. When the craft is a living one, museum studies, as valuable as they are, must be checked by the results of field work" (p. xviii).

Repair and replication of a piece of valued or favoured clothing is not unusual and not a modern concept as seen by the few but significant pieces of historical (pre-1800) feather cloaks discussed in Chapter Six. It is thought that garments of the Strath Taieri pieces (D10.172, D10.172A and B, D10.173) in Otago Museum were well worn and repaired or added to at times (Simmons, 1968, p. 7). The replica of the Lake Hauroko feather cloak in Otago Museum (D96.106) made in 1967 by local weavers and museum staff has facilitated valuable research into historical Māori clothing. Most importantly it mitigated continued access and study that may compromise the cultural integrity or tapu (sacred nature) of the burial site and contribute to further material degradation.

8.6 Discussion of current Iwi relationships with birds, kākahu, taonga Māori, and museums

In Māoritanga, all birds have significance (Parata, 2017). The importance of each bird has changed at different times and locations. Upon arrival in Aotearoa, Māori would have relied heavily on a variety of birds for food and feathers for decoration. Lander (2017) reiterated this importance:

> "I think they were all of significance, symbolically, and you probably see that reflected in the wero [challenge], with the darting movements. The person issuing the wero becomes bird-like…and the wearing of the feathers is a part of that. The movements are part of that".

Parata (2017) felt in the past, Pākehā have misled Māori regarding access to resources, and have failed to provide Māori with all the information to make informed decisions. That the Wai 262 tribunal claim was important because it encompassed the relationship of Māori to the environment but also to our world in general including whakapapa, language, intellectual property etc. and empowers Māori to return the mana (authority and pride) back to the tūpuna (ancestors) (Parata, 2017). It is acknowledged that not all Māori and Pākehā have corresponding conservation ethics, but that in order to have some say in the management of resources Māori and Pākehā do need to sometimes work with the Government (Harris, 2017; Prime, 2017).

Māori envisage rights as kaitiaki under the Treaty in the preservation and care (management) of taonga and resources (Beverley, 1998; Kawharu, 2000; Smith, 1994). In 1991 a group representing several iwi lodged a claim with the Waitangi Tribunal known as the Wai 262 claim, often referred to as the "flora and fauna claim". It acknowledged the place in contemporary New Zealand life where core Māori cultural values are acknowledged such as the obligation of iwi and hapū to act as kaitiaki (cultural guardians) towards taonga (treasured things) such as traditional knowledge, artistic and cultural works, important places, and flora and fauna that are significant to iwi or hapū identity (Williams, 2001; Wright, Nugent, & Parata, 1995; Young, 1995). Its specific concerns addressed the protection, control, conservation, management, treatment, propagation, sale, dispersal, utilisation, and restriction on the use and transmission of the knowledge of New Zealand's indigenous flora and fauna and the genetic resource contained therein (New Zealand Conservation Authority, 1997). In the 2011 Wai 262 Waitangi Tribunal Report, access to and the protection of taonga species such as harakeke is debated under the notion of kaitiakitanga (guardianship). The 2011 report was created in response to Māori claims of governance and policies that protect, conserve and at times restrict access to New Zealand flora and fauna for iwi Māori. In that access to protected native birds under the Wildlife Act 1953, (Section 61(4)) for weaving is deemed a localised resource management, and dependent on the discretion of the local Officer or Ranger working on behalf of the Government, Department of Conservation.

Co-management of land and resources as stated under the Wai 262 Treaty claim would facilitate a re-establishment of how Māori relate to the landscape and birds (Harmsworth & Awatere, 2013; New Zealand Conservation Authority, 1997) and would resolve some of the often conflicting dichotomies of Māori access to scientific data and conservation management programmes (Kansa, Schultz, & Bissell, 2005). Customary Māori bird use is a polarising issue in terms of traditional harvesting rights versus the preservation of threatened species, particularly in the North for kukupā and kuaka (Barber, 1995; Feldman, 2001; Kirikiri & Nugent, 1995). In the Motatau area, between Kaikohe and Whāngārei, kukupā numbers are expected to increase from joint conservation management between Ngāti Hine land-owners, the Department of Conservation, and Landcare Research (Harmsworth, 2005; Harmsworth & Awatere, 2013; Innes, Nugent, Prime, & Spurr, 2004). Rakiura iwi of Stewart Island, in conjunction with University of Otago scientists initiated a project to sustainably harvest tītī (muttonbird: *Puffinus griseus*) for future generations. The project, *Kia mau te tītī mo ake tonu atu*, uses western science and traditional ecological knowledge to manage and utilise this important traditional food source for Rakiura Māori (Lyver & Moller, 1999; Moller, 1996; Moller et al., 2000). Often such combined projects demonstrate the dynamic synergies of understanding the importance of traditional and contemporary Māori knowledge in the natural environment and fulfil both Māori and Western aspirations.

The Waikato, Taranaki, Whānganui and particularly Bay of Plenty - East Coast areas were well represented in cloak provenance records for the cloaks collated in the International Register. The feather identification of the Te Papa cloaks recovered unrecorded information about weaver markers (Harwood, 2011a, 2011b). Further examples of forms of communication in kākahu that add to this research can be found in Chapters Six and Seven. Recording and sharing the knowledge and kōrero (stories) about kākahu and kairaranga (taonga and practitioners) between Māori communities and public museum collections could potentially unlock previously unrecorded and unknown information. Therefore, regional weaving knowledge is also paramount in understanding the hundreds of kākahu in museums to attempt to recover iwi connections.

Rangimārie Hetet (Ngāti Maniapoto), and her daughter Diggeress Te Kanawa, and those who learnt from them to some degree, use a distinct variety of harakeke (muka), and processing style along with a technique of weaving that can be seen in their kākahu in museum collections listed in the Waikato Museum, Kāwhia Regional Museum and the kahu kiwi woven by her daughter in-law, Erenora Puketapu Hetet at Te Papa (ME016788), some of which are listed in the International Register. The style is elegant, understated, and meticulous, and most importantly unique to them. Henare (2017) acknowledged a Ngāti Whātua weaver, Puhi Brown (previously Hoterene) as one of her teachers:

> "The techniques have been passed on to me through kuia from Ōrākei [Auckland], from Ngāti Whātua which initially came from the Kaipara, and my learning was a little bit different. [Puhi] is the weaver at Ōrākei marae…. [and] the techniques that she used were taught to her by Rangimārie Hetet…in exchange for some of her tukutuku techniques. So, the techniques that I've learnt have come from Rangimārie and Digger. Their techniques evolved. Some people never taught outside the family. I just know when I see anyone miro, .. I know that's her, where the technique came from [Rangimārie]. Someone was taught by someone, who taught [someone else] ..and it's just carried on. And her [Puhi] techniques evolved, so the techniques have evolved. So, having learnt from this kuia from the Kaipara after 25 years I came home. And she's slowly losing the use of her hands ….she's probably the closest thing personally, resource, to anything from the past when it comes to raranga [weaving]".

Weavers and kākahu that have specific techniques and patterns are generally known amongst the iwi and hapū. Maihi (2017) when questioned on this topic related a story of when she was at Queen Victoria School in Auckland and they were asked to design their tāniko bands:

> "So there were 80 girls and there were 80 different designs… we did not have the same design. Everybody had a design according to their whānau, their hapū. Also, Rangimārie [Hetet] was saying not to learn your pattern outside, you keep it to yourself, it's almost like it has its own kōrero. Because they would know why they have done it like this".

Feathers woven in backwards could potentially recover provenance in museum cloaks if they are specific marks left by weavers. Weavers also unconsciously leave a tell in their weaving that forever connects them to their work. For example, as weavers, both Lander (2017) and Henare (2017) indicated that the cloak neckline or collar where the weaver casts off (finishes), is generally very unique and specific to the weaver, and while no two kākahu will be the same, some materials and (or) techniques are generally repeated in the same manner by a weaver. Henare (2017) provided more detail stating that she wasn't aware that she incorporated a "marker" in her work, however she referred to this casting off at the neckline, that is apparently quite unique to some Northern weavers:

> " I don't add anything, but that whole, the top, .. when you're casting the top off there's always that [technique] ..I quite like it because it's regal.. how it comes from the middle out… the tapiu, or tapiki.. when you cast off, you cast off from the centre and you go out.. and you can actually build it up so you've got a kind of ..collar ..when you use that technique ..and I really like doing that. Our rain capes are done like that".

Weavers would typically cast off (finish) from the bottom left hand corner moving across to create a neckline using remaining and sometimes additional or coloured whenu (warps) as adornment, often creating a plaited collar, and the ties added separately later. That this technique of casting off at the middle of the neckline is specific to the north could be used to identify northern cloaks in museum collections.

Written records of possible carver and weaver signatures are uncommon, this topic was rarely discussed amongst communities, so was not readily accessible. Bonica (2017) relayed possible artist markers in the form of a lizard on a facial tā moko (tattoo) on a toi moko (preserved head); and a person's raparapa (house barge board) carving from the 19th century. Specific carving styles have often been traced to an area and or carver (Brown, 2003; Day, 2001; Ihimaera & Ellis, 2002; Mead, 1990; Neich, 2002, 2004; Ngata, 1958).

Northern iwi have strong associations with artforms such as carving and weaving (French & Hakopa, 1993; Tewhata, 2013). Yet, this knowledge is often under or misrepresented in the records, literature, and museum collections, with less than 10 (of c.600) cloaks in the International Register with recorded provenance to Northland. The kahu kiwi in the Te Papa collection (ME014382) with a possible provenance to Northland was made before 1900. With an unconfirmed locality like Northland, it could suggest that it has a Māori affiliation to this area, or the owner or donor lived there when the museum acquired the kākahu, however verification could prompt major historical northern traditions (kōrero).

Past and ongoing issues with the Government and Museums centre around questionable acquisition methods, care, and appropriate display of iwi taonga (Brown, 1996; Te Awekotuku & Nikora, 2003; Tipene-Hook, 2011). Iwi perspectives are understandably all along the spectrum. Parata (2017) voiced his concern over specific taonga in museums that were taken unlawfully or unethically from his iwi, stating that "we all want our taonga back and we know that some of it was sold to them, some of it was stolen by them". Harris (2017) suggested museums or galleries should provide "a space for Māori practitioners to make, and appreciate, and replicate taonga". Harris (2017) described his involvement with Te Waimate Mission House in Waimate North Kerikeri in that it is a "colonial house and it tells the story .. of colonial history. But it doesn't tell the story of ..our pre-European history, and I thought well if there is a chance that we can do something and how would we do it". Harris (2017) proposed to have a space just for weavers, such as Toi Te Rito Maihi, to work and harvest the harakeke at the Waimate station, "It's just swamp area. It's being planted out and it's got a lot of muka in it, so I said to them they can harvest [it], but I thought even better if we had [an area] where they can harvest and dry it [process it]". This concept was successful at the New Zealand Māori Arts and Crafts Institute (NZMACI) at Te Puia in Rotorua, and more recently for the *Kahu Ora: Living Cloaks* Exhibition at Te Papa in Wellington in 2012, that exhibited the continuing or living aspect of this craft.

Henare (2017) indicated that the role of museums should only be an intermediary function, in which iwi Māori should be legitimately in control of their own taonga:

> "I truly believe that when something is ready to turn to dust then it should be let go. … I love the fact that people can go to the museum and they can view their taonga and that they're still here but we know, .. that it's only been recently that they've been actually taking care of these things. So I would so love it if every rohe [area] could have its own, or every marae could have its own museum or a storage place where they can bring out their taonga and their mokopuna [descendants] can touch them and they can .. be a part of their lives. …. so the whole thing about preserving something … because like anything they have a lifespan and we should allow them to [go]. If they were vessels of knowledge for us we can only learn so much. But where we are continuously as humans learning and that's totally different, but it has another life after this one. That's how I see it anyway".

It is that continued knowledge through kōrero and whakapapa, the learning of techniques and ongoing use and re-use of materials that continues the life of taonga (Tapsell, 1998). According to Henare (2017) most Māori do have a general sense of how to care for taonga to maintain it:

> "I really love that I wished as a child that, because I never went into that room and I remember my tūpuna's whare [ancestor's house] and .. it was kept dark. So, you know there was some, .. in most houses people I know that used to keep taonga like that kept them in a dark place or under their bed. So, in the ideal world yes, every marae should have a little room or whare that they can keep their taonga in and be proud of them and then there's no fighting over them then. Because they often .. get lost. Or the kōrero that goes with them get lost."

The importance of Te Māori exhibition implemented a change towards projects that empowered Māori to participate or contribute to the physical, spiritual, and intellectual care of taonga in museums. Bonica (2017) discussed the handling and study of taonga in museums:

> "I think there needs to be more iwi involved with restoration of taonga etc, iwi talking about their own specific areas, taonga from their own areas, kaitiakitanga [guardianship],… becoming conservators etc. Those examples of information or knowledge potential for re-learning of techniques and processes. A whole library of examples which can be opened out through involvement with the museum, iwi, etc. How are you going to disperse that information? it's about a body of knowledge and how it's curated, .. by Māori. …It's the responsibility of the people who hold that knowledge as to how it is going to be used".

8.7 Current research and future trends regarding kākahu Māori in museums

The connections between source communities, whānau (family members), and taonga are important for museums to recognise. When taonga are acquired for museums, even when provenance is known, it is inevitable that access and use can be restricted. Opening museum doors for whānau, iwi practitioners, and experts visiting museums is one of the most valuable resources in understanding the production of taonga and how they relate to the peoples from which they originate. This requires museum staff resources and time. Some of the interesting work and research on museum taonga is designed around scientific identification of materials and techniques to recover origins. Other projects have evolved from reviewing literature, biographies, and museum collection and historical records including correspondence, catalogue records, literature, photographic and archival records (Harwood, 2014).

The scientific studies reviewed in this chapter were selected to highlight and determine the best practices for recovering the geographic origins of kākahu Māori in museums when provenance is not recorded. The techniques were analysed based on their strength and feasibility as scientific tools and in effectively answering the objective of determining geographic origins of the materials in Māori feather cloaks, and the subsequent interpretation of results.

8.7.1 Digital taonga databases

Māori contentions around kaitiakitanga have derived from the removal of guardianship rights from taonga including te reo (language), the whenua (land), moana (oceans), plant and animal life, and many of the cultural objects in the form of man-made taonga (treasures) and taonga tuku iho, handed down. However, concerns from indigenous communities' stem from past abuse regarding indigenous knowledge, and histories and how the information is portrayed, disseminated, and sometimes misappropriated (Peers & Brown, 2003; Smith, 2012). This continued separation and disengagement can persist as these 'resources' are now the legal property of the Crown, including taonga Māori held in New Zealand museum collections (Tapsell, 1998, p. 174).

International studies have illustrated a change in developing infrastructure to support indigenous knowledge and research regarding museum collections (Stanley, 2007). Of current and future interest for indigenous peoples is that cultural knowledge in the public domain can be managed appropriately (Anderson, 2005; Burri, 2010; Christen, 2005; Nakata, 2002). This is from an international recognition of best practices for engaging with indigenous communities that acknowledges cultural and intellectual property (Janke, 2005; Peterson, Allen, & Hamby, 2008). Digital collections allow communities and researchers to access information from the other side of the world, that can now include recent iwi led research initiatives regarding taonga Māori databases that locate, document, and disseminate information to iwi members (Coughlin & Jackson, 2010; Shahani, Nikonanou, & Economou, 2008). Previous research initiated by Te Awekotuku and Nikora (2003) documented some of the taonga of Ngāi Tūhoe in New Zealand museums. Te Wharepuri is a research library and archive centre that opened in 2014, where

Tūhoe and the wider community can access information, and reconnect with their Tūhoe cultural heritage including showcasing local artists.[12] In Gisborne, the C Company house was opened in 2014 to commemorate the role of the C Company in the 28th Māori Battalion.[13] There is also now an impetus on iwi Māori-led research and digital projects such as Te Aitanga a Hauiti initiated in 2006 on the East Coast in reconnecting iwi, and recovering and cataloguing museum taonga, where digitising this research increased accessibility and dialogue, that operated as a form of digital repatriation (Brown, 2008; Ngata et al., 2012).

The International Register of Māori feather cloaks has facilitated future research initiatives for iwi Māori in which visual and museum record comparisons can ascertain possible associations between kākahu and source communities, weavers, and owners. Already, similarities and connections in cloak materials, techniques and colours and designs, writing, symbolism and hidden or subtle weaver markers have been identified in pre-and post-European cloaks (see Chapters Six and Seven).

8.7.2 Microscopic Feather identification research

Museum bird skins are the most effective source of sight identifications of feathers (Gill, 2006, 2014; Robertson, Harkin, & Govan, 1984). They showcase the differentiation of species based on taxonomy, genetics, morphology, location, age, and sex of specimens. Since the early 20th century, light microscopy has proven to be a valuable tool in designating avian taxonomic classifications (Brom, 1991; Carlisle, 1925; Chandler, 1916; Dove, 2000; Heacker-Skeans, 2002). This method has identified feathers in the areas of forensics (Dove & Koch, 2010); science museum collections (Brom & Prins, 1989); ethnological museum collections (Dove, 1998; Harwood, 2011a; Pearlstein, 2010); archaeological and historical artefacts (Dove et al., 2005; Dove & Peurach, 2002; Rogers, Dove, Heacker, & Graves, 2002); and in ecology and conservation (Day, 1966; Dove, 1997, 2000; Dove & Agreda, 2007).

Dove (1998) and Pearlstein (2010) demonstrated the application of microscopic feather identification to determine the geographic origins of museum artefacts. As discussed in Chapter Five, Dove (1998) identified the red feathers in a British Museum Pacific artefact

[12] https://www.ngaituhoe.iwi.nz/library-archives
[13] 'C Company Māori Battalion Memorial House, Gisborne', URL: https://nzhistory.govt.nz/media/photo/c-company-maori-battalion-memorial-house-gisborne, (Ministry for Culture and Heritage), updated 17-Feb-2017

(VAN 345), a feathered pendent with chicken feathers and red passerine feathers, identified as a Hawaiʻian passerine iʻiwi (*Drepanis coccinea*). The pendent was previously assumed to be from Tahiti, and feather identification verified species and subsequently allocated provenance based on the natural distribution of this species in the Hawaiʻian islands (Dove, 1998). Dove also identified turkey (*Meleagris gallopavo*), in an historical native Californian feather blanket (2004.023.001) in The Agua Caliente Cultural Museum (ACCM), California (Pearlstein, 2010). The historical natural distribution of turkey, a common North American Galliforme indicated the provenance of the blanket was southern Californian (Long, 1981; Pearlstein, 2010). Pearlstein's (2010) methods of detailing and interpreting the blanket materials and techniques verified the production date and location that was previously unrecorded. An acknowledgement of The Native American Graves Protection and Repatriation Act (NAGPRA) legislation passed in 1990, and understanding of the historical context of the blanket in native Californian society enriched the significance of the identification and interpretation of bird, feather, and social use (Pearlstein, 2010).

Scanning electron Microscopy (SEM), similarly illustrates the diagnostic differences in downy feather barbules at higher magnification and has yielded similar effective results recorded by Davies (1970); Reaney, Richner, and Cunningham (1978); and Laybourne et al. (1992). In a collaborative project in England, the Pitt Rivers Museum, University of Oxford in Oxford, and British Museum in London, Scanning Electron microscopy (SEM) was used to identify hair and fibres; and Polarized Light Microscopy (PLM) helped to analyse plant materials in collection items collected during Cook's voyages (Cartwright, 2014). At present, both light microscopy and SEM analyses require detached feathers or feather sections for study.

8.7.3 DNA analysis of feathers

In the last 10-20 years there have been significant advancements in DNA studies on New Zealand birds for conservation purposes (Colbourne, 2005); in the identification and sexing of species (Grant, 2001); taxonomic studies (Burbidge, Colbourne, Robertson, & Baker, 2003; Haddrath & Baker, 2001; Houde & Braun, 1988; Huynen, Millar, Scofield, & Lambert, 2003); and evolutionary research (Baker, Huynen, Haddrath, Millar, & Lambert, 2007; Brooke, 2000; Bunce et al., 2005; Cooper, 1994; Harshman, 1996). Previously, genetic feather sampling consisted of the removal of cells from the base of the feather, or calamus, however it is now possible to identify species from just the feather barbs and shafts, with varying degrees of destruction (Boonseub, Johnston, & Linacre, 2012; Rawlence, Wood, Armstrong, & Cooper, 2009; Speller, Nicholas, & Yang, 2011). DNA analysis has also been successful in determining the origins of museum collections and distribution of species (Barnett, Yamaguchi, Shapiro, & Nijman, 2007; Ross, Arndt, Smith, Johnson, & Bouzat, 2006). Whereas museum collections themselves have been at the centre of analyses in which their use in understanding the genetics of species has been considered (Gill, 2006; Gillette & Bartle, 1982; Guralnick & Cleve, 2005; Leeton et al., 1993; Payne & Sorenson, 2003; Rawlence et al., 2009; Pyke & Ehrlich, 2010). Brown kiwi has been the focus of recent genetic analyses in New Zealand (Shepherd, 2006; Shepherd & Lambert, 2008). The future of recovering the materials and origins of feather cloaks is reviewed here with recent examples that have attempted to provenance Māori feather cloaks (Hartnup, 2012; Hartnup et al., 2008; Hartnup et al., 2011).

One of the most relevant research papers published on the determination of provenance of Māori feather cloaks using genetic markers in brown kiwi was authored by Hartnup et al. (2011). The study incorporated DNA of ancient and contemporary kiwi populations. The researchers acknowledged that most cloaks in museum collections have no recorded provenance, and to rectify this problem, the study attempted to geo-locate the origins of Māori feather cloaks in museum collections by analysing the DNA in the cloak feathers and comparing the DNA to birds from known geographic regions. In this study approximately 1,000 DNA samples were taken from around 100 Māori feather cloaks, predominantly from the North Island, and incorporated the North Island brown kiwi, where 185 current DNA sequences from North Island brown kiwi from 26 North Island locations were used as a reference for cloak comparisons (Hartnup et al., 2011). The genetic material was extracted from the base of the feather, or calamus, and sequences from the cloaks were compared to reference samples from ancient (pre-1800) and current kiwi populations predominantly from throughout the North Island (Hartnup et al., 2011). Cloak feathers were sampled from national and international museum collections including the Museum of New Zealand Te Papa Tongarewa (ME014499, ME015753); Hawkes Bay Museum and Cultural Trust; Auckland War Memorial Museum; Canterbury Museum (2001.169.6, E173.149); Whānganui Regional Museum; Smithsonian Institution National Museum of Natural History in Washington D.C; the British Museum in London, and Horniman Museum (England) (Hartnup et al., 2011). Most of the museum collections containing Māori feather cloaks were produced in the 19th century.

The study found that the kiwi in the feather cloaks originated from Northland, Coromandel, Bay of Plenty, Hawkes Bay, Taranaki, and Whānganui (Hartnup et al., 2011). It was discovered that 15% of the cloaks had haplotypes of mixed origins, in that they contained kiwi feathers from different geographic locations (Hartnup et al., 2011). Kiwi appear to have a high degree of genetic variation in remnant populations (Worthy, 2010b). This is likely due to converging populations overlapping due to reduced habitats. It was concluded that finding various markers for kiwi from different areas in the same cloak suggested trade amongst iwi and adapted human behaviours from extended hunting trips or overlapping tribal areas after inter-tribal conflicts over land (Hartnup et al., 2011). This assumption was considered premature based on inconclusive results (Wehi et al., 2012).

8.7.4 Harakeke, plant material analysis

Based on recent studies, it is accepted that more scientifically robust analyses are required to build a stronger history of cloak origins and eliminate possible bias and inaccurate scientific interpretations of Māori trade, gifting, and hunting practices. Processed harakeke (muka) forms the foundation in which Māori cloaks are produced, and its inclusion in the analyses is therefore also advisable if possible. Māori treasure harakeke as a taonga species by utilising its versatile leaves to create binding, baskets, mats, netting, and ropes (Hīroa, 1923, 1924b; Pendergrast, 1996; Tregear, 1904; Wehi, 2006, 2009). Its use and prevalence in archaeological and ancient Māori burial sites suggests its cultural significance over a long period of time (Anderson, Goulding, & White, 1991; Clarke, Petchey, McGlone, & Bristow, 1996; Hamilton, 1892; Jacomb et al., 2004; Lander, 1992; Smith, 2013). There are several varieties of flax, some are more suitable for cloaks, others for making nets, with the two main types of flax used by Māori recorded as *Phormium tenax* (harakeke) and *Phormium cookianum* (wharariki) (Scheele & Smissen, 2010). Microscopy has proven effective in fibre identification in overseas ethnological and archaeological artefacts (Goodway, 1987). Positive identification of flax is integral to this research and possibly requires combined scientific verification using microscopy and scanning technologies, and weaver knowledge (Bergfjord & Holst, 2010; Carr, Cruthers, Girvan, & Scheele, 2008; Carr, Cruthers, Smith, & Myers, 2008; Cartwright, 2014; Lowe et al., 2010; Smith, Lowe, Blair, Carr, & McNaughton, 2013). Weavers grew their own harakeke for cloaks and they were protected and maintained for generations, however because only certain types of flax were best for cloak production, plants were moved or parts shared and grown in different locations to accommodate weaving communities, therefore making it difficult to trace the original location of cultivars or plantations (Lowe et al., 2009; Scheele, 2005; Te Kanawa, 1992; Wehi, 2006, 2009).

Scheele and Smissen's (2010) study looked at how the identification and DNA analysis of harakeke can trace the plant to a specific area of origin. In the future, the potential for science to help trace the movements and origins of plants in museum textile collections could be invaluable. Scheele and Smissen's (2010) research used samples from the New Zealand national flax collection, known as the Rene Orchiston Collection, located at Landcare Research in Christchurch, Canterbury (Scheele, 2005). It is the largest collection of varieties of New Zealand flax catalogued according to region and is studied and used by botanists, museum conservators, and weavers to better understand weaving and ethnological museum collections containing flax (Scheele & Smissen, 2010). Fifty five samples from the collection were analysed and compared to non-domestic flax samples in order to genetically map their genome as part of a national reference database and assist with flax identification, speciation, interspecific hybridization and tracing the movement and origins of historical flax cultivars (Scheele & Smissen, 2010). The study showed substantial variation within and between species, where the varieties were specific to an area, climate, and soil condition, and that both species of flax (*P. tenax* and *P. cookianum*) had hybridized, or genetically mixed with each other (Scheele & Smissen, 2010). It was confirmed that Māori moved flax cultivars around, so the origins of plants could not be verified using scientific techniques. However, some cultivars were well known to weavers, and their origins confirmed based on long held weaving knowledge and their physical attributes such as plant and leaf colour and shape (Scheele & Smissen, 2010). Less well-known cultivars had not been described in detail and therefore not as easily distinguished as the better-known flaxes (Scheele & Smissen, 2010).

8.7.5 Isotopic analysis

Isotopic analyses have yielded some success and potential in geo-locating materials. Overseas studies on archaeological artefacts have proven that isotopic analysis can trace the origins and movements of materials in metals (Gale & Stos-Gale, 2000; Ling et al., 2014; Mu et al., 2014; Stos-Gale, 1993, 1998); in wood (Hajja, Poszwaa, Bouchez, & Guérolda, 2017; Thomas, Biers, Cadwallader, Nuku, & Salmond, 2017); and textiles (Frei et al., 2009; Frei, Skals, Gleba, &

Lyngstrøm, 2009; von Holstein et al., 2016). Isotopic analysis of the bone collagen in extinct moa has contributed to knowledge regarding habitat, environment, and diet (Holdaway, Hawke, Bunce, & Allentoft, 2011). Isotopic feather analyses in migrating birds demonstrated the ability to trace the chemical elements contained within the feathers and therefore movement in species (Bowen, Wassenaar, & Hobson, 2005; Hobson, Van-Wilgenburg, Wassenaar, Moore, & Farrington, 2007). In theory, these isotopic elements can also be measured in well-curated museum bird specimens and compared to ethnological materials such as feathers in cloaks (Gill, 2006; Gillette & Bartle, 1982; Hobson, Greenberg, Van-Wilgenburg, & Mettke-Hofmann, 2010).

Certain isotopes (Carbon, Hydrogen, Nitrogen and Sulphur) are present in the water bodies along New Zealand's geographical gradient which demonstrate unique isotopic signatures that when ingested by birds can be retained indefinitely in the feathers and therefore used to geo-locate the bird's origins (Rogers et al., 2012). The stable hydrogen isotope (δ^2H) found in feathers and tissues were proven to be a powerful tracer of geographical origins in migrating species by linking the isotope to a specific water body along latitudinal and altitudinal gradients (Rogers et al., 2012). Keratin protein in nails, hair, and feathers has been useful in undertaking analysis on the hydrogen isotope which is metabolically fixed and retains its specific isotopic markers that are unique to the geographic location that the tissue was grown, although it is not as strong in carnivorous species (Rogers et al., 2012). Earlier works have demonstrated some success in New Zealand isotopic studies as effective ecological tools (Stewart, Cox, James, & Lyon, 1983; Nelson, Northcote, & Hendy, 1989; Williams, Holdaway, & Rogers, 2012).

A review of Rogers et al. (2012) assessed the viability of conducting isotopic analysis on feathers of non-migratory New Zealand species, the native tūī (*Prosthemadera novaeseelandiae*) and introduced California quail (*Callipepla californica*). Feathers were acquired from museum birds from known origins collected between 1880 and 2006 from the Auckland War Memorial Museum, Museum of New Zealand Te Papa Tongarewa (Te Papa) in Wellington, and Canterbury Museum in Christchurch, with the objective to gauge geo-locating potential from analysing the Hydrogen isotope present in the water (H_2O) of the bird feathers compared to water bodies throughout New Zealand (Rogers et al., 2012). With the possibility of linking Māori cloak feathers to a geographic area in the future. The analysis was conducted at the National Isotope Centre at GNS in Wellington and proposed several benefits of this research compared to DNA analysis in that isotope analyses can process a large number of samples; it is quicker and more cost effective compared to mtDNA (Mitochondrial genetic) sampling; and that isotopic analysis is location specific, whereas DNA relies on an identifiable group of individuals that have genetic markers that are similar (Rogers et al., 2012). The study conceded there was a need for a strong reference precipitation model to compare isotopes in known bird species to geographic areas, using species-specific isotopic base maps for geographic regions, as well as looking at other isotopes such as Carbon, Nitrogen, and Sulphur that could strengthen further isotopic distribution studies (Rogers et al., 2012). Additionally, it was acknowledged that feeding ecology and bird age could be explored as additional factors in further research before any inference of provenance be made (Rogers et al., 2012).

8.8 Discussion of current and future research trends regarding feather cloaks

8.8.1 Microscopic Feather identification research

Questions surrounding the potential of developing further scientific techniques in the feather identification and provenance of ethnological collections are new, particularly for New Zealand. It is recognised that microscopic identification of feathers can lead to a wealth of knowledge regarding the materials and techniques employed in indigenous artefacts not previously known (Harwood, 2011a, 2011b). While the applied methods for microscopic feather analyses are useful for some species identifications, limitations have been highlighted from the description of New Zealand bird orders discussed in Chapter Two. In that, an entire reference database of feather types from numerous species in a bird order needs to be available for comparison, this is due to the similarities in diagnostic features within and between bird orders of bird groups such as ratites (moa and kiwi), raptors (harrier and falcons), and seabirds (albatross, gannets, tropic birds, etc). The reviewed studies of Dove (1998) and Pearlstein (2010) based feather identifications on comparative analyses in the Smithsonian Institute's feather identification lab. The success of these studies was dependent on extensive reference collections of microscopic feather-down, something that is still not supported in New Zealand museums (see Chapter Two). Feather identification of the turkey in the North American feather blanket successfully traced the origins of the item to California in America (Pearlstein, 2010). Likewise, the characteristic features of i'iwi feather down could differentiate between red Hawai'ian and Tahitian passerines (Dove, 1998). However, similar traces may not be as effective in New Zealand due to the smaller, thinner land mass and cross-over of bird distributions (Robertson et al., 2007). Microscopic feather analyses of New Zealand bird species can ascertain species identification at the least, and geographic location obtained from other scientific analyses.

8.8.2 DNA analysis of feathers

The research conducted by Hartnup et al. (2011) on genetic analysis on New Zealand bird feathers confirmed that DNA sequencing should extend beyond ancient and current bird (kiwi) populations, and conducted on museum bird skins of known geographic origins collected at around the time the cloaks were made, 1850-1950 (Wehi et al., 2012). Then the gene sequences would be comparable between the kiwi in the cloaks and bird skins. Generally, the records surrounding museum bird skins can be well documented including region, dates, species, and sex. Expert knowledge from an ornithologist or bird ecologist would have also mitigated assumptions based on 19th century bird distributions. It is also imprudent to assume cloak provenance based on feathers alone, as cloaks and feathers were often gifted, traded, or sold within and between whānau, hapū, iwi, and non-Māori, which can therefore alter the locality, history and ownership of that cloak. Also, that kākahu are currently in museum collections suggests they were certainly gifted to people outside of their kin and region, putting ownership and donorship under question. DNA analysis has its limitations relating to cost, and reliability on sources that are not contaminated or deteriorated, and analysis on feathers is still in its infancy in New Zealand. Originally, the study had intended to combine bird and muka DNA to geo-locate feathers and the flax to a specific area to reconnect cloaks to their origins, while this is yet to be conducted, future studies could potentially yield interesting findings.

8.8.3 Harakeke, plant material analysis

Scheele and Smissen's (2010) genetic studies on harakeke acknowledged the limitations and possible discrepancies in comparing collection and wild flax populations, finding that some of the populations had different markers within the sample. Additionally, a possibly larger sample of flax needs to be compared against wild and collection plants. The study also showed that some collections had been acquired over the years and documented with inaccurate and incomplete information associated with them (Scheele & Smissen, 2010). Finally, the Landcare collection highlights issues with cross-hybridisation from previous trade and breeding activities over the last 150 years (Scheele & Smissen, 2010). Importantly, the research created new knowledge, and this branch of information undoubtedly enhances our understanding of the genetic significance of harakeke varieties throughout New Zealand. Positively identifying muka (harakeke) in cultural artefacts and accurately providing a detailed catalogue of its uses will be essential in understanding and acknowledging its importance in Māori feather cloak production over time (Cruthers, Carr, Laing, & Niven, 2006; Smith & Laing, 2011; Smith, Te Kanawa, & White, 2011). The next step is analysing the feasibility of extracting DNA from processed harakeke (muka) within cloaks alongside bird feather DNA supporting any possible attributions to an area (Harwood, 2011a; Wehi et al., 2012).

8.8.4 Isotopic analysis

The study by Rogers et al. (2012) showed the need for a robust reference precipitation model to compare isotopes in known bird species to geographic areas before trying to augment the results and allocate locations to known iwi boundaries. The isoscape model should have been comparable to bird skins from the precipitation sites if possible. There is also variation of isotopic properties in individuals within the same population that could decrease the reliability of this tool. The study did eliminate a dependence on DNA based on individual groups, as isotopic analysis is location specific, therefore the movement of individuals due to trading, hunting, or translocation for conservation purposes later in the 1800s is negligible. Also, unlike DNA sampling which would require removing feather samples from museum birdskins, isotopic analysis is not affected by contamination or chemicals from skin preservation methods (Rogers et al., 2012). This study needed to indicate clearer distinctions between geographic areas for both tūī and California quail and required further research that includes a wider range and number of bird species, bird specimens, and sites for comparisons for study strength. Rogers et al. (2012) believed this data can be used with some degree of confidence, and it is possible that this tool has merit. The concession that it was difficult to differentiate between different North Island iwi boundaries is most certainly one of the issues regarding Māori populations, and this study should not have compared the data so early to iwi distribution maps. The interpretation of results should have been left for another paper or for further study. Research on geolocating cloak origins based on the isotopic (elemental) composition of area-specific paru (mud) dye conducted by textile conservator and weaver, Rangi Te Kanawa (Ngāti Maniapoto) and the National Isotope Centre at GNS could be another facet of material analyses in geo-location studies.[14] There is certainly potential for conducting future analysis in this area, particularly if it supports DNA and isotopic analyses of feathers and muka. Preferably it would be conducted simultaneously to corroborate findings.

There is certainly potential for conducting future analysis in any scientific fields, given the research is conducted ethically and appropriately and with integrity that contributes to the knowledge surrounding the taonga and its relationship to the source community. Multi-disciplinary studies conducted in conjunction with or within the same parameters tend to further substantiate findings. Recovering the origins of cloaks is dependent on the components of construction aligned with the Mātauranga Māori, western scientific knowledge, and the history or kōrero (stories) surrounding them. As discussed in Chapter Six, we know that Māori moved seasonally preferring areas of high food resources and temperate climates in which important resources such as seals, fish, birds, cloaks, weapons, pounamu and obsidian were highly valued, and these resources in turn became mobile from human behaviours and were often moved, traded and gifted between areas and iwi (Davidson, 1992, p. 10; Firth, 1959; Hīroa, 1966). A case in point is the waka huia discussed in Chapter Seven that was found in a shelter in Otago with 70 North Island huia feathers, kākā feathers, and tapa cloth currently in Otago Museum, Dunedin (D33.1892a) (Otago Museum, 2006; Phillips, 1963; Rowley & Simmons, 1966; Simmons, 1968). European activities starting in the 19th century have also influenced bird distributions, with declining habitats, birds that were moved or transported to offshore islands, higher altitudes, and increasingly remote areas. Large scale hunting and trade also displaced bird populations, and conservation efforts from official translocations of New Zealand native birds from the 1860s, through to modern breeding programmes permanently relocated birds outside of their historical ranges (Miskelly & Powlesland, 2013). This last point is pertinent in terms of current scientific studies, as traditionally, genetically isolated populations of sedentary birds such as brown kiwi, is the subject of most DNA analyses. Brown kiwi are also the most common species in Māori cloaks according to the International Register and have been transferred and used in conservation and captive breeding programmes since 1863 (Miskelly & Powlesland, 2013).

[14] https://www.gns.cri.nz/Home/News-and-Events/Media-Releases/Prized-Maori-cloaks-to-be-reconnected-to-their-place-of-origin-05-11-2015

8.9 Conclusions

Of the six Pukerātā Marae cloaks with feathers, the most common species recorded was chicken in four cloaks; pheasant in three cloaks; brown kiwi and kukupā in two cloaks; and paradise duck and peacock in one cloak each. However, two of the cloaks predominantly featured kiwi, and one cloak would be classified as a kahu kukupā (pigeon feather cloak). The chicken and pheasant feathers were later additions, probably added to replace native bird feathers that had detached (fallen) from the cloak. The prominence of brown kiwi feathers, kukupā and unique twined designs in the kaupapa and borders of some cloaks, were representative of Northland and the Hokianga. It is thought as close single pair twining, twilling, and tāniko wrapped twining of coloured geometric patterns were all found in pre- and post-European cloaks, they hold a high degree of historical importance in understanding Māori cloak production. More recently incorporated elements such as introduced chicken and pheasant feathers represented the transition from protected native birds in the late 19th and 20th century and how weavers used exotic species to replace native bird feathers. The presence of wool, cotton, and craft threads are European influences, however some of the cloaks possibly date to the 19th century, and because of their age and importance to the whānau and Pukerātā Marae, they have been repaired over time. The incorporation of symbology in the large prominent star patterns in feathers is also not commonly seen in kākahu but can be observed in flags or tāniko patterns, and is also a European influence within a Māori context, to tell a Māori story.

The Pukerātā Marae cloaks represent whānaungatanga (family relations) and are a model example for what can be achieved by marae actively engaging in the management and spiritual, physical, and intellectual care of taonga. The 2012 creation of a Marae taonga catalogue; and the knowledge acquired from oral iwi narratives, and from the imaged and studied Marae kākahu is an important permanent record of mātauranga (knowledge) within Ngāpuhi iwi pertaining to bird use, and cloak production and customs. The recording of iwi knowledge that encapsulates historic and contemporary information, whakapapa, kōrero, and language is increasingly important in indigenous research (Doherty, 2009). The unique fashioning of geometric designs in the kaupapa of the marae cloaks were clearly identifiers of a specific weaver, or group of weavers from the area. Apart from the replica produced by Digger Te Kanawa in 2002, there have been no other records of this kind of woven design element in any museum collections to date. The similarities in bird species, feather use, patterning, scutching, and weaving techniques such as the decorative designs, and woven necklines reinforced the relationships between kākahu and iwi, and local weavers from the area.

This study reiterated that recording and verifying all the relevant materials and techniques of Māori feather cloaks in the museums around the world could lead to exciting findings and possible reconnections of cloaks to weavers, whānau, and their origins. Weaver signatures have been demonstrated in the possible insertion of elements such as hidden or inconspicuous coloured feathers, wool, letters, thread, backwards feathers and certainly in other more subtle techniques. The collar or neckline where the cloak is cast off has been proposed as a possible reference point for identifying northern weavers. Records from practitioners who are familiar with the work of other weavers would be invaluable. Recording the species, feather type, and location on the cloak is also an important step for comparative cloak collection research, as is documenting other materials, techniques, and designs in possibly recovering provenance information.

By inviting other researchers, weavers, conservators, and specialists to view the Pukerātā Marae kākahu, the whānau and marae members continue to learn more about the kākahu such as the history, materials and techniques utilised, and how to care for them. With the assistance of visiting experts and Te Rūnanga-a-Iwi o Ngāpuhi this marae has had at least two workshops since 2011 in which marae photographs and textiles were assessed by paper and textile conservators, including Rangi Te Kanawa (daughter of Digger). Techniques on the documentation, restoration, storage, display, and preservation of the taonga were addressed and developed with marae members.

There is a precedent for Iwi Māori to be supported with resources, experts and skills to undertake or contribute to the co-management of taonga species. Likewise, with assistance from iwi-led management agencies, or rūnanga (iwi councils), it is suggested that wānanga for each rohe (region) be conducted pertaining to the relationship of iwi and taonga in private and museum collections. It is suggested that the whakapapa (genealogies) and kōrero (histories) of mana taonga, taonga that have a known relationship with a tūpuna (ancestor), whānau, hapū or iwi, be conducted by the whānau or a researcher(s) that have worked with, were delegated by, or are known to the hapū members. Where any researcher needs to address the objectives of iwi, in what is needed regarding the museum collections, and what researchers can contribute. Iwi should be financially and structurally empowered and supported to initiate research to locate and record their own taonga in museums around the world, even if this is digitally achieved. That iwi be resourced with Information Technology and staff, that they are provided free and easy access to taonga (including images) in museums, and given information regarding material and technical production, care, use and display. That research that may impact on the cultural, spiritual, intellectual, or physical aspects of taonga in museums, even if provenance is not known, be put through vigorous debate in the Māori, scientific, and museum communities. Likewise, museums, particularly regional museums, are also given adequate resources such as staff and technical expertise to catalogue and care for taonga Māori in collections.

According to customary protocols it is the role of tangata whenua not the tribe of origin to take responsibility for the care and protection of taonga (Tapsell, 1998, p. 95). This is based on the social expectations of the recipients of gifts to care for the taonga, not the donor. In a museum context, it refers to a Māori governing body that upholds the 'mana of the whenua' and the tikanga of all taonga Māori within the institution for which they are spiritually responsible (Tapsell, 1998). Auckland War Memorial museum was the first New Zealand museum to institute a 'taumata-a-iwi'- tangata whenua museum governance structure, derived from legal obligations to the Treaty of Waitangi, and where most Māori members were given tangata whenua status (Tapsell, 1998, p. 220). This is particularly pertinent when so few museum taonga have recorded provenance, and staff (kaitiaki), pākehā, and Māori from numerous (different) iwi are charged with the physical and spiritual care of taonga in museums.

In the times of collecting taonga Māori starting from the 18th century, many of the connections to the makers, iwi, hapū and whānau, and their locations and dates of production have been lost or not recorded and retained. Today, the materials and techniques of some of these taonga identified and analysed have the potential to unlock some of the information surrounding the origins of museum taonga. However, there are certain implications with the discovery and publication of this knowledge that requires ongoing dialogue and consideration. A review of the bibliographies indicate that any research conducted in this area should be transparent in the analysis, limitations, errors, bias, the objectives and why and how they intend to conduct the analysis, namely why it is important. Initiating a scientific methodology that is replicable, unambiguous, and transferrable to ethnological collections is essential. It is also suggested to not involve or include the analyses of taonga Māori, historical records, oral histories, or interpreting Māori behaviour until the science of the analyses is robust and accurate and can be verified. That any analysis or sampling of the materials in taonga should be undertaken with the objective that any knowledge gained should be returned and retained for that particular taonga, and that it should be communicated and disseminated (or easily accessed) for relevant stakeholders, including iwi Māori, museums, and the scientific community. In fact, iwi Māori should probably be involved or included from the initiation of the provenance research before the study attempts to associate a taonga to an area or tribal group before the science can be verified. The research should also combine Māori, scientific, oral history, ecological, and taxonomic perspectives, alongside historical, museum and archaeological records that reference back to the taonga and the context and environment in which they were made and used. A cloak that has all the feathers, paru (mud), and muka from the same area is more likely to not have translocated or traded its materials. Yet, the cloak itself could have been gifted and traded to a different iwi or people, whereby reassigning provenance to the recipients of the cloak. The most important factor that is often overlooked is the personal and relational aspects of kākahu to a people and determining whether this research should be grounded in or more engaged in Mātauranga Māori where the western Scientific methodologies are just one of a number of tools to unlocking historical information.

8.10 References and Sources

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CHAPTER NINE: CONCLUSIONS

Tukuna ma tō mātauranga e kawe koe ki hea, engari,

tukuna ma to ngākau e kawe ko wai koe.

Let your knowledge determine your destiny, however, let your heart determine who you are

(Haupuru Harwood, Ngāpuhi, 1987)

9.0 Abstract

Te reo o te kākahu: an ethno-ornithological chronicle of the history and language of Māori feather cloaks allowed for a different voice for kākahu that has rarely been heard regarding the birds adorning them. Without a recorded history or narrative from the weaver or owner, information on historic and even some contemporary museum cloaks can be lost. It was therefore imperative to better understand the layered language and knowledge of kākahu Māori to address the material and spiritual aspects of how and why they have been made over time. More specifically, what each kākahu communicated to observers. This final chapter summarises the significant influences and changes in Māori feather cloaks over time from the perspective of bird and feather use. From recording Polynesian, historical, European, and northern iwi (tribal) influences, to social and personal preferences that in turn can be impacted by climate, time, and bird distributions. It outlines the current knowledge and proposes future recommendations for Māori feather cloaks in museums. Such as what research is needed and what is appropriate, the gaps in knowledge, and why there needs to be involvement with iwi, communities, and practitioners to recover and record practical and spiritual information. Discussion focusses on the creation of iwi taonga databases of museum collections that iwi, hapū (sub-tribe) and whānau (family) researchers can access. It recommends what whānau, marae (Māori meeting grounds) and museums can do with and for their kākahu, in terms of the identification and documentation of materials and techniques, recording history, photography, and conservation. Finally, it highlights the need for collaboration between the wildlife management agencies, iwi Māori, and weavers and what iwi and hapū could do to protect and obtain adequate access to natural resources such as harakeke and native birds for kākahu Māori.

9.1 Thesis overview: Summary and major findings

The whakapapa (genealogy) and histories of iwi Māori (tribe/ peoples) continue within oral traditions, and they are represented in our taonga (Māori treasures) such as toi whakairo (carving), tā moko (tattoo), and whatu raranga (weaving) (Harwood, 2011b). This research aimed to accurately record the materials, techniques, and functions of Māori feather cloaks over time to interpret the language within each cloak, essentially what it is communicating to the observer. Each kākahu is different, each tells a different story. Whether it refers to the birds, the colour or types of feathers, who is wearing the cloak, who wove it, or if it reflects events, landscapes, cultural (tāngata Māori), social (iwi Māori), religious or political, or personal symbolism, are all part of that communication (Harwood, 2011b).

This thesis explored findings of bird and feather use in exemplary kākahu (cloaks) Māori in national and international public museums, and a private Ngāpuhi marae collection dating from the timelines of the 16th century to present day. The themes of material, technical, colour, and design, and functional production and use were addressed within the parameters of Polynesian, historical, European, environmental, social, and personal influences. The mechanisms or processes for change in the evolution of feather cloaks coincide with the essential components of Māoritanga (the essence of being Māori) today, that broadly reflect aspects and responses to these influences. In cloak production, the agents of change, the weavers, are motivated by social and personal choices, directed by their own knowledge and skills, and dependent on the resources available to them (Martin, Weisenfeld, & Bekmeier-Feuerhahn, 2009).

A major assumption from previous research was the notion of 'traditional' Māori clothing that transitioned between linear phases over time (Hīroa, 1926; Mead, 1969; Simmons, 1968). This study of the history of feather cloaks was not a reflection of linear timelines in which certain factors and influences started and ended at specific phases of history. Māori innovation was and is continuously evolving and adapting to different changes. Weavers in turn use, reuse, and reinterpret different materials and techniques to retain and continue important information and skills, and adapt and test different ideas. Ngāpuhi weaver and artist Maureen Lander (2017) eloquently described it as follows:

> "What people don't understand is for Māori tradition is to respond to the new and to be innovative. That is the tradition. Otherwise you would not be using flax [*Phormium* sp.] in anything. They [weavers] had to respond to what was here".

9.1.1 Themes

Establishing themes as a method in multi-disciplinary research was essential, enabling the cross-examination of information in the social and physical sciences, a major component of this research (Opler, 1945). In terms of clothing, variations of the ancient techniques of working with animal and bird skins, feathers, fur, and twining have appeared around the Pacific in North and South America, Polynesia, and New Zealand. Twining has undoubtedly been the most important application of woven technology in protective and prestigious Māori cloaks. Over the last 500 years, variations of half-hitch, close, spaced, single, and double pair interlocking twining have been employed in clothing as protection from the cold and in battle, and over time to secure whenu and decorative elements such as animal skins, hair, feathers, hukahuka (dyed muka tassels) and more recently wool in place (Blackman, 2007). After 1800 the standard technique for Māori cloaks is described as spaced double pair twining in which the feathers are bent and secured along the rows as the cloak is made (Harwood, 2011a). Overhand knotting and binding are simple yet effective methods of securing feathers together, and there are indications feather binding had spiritual connections in religious ceremonies in historic Polynesian and Māori societies (Adams, 2016; Best, 1976; Hooper, 2006; Kaeppler, 2007). As discussed in Chapter Five, clothing with feather knotting and binding was recorded in traditional Hawai‘ian and Tahitian feather cloaks, in which feathers were often bound before they were tied to a net backing. In Polynesia, raranga weaving was practiced for essential mats, housing, and clothing. Plaiting as a form of raranga, was observed as whenu threads in Tahitian taumi (breast plates) and Tuāmotu burial cloaks. In New Zealand, for several 18th century Cook-collected Māori cloaks, the feathers were knotted as a means of attachment and some had bound feathers that were then twined into the cloak backing, as detailed in Chapter Six. Feathers that have been intertwined amongst plaited threads or warps were recorded in an historical South Island burial cloak, a dog skin cloak collected on a Cook voyage, and in 19th century taiaha kura (fighting staff) adornment. Also, from the time of Cooks voyages, forms of decorative plaiting have adorned the neckline in cloaks, at times incorporating the residual warps in the plait. Sewing as a pre-historic technique has functioned as a method of joining, mending, or adding skins, feathers, cloth, and other decorative materials to Māori cloaks that continues to this day (Wallace, 2002). Other techniques that were not necessarily employed for feather attachment but that are relevant and should be recorded in conjunction with other elements for further provenance studies. One is tāniko (wrapped twining incorporating coloured geometric designs) and variations of close single pair twining and twilling, including diagonal twining, an old form of raranga weaving in which coloured aho wefts skip one or more whenu warps in a row (Hīroa, 1926). They were recorded in pre- and post-European feather cloaks in museum collections and private marae cloaks, and were associated with prestigious kaitaka, kahu kurī, and feather cloaks in this study and discussed in Chapters Six, Seven, and Eight. Tāniko in kaitaka are typically the focal point, with the addition of feathers and wool later, this in turn possibly downgraded the status of kaitaka from the 19th century by fusing materials and techniques in a cloak, as seen in korowai.

All flora and fauna are of cultural importance to Māori. However, according to the International Register, New Zealand flax (harakeke: *Phormium tenax*) has and continues to be the fundamental foundation material in Māori feather cloaks. The close association of this taonga species with whakapapa (genealogy) and whānau (family) encompasses the traditions of the female artform of weaving, and the importance of kākahu in retaining ancestral memories and maintaining family ties (Harwood, 2011b; Williams, 1957). After the 1800s the convenience of wool and cotton prompted the assimilation of introduced materials and large-scale production of Māori cloaks. Today flax, wool, cotton, and cloth are the most common materials for Māori feather cloak production.

The selection of birds, colours, and feather types are closely tied to social or cultural influences (red is the pre-eminent colour of Māori society); environmental factors (the climate and distribution of species); and personal influences, in that weaver's beliefs, preferences, and artistic expression could determine the kind of cloak made. Material prevalence in cloaks does not necessarily represent preference but could also reflect availability and accessibility particularly after 1850. To date over 30 species of birds have been recorded in around 600 cloaks in national and international public museum collections, as a preliminary study of the International Register created for this thesis research. Many of the birds recorded in historical cloaks were also prominent in cloaks made after 1800. These species being brown kiwi (*Apteryx* spp.), kākā (*Nestor meridionalis*), weka (*Gallirallus australis*), kākāpō (*Strigops habroptilus*), kākāriki (*Cyanoramphus* spp.), albatross (Procellariiformes), tūī (parson bird: *Prosthemadera novaeseelandiae*) and pūkeko (swamphen: *Porphyrio melanotus*).

As discussed in Chapter Seven, currently the most common bird species and feathers recorded in the International Register of Māori cloaks made between 1850-1950 included brown kiwi body feathers; then the red belly and orange underwing feathers from the kākā; the green neck and white ventral feathers from kererū (N.Z. pigeon: *Hemiphaga novaeseelandiae*); multi-coloured chicken (*Gallus gallus domesticus*) body feathers; black body feathers from the tūī; multi-coloured male pheasant (*Phasianus colchicus*) body feathers; and multi-coloured male peafowl (*Pavo cristatus*) body and tail feathers. To a lesser extent brown weka body feathers; mainly blue ventral feathers from pūkeko; green kākāriki body feathers; white duck feathers (*Anas platyrhynchos*); and black turkey (*Meleagris gallopavo*) body feathers were also common. Ngāpuhi cloaks made from the 19th century through to today reflect a preference for iconic Northland birds brown kiwi and kererū. The decline and legal protection of these species over the last 150 years, contributed to the subsequent inclusion of readily available introduced birds like chicken, pheasant, and peacock to replace lost native bird feathers or incorporated into fully decorated cloaks. The majority of introduced game birds were imported after 1850 and featured in large numbers of Māori cloaks from the late 19th century, so that modern cloaks generally have a mixture of native and introduced species. While weavers would readily use materials available to them, it was unclear as to the extent to which introduced birds were included out of desire or necessity, which was more likely the latter. In general, incredibly rare, and therefore significant native birds and feathers were not, and could not be used to cover full cloaks, nor were they incorporated into many cloaks. If they were, their value would be reduced, and the birds would decline and disappear.

The language or terminologies in classifying Māori cloaks and birds are based on several factors. Foremost many bird, and cloak names and titles function as mnemonic devices originating from Polynesian cultures, particularly Hawai‘ian and French Polynesian as detailed in Chapter Five. Iwi Māori also have their own dialects, techniques, knowledge, and naming systems for cloaks and birds. Today, most generalised cloak titles use korowai, in museums there are more descriptive titles, such as the prefix for most cloaks kahu, used to define the type of cloak, such as kahu kiwi (kiwi feather cloak) or kahu kurī (dog skin cloak). Certain birds and feathers revered for their cultural and social symbolism include the brown kiwi; kākā, kākāpō and extinct huia (*Heteralocha acutirostris*) for their unique feathers. Birds that probably symbolise importance based on Polynesian traditions, influences, and language include again kākā, and chicken, kiwi and extinct moa (Dinornithiformes); kōtare (kingfisher: *Todiramphus sanctus*); the cuckoos (Family Cuculidae); ruru (*Ninox novaeseelandiae*); and possibly kererū. Birds are also named based on their physical attributes including kākā, kākāriki (little parrot), amokura (*Phaethon rubricauda*), meaning a red appendage; or behaviours such as the calls they make (onomatopoeia), kākā, ruru, kiwi, and pūtangitangi (paradise duck: *Tadorna variegata*). Albatrosses and herons (Family Ardeidae) are revered for their sacred white feathers, whereas the importance of kāhu (swamp harrier: *Circus approximans*) and bittern (matuku: *Botaurus poiciloptilus*) were based on their behaviours (Riley, 2001). The personification of animal traits in artforms and behaviours is an historical human trait that Māori adapted in Aotearoa to represent a wide range of species. Transliterations and new Māori names for introduced species have been accepted in the language for chickens (heihei), pheasants (peihana), and peacocks (pīkake) (Orbell, 2003).

New Zealand bird availability has and can change over time due to natural environmental influences such as seasonal migrations, the time of the year, temperatures, breeding, food availability, competition, and predation from other birds and mammals. Direct human influences such as fire, habitat destruction, hunting, faunal introductions and releases, breeding, and translocations have also drastically impacted bird distributions and abundance. New Zealand Māori and European fashions are no different to any other culture in that what was different, and new or rare, was going to create interest and imitation (Mead, 1969). Cultural and social influences depend on the time and location, and community expectations in making, using, and obtaining a kākahu. Whereas, personal preferences are distinguished by a weavers' individual choices, beliefs, style, artistic skills, and knowledge that in turn is dictated by what is wanted in the cloak, what the weaver is wanting to communicate, and what is socially acceptable, and available (Jacomb et al., 2004; Maihi, 2011). All these influences can have several variables, and they all inevitably interconnect. In a cloak, the materials in particular can be recorded objectively, it is the 'why' they are used that can be open to interpretation.

Māori cloaks over time feature a diverse range of birds, colours, and designs in which no two cloaks are alike, even when created by the same weaver. The most prevalent colours recorded in cloaks were brown, red (& orange), white, black, iridescent dark/ black, green, and blue feathers. Rare white albino feathers originating from brown kiwi feathers were integrated into the patterns in some of the kiwi cloaks to augment and contrast important colour forms of this species. It was theorised in this thesis that similar geometric designs of rectangles, triangles, and diamonds, found in historical and Polynesian weaving and textiles including mats, basketry and tapa cloth appeared in Māori tāniko designs in kaitaka (fine dress cloaks) from the late 18th century, these patterns in turn transferred to feather cloaks in the 19th century when kaitaka and tāniko techniques declined. Over time the significance of these designs have been associated with certain iwi and even weaving families, that should be recorded before they are lost. Unfortunately the lack of provenance information associated with the museum cloaks in the International Register was insufficient to definitively state whether specific designs were associated with certain iwi.

The orientation of cloaks was deemed an important aspect of function or use in pre- and post-European Māori cloaks. In Chapter Six, at least two Cook-collected cloaks featured wide tāniko borders at the suggested base of the cloaks, with most of the feathers pointing to both the neckline, away from the base- which is the incorrect orientation based on current function, and a small number facing the baseline, with the correct (or current) orientation. While it appeared to be from weaver error, that the two cloaks shared similar bird and feather use indicates the occurrence was possibly intentional. Modern cloaks feature the tāniko borders at the bottom with the feathers pointing towards the base, however Māori portraits and 19th century photography often highlighted the decorative tāniko worn upside down and at the neckline to showcase this feature. Also, in Chapter Six, at least two Cook-collected cloaks have been documented with fringes at the base and neck ties at the proposed top of the cloak. Whereas 19th century dog skin cloaks featured both the ties and fringe along the neckline. These irregularities call into question whether weavers were aware of the correct orientation of twined cloaks once it was finished and the cloak was turned around 180° to wear. Writing and initials in 19th century cloaks, discussed in detail in Chapter Seven that are incorrectly orientated suggest this may be the case. Kaitaka paepaeroa were defined as fine cloaks made in the traditional manner but are turned 90° before the tāniko borders are added, so that the warps lie horizontally and wefts vertically. Another explanation was that weavers are continuously experimenting with their weaving and were not restricted by how the cloaks were worn, as some cloaks and waist garments were interchangeable. It is also possible the incorrect placement of ties, feathers, and writing were genuine mistakes or erroneous experiments and as such the cloaks were readily traded, gifted, or sold.

Feather cloaks in traditional Polynesian and Māori societies represent wealth, royalty, status, prestige, and power, and play a role in how the wearer is portrayed. Cloak traditions in how Māori incorporate kākahu into social and familial exchanges and events have only changed with the mechanisms not the context. In that traditionally Māori weavers created a cloak from a request, concept, event or with a person in mind (Maihi, 2011). Through social and whānau processes, the owners would then decide when and where it was worn (Tapsell, 1998). Cloaks were worn for warmth in and after life, and sometimes gifted between whānau and iwi as part of these death customs as discussed in Chapter Seven. Today specific kākahu fulfil this purpose and are used at tangihanga (funerary customs), or marae or whānau events and shared amongst family or marae members (Hīroa, 1966; Mead, 1969). Throughout history kākahu have been gifted, traded, or sold for other items of value or for money more recently (Mead, 1969, Tamarapa, 2011). In museum ethnological collections they exemplify traditional practices and artistry. Brightly coloured indigenous featherwork has always sparked admiration and curiosity in observers and collectors and the exponential increase in cloak production and acquisitions in the late 19th century met this demand.

9.1.2 Methods and Methodologies

Oral history interviews conducted with semi-structured conversational questions in 2017 substantiated and corroborated research of material evidence and literature, and most importantly filled gaps in knowledge that were previously undocumented in this field of study (Eni & Rowe, 2010). A wide range of subjects were recorded regarding Northern iwi bird and feather importance, access, and use; cloak terminology, production, and function in historic, Polynesian, and contemporary environments. Finally, current iwi Māori relationships with taonga and museums were discussed. This method demonstrated the need for contributions of traditional knowledge in indigenous studies, regardless of researcher ethnicity or experience.

Over 600 pieces of literature and archival material were examined for this research, that incorporated an in depth examination of materials, techniques, and museum collections depicted in the major works on Māori clothing from Te Rangi Hīroa on *The Evolution of Māori clothing* (1926), Ling Roth's *The Māori Mantle* (1923) and Hirini Mead's *Traditional Maori Clothing: A Study Of Technological And Functional Change* (1969). Elsdon Best's (1898, 1977) work on recording Ngāi Tūhoe knowledge pertaining to forest lore and weaving should have recorded how these two areas intercepted. An exhaustive study of literature, archival records, graphic and material evidence of Polynesian featherwork; early New Zealand clothing; early European voyages, records, journals and settlement; iwi Māori relationships to birds, cloaks, and museums; and bird distributions and climate was also conducted for this research. For such a large body of work it was not necessary to critically review each piece of literature, but to glean pertinent information that contributed to the narratives that could be confirmed with the oral history interviews, material evidence, and other primary and secondary sources.

The International Register was initiated from ethnologist David Simmons' (1981, 1982, 1996, 1997) unpublished catalogues of Māori collections in international museums. The Register recorded approximately 600 Māori feather cloaks in close to 100 museums around the world and encompassed kākahu dating from 1500 A.D. to present day. Most of the early historical Māori feather cloaks dating between 1500-1700 A.D. were found in New Zealand museums. Whereas all the known cloaks with feathers collected on Cook's voyages made in the 1700s are in European and United Kingdom public museums. Most cloaks listed in the Register date from after European arrival 1850-1950 A.D. Around 30 New Zealand museums hold at least 300 feather cloaks, and around 70 museums in international collections, hold roughly the same number. The largest collections in New Zealand were the Museum of New Zealand Te Papa Tongarewa (Te Papa) in Wellington (124); Otago Museum in Dunedin (38); Museum Theatre Gallery Hawke's Bay Tai Ahuriri, in Napier (36); Auckland War Memorial Museum, Auckland (24); Canterbury Museum, Christchurch (19); and the Whakatāne District Museum and Research Centre, Whakatāne (13). The largest overseas collections were in England in the British Museum, London (47); Pitt Rivers Museum, University of Oxford, in Oxford (17); and Bristol Museum and Art Gallery in Bristol (16). In the National Museum of Ireland in Dublin (10). The largest collections in Europe were at the World Museum in Vienna Austria (5), and the National Museum of World Cultures in the Netherlands (3). In North America, the largest collections were in The Field Museum Chicago in Illinois (13); and Fowler Museum UCLA, Los Angeles in California (15). Museums Victoria had the largest Australian feather cloak collection (8), and after that the Australian Museum in Sydney, N.S.W. (4). Excluding David Simmons' attributions, the most common recorded production localities comprised of the Bay of Plenty (geometric patterns), Waikato, Taupō, and Whānganui (tāniko patterns). Preliminary bird use in the International Register was comparable to the identification of Te Papa's Māori cloaks in 2007, in that the most common species were brown kiwi, kākā, kererū, chicken, pheasant and peacock (Harwood, 2011a). Ethnologist Mick Pendergrast had already identified the feathers in the Auckland and British Museums (Pendergrast, 1987, 1997; Starzecka, Neich, & Pendergrast, 2010). Frequency of bird use in museum cloaks does not necessarily equate to weaver preference, as it could also reflect collector bias. At least 300 cloaks in the International Register still require complete and positive feather identification.

Feather identification formed the initial response to answering questions pertaining to bird use in cloaks. Techniques were based on the feather identification of Te Papa's Māori cloaks from 2007, and from subsequent identifications of feathers and hair materials in museum ethnological collections (Harwood, 2011a; Tamarapa, 2011). Feather identifications from photographs and personal observations (examinations) conducted throughout the duration of this doctoral research from 2015-2019 have been stated as such in the chapters and International Register. Microscopic descriptions of the 21 New Zealand bird orders provided for the first time in Chapter Two indicated that some microscopic characteristics highlighted similarities between related bird groups, as well as their taxonomic positioning. The selected species from the 21 bird orders exhibited some useful diagnostic characteristics comparable to studies previously conducted to demonstrate taxonomic differences based on structure, pigmentation, measurements, and distributions of downy feather barbs, barbules, and nodes (Chandler, 1916; Day, 1966). The differences can be associated with their taxonomic allocation, but are also apparent in similar bird groups, such as ratites including moa (Dinornithiformes) and kiwi (*Apteryx* spp.) that both have scale-like pronged nodes along the length of medium sized hair-like barbules. That raptors like the harrier (*Circus approximans*) and falcon (*Falco novaeseelandiae*) share comparable barbule lengths, and small nodes with pigment and prongs. Most seabirds and waterbirds had limited down, and short to medium barbules with prongs of varying lengths. This was likely an evolutionary adaptation in that down in waterbirds was limited and nodal structures were reduced to prongs possibly to streamline long distance flight and water mobility, in that expanded nodes trapped air (Dove & Agreda, 2007).

This research also demonstrated that microscopic feather descriptions and comparative studies need to be conducted on more than just one feather type per species, and more than one species per bird order for a viable reference database for New Zealand feather identifications. Organisational support for a feather identification lab in the Smithsonian Institution National Museum of Natural History in Washington D.C. reiterates research importance and application in forensic studies, ethnology, archaeology, and wildlife management (Dove, 1997, 2000; Dove & Koch, 2010; Dove & Peurach, 2002; Pearlstein, 2010). The research also emphasised a need for microscopic feather descriptions conducted on other extinct birds. Where the macro- and microscopic characteristics of moa feathers cannot be distinguished by feather comparisons, and microscopy is not practical, where it is ethically feasible and scientifically warranted, it is suggested that genetic analysis be performed on feathers from paleofaunal sites for positive identification. Species of moa have been positively identified by DNA through coprolites (Wood, Wilmhurst, Worthy, & Cooper, 2012); bones (Huynen, Gill, Doyle, Millar, & Lambert, 2014); and soft-tissue and feathers (Rawlence, Wood, Armstrong, & Cooper, 2009; Rawlence, Wood, Scofield, Fraser, & Tennyson, 2013). DNA analysis has even shown potential in identifying or verifying feathers in ethnological collections (Hartnup et al., 2011).

9.1.3 Probable influences in Māori feather cloak production and use

The conditions in which Māori arrived in New Zealand such as the necessary acclimatisation to flora and fauna and the climatic factors produced a transition from feathers cloaks for status in the Pacific to a combination of status and warm protective wear in New Zealand. The research in Chapter Five examined relevant examples of Polynesian twined clothing and feather attire through the themes of language, materials, techniques, classification and status of cloaks, as well as the significance of birds and feather colours of Polynesian and Māori cloaks using oral history interviews, archives, literature, and material evidence from museum collections. Major contributing authors Hīroa (from 1926-1966) and Brigham (from 1892-1918) produced a large body of knowledge through their research and publications conducted at the Bishop Museum in Honolulu, Hawai‘i.

Polynesian culture, language, and history influence Māori feather cloaks to this day. In the importance of the colour of red feathers; the personification and idolisation of certain birds, such as the kingfisher (Family Halcyonidae), pigeons (Family Columbidae), and man-of- war birds (Family Fregatidae) etc.; and the political, spiritual and religious importance of Polynesian feather cloaks for high ranking individuals. One adaptation Māori did not undertake is the production of feather cloaks and their functionality, in that Hawai‘ian and Tahitian climates are warmer, and the cooler netted or framed (open) backing of these cloaks reflected this. Due to the wider range of New Zealand birds, the larger landmass and populations, the range and number of feather cloaks was greater in New Zealand than in any Polynesian nation. Although still associated with high ranking individuals, twined feather cloaks also served a functional purpose for warmth, gifting, and trading. According to the literature and accounts, both New Zealand Māori men and women appeared to be associated with feather cloak production and use, as opposed to just men in Polynesia. Increased support for indigenous Polynesian and Māori researchers and practitioners researching and publishing on aspects of ornithology and material culture could help to elucidate many of these issues.

Chapter Six documented the first examples of what is known of Māori feather cloaks that were found in South Island sites and made as early as the 1500s. Physical examinations of material evidence and a study of over 120 years of literature were collated to create a timeline linking materials, techniques, locations, dates and most importantly the context in which the pieces were found. They represented a crucial stage in the evolution of Māori feather cloaks before European settlement that combined historical and Polynesian weaving techniques and adapted materials and cloak function. The study of the feather cloaks observed during the early European voyages involved co-ordinating recordings of cloaks in paintings, ship logs and diaries, and examinations of cloaks and images based on physical examples retained in British, Scottish, and European Museums.

The sacredness of certain cloaks was always held and acknowledged in high regard within each whānau, and the individual nature of the kākahu seen as a mark towards the wearer. On first contact with Europeans, Rangatira (Māori chiefs/ leaders) were identified by the higher standard of cloak worn, typically layered kaitaka (cloak with tāniko border) with sometimes either feather cloaks or dog skin cloaks on the outer layer. Rain cape-like garments from the 16th century in the South Island were some the earliest forms of existing Māori clothing found (Hamilton, 1892; Simmons, 1967, 1968). The early Māori feather cloaks were each unique and yet incorporated aspects of Polynesian styles of weaving such as plaiting, twining, and half-hitch twining (Hīroa, 1926). Dog and bird skins appeared in material evidence from 1500-1800 A.D. but were certainly used before this. These add-ons were likely continuously refined as tufts of hair and small bunches of feathers served as resplendent additions into the 19th century. Apart from moa and kōtare, the species identified in the historical cloaks to date are also prominent in cloak collections that mostly date from 1850-1950 A.D.

From the 2007 feather identification of Te Papa's Māori cloaks it was possible to gauge relevant material and technical processes, particularly 'non-traditional' influences from post-European settlement (Harwood, 2011a). The 19th century emphasised numerous European changes on Māori artforms, particularly Māori weaving, as detailed in Chapter Seven. Mead (1969) refers to this transitional period as showing a number of changes in the decline of the more prestigious cloaks such as kaitaka, kahu kurī, and kahu kura (kākā feather cloaks), and an increase in full feather cloaks. By the end of the 1800s, kahu kiwi and cloaks with mixed native and introduced feather cloaks like fowl and game birds, chicken, peacock, and pheasant appeared along with coloured wool, cotton and candlewick and mammals (dogs, sheep, and goats), and techniques such as sewing, and imported dyes (Long, 1981; Pendergrast, 1987). Other influences such as patterns, symbolism and writing in cloaks were recorded, and examined using national and international examples to highlight the significant changes and religious and political responses to European colonisation.

In the 1800s, Māori moved from traditional flax clothing to European style fashions, and feather cloaks became more of a cultural entity worn over suits and dresses, and played a role in performances, events and at funerals rather than just an indication of status in a few selected individuals (Mead, 1969). Some of these changes were the result of a transition in the economic and cultural functions of cloaks, and increased production was likely a direct response to tourism and acquisitions for private and public collections. Other possible European influences caused decline in bird numbers from hunting, habitat destruction, and introductions of predatory and competing birds and mammals, that were already aspects in pre-European New Zealand, accelerated exponentially in a short time after 1800. While these documented changes were facilitated by European settlement, the concepts behind Māori cloak production, use and innovation maintained that these mechanisms of change: the inclusion of new materials and techniques, designs, symbolism, colours, forms of communication, and function in use remained as central factors in Māori artforms.

Chapter Eight highlighted how local environmental and (northern) iwi knowledge influenced how Māori cloaks in private and marae collections are made and used. Feather cloaks were examined in Pukerātā Marae Ōtaua near Kaikohe (Northland), and the species used reflected the relatively high distribution of preferred bird species like brown kiwi and kererū at the time of production in the 19th century, and reduced distribution of these native species in 20th century cloaks resulting in the replacement and inclusion of introduced species like chicken, pheasant and peacock (Heather & Robertson, 1996; Robertson, Hyvönen, Fraser, & Pickard, 2007). The presence of pūtangitangi feathers was also representative of a bird that had become common in the area after it had been translocated. The other major findings from these examinations include the use of glossy golden muka in some cloaks due to the unique hāro (scutching) method specific to the area, and the recording of exceptional weaving resembling tāniko designs known as a type of close single pair twining resembling twilled (or diagonal twined) weaving in at least two of the marae cloaks. While twilling has been found in a small number of historical and contemporary cloaks, the twined geometric designs placed in the kaupapa of two marae cloaks were also exclusive to the area. The other elements of interest included the unique plaited necklines also specific to the area; and star motifs, that represented constellations and figuratively embodied birds in flight. This research emphasised the ongoing traditions of Māori feather cloak production, in that it is continuously changing, adapting, and adopting new elements. This assisted in understanding the artform as it is today and how cloak weavers retain and continue iwi-specific knowledge and skills, techniques, and designs from their own area, while also implementing new materials and techniques to expand their skills. The ongoing importance of the cloaks for marae members and whānau was emphasised in their historical and ongoing use and repair, and functions in marae events including tangihanga, and in weaving and teaching opportunities.

Aspects of individual weavers that showed an inclination towards certain birds, designs, or techniques were apparent in pre- and post-European cloaks. Examples of individual weaver behaviour was observed across the timelines and incorporated the inclusion of single feathers from culturally, socially, or personally significant species such as ruru representing kaitiakitangi (guardianship) and tapu (sacred) traditions relating to kōtare; single feathers woven in backwards; hidden elements including feathers; and other symbology or writing such as the weavers name or initials. It was apparent that weavers were also just as likely to experiment or respond to change by adding new or rare elements, contributing unique creations.

9.1.4 Current issues and trends in research relating to Māori feather cloaks

At present weavers can only access certain protected birds through the Department of Conservation (Te Papa Atawhai), who disseminate birds and feathers to registered practitioners. Issues stemming from the legalities of the Treaty of Waitangi and Wildlife Protection Act 1953 and addressed in the Wai262 claim maintain that the decisions regarding management and use of taonga species rest with one Government agency, whereby alienating Māori and failing to acknowledge traditional kaitiakitanga (guardianship) rights (Galbreath, 2002; Kirikiri & Nugent, 1995; Wright, Nugent, & Parata, 1995). Some appointed iwi and hapū governance groups have been charged with working alongside DOC to recommend how to distribute birds to practitioners on a case-by-case basis. While some practitioners have preferred direct access to DOC, others appreciate that until native bird numbers are fully restored, that these relationships are the first step in regaining some of these lost rights.

Similar issues arising from Governmental ownership of taonga in museums have involved the dubious acquisition, access, and display of taonga Māori, encouraging an ongoing disconnection with iwi Māori. In response, iwi governance groups connected to the area in which the museum is located (tangata whenua) have been delegated with the appropriate use and care of taonga Māori that they may not necessarily be associated with. While it is important to have iwi involvement to mitigate future problems for taonga that have no recorded history, it is also important to incorporate input from those iwi connected to mana taonga, a taonga depicting or directly linked to an iwi, hapū, whānau, or tūpuna (ancestor) (Tapsell, 1997).

Scientific analyses were theoretically tested regarding their potential to identify and provenance Māori feather cloaks in museum collections and to reconnect them to geographic areas. In 2007, of the 110 feather cloaks in the Te Papa collection at the time, 60% had no known (recorded) provenance, in that any linkages to a maker, owner, iwi, or geographic region were not documented (Harwood, 2011a). The future of unlocking the history Māori feather cloaks lies partly in the materials and techniques used by the weavers who inadvertently inserted this information when making them. The future of scientific research in this area lies in the combination of tested tools such as morphological, chemical, and genetic analyses on the plant, animal, and other organic materials. Studying the birds and plants in museum feather cloaks by verifying species and analysing geographic origins are a sound approach to reconnect kākahu with iwi. Provenance studies that focussed on microscopic feather identification, isotopic analysis of feathers, and DNA of feathers and harakeke were critically analysed to gauge the reliability of these techniques and interpretation of their results (Dove, 1998; Hartnup et al., 2011; Pearlstein, 2010; Rogers, Wassenaar, Soto, & Bartle, 2012; Scheele & Smissen, 2010). A review of methods established that microscopic feather identification research is the quickest and most cost-effective tool in establishing bird species. The microscopic and birdskin reference image databases used for identifications are digital, and therefore mobile yet require a complete library and full access to species across the orders and feather types. While it is not necessary to use whole (intact) detached feathers from items, it is preferred for comparative analyses to reference feathers. Isotopic and genetic studies demonstrated the importance of comprehensive, accurate reference groups in identification and provenance research, and verifying results before allocating connections to iwi Māori.

9.2 Limitations

The administration and research in compiling the Māori feather cloaks in the International Register took a considerable amount of time and organisation, including collating the work of Simmons' unpublished Auckland Museum manuscripts (1996, 1997, 1982); and Bolton and Specht (1984); Gathercole and Clarke (1979); and Kaeppler and Stillman (1985), as well as reviewing over 100 major publications on the subject. It involved ongoing communication and the sharing of information with over 200 museum personnel, acquiring permissions for information, copyright, images, and stakeholder permissions to use and discuss cloak details and images for this research. It also involved providing research information, and feather identifications where required from personal observations and images supplied by museums.

Many of the cloak titles in the International Register provided by museums had incorrect labelling or lacked titles and descriptions in general. This made associations between iwi and designs difficult to confirm. This could be rectified with proper documentation and comparisons to other museum collections in which the classifications have been standardised by Mead (1969) and Pendergrast (1987, 1997) in the Museum of New Zealand Te Papa Tongarewa, Auckland War Memorial Museum Tāmaki Paenga Hira, and British Museum in London (Harwood, 2011a; Starzecka, Neich, & Pendergrast, 2010; Tamarapa, 2011).

The International Register does not include museums that did not have any feather cloaks or did not want to participate. Cloaks and some images that did not have specific clearance (permission) for use were omitted. In New Zealand, this number was over 10 museums, in Europe 5 (mainly France), Australia 2, Asia 3, North America 1, and South America 3. In Europe, Asia, and South America, language was most likely the main barrier. In the New Zealand regional museums, local iwi governance groups largely dictated who could access collection information, even if the origins were unknown or not associated with that area. The initial request for cloak information stipulated that cloaks needed to be permanent museum collections; catalogued as Māori made or inspired; a shoulder garment; and that images needed to be free of copyright, reproduction fees and stakeholder (iwi) clearances. This ultimately limited the number of cloaks in the Register, in that an accurate estimate of Māori feather cloaks in national and international Museums would total over 1,000 kākahu. This number would include the cloaks in museums that did not respond, that were not contacted, and cloaks that could not be included, based on the criteria above. Many museums do not allow use of website images, information or links without permission, whereby restricting aspects of this research to be shared with source communities when they did not respond to enquiries for information. Under New Zealand's Official Information Act 1982, members of the public can request general governance, acquisition, and collection information from a public museum, but it is generally at the discretion of the museum board or governing body and their relationship with local iwi that determines what information if any is released upon request to members of the public. This includes images and collections associated with iwi, hapū, whānau or individuals. Other issues encountered in the International Register research was the lack of Museum and staff resources that impacted on access to collection information particularly for small New Zealand regional museums.

This study was limited to museum cloaks containing feathers from each timeline. However detailed research of other woven forms of clothing from around the world, in Polynesia, in New Zealand archaeological sites, Cook-collected cloaks, and post-European collections around the world were beyond the scope of this study. Likewise, Māori garments that could have been worn as waste or shoulder garments such as piupiu and rāpaki were also excluded. Any further research on individual cloaks would need to include a wider study of other cloak classes in the time and, or location of cloak production for context.

There was restricted access to museum bird skins and feathers for reference image databases, in that samples of different feather types and species in each order could not be sampled for this research. There are 435 bird species from 21 bird orders listed in the Checklist of the Birds of New Zealand, and includes living and extinct species in New Zealand, Norfolk and Macquarie Islands, and the Ross Dependency and Antarctica (Checklist Committee (OSNZ), 2010). This proposed reference feather database could amount to 1,000s of study feathers if several feather types are examined. However, sampling would only need to occur once, the calamus could contribute to DNA analysis; the down stored as a permanent reference for future microscopic study, and the rest of the feather used for future identification and species research.

The language of classifying Māori cloaks has its limitations in that information can be misheard, misspelled, misinterpreted, not recorded, or recorded out of context. Ethnologists sometimes based their observations on one record, at one time, in one area, and it was generalised for all Māori. This was particularly apparent with the terminology of techniques, making it important to reference supporting evidence and to also provide detailed records (images) and observations to clarify any future confusion and interpretations.

9.3 Future Research and Recommendations

The International Register was the first of its kind to attempt to catalogue a full list of Māori feather cloaks in public museum collections in New Zealand and around the world. Currently approximately 600 cloaks were listed, around half in New Zealand and the rest located in the Australian, United Kingdom, Europe, and North American museums. At least 300 Māori feather cloaks still require scientific feather identification or verification. Additionally, time dedicated to the proper documentation of materials techniques, designs, and museum records - including imaging, measurements, and provenance information is desired. Continued research contributing feather identifications through personal examination would enhance the knowledge surrounding each cloak, the museum records, and Māori feather cloaks in general.

An interactive online International Register would ultimately allow ongoing monitored access for iwi, researchers, and museums. Te Aitanga a Hauiti are an example of how iwi led taonga databases can facilitate iwi access and research of museum taonga (Brown, 2008; Ngata, Ngata-Gibson, & Salmond, 2012; Te Awekotuku & Nikora, 2003). Whakapapa-based kinship groups interested in tracing related taonga in museums and maintaining taonga on their marae are encouraged to initiate inventories and documentation including imaging of taonga as observed in the Pukerātā Marae (Northland) catalogue created in 2012. It has been suggested that iwi Māori actively contribute knowledge and skills to museum collections, and in turn learn skills in how to work with taonga in a museum environment (Bonica, 2017). These skills would encourage each Marae or rohe (region) to create their own 'museum' so that Māori are in control of their own taonga and the knowledge and stories associated with them (Henare, 2017).

There is a need for the positive identification of materials and techniques in museum collections. Larger museums have more resources and staff available to document kākahu as seen in Te Papa Museum in Wellington. In smaller regional and overseas museums, this is challenging. It is recommended that museums initiate open dialogue and negotiate reciprocal partnerships with iwi, practitioners, researchers, and experts to support in the documentation of materials, techniques, and histories of taonga Māori collections. Also, that this dialogue includes how to appropriately acknowledge whakapapa relationships to a people and area that translates to how taonga are acquired, cared for, researched, and accessed via exhibitions, publications, and online. There is also a need to standardise museum policies and adequately disseminate available resources (staff, knowledge, time) to support these recommendations.

The identification of feathers in Te Papa's Māori cloaks in 2007 warranted further research in other national and international collections (Harwood, 2011a). It has undoubtedly led to additional important findings and, possibly, associations in the location of cloak histories. One of the most interesting discoveries resulting from the 2007 research has been the discovery and recording of hidden feathers incorporated into some cloaks. At least 30 of the 110 Te Papa cloaks examined had hidden feathers or a subtle use of feathers, as well as the inclusion of other materials (e.g. wool) (Harwood, 2011a, 2011b). Presumably, these were inserted by the maker as an individual mark or memory of an event or person and, in some cases, could indicate the identity of the weaver. They may also provide an idea of the status of the wearer, and the time and environment in which he or she was living. Documentation about the use of feathers (particularly the location of all hidden materials), as well as unique techniques, designs, symbols and writing in other national and overseas cloak collections in the International Register could test this hypothesis and, through the comparison and matching of these unique feather insertions or 'signatures', potentially recover the provenance for some cloaks.

Future recommendations for microscopic feather identification research would involve sampling body feathers from each species in the 21 bird orders from museum collections and (or) wild populations. This knowledge would be available to New Zealand museums, the public, and international museums for identification purposes of ethnological items and wildlife specimens. Also, that extensive microscopic research is conducted on verified species of moa feathers, to investigate a possible diagnostic feature in moa feathers that can differentiate species of moa (Dinornithiformes) from kiwi (Casuariiformes). Additional microscopic feather analyses should be conducted on other extinct birds possibly in conjunction with genetic and isotopic analyses.

A review of scientific research conducted to date that aims to determine museum collection origins illustrated that the research should be clear in the methods, limitations, errors, biases, and the objectives of why the analyses should be conducted. The scientific methods should also be robust and replicable for museum collections. Iwi Māori should also be involved from the initiation or planning stages of taonga research to mitigate any premature conclusions regarding Māori movement, trading behaviour, and inter-tribal relationships. At least, the study should refrain from allocating provenance to a tribal group or area before the science can be verified, and Māori knowledge integrated. As the research should be grounded in Mātauranga Māori foremost, alongside other disciplines and tools including scientific, oral history, ecological, and taxonomic perspectives, alongside historical, museum and archaeological records. These fields should be employed to deliver a robust and well-rounded research design that complements and collaborates the research findings. Finally, that the results should ultimately benefit or enhance the knowledge surrounding the taonga for the people associated with it, not the people studying it.

Fragility in historical cloaks often prevents constant handling and study. Replication of such cloaks by contemporary Māori weavers can mitigate further exposure and potential damage ensuring iwi, weavers, and researchers can continue to appreciate these taonga, and increase the ever-growing body of knowledge and appreciation of these kākahu (Bonica, 2017). For marae kākahu that have degraded, are damaged or aged, repairs can increase the longevity of pieces that play important roles in life events. Conservation treatment, storage, and handling advice can also be sought from museum staff and specialists to use and preserve taonga for generations.

Māori access to native materials requires an acknowledgement in the form of a legislative response to the Wai262 claim from the Government regarding the inherent relationship Māori have with the environment, and Māori rights and input into how the intellectual, physical, and spiritual aspects of the environment is administered. This management could be implemented with increased iwi or hapū-led projects or co-partnerships with Governmental environment agencies like the Department of Conservation (Te Papa Atawhai), or Landcare Research (Manaaki Whenua). Also, that Māori should dictate what these forms of management are and how they can operate or contribute. Regarding access to native birds, it is proposed that local individuals, whānau groups, and iwi Māori decide and nominate representatives to work with Government agencies to develop ongoing policies that create and maintain relationships with practitioners who require native materials (Parata, 2017; Prime, 2017).

A review of ethnological accounts from the late 19th and 20th Centuries reflects the prominence of male authors on the subject. This however has changed in the last 40 years with female and indigenous researchers and practitioners such as Adrienne Kaeppler (1978), Patricia Wallace (2002), Digger Te Kanawa (1992), Maureen Lander (2011), Toi Te Rito Maihi (2011), and

Margery Blackman (1998, 2007, 2011) publishing and providing a balanced opinion and important voice in this field of study. It is recommended that ethnological researchers become encultured with the community they are studying, and try to meet and work and study alongside the taonga and the people that made it to understand the language, materials and techniques, history and the kōrero surrounding it (Hart, 2010). More important is encouraging and supporting Iwi Māori and weavers to tell or record their own stories, around private and museum taonga, bird and feather use, designs, and relationships to the environment etc.

This thesis has argued against the linear and classified timeline of Māori feather cloaks, proving that Polynesian language, materials, techniques, and colours and designs have influenced Māori cloaks over time through to today. That European influences did not create change but only accelerated the mechanisms of change, in increasing the decline in native birds and dogs, increasing cloak production and collection for museums, and introducing new and exotic materials. That Environmental influences played an important part in developing warmer drier twined cloaks upon arriving in Aotearoa, and the distribution and access to certain native bird species. That social and religious factors have dictated forms of prestigious feather clothing through to today in how Māori men and women have made and worn certain cloaks. Finally, and possibly most importantly, it considers the familial and personal knowledge such as designs, materials, and techniques that are exclusive to an area, whānau, and individual weavers that establish genealogical ties and artistic expression.

In conclusion the research highlighted the main aspects and findings from the bi-cultural examination of material evidence from the major timelines and influences as detailed in each chapter. The study provided an overall chronology of the changes in Māori feather cloak production and use to present day, including predicted future trends and recommendations. There will likely never be a complete picture of the history of Māori feather cloaks without incorporating private collections and kōrero from each iwi, both beyond the scope of this research. Any such study needs to acknowledge that the methods or evidence utilised should, firstly attempt to fill in the gaps of knowledge, and then substantiate the evidence where possible for the benefit of kākahu and the iwi associated with them. How the evidence is interpreted is also a crucial factor in the validity of any conclusions. Recording and interpreting the findings associated with the different aspects of feather cloak production and use can in ways help us understand how best to proceed for future research of Māori feather cloaks in museum and private collections, and for the artform in general.

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APPENDIX ONE: ETHICS APPROVAL

Te Whare Wānanga o Awanuiārangi

EC2016/01/007
ECR2016/01/007

30.05.2016

Hokimate Harwood
Te Papa Museum
P.O Box 467
Te Aro
WELLINGTON 6140

Tēna koe Hokimate,

Re: Ethics Research Application EC2016.01.007

At a meeting on 24.05.2016, the Ethics Research Committee of Te Whare Wānanga o Awanuiārangi considered your application.

We are pleased to advise that your submission has been approved. The Ethics Research Committee wishes you well in your research.

Ngā mihi nui

Associate Professor Nathan Matthews
Chairman
Ethics Committee
Te Whare Wānanga o Awanuiārangi

Private Bag 1006
Francis st
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PaeTukutuku/Website : www.wananga.ac.nz

APPENDIX TWO: INTERVIEW QUESTIONS

<u>BIRDS</u>

1. **What birds do you think are of significance for the North? Physically, metaphorically? Superstitions? Stories?**

2. **What is your recollection of how birds were acquired in the past? What birds? When? By whom (men)?**

3. **What is your recollection of what the birds were used for? On request? Were they for a specific reason? Food for the sick, feathers for cloaks?**

4. **How are birds acquired by Māori today? With permission from DOC?**

5. **What are birds used for today? Food, feathers for cloaks?**

6. **What are your views on how the Government can share access and co-management strategies with Māori for conserving birds?**

<u>KĀKAHU</u>

7. **What is your recollection of northern feather cloaks from the past? Kōrero of well - known cloaks? Which birds? Surviving?**

8. **What is your recollection of any cloak weaving families in the north?**

9. **Can you describe any tikanga or traditions regarding the making of traditional clothing or cloaks in the north? Colour Red, male, female roles.**

10. **Can you describe how feather cloaks in the north are used today? For weddings, tangi, graduations etc? Just one cloak used for the same purpose?**

11. **Do you have or are you aware of any family or iwi taonga in a museum?**

12. **What are your views on how museums can provide access and exchange knowledge with iwi and whānau Māori regarding taonga?**