(Re)Constructing the Kōauau:

Traditional and Modern Methods in the Making of Kōauau Rākau

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Abstract

Until recently written work on the kōauau has remained hidden within ethnographic accounts and anthropological analyses of the nineteenth and early twentieth century. Descriptions regarding the traditional construction methods of the wooden kōauau, a traditional, short, open-ended, tube flute played using the oblique embouchure, are often brief and second-hand, usually describing the object as it is physically rather than the process by which it was made. As yet, very little has been done academically on the process of construction: the *making* of kōauau. Interest in taonga pūoro (traditional Māori musical instruments) within academic discussion has been increasing alongside the pragmatic revival of a musical practice motivated by a small group of high-profile, respected exponents. By collecting oral tradition and combining ethnographic evidence with structural knowledge from existing museum artefacts for purposes of reconstruction and re-enactment, these people have been revitalising and reviving the traditional practice of taonga pūoro. Situated within an ethnomusicological framework of fieldwork-based research this thesis incorporates interviews, practical reconstruction, the study of museum artefacts, and a thorough survey of ethnography in a comparative analysis that considers the possibility, validity and probability of different techniques. Focussed specifically on traditional methods, one technique in particular, that of using a hot coal to burn the central bore that runs through the length of the shaft of the flute was central to the research. In total eighteen instruments are presented that were created during the research by methods that included cord drill, gouging of pith woods, 'found sound', tunnels made by moth grubs, and fire.

E tū e te Tari Māori, ki te wehenga o ngā ora,

Tirohia atu ngā ara tawhito o namata.

Uia ki te wāhi ngaro, "Kei hea tō wāhi pai?"

Haere rā reira ka kitea rā e koe,

Te tānga manawa mō te iwi – mō te rahi, mō te iti

Hoea tō waka kia mārō te haere…

Arise Māori house and seek out life,

Study the ancient pathways of long ago.

Ask of the hidden reality, "Where should I go?"

Go there, and you shall see

The beating heart of your people, of the great and the small.

Row your canoe and be committed to your journey…

(Marsden, 2003: xv-xvi)

Acknowledgements

I stand upon the shoulders of giants. From the lofty heights that these greats have already achieved I have viewed a vast beautiful land with a deep perspective, the horizon for which I have not yet seen. Whano, whano! Haramai te toki! Haumi ē! Hui ē! Tāiki ē!

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Table of Contents

List of Illustrations

Introduction

> Fire was employed in the process of hollowing out a *koauau* flute, and the small holes were formed with the *tuiri* or cord drill. These flutes were often made of a piece of *tutu* stem (*Coriaria ruscifolia*), a section of the same being dried and the pith was destroyed by fire in a curious manner. Live coals of *manuka* or other hard wood were used in the process. One such was placed on the dry pith at the end of the section, and the operator blew the coal to keep it alive and to cause it to burn the dry pith below it. When the coal deadened, it was replaced with a fresh ember (Best, 1976: 237).

Until recently, written work on the kōauau (pronounced *kaww-oh-oh*) was found either within ethnographic accounts and anthropological analyses of the nineteenth and early twentieth century, or modern texts generally prepared for universities or schools. Descriptions of traditional construction methods of the kōauau within ethnographic accounts are often painfully brief and second-hand. What may seem like a plethora of writings including Andersen (1933), Beattie (1990; 1945; 1949; 2009), Best (1976), Buck (1966), Colenso (1869), Dashper (1996), Flintoff (2004), Kennedy (1931), McLean (1968; 1974; 1982; 1996), and White (1887-1891), specifically yields little on traditional construction. A number of these are simply re-writings of the original ethnographic and historical texts they cite back to, and some we are warned by their own peers are unreliable.

Descriptions of construction often describe the object as it is physically: *how* it is, and so how it was *probably* made. This might be expected from an organological perspective where an instrument is more often assessed out of its usual context as it stands alone (Dournon, 1992: 245-300), but early ethnography also skims around the topic as if it were unimportant. The term ‘construction’ in these ethnographic accounts is defined to mean the object and its form, not the process by which it was made. As yet, very little has been done academically on the process of construction: the *making* of kōauau.

Interest in taonga pūoro (traditional Māori musical instruments) within anthropological discussion has risen increasingly in the last thirty to fifty years since the extensive fieldwork and writings of Mervyn McLean (beginning in 1958). A great deal of this academic interest has revolved around another kind of Māori flute, the nguru, and among other issues, particularly the way it was played.

More recently taonga pūoro and the kōauau have been vigorously and pragmatically revived by a small group of high-profile, respected exponents led by Richard Nunns, Brian Flintoff, and the now late Hirini Melbourne (1949-2003). Other practitioners, that is people who make and/or play these instruments, include Warren Warbrick, Te Poroa Joe Malcolm, Bernard Makoare, Alistair Fraser, James Webster, Horomona Horo, and Jason Phillips. By collecting knowledge of the ‘old ways’ from those who knew them, and then combining ethnographic evidence with structural knowledge gleaned from existing museum artefacts for reconstruction, Melbourne, Nunns and Flintoff in particular returned these instruments to those older people who could not remember, and through re-enactment triggered embodied memories and knowledge often long forgotten since childhood. It can be assumed then that any analysis of the construction of the kōauau therefore will owe a great deal of its research information to these revitalisation specialists and their methods of reconstruction and re-enactment. Through their work, they have become known as, and chosen by the older people to be, physical and living 'stores' of knowledge and oral tradition.

With over thirty years of experience travelling the country and the world collecting traditional knowledge, performing and researching taonga pūoro, Richard Nunns is considered the leading ethnomusicological specialist in this field, a Tohunga Pūoro. Brian Flintoff, an eminent New Zealand carver has worked alongside Nunns as the maker of instruments, spending many years preparing notes on the construction and culture of the instruments with Hirini Melbourne, who was a renowned Māori musical and education specialist. Together the three of them established *Hau Manu* a revivalist group effort designated to mentor and educate people in the art of taonga pūoro. Flintoff recently published a book called <u>Taonga Pūoro -Singing Treasures</u> (2004) that diligently compiles some of these notes. Warren Warbrick is Tohunga Whakairo for Rangitāne and lives in Palmerston North. He has researched, constructed and used stone tools for over twenty years, utilising them in his work as a carver, artist and sculptor. He is respected throughout New Zealand as a leading authority on the traditional application and manufacture of stone tools, and an eminent maker of taonga pūoro. Twice during the early period of the research, I arranged to meet with Hirini Melbourne for an interview, but at the time he was critically ill. Both times I travelled from Palmerston North to Hamilton, and was turned away at his door due to his worsening condition. While this was regretful, I was able to maintain a very enlightening communication with him by email. On one of these visits, I met with a student and peer of Melbourne's, Rangiiria Hedley, a renowned practitioner in her own right, who agreed to be interviewed.

A large portion of Māori musical tradition in regard to instruments has become veiled (covered over) through the actions of colonialism, modern development and time. A great deal of what has been revived has been woven back together from the oral traditions and histories of the tangata whenua: from those surviving who remembered, and from those who did forget and through re-enactment remembered once again. This research aspires to bring some of the vast body of acquired knowledge of these experts together in an academic thesis that stems from a multiplicit relationship between interviews, ethnographic analysis, the practical exercise of reconstruction and re-enactment (experimental archaeology), and the data gained from instruments residing in museum collections. The rationale for reconstruction and re-enactment as valid research methods is defined and emphasised by the importance and relevance of these techniques as vital to revitalisation (Nettl, 1992: 386) and 'traditionalist revivalism' in the field of taonga pūoro. For these reasons, reconstruction and re-enactment within Māori arts would be worthy of a study of its own, and a project such as this acts well as a reflexive and practical precursor if this were to ever happen. The validity of reconstruction is relevant at a personal level to a large section of the participating group. This aspect of reconstruction is also fed by an Experimental Archaeology perspective which employs a multiplicity of different methods, though the data collected from reconstruction is the aim of this perspective and not the object itself. Nevertheless the elements of reconstruction and data collection and analysis are inherent to this work, and a general reading of works by Auscher (1961), Reynolds (1987), Stone (1994), and Tringham (1971) has informed this research. A number of revitalisation projects are underway around the globe that have involved reconstruction and re-enactment including the work of Panayiotis Stefos in Greece, Manjun Karimov with the ancient instruments of Azerbaijan, and R. Carlos Nakai with First Nations flutes in the U.S. I was fortunate enough to meet and talk with Nakai in 2005 at a conference in Rotorua, and his work of forty years reviving the flute of Native America has hugely informed musical revival methods around the globe. In regards to an anthropological paradigm for this research I situate the work within the framework presented by Sluka and Robben in their introduction to Ethnographic Fieldwork (2012) that presents a paradigm of nine interrelated elements among which fieldwork is defined as "the primary method" in which "long-term" subjective and objective research is performed in the form of participant observation. Fieldwork-based research is defined as in opposition to laboratory-based research. From this perspective the following work fulfils the basic "conceptual and theoretical oppositions" that include the microanalysis of ethnography versus cross-cultural macroanalysis, an analysis of differences and similarities, "present" synchronic versus "long-term" diachronic research, and the combined subjective and objective practice of participant observation (Robben, 2012: 5-6).

The importance of construction from an ethnomusicological perspective is highlighted by Dournon and detailed with a field example, as a way 'in' to other aspects of general and musical culture. In her recommendations for investigation she notes that one of the "main questions the research worker should ask about the instrument… (and) its maker… is construction techniques" (Widdess, 1992: 219-231). Widdess though advocates an ethnomusicology that revolves around context and change, noting that a focus on the material artefact is more historical and musicological in perspective (Widdess, 1992: 219-231). Nevertheless both he and Nettl note a renewed importance in the role of history and archaeology both in anthropology and ethnomusicology (Nettl, 1992: 385-386). According to Widdess, the analysis of kōauau in museum collections for archaeological data would be seen as coming from a heavily historical perspective in ethnomusicology (1992: 219-231), and worthy of note is his recognition of this perspective's role in a balanced study that requires the artefacts living context also be represented. The method of research for this thesis is firmly seated within ethnomusicology with George List's definition in 1979 that the discipline "now encompasses almost any type of human activity that conceivably can be related in some manner to what may be termed music" (Myers, 1992: 13). That a hallmark of ethnomusicological research is a coupling of ethnography and innovation (Myers, 1992: 12-16, 375-399) confirms the place of these methods in the study of ethnomusicology.

To analyse the data presented by the practical experiments, I developed an equation of plausibility that set to define a standard regarding the potential that a method might hold for being accepted as traditionally valid. This was an attempt at determining the genuine feasibility of a technique by comparing elements of the research within a single statement. That something is possible because it is achievable (construction or make-ability) and has reasonable function (playability) is not enough to determine whether it might have been done actually or traditionally, but when set against the validity of historical evidence (ethnographic texts, museum evidence, oral tradition) we can begin to determine the plausibility or probable likelihood of a method as representing a 'traditional' one. This equation therefore reads as: 'Function' + 'Construction' vs. 'Validity' = 'Plausibility', or in more general terms: 'Playability' + 'Achievability' vs. 'History' = 'Probable Likelihood'.

The general objective of this project was to investigate the different methods used in the construction of the traditional Māori flute, the kōauau. Research focussed specifically on the traditional (rather than westernised, modern or contemporary) methods employed in the making of the wooden variety, kōauau rākau. In particular one method of construction, that of using a hot coal to burn the central bore that runs through the length of the shaft of the flute (Best, 1976: 237) was central to the research, as it was the intriguing nature of this method which first lured me into the study, and then sparked debate amongst various experts during the research regarding its plausibility. In an attempt to establish whether this particular method was in fact done, a series of practical experiments were employed involving other methods of construction that were assumed to be relevant to experts in the field. These 'known' and 'estimated as known' methods were to be used as a counterpoint to offset the study of the hot coal method, in an attempt to set a research standard on which comparisons and analysis could then be made. These practical experiments took many forms, from impromptu one-to-one informal 'making sessions' through to large group practical workshops at international flute symposiums led by myself involving anyone who was willing to take part. One of the most informative fire workshops I led was held at a marae in Golden Bay with a number of staff from Te Papa Museum present. When it came to direct participation, most adults simply refused to take part and it was the local children in attendance with their parents who keenly became involved, building fires, collecting embers, and experimenting with various woods and techniques for enticing the coal to bore downward. Working *with* these young people, enabling them to partake, encouraging them to explore possibilities and then observing them, I gained a great regard for the intuitive nature of the research and a respect for children who often have fewer psychological boundaries when it comes to 'getting a job done'. Some worked diligently all afternoon through to sundown achieving more in that short time than what it had taken some parts of my research to achieve over years. Soon I was dividing my practical research into conceptual sections of style and methodological technique. Some were being drilled, while some were being gouged, and others were simply being found ready to play, picked up off the ground on walks along the beach or into the bush. Tools were being made and used: cord-drills (tūwiri), adzes (toki), hand drills (wiri) from bird-bones, gouges from sheep and cow bone, awls of wood, grindstones of sand stone, and scrapers of stone and shell. Some kōauau took days to make, while others were made in moments. Resources were varied. Twenty-thousand year old woods from swamps, fresh woods cut and worked green, recycled fence posts and floor joists, branch woods, heart woods, woods found and unidentified, toxic woods, and edible woods. Over the space of nine months in 2002 to 2003, upward of thirty kōauau were constructed. But the research didn't stop there, and the work continued. Always looking for sound from within the natural world, I continued to read and scour ethnography. Travelling to teach, or research, I always kept one eye on the road, and one eye out for something to play. My kete of instruments grew to include other Māori instruments: percussion mouth harps, tapping stones, bird callers, other styles of flute, and shell horns. As I played, I gathered a deeper sense of what it was for *me* to be Māori. I had finally found a way in to this part of my identity that until then had remained unfulfilled. As I made and played the instruments I communed with my ancestors in the breath, with the land in the stones that brought rhythm, with the forest in the woods that vibrated, with the sky in the melodies I created. Theories regarding particular possibilities began forming. Connections were becoming woven into each other. Understandings were being recognised. The academic was interlacing with the practical, the spiritual with the physical, the intuitive with the reasoned. Things were coming together. The research was now reaching out over a very extended time frame, and to the extent that it was not actually research purely for academic reasons anymore. I had taken a post graduate diploma in 2003 so I could re-enter the workforce. Academic life was over. I was no longer perceiving the work as research: it had become my life's journey. All roads were coming together. I was gainfully employed in a relatively unrelated job, my family was growing, both in age and in number, and being a good father was my highest priority. Occasionally I would teach or present a workshop if it was requested. As a musician I was still very active in the underground/alternative rock scene. I was singing and playing guitar in bands, writing songs and gigging. As the push toward academic work lessened, I began seeking to express the taonga pūoro in the way I knew best, musically. Music is what I do, and this next step made pure sense. A friend loaned me a digital loop pedal and I began composing layered soundscape style pieces of music, reimagining past ensemble methods from a solo framework. The leap had finally happened. I was now home. I was writing and experimenting musically, developing compositionally, expressing musically as a Māori, and expressing Māori as a musician. The next natural step of course was to perform. Deciding that the music was personally profound enough to never have to publically express it I realised that I was actually practicing it in a far deeper way than I had ever undertaken music before. The outcomes were personal and the drive to perform simply did not exist: the playing of the music was a form of prayer, a highly personal and spiritual form of meditation. Nevertheless, someone eventually asked me to perform in a concert setting, and there I learned that what I was experiencing could be truly shared and that many in the audience were able to experience it too. And then someone rang to ask me about how to make a kōauau using a particular traditional method and inquired as to where they could find my thesis. This brought a great realisation upon me. I had not finished what I had first set out to do. In 2010 I began reviewing my notes, revisiting the research, and redeveloping the work. I began making again with an intention of experimentation. I began re-reading the texts, and incorporating new works that had been published since 2003. In fact, a great deal had changed at ground level in the world of taonga pūoro. Academic theses were being written by and about a new generation of practitioners, of which I was now one. Documentaries for television had been made and aired. Albums were being produced. Taonga pūoro was coming of age. At the end of 2010, I began *writing*. The experimental work though, was not completed, even if I thought it was. Little did I know but new discoveries were yet to be made. In 2011, on a teaching trip to Great Barrier Island, I discovered a large form hollow kelp dried on the beaches there, and with that, the final experiment for the research was complete.

The structure of the thesis is as such: Chapter 1 is the research standard set by a known and accepted way to drill holes, the cord-drill. Chapter 2 is the research standard set by known and accepted resources, and the methods used to construct kōauau from them *without* the use of fire. Chapters 3 and 4 are discussions and experiments on resources and methods that presented themselves in the field as obvious and potentially relevant. These chapters are about discoveries made in the field and look into plausible 'realms of possibility'. Chapter 5 is about the work done with fire. Within each chapter are experimental tables that outline statistics and conclusions regarding each experiment, and discussions on their construction and function (i.e. possibility). A main discussion is presented which endeavours to pull all of the fields involved together in a way that considers the historical and cultural evidence (i.e. validity) *comparatively* with the conclusions reached from the practical experiments to finally determine the method's potential plausibility.

Chapter 1

The Pull-Cord Drill

This chapter presents a discussion of the methods and techniques employed in the use of the tool that is sometimes known as the pull-cord drill. To achieve a greater understanding of the use and the relevance of the pull cord drill in the research, several experiments using the drill were constructed. The physical details and construction process of this flute, known as *Kōauau Tūwiri Tōtara*, are outlined as vital to the discussion and conclusions achieved by this section of the research.

In an attempt to gain a research standard against which all other practise could be relatively set, it was decided by Warren Warbrick (2002) and myself that for this part of the research we would construct a kōauau using a known traditional drilling method used by Maori: the pull-cord drill, known here as the tūwiri.

The tūwiri is a vertical pull-cord drill (a variant of the pump drill) used in a 'free-style' manner by a single technician, and consisting of a shaft or spindle, a weighted balance of varying types attached approximately half-way up the shaft, two cords attached to the top of the shaft, and a drill bit usually made of stone fixed to the bottom of the shaft (Best, 1974: 73-89, 91-94, 429). This type of drill possesses many names within ethnography and tradition including *tūwiri*, *tūiri*, *tūawiri*, *moa*, *hōrete*, *wiri* and *pīrori*. There a many references in ethnography that discuss how, when and where this drill was used by Māori.

Regarding the construction of flutes, the tūwiri is cited by Elsdon Best as being used to drill finger-stop holes (1976: 237) and as yet I have found no reference to it being used to drill the main bore of wooden kōauau. Mention is made in several cases to a stone-point drill being used to bore other types of flutes (nguru) made of stone (Best, 1976: 264) and whale teeth (Best, 1974: 85), though no clarification is made whether this is cord operated or hand twisted.

Beattie makes scant reference to the tool but mentions the use of the pīrori as “a revolving drill to bore the pounamu (greenstone)” (2009: 71).

The pull-cord drill differs from the pump-drill as it has no horizontal crossbar attached to the cords, though the overall rotational drilling action of the two is relatively identical. One practical difference lies in the use of the technician’s hands: with the pump-drill a free hand is created that can then be applied elsewhere, holding the shaft steady from the top to apply pressure or guiding the point, whereas the cord drill requires a hand on each cord. Both forms are found globally throughout history, the pump-drill being used by the Romans, across the pre-colonial Americas, and in parts of the Pacific. Discourse on the pump-drill in “The Journal of the Polynesian Society” is opened by Best in the Notes and Queries section where he discusses one unique instance of a pump-drill being used by a Tūhoe man. In reply the editor notes the Samoan use of “a form of ‘pump-drill’ for boring holes” (Best, 1910: 224). The Wilkes Expedition recorded the use of the pump-drill in Fakaofu, Tokelau in the early 1840s being used to drill small holes in fish hooks and pendants (MacGregor, 1937: 154-155). Because of a consistent lack of written accounts regarding the Māori pump-drill, its use remains a point of conjecture amongst practitioners and experts. It would be fair to say that it was used on occasion at least, but as to whether it is pre-European remains contentious (Best, 1974: 84 - 89).

The ‘free-style’ pull-cord drill is known to have several variations amongst the Maori (Best, 1974: 78, 94, 429). These variations differ around the types of balancing and weighting employed, and in one instance the size of the drill. The term ‘free-style’ is used here to indicate the drills use without the presence of a holding or mouth cap, or a fixed holding frame. ‘Free-style’ also denotes the use of the drill by a singular operator, rather than the type that requires two technicians, one attending either the shaft with a holding cap, or the drill-point to keep it in place. According to White and recorded by Chapman (then Best), one variation did involve a ‘holding-frame’ (Best, 1974: 76), whereby the drill was held in position by a horizontal top bar in a frame. In regard to drilling deep or large holes, Best makes reference in Maori Storehouses and Kindred Structures to “boring holes in big timbers” for the construction of pātaka whereby large cord drills were used, that were “much larger than those used in drilling stone implements and ornaments”. This was a significantly bigger drill that took three technicians to operate, one who “would attend the drill point to keep it in position, while two others manipulated the cords” (1916: 25). These holes were used to fix walls to floors using aka vine bindings. Such a large drill might bore a kōauau in very quick time, and therefore should be a subject for further research. Though I have not spoken with Danté Bonica about this, I do know of a video that Alistair Fraser has seen that demonstrates the use of a large drill operated by *two* technicians under the instruction of Bonica (Fraser, 2010 - 2012).

The variations in drill form I wish to discuss for the purposes of this research involve the way the drill was structurally balanced and weighted, not how or where it was used, or size.

Various types of fly-wheel were employed. Elsdon Best attributes variations regionally stating that "different districts used different forms of substitutes for a fly-wheel" (1974: 94). Differences included flat, round wooden discs, spoke wheels made of vine, stones (that were attached using various methods), and wood blocks. In Greenstone Trails Brailsford quotes Heaphy (1862) in witness of one cord-drill having "the hardened intervertebral cartilage of a whale" as the circular flywheel plate (1996: 24).

This research employed three types of flywheel variant. One method, *Variation* 1 (*Fig. 1.11*), involved a light circular fly-wheel made of vine that was attached to the shaft of the drill for stability (Best, 1974: 75, 84-85, 429). In another method, *Variation 2* (*Fig. 1.12*), heavy stones of equal weight and size were bound to the shaft to balance and weight the drill (Best, 1974: 77, 80, 83, 94). A third type, *Variation 3* (*Fig. 1.13*), combined both the wood of the flywheel and the weight of the stones. With this variant wood blocks were fixed vertically along the shaft and is very similar to the drill that Elsdon Best discusses where two pieces of hard, heavy wood such as maire "were lashed in a horizontal position across the spindle, to act as a fly-wheel" (1974: 75, 83, 89, 94, 429).

Through experimentation it was discovered that each style of drill has certain advantages that can be applied to particular tasks required.

For this research the use of the cord-drill is assumed to be for the construction of kōauau from a wood of 'solid' grain form. That is, a piece of wood that is 'hard' or 'solid' right through, branch wood that is dense of grain (without soft pith), has been milled, or heart-wood. In the modern world, timber can be milled using saws across the grain of the tree, whereas traditionally, large amounts and lengths of timber would have been mostly split with the grain. From what can be ascertained by this research, kōauau constructed from non-pithwood branches were still made from branch wood. Research at Okains Bay Museum by Rod Wallace (2012) on a wooden nguru made from a kauri branch also indicates this (Thacker, 2002; 2010). This would have been easiest: the shape of a branch is cylindrical (the basic form of a flute) and the construction (drilling and carving) involved less effort following the grain. Andersen, Best, Beattie and McLean all make reference to the use of woods such as mataī (Best (1976: 236, 251); Andersen (2002: 236); McLean (1996: 373)), mako (Beattie, 2009: 79) probably referring to *Aristotelia serrate* (Williams, 2001: 170), māhoe (McLean, 1996: 373) and ngaio (Andersen, 2002: 243).

Construction – Kōauau Tōtara Tūwiri:

A number of issues were raised during this experiment and the construction of this kōauau. The biggest issue was whether the pull-cord drill was actually used to drill deep holes, and if so, whether it was used to drill traditional wooden kōauau bore as might be generally assumed.

Practical experimentation was confounded by various physical problems during the actual process, such as the fragility of the stone bit being increased through continuous and enclosed use, and the way the drill tends to stick and jam continually in the hole being drilled, requiring the use of some kind of innovation that might involve either an adjustment to the drill itself or some type of lubrication. Another issue directly related to use of tūwiri is the need for the blank to be held firmly over a long period to allow for the intensive action of the drill to be applied successfully to it. Discussion must also consider the time/effort factor. One factor raised a lot by research participants was effort. A recurring opinion was that, if given a choice, the easiest or simplest method was traditionally chosen. This was recognised and quoted as part of a generalised and self-confessed, over-arching subsistent “Māori way” of achieving things. This does deny though, the consideration that master-crafts require a large amount of learning, commitment, skill, time, devotion and care. When a master crafts-person has years of practice in acquiring and refining a skill, often the easiest and quickest way is the application of the learned skill. This method may be confounding and difficult, appear counterintuitive, even counterproductive, to anyone that is unskilled. As already mentioned, use of pull-cord drill to bore wooden kōauau does not feature in ethnographic literature. This lack of presence should be considered important, and may be so for a number of reasons. There is a possibility that such a happening at the time was so obvious to the writer that it was passed over as unimportant. This reason does not abide with other ethnography of the time, and is weakened by the presence of reference (though non-specific) to a “stone-pointed drill” in the production of a whale tooth flute (Best, 1974: 85). There is an apparent belief in modern research that it was used. Komene in his M.A. thesis identifies cord-drilling as one of two techniques used to achieve a kōauau bore, the other being the technique that uses a burning ember (2009: 70-76).

There is no doubt after this experiment and in accord with Komene (2009), that using the cord-drill achieves the type and size of hole required for a kōauau bore. It was for this reason that the decision was made to establish this method as the relative standard in this research. While time and effort need to be considered as relevant, they are not as important as other factors regarding function and the prevalence of evidence in museum artefacts. Time and effort are relative factors which impact differently between individuals, and within different cultures and historical periods. Modern impressions of time/effort are affected greatly by the ability to complete a 13mm x 130 mm hole through solid, milled wood in less than 2 minutes using a power drill and steel twist-bit (I jokingly refer to this as the 'Makita Effect').

Function – Kōauau Tōtara Tūwiri:

The finished bore of *Kōauau Tōtara Tūwiri* is very functional with an exceptional range of tonal control when the distal end is stopped and opened using the palm of the hand. The tone is sweet but strong, with a full, rich, and mellow sound rather than a brighter, harsher note that can be expected with the short, open ended kōauau. The notes resonate crisply until blowing ceases. The quietly deep, vibrating lows and the loud ringing highs, including the beautiful tūī-like 'popping' overblow illustrate well the sound achievable with hardwoods such as tōtara and mataī. The overblown sound can be maintained continuously. The external construction of the flute, with the walls reduced to within about 10mm of the bore give the structure of the flute a lightweight feel that heightens its bright tonal qualities.

In the equation that sets 'possibility' ('function' with 'construction') versus 'validity' in an attempt to consider 'plausibility' I would conclude that there is a high rate of success in the use of this method. The plausibility that this method was used traditionally is enhanced by the high presence of similarly shaped or styled bores found in various flutes in museum collections around the country; especially in Canterbury E150.555, 19xx.1.2076, and in Otago D21.58, D30.880, D33.795, D33.1591. The resulting flute created with the pull-cord drill process, *Kōauau Tōtara Tūwiri*, has a magnificently round, tapered bore. I believe (as do other experts in this field) that cord-drills make excellent nguru bore due to the smooth tapered hole and beautifully rounded bottom-end that they produce. Rather than drilling right out through the bottom, the job would be finished previous to the end of the blank being reached. Such a bore could then be smoothed using any number of techniques and tools, including the use of shaped sandstone rasps (Best, 1929: 36) inserted into the hole. The use of burning hot poker sticks may be successful, or even the continual insertion of a finger could achieve the required smoothness, especially if sand was incorporated and rubbed around the inside of the bore. A bore made with a cord-drill in the way demonstrated in this experiment, using water, finishes a bore that is a lot smoother than other techniques used in this research. So smooth in fact that further finishing that involves secondary sanding could be considered unnecessary.

Left purposely in an 'unfinished' state as a representative of the tūwiri experiment, *Kōauau Tōtara Tūwiri* plays fantastically as a simple diagonal tube flute without any embellishments.

Physical Attributes Prevalent With Cord-Drill Method:

Cord-drilling creates certain effects in wood when used. These include:

- A very round, relatively consistent and smooth walled hole.
- Fine horizontal ridging and banding around the walls, all the way down the hole.
- The presence of compacted wood pulp when water is incorporated in the process.
- A curved, rounded bottom when not drilled right through.
- When drilled right through, the distal hole has a tapered/cupping effect, whereby it is smaller than the proximal diameter.
- An overall tapering of the bore from proximal to distal ends.

- When a bore is drilled from both ends, to meet in the middle, this effect of taper and cupping can present as a pronounced singular ridge in the mid-section, half way along the bore.

Main Discussion:

After a number of drilling attempts using the first two drill variants, it was this third type that was used to complete the flute *Kōauau Tōtara Tūwiri*. The drill that is *Variation-3* (*Fig. 1.13*), with the wood block balance weight, allowed enough weight downward to proceed at an acceptable rate, while being light enough to allow the flow of wood waste upward and out of the hole. Cord-drill *Variation-2* (*Fig. 1.12*) did not allow this 'self-cleaning' progress due to its heaviness. The balance weights in *Variation-3* were also attached by way of a strong 3-plait muka (prepared flax fibre) cord binding that enabled them to be easily loosened and moved along the shaft, allowing the point of the drill to run deeper and deeper into the cavity without obstruction. The weight of *Variation-2* often caused the drill to jam, while drill rotation speed was slower and less propitious, generally making the process difficult. The light weight of *Variation-1* caused the drill to be very quick in its rotation, but less downward in nature, making progress slow and lengthy. Cord-drill *Variation-1* (*Fig. 1.11*) is very good for drilling small and shallow holes quickly. Elsdon Best notes this drill type being used to drill wenewene (finger-stop holes) when referring to tutu kōauau being made: "Fire was employed in the process of hollowing out a kōauau flute, and the small holes were formed with the *tuiri* or cord drill. These flutes were often made of a piece of *tutu* stem (*Coriaria ruscifolia*)" (1976: 237). A useful analogy to compare these three models of drill might be to think of them in relation to a gearing ratio, whereby one is easier to use but does less, or lighter work, while another is heavier and harder to use, but achieves more.

Another issue confronting the use of tūwiri being used to drill deep holes is that of the heat generated by friction and its effect on the stone bit. Stone is hard, but brittle. Stone bits wear (become blunt) slowly against wood, and generally break (for a number of reasons) before becoming worn out. If dropped, or mishandled, they can shatter. Heating and cooling can cause the stone to weaken, become even more brittle, and cause it to crumble. At times the drilling process would induce very high heat, causing scorching and smoking, and shortening the life of the stone bit greatly as it was heated and cooled repeatedly. The heat from this friction at times seemed to threaten the very nature of the wood being drilled and the bore being made. The possibility of the whole piece cracking from this heat seemed very real. At times the threat of setting the wood alight seemed very likely also. This is an interesting point to note in regard to the use of fire in construction, and the evidence of fire being used in many museum pieces.

In an attempt to combat this issue, water was introduced into the process as a coolant, being poured down the bore being drilled and immersing the drill bit. In turn, the water created a grinding, pulping effect that appeared to cause a greater drilling action overall. With the introduction of water another issue was raised: that of a wet and very messy wood pulp as waste rather than a dry wood dust. At times it was required that the bore be scraped and cleared of this mess, though during the process a large amount of the gluey type pulp did work its way up and out of the top of the piece, flicking out in a wide circular arc across the worker and work space. In Stone Implements of the Māori Elsdon Best denotes the use of water in several places, in some cases with sand, and some specifically without (1974: 78, 83, 85, 91, 92). In these cases, water was used as a lubricating and grinding agent in the act of drilling and working stone.

Another requirement for achieving this type of drilling is the way that the blank flute piece needs to be held stationary while being worked upon. A brace system (*Fig. 1.5*) was built to achieve this, keeping the flute blank fixed and steady against the frenetic force of the drill in action. It could be imagined that possibly an assistant could hold the blank steady enough to allow the job to be done, or that if working alone a skilled practitioner might be able to hold it between their feet while sitting or that some other less-specific method might work, such as lashing the piece to an already existing structure, pile or platform. All of this considered, Warbrick decided a cross-brace vice system based on his own understanding of traditional principles was relevant and appropriate. To this cross-brace the blank was lashed, and then the brace was held firmly by being knelt upon. This method worked very well, though when the bore needed to be cleaned of pulp waste the whole system had to be turned over. Before too long, for the purpose of ease, waste was simply scooped out by the technician with the fingers. After a period, the whole system was moved up to chest height, whereby the brace was clamped to a work bench. This allowed the drilling to be done in a standing position. From this position, drilling was easier on the body and much more expedient practically. Once I had learned the skill of using the drill, work progressed smoothly, and rapidly. In fact, from this experience I would flag drilling a deep bore for a kōauau as a very good way to become proficient in the use of a cord drill. Achieving the first few centimetres becomes a lesson in aptitude, balance and force. This initial period can be tricky. Keeping the drill balanced and upright for a novice can be difficult, but once the drill is set well within the bore, the lesson becomes one of determination, patience and stamina. The technician does not have to be strong, but constant repetitive use over a period of hours does require fitness, psychological determination and core strength. The time required to drill this bore was somewhere in the vicinity of 15 hours. This may seem a long time frame relative to modern drilling methods, and other types of flute bores made in this research, though from another perspective such a time frame could be perceived to be less than one week of modern workforce labour time.

In regard to using tūwiri, Komene states that there is a “considerable degree of skill required... to maintain its upright position...” and that the process is “a slow and painstaking task” (2009: 71). From my own experience I will agree partially with this statement. The topic is subjective, and complex, and I am not content in simplistically charging discussion with the ‘slow’ and ‘painstaking’ factors often repeated in historical ethnography. The use of tūwiri does require a degree of skill, but once acquired, this skill greatly increases the efficacy of any task requiring the boring of holes. It certainly is not a skill beyond the capabilities of an older child, and my own 2 sons, 9 and 11 years old, are now able to manage a tūwiri to achieve holes for the middle of their porotiti. I believe the tūwiri achieves well the job desired, and when applied with determination, the job as a focussed task is completed within good time, while greatly increasing the implicit skill of the practitioner through singular, concentrated practice. After a focussed period the task of drilling with tūwiri could be considered as simple and quick, even easy, in the way that any well practiced, acquired skill might be.

At the completion of this first 120 mm bore I became able to use the drill freehand successfully in a number of situations that included holding a kōauau-tutu between my feet in a cross-legged sitting position to furnish wenewene (finger-stops) into the flute (see chapter 3). Komene contends that tūwiri are "too heavy duty for inserting the wenewene" (2009: 73). My experience with *Variation-1* and *Variation-3* suggests otherwise. I would not use the heavy, stone-weighted *Variation-2* for this, or other delicate jobs involving wood though, as it would be too heavy and cumbersome. The drill in this research known as *Variation-1* is ideal for this task.

In regard to kōauau rākau construction Elsdon Best implies in Games and Pastimes of the Māori that tūwiri were used *only* for drilling wenewene on kōauau made from tutu, as the bore was made using hot coals (1976: 237). It should be considered as significant that maybe Elsdon Best never saw the tūwiri being used to drill the bore of kōauau. If he did he appears to have omitted it from his publications. He does claim that a particularly large flute in the Dominion collection was probably "formed by means of a drill in the first place, yet shows signs of having been worked by means of a sharp pointed implement thrust down" the bore, possibly being enlarged this way (Best, 1976: 251). This flute he believes to be made of heartwood mataī. It is notable that here is an incongruently casual mention of drill-use, even though when in explicit discussion about construction method (Best, 1976: 237) there is an obvious but non-specific omission of this mode. Such a discrepancy reminds us that Best's work does suffer irregularities. Even so, there are points that could be noted in relation to this matter. The hot coal method Best cites is particular in its association to tutu, which is a pithwood, and therefore, more than likely branchwood, while the flute in the Dominion collection he discusses is hard, mataī heartwood. The difference between the two resources must be considered important in relation to drilling, as hot coals work with a different action in each (see chapters 2 & 5). Through omission, Best implies that hot coals were used to bore pithwood kōauau, while harder, non-pithwood timbers involved a hybrid method incorporating various techniques: possibly drilling first followed by gouging and chiselling. I would also argue (without viewing the flute) for the possibility that hot coals may have been used between these two techniques to enlarge the bore, whereby the drilled pilot-hole acts well to channel (excite) and vent (exit) the scorching, with any evidence of fire being cleaned away by the third technique.

As mentioned above, in Stone implements of the Māori Best also refers to the "stone-pointed drill" being used "in the task of hollowing out a whale's tooth (rei tohorā), in fashioning a flute (*kōauau*)" (1974: 85). This does not specify the drill to be a tūwiri though, and as discussed later, this citation is confusing to say the least. Komene claims the use of sand was incorporated while drilling "to assist the flint... to increase friction" (2009: 71). This was not tested in the cord-drill reconstructions of this research in 2002. Nor have I used sand with tūwiri to drill wood since these initial experiments. Too much rather than not enough friction was the problem that required solving in this research. It may be that sand does well to cool things, while also acting as a rasping agent, increasing efficiency of the process all round. This area of study requires further research.

Other problems were encountered during this process. Because of the water, the issue of rot became problematic. At times I was only able to achieve short bursts of drilling, and so these 15 hours of work actually were achieved over a period of weeks. In the process of leaving water in the blank until the next week's session the wood did rot, as can be seen by the brown stain on the outside of the flute (*Fig. 1.1*). Using hindsight, I would recommend that each drilling session be run until the bore is dry or free of excess water, therefore eliminating the risk of rot. Another possibility would be to not use a stone bit, instead using no bit at all, with the shaft sharpened to a point, as was sometimes the practice when using a palm-drill on stone and crystalline (Best, 1974: 74, 91). This method uses water and sand to raise the efficiency of the process. Such a drill may have just as many problems, or possibly more. The drill shaft could possibly shorten as fast as the hole would deepen, though if a particularly harder wood such as mānuka was used that had also been fire hardened, this problem would lessen. The replacement of drill points would be less of a problem with this method. I would contend though that the replacement of drill points is much easier than that of the whole drill shaft. It should be noted that both Warbrick (2002) and Bonica (2002) made several pointed references to me in personal communications regarding the ease and efficacy of drill-bit manufacture when skilled to do so.

Another option that could be considered would be to use a metal drill bit. “Nails and other small pieces of metal could be fitted directly into the old traditional pull-cord drill for faster results than the old stone drill-point” (Starzecka, 1996: 77). That the use of metal in Maori wood working may well have been around since the 1700’s when the first European ship sank in the coastal waters of Aotearoa, was also pointed out in my first interview with Dante Bonica (2002) in a workshop at Te Papa Museum. “Ships nails of copper and iron were beaten to make efficient carving chisels. Flat hoop iron from barrels could be turned into adze blades, although plane blades from a ship’s carpenter’s toolkit made even better adzes” (Neich, 2001: 148).

Upon hearing this, a colleague involved in his own research, Cleland Wallace, proceeded to make a series of small drill bits out of railway iron and leaved car spring which he mounted to his tūwiri and used successfully. My own adze (toki) is constructed of steel, and bound with ribbed elastic cord to a eucalyptus haft (*Fig. 1.14*). This tool was made for me by Warren Warbrick in 2002 when I started the research and remains ever useful and in its original form still 10 years on. Recently on a teaching trip to Great Barrier Island (Aotea) I was graciously gifted a small artefact by a local that is clearly a drill point. It has raised debate amongst peers knowledgeable in the field as to whether it is metal, or in fact stone.

An absence of reference to pull-cord drill being used to bore kōauau is also notable within James Herries Beattie's work. Beattie notes individually the commonly used woods for construction of kōauau, most of which are what this research refers to as 'pith woods' (2009: 78, 79, 258, 259, 483). Flintoff agrees, noting that neinei (*Dracophyllum traversii)* features as a popular South Island wood for making kōauau (Flintoff, 2001-2012). He also raises this point in his book Singing Treasures (2004: 66). As discussed previously, pithy branchwood might exclude the use of tūwiri by their nature, being reamed or burnt, or both, to remove the centre. Yet with Beattie there seems to be no explicit discussion of how this pith was removed, almost as if the making of the inside of the flute was mostly insignificant. Neinei has a very solid pith core, one that could be removed more easily with a drill than with a hot-poker. This research concludes that the predominant material utilised in the South Island that remains today in museums was large sea-bird bone, which the southern collections are full of. This is a completely different discussion altogether and not one to be undertaken in this thesis. The wood that is listed most in Beattie's southern ethnography is that of tutu and tutu-rākau.

Alistair Fraser spent several weeks in 2011 in creative residency on Rakiura (Stewart Island) where he constructed a tūwiri from found resources, and drilled a soapstone karanga kākā (kākā caller). This work was extremely successful, taking him under 2 minutes to drill a 20mm deep hole into the soft talc. At the same time he drilled another, which he donated to this research (*Fig. 1.9 and Fig. 1.10*).

While the cord drill creates a hole that is excellent for kōauau, and ideal for nguru, there appears nowhere in ethnography (as yet that I have found) any conclusive evidence that this tool was used for this purpose. Considering that the cord-drill was in use during the time of Best and Beattie, and that sightings of its use in the construction of other objects were duly noted, there is no apparent reason why either might exclude mentioning any sighting of such a happening if indeed they had experienced it. That this method is easily constructed and results in a high degree of function affirms the plausibility that it was done, but this is backed up only by vague reference within ethnography (Best, 1976: 251). A lack of ethnographic evidence lowers the validity that it was actually an accepted cultural method for kōauau bore construction, but this is offset by the prevalence of evidence in museum collections where a number of flutes I have viewed show physical attributes concurrent with cord-drill construction, especially E150.555 in the Canterbury collection and the soapstone kaka caller D30.880 and two stone nguru in Otago Museum D33.1591 and D33.795. That it takes a good length of time to drill a bore of any length does seem to be contradictory to the lack of eye-witness accounts. In defence of this, while it is obvious that a number of stone nguru I have seen in the Otago Museum collection were bored using a turning drill of some sort, like the tūwiri, there appears to be a lack of ethnographic accounts for this happening also. For reasons that I have not yet fathomed, the action of drilling flutes has escaped early ethnographers.

Kōauau Tūwiri Tōtara

Flute Name: **Kōauau Tūwiri Tōtara**

(Figure 1.1) Kōauau Totara Tūwiri length.

Dimensions:

120 mm *(long, top to bottom)*

33 mm *(wide at top end)*

35 mm *(across at widest mid-point)*

24 mm *(wide at bottom end)*

22 mm wide *(wide at proximal inside bore)*

12 mm wide *(wide at distal inside bore)*

(Figure 1.2) Kōauau Totara Tūwiri.

Materials:

Tōtara branch (*Podocarpus totara*).

Branch was fresh (not dried) when work was started.

Tools Used:

Tūwiri / argillite bit / water / mānuka cross-brace / hōanga (sandstone) / pumice / mussel shell harakeke braid on supplejack bow / sand / stone toki.

(Figure 1.3) Kōauau Totara Tūwiri proximal.

Physical Characteristics:

A strong, hard-walled flute with a wide 'bowl'-shaped bore that runs smoothly in a tapered fashion from top to bottom, decreasing in bore width by a total of 10 mm. The wood is a golden blond colour that is consistent with tōtara. A brown water-rot stain extends from the distal end up one side over half the length of the body. The external walls are finished and smooth. The distal end of the bore is ragged. The surface of the bore is of a 'reconstituted', or mash-like consistency that is reminiscent of papier mache. Vague horizontal bands occur around the bore as it descends, indicative of the use of a stone point cord drill.

(Figure 1.4) Kōauau Totara Tūwiri distal.

Construction Process:

1. An appropriate branch 700-800 mm in diameter that would allow adequate room for a wide bore and thick walls, was selected and cut from a tree.

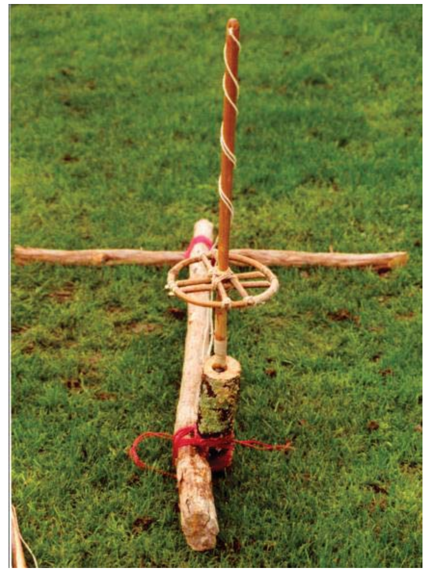
2. This piece was then cut to a length of approximately 1400-1500 mm to create the flute 'blank'.

3. This blank was lashed to the cross-bar brace system.

4. Drilling began with the flywheel-type pull-cord drill.

5. After a period it became apparent that the flywheel type drill was too light as the hole was not being created fast enough in relation to the large amount of effort being expended. A certain amount of downward force was to be required by the drill that was not available in the technique. It was decided that the stone-weight balanced drill would be used.

6. Again, after a period it became apparent that this type was too heavy as the drill was now jamming constantly, and was difficult to use because of a heavy wobble. A certain amount of upward force, or lifting, was now required by the technician, which was counter to the technique and the directional process. It was decided that a wood-weight balanced drill would be constructed for use.



(Figure 1.5) Cross-bar brace system.

(Figure 1.6) Drill Variation-2 in use.

7. Drilling continued successfully with this third type of drill.

8. After a period, it became obvious that there was an issue involving frictional overheating, so water was introduced to the process as a coolant.

9. At a total of nearly 15 hours of drilling, and many blisters, a bore of 1200 mm was achieved.

10. The blank was removed from the vice-brace, and stripped of its bark using the sharp edge of a mussel shell.

11. Using a stone toki, the blank was shaped to its final form.

12. With a sandstone hōanga, the flute form was refined and smoothed.

13. Using a pumice hōanga, the blank was finely sanded to its current outside condition.

14. With a flax braid strung across a bow, and sand spread along the length of this braid, the flute bore was smoothed of most of its loose, rough wood. Though this bore may be considered unfinished and still slightly shaggy in its condition, this does not greatly affect its function.

(Figure 1.7) Drill Variation-3 in use.

(Figure 1.8) Cord-drill Variation-3.

15. To finish, the Kōauau was played, and decided to be very satisfactory.

Construction started and completed in 2002.

Made by Rob Thorne and Warren Warbrick.

Discussion:

The use of tūwiri to drill kōauau bore seems strikingly obvious. The experiments done for this research show a high level of practical possibility, resulting in a very functional bore that rings true to its purpose. While these experiments convey that it is highly plausible that tūwiri were used traditionally, I have not managed to find anywhere in ethnography that it was done. As discussed already, specifically in relation to wood, and kōauau, a number of ethnographic accounts mention the use of other techniques, or resources that would not require tūwiri, and other accounts that mention the use of tūwiri *upon* kōauau for the installation of wenewene (Best, 1976: 237), but as yet, I have not chanced upon the obvious. Of course, these other citations that do imply the use of tūwiri, such as with Best in regard to the drilling of whale tooth to construct a flute, directly alludes to the use of a (cord) drill for drilling bores, yet in the same paragraph, Best concludes that "longitudinal drilling… was impossible" (Best, 1974: 85). This is confusing, as there is a great deal of longitudinal depth required in drilling a whales tooth, and surely, if he had known it was done, he would have made mention here to the cord drill being used to bore wooden kōauau. This citation becomes even more confusing at the naming of the whale tooth flute as kōauau, and I would speculate that the instrument being constructed from this resource is in fact a nguru, and so is not being drilled right through.

The validity of the experiments here become reinforced by the presence of evidence in museums that suggest that some (solid) wood kōauau were drilled using tūwiri. These older flutes demonstrate the same type of worked patterning down the bore as the ones made here, with horizontal banded ridges and grooves, and central 'hour-glassing', yet sufficient warning is issued by renowned experts that these may not be as old as is recorded, or may have been made specifically for the museum trade, or that a combination of traditional method (tūwiri) and steel (point) could lurk beneath their seemingly 'traditional' surface. It should be recognised that instruments made this way by Māori in the late 19th and early 20th century ring in at over a hundred years old, and that as time rolls on, so tradition soon takes on a fluid form.

Conclusion:

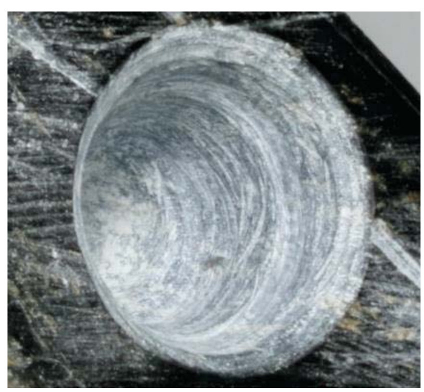
Though the construction of *Kōauau Tōtara Tūwiri* was time consuming in comparison to most of the instruments made in this research it was practically very simple. Once the ability to use the drill was achieved it simply became a matter of time and determination. This is not the only bore that was achieved in this research using tūwiri, and each one progressively became easier physically and mentally. As a skill task, the drilling of kōauau worked well as an exercise. After drilling the first bore, I was able to manipulate the drill in many other, much trickier and more delicate contexts.

From the experiments performed here, and the instruments I have witnessed in museum collections, I have come to believe that tūwiri were used to drill bores for wooden kōauau. From the instruments I have seen in collections, I also believe that they were used for drilling stone nguru, and if this is the case, the use of a cord drill on wood becomes even more obvious. I cannot ascertain why ethnographers would omit such a relevant, and extremely obvious action from their observations, if ever they did see anyone actually constructing kōauau, but can only assume that in fact, this is what has happened. It would seem that no ethnographic historian actually witnessed the making of a kōauau in this way, and if they did, they didn't realise it as so, or thought it irrelevant to their work. If for some reason, there was a strong cultural prohibition (myth based maybe) that restricted the drilling of kōauau rākau with tūwiri, I have as yet to discover it.

The stone-point tūwiri bores a very round, fabulous sounding hole, with consistently smooth walls. The bores I have drilled with tūwiri are highly functional and profoundly practical, and I highly recommend the making of kōauau and nguru with this method for its qualities of sound and as an excellent learning exercise in the use of traditional Māori tools.

Soapstone Karanga Kākā Cord-drill experiment by Alistair Fraser, 2011.

(Figure 1.9) Tūwiri experiment in soapstone by Alistair Fraser.



(Figure 1.10) Karanga kākā tūwiri experiment in soapstone by Alistair Fraser.

Tools:

(Figure 1.11) Cord-drill Variation-1.

(Figure 1.12) Cord-drill Variation-2.

Tools:

(Figure 1.13) Cord-drill Variation-3.

(Figure 1.14) Small steel adze/toki.

Chapter 2

Pith Wood: Holes Grown & Gouged

This chapter is a discussion of the methods and techniques employed in the use of those particular woods that are sometimes known as pith woods. The evidence in this discussion is an example of how construction method can be strongly determined by resource type. To achieve a greater understanding of these woods and the methods used in relation to the research, a number of experiments using various pith woods were performed. From these experiments a number of flutes were constructed, of which two are submitted here: *Kōauau Poroporo* and *Kōauau Tutu*.

Discussion of the push method is informed by several fields: ethnography, practical experiment, personal interviews, and museum evidence.

Some woods grow with a soft core known as pith. Pith is a substance found in vascular plants and consists of spongy parenchyma cells that are encircled by a ring of xylem (woody tissue) and then a circle of phloem (bark tissue). Sometimes pith is hard and just slightly softer than the exterior such as in neinei (*Dracophyllum latifolium*/*traversii*), or thick and juicy as with tutu (*Coriaria arborea*). Often, as with poroporo (*Solanum aviculare*), it is soft and easily removable, and this can be done by pushing a thin strong stick into (and then through) the centre of the branch, forcing the pith out the other end. Sometimes drying or curing the wood causes the pith to disintegrate and no pushing is needed. In these cases the pith deteriorates into a dry dust or loose web like substance that crumbles on its own, or on contact. Some types of wood show little sign of pith when they are green, but with drying or rotting, open up from the inside like a barrel (whau, patē, houhou). In reference specifically to the use of tutu that is gouged to be made hollow, without the use of fire, Best mentions in Games and Pastimes of the Māori that the whio, a longer flute than the kōauau, was "made from a piece of tutu (Coriaria ruscifolia) the pith of which was removed by means of using a piece of wood as a borer" (1976: 253). Buck repeats this in his The Coming of the Maori though refers to the resource as "a piece of *tupakihi*" (1966: 264). In this research, when harder piths required something stronger and sharper than a stick, bone awls were used. Long thin albatross wing-bones are ideal for such a task.

Though not musically related, Beattie collected information in Murihiku (Southland) regarding the use of a fire-hardened mānuka poker for the hollowing of "patete" by removal of "the pith (kaikai)" for the construction of the pōhā straw called the pupuhi. The poker "was called a koko and the pushing the pith out was koko kia puta". Of note also is that since the arrival of the Pākehā "wire is used and the blowpipes are made longer" (2009: 177).

Written accounts are specific to the use of pith woods. Best reports the making of kōauau from tutu, poroporo and neinei (from an account by Captain G. Mair) "all of which are hollowed out easily on account of their having a soft pith" (1976: 236) more than once (1976: 248). Beattie describes the use of poroporo (2009: 258) and tutu (2009: 78, 259), and Andersen (2002: 254) refers to pōrutu being constructed from pigeonwood or [poro]kaiwhiri[a] (*Hedycarya arborea*). These references to the use of pith wood repeat throughout modern ethnography (McLean, 1996: 373). Andersen in "The Journal of Polynesian Society" makes note that when wood was used to make kōauau "it was generally whau (cork-wood or *Entelea arborescens*)" (1933: 233), though he makes note further on that the "kōauau was made also of tutu (*Coriaria sarmentosa*), or houhou (*Nothopanax arboreum*)" (1933: 237).

The occurrence of kōauau made from pith woods in museum collections is apparent, again especially tutu. Tutu can be more easily identifiable than other woods due to its obvious external feature of squaring and darkened, longitudinal bark striations. The large and obvious xylem cells that become exposed when the wood is shaped to effect a flute edge are easily identifiable with tutu also. Even so, it is impossible to be absolutely certain in determining a type of wood just by looking at it. My grandfather (Robert Blades Thorne) was an experienced and very skilled carpenter, fitter and turner and woodworker. He taught my own father (Dennis Eugene Thorne), who in turn told me that the only sure way to identify a wood was "to see it growing in the ground". I have shared this with many people knowledgeable about wood, and who are very good at identifying wood types, and they have agreed with the sentiment. Varying woods possess similar features, especially if they are all of the type with a large central pith and a ringed, open xylem structure.

Of the flutes in these collections that markedly resemble tutu, some of the most relevant would be the 'Notched' D29.1274 from the Otago collection and 1940.24.36 from the Whanganui collection. The artefact D29.1274 from the Otago collection is unique due to the strange square notch at one (possibly the playing) end which suggests that it may in fact be some other 'unknown' type of flute or wind instrument. This feature is possibly consistent with that of a notched flute, or even a fipple or block flute. Even if this instrument is not specifically a kōauau it is still very relevant to this discussion as it is made from what appears to be tutu. Because of its obviously burnt features though, this piece is more relevant to the fire construction discussion in chapter 5.

The small artefact 19xx.1.2076 in the Canterbury Museum collection strongly resembles poroporo, of which Roger Fyfe (Senior Curator of Anthropology) agrees. So much so in fact, it was he who brought it to my attention on my second visit in 2010. When I showed him my poroporo reconstruction, he rushed off to access it from a completely different (and non-musical) area of the collection (Fyfe, 2002; 2010).

The ‘gouge’ or ‘push’ method of bore construction may have been used as an expedient way of making kōauau from green or fresh materials. Pith woods tend to dry quickly but unevenly: being of differing consistencies (opposing densities), the pith and the outer wood dry at different rates, shrinking and expanding in opposition to each other. Such issues can cause wood to crack, rendering materials useless for the task they are being prepared for. For this reason, it might be considered that making from freshly cut samples are preferable, whereupon the green pith is completely removed. This can allay some of these problems, speeding up the overall drying and construction process. When pith is removed from a branch the singular consistency of the outside wood now has an internal chamber of air to assist with its seasoning. In this way, drying can be achieved more evenly and quickly. This can also reduce the potential for rot, which can be considered as the opposite to seasoning.

In these research experiments, success with seasoning was more successful when pith was removed when fresh. Pieces left whole to dry not only took much longer (upward of 6 months) but often cracked the entire length of the sample making them unusable. Longitudinal cracking and separation in tutu samples is consistently a problem and for successful preparation of short tutu samples, the pith needs to be removed whilst green. This is a dangerous practice with this wood, and I do not recommend it. Nor will I accept any responsibility for those who choose to take this risk. The risk of poisoning from toxic woods can never be highlighted enough and cannot be formally recommended in any situation.

During experimentation I discovered no toxicity problems working with poroporo (*S. aviculare/laciniatum*). This is not to say that risk is not there, or that the work I have done may not result in side effects in the long term. The ESR (Institute of Environmental Science and Research) Review of Non-Commercial Wild Food for the NZ Food Safety Authority goes into detail about the active glycoalkaloids, solasonine and solamargine and their effects on the human nervous system at low and high doses (2005: 18, 98, 112, 146). Murdoch Riley notes the use of poroporo for birth control, and how it was farmed commercially through the late 1970s for the purpose of extracting its active hormonal ingredient (1994: 364). An urban-myth which I have not been able to confirm purports that one reason this particular enterprise was abandoned is because men working on the plantation were reportedly growing breasts. Andrew Crowe in A Field Guide to Native Edible Plants of New Zealand lists poroporo under *Poisonous Trees and Shrubs* (171) and stresses in bold type that "**the leaves and unripe berries are poisonous**" (1981: 46).

In my experience, the effects of working green tutu were much more immediate and risky. One early experiment involved me gouging the hard, thick, juicy pith from a piece of cut tutu branch. After 20 minutes of working, the skin of my hands had become saturated with juice, and covered in mashed pith. My powers of perception became altered, whereupon I became sensitive to light, everything became brighter, I felt dizzy, and experienced an overwhelming sense of nausea followed by a headache. I completed the task at the 30 minute mark, in which I had removed the pith completely from a 200mm length. I ceased work immediately and washed my hands thoroughly. These symptoms were synonymous to an intoxicating experience I had as a teenager when I applied polyurethane to a piece of furniture in a non-ventilated area. While I recovered quickly from this experience with tutu, with no apparent long term effects, I would not recommend undertaking extensive periods of work that involved contact with the pith or juice of freshly cut tutu. The psychoactive elements and dangers of tutu became very apparent to me with this experience, and though I appear to have escaped unscathed, as yet, the risks of compounding toxins with such things (of which I am uncertain) must be seriously considered. The toxin in tutu goes by the name of tutin and has long been considered to be a glucoside. More correctly it is in fact an antagonist of the glycine receptor, one of the most widely distributed inhibitory receptors in the central nervous system, related to physiological processes in the “spinal cord and brain stem” (Wikipedia, 2012). It is only found in tutu. Effects of tutin poisoning include muscle spasms, hallucinations, “rigidity of the spine to convulsions at later stages” and death (Riley, 1994: 484).

One interviewee I spoke with, in Rotorua in 2005, mentioned the use of tutu in divinatory seer rituals, the tohunga matakite (prophetic visionary) drinking a specifically prepared juice that then allowed them to see the future. At the time, this older woman was undergoing a regular traditional-based cancer treatment that involved a sauna-like process she termed as a “hāngī bed” of tutu leaves on hot rocks (Participant"W", 2004). Another participant, in 2012, spoke of his grandfather becoming heavily intoxicated and communing “with the wairua (spirit)” when under the influence of a preparation he termed “the white lightning”, which he consumed in very measured amounts. This man’s grandfather, born in the latter half of the 19th century, was a man of “the old ways” who still slept in a bark hut in the 1970’s on a dirt floor (without mats), and continued a traditional existence to the best of his ability until his death. This included the practice of karakia (ritualised prayerful invocation) for everything in his daily life (Participant"N", 2012). I have had two others speak to me of this practice, one saying that they read it in a Best book somewhere, while another claimed it was either somewhere in “Journal of the Polynesian Society” or “Māori Manuscripts and Archives” (Māori-MSS), but as yet I have not managed to find and confirm this vague oral reference.

Murdoch Riley in Māori Healing and Herbal makes note of the New Zealand species’ Central and South American cousin and its psychoactive uses in an ethnobotanical context. This species, *C. thymifolia*, is deemed a narcotic hallucinogen, and the berries are reputed to “give a sensation of flying, and in some places only sorcerers are allowed to eat the fruit and experience such delights” (1994: 484).

The ease with which flutes can be made from pithwood is undeniable, and there are many tree types in the New Zealand native agenda that have pith, and are not as apparent in their risks as poroporo and tutu. Whether the wood is found ‘fallen’ on the forest floor virtually ready to play immediately, or cut fresh and worked to be played immediately, pithwood construction is an example of how kōauau need not be labour or time intensive. In regard to viability, pithwood kōauau rank highly on my own personal favourite list. That the two most popular cultural preferences used in this method have toxicity and ritualistic magical qualities is of no surprise. The wooden flute has a long history of being magical across cultures, with a coinciding issue of being produced from toxic resources. Woods that have been used to make European (and American) wooden flutes (and bagpipes) over the last 300 years that have toxicity ratings include laburnum, cocobolo, cocus and boxwood. Ritualised magic regarding the flute and the power of it to alter consciousness is very wide, tracing back to the Egyptians, to Greece, China, Africa, South America, the Celts, and the myth of Kokopelli in North America. While the varieties of magic differ widely, from creation magic, fertility, sex and love magic, through to rain, wind and season magic, divination and seer magic, there is no doubt that the flute has been central for thousands of years to ritual magic all over the world. An excellent Western European example of belief in the mystical power of flutes is in Mozart's "The Magic Flute" (1791), whereby the music of the flute protects and enables believers to pass through the dangers of fire and water and into an enlightened state. This topic of flute mysticism, and its inherency within some ritual magic, is worthy of further study. The relationships between construction method, resource type, ritual, and belief are comprehensive enough to be deserving of extensive research. It is here then, that I wish to flag that I believe it to be significant that a culturally magical instrument such as the flute would be constructed from a magical resource such as tutu, reported to be used in Māori ritual by tohunga to divine the future, or the fertility and food related resource that is poroporo, a member of the *Solanaceae* family, and therefore a distant cousin to mandrake, belladonna, cannabis, tobacco and datura. As a member of the *Solanum* genus, some of our native's closest cousins are the eggplant, the tomato and the potato, all of which are highly edible species.

Construction – Kōauau Tutu:

The first important consideration when discussing the construction of this particular kōauau must be the toxicity of the resource. I will not openly recommend the use of tutu (*Coriaria arborea*), especially when fresh. Even so, opinions do vary regarding its dangers. According to Salmon the sap is poisonous in the spring, as the seeds are in autumn. “In a healthy person as little as 1 milligram (of tutin) produces nausea, vomiting and general incapacity over a period of twenty-four hours. No antidote is known” (1980: 128). It has reportedly caused death in cattle that have eaten it and even killed circus elephants that were allowed to feed on it. For this reason it has been the aim of extensive eradication programmes in regions across New Zealand, particularly on farm land. In Maori myth the story of how tutu was one of the first plants to take hold upon Papa after Tāne separated her from Rangi implicates the plant in the magic and mythology of creation (Riley, 1994: 484). In a relative but modern context it is known as a ‘disturbance’ plant whereby it is often one of the first forms of vegetation to naturally establish soon after bush is cleared. I have spoken with Department of Conservation staff who work hard to keep it under control at springtime because of its rapid growth causing it to block flooding streams from snowmelt.

It is intriguing to note therefore, that there have been many (Maori and colonial) positive ethnobotanical uses recorded for tutu. A well-known use was in the making of a non-intoxicating drink. Some records claim that this was only intoxicating if it was not prepared fresh, being recognised according to the colour and taste. The drink was prepared traditionally using a filter of raupō or toetoe, and later calico, to keep the deadly seeds out (Riley, 1994: 485). From what I can deduce, this drink has several intentional forms, one which is in fact a mildly intoxicating beer, another that is a cordial, and only refreshingly thirst quenching in its effects, and yet another that was an extremely potent distilled spirit.

Externally tutu was used in a many ways. Riley lists 25 ethnographic cases, including that of poultices from the boiled inner bark for abscesses, bathing solutions for ulcers, cuts and burns, and bandages of dry leaves for drying up weepy rashes (1994: 485-487). When considering traditional medicine and its contexts, it must be realised that the system is inclusive and holistic. One participant I worked with used the saying “what ails you also heals you”, expressing that while one part of a plant might make you sick, another part will harbour the antidote (Participant"T", 2003). That a plant, or method is used, should be considered as relative to a wider context. Therefore, tutu being used for various medical purposes must be considered in the light of its musical uses, in some way at least, and how these might relate culturally and practically. A number of uses refer to sprains and broken bones. One in particular speaks of scraping out the pith with a knife or shell (probably a split length) whereby this is applied as a plaster to the injury, and then wrapped in raupō or harakeke. It continues by recommending a length of bark as a splint. Another entry refers to the break being set and splinted and the use of karakia that invokes the bone setting powers of the treatment. Yet another refers to the pith being removed and bound to inflammation directly. Another related use was tutu soot (ngārehu) being mixed with weka or shark oil to procure an ink for tattooing (all Riley, 1994: 486-487). All of these citations are of interest to a greater understanding as to possibly why a toxic plant might also be used to make flutes by removing the central pith. An obvious observation might conclude that when the pith is removed from a section (without it being split) one is left with a kōauau ‘blank’. This kōauau might then be considered as integral to healing in some way: sonically, or in rehabilitation (Robinson, 2005: 246-248).

During a hui in Rotorua, in 2004, I was participant in a discussion amongst instrument makers regarding a traditional method for choosing of a tutu branch section for kōauau construction. This referred to the selection of branches specifically in relation to their position on the tree, and to the position of the tree itself. One tradition laid out criteria that included hard to reach branches on trees situated on cliffs, above a river, and facing certain points on the compass. Continuing discussion related the precarious nature of the sought after branch in regards to danger and achieved courage. That when a 'love' flute is properly made and played, the one being wooed is assured of the maker/players strength of resolve and courage in winning their heart, due to the great risks taken in the making of the flute. Another possible reason for these requirements when acquiring a branch may have to do with the weathering of the branch and the subsequent growth patterns that create perfect pith to branch-wall ratio, or seasonal changes in toxicity levels. This issue is definitely worthy of further research, practically and culturally.

Function – Kōauau Tutu:

The finished bore of *Kōauau Tutu* is highly functional. It has a great deal of tonal control, with a bright, very loud ring to its sound. The length of the flute enables a very loud, singular upper register overtone to be achieved. This is very reminiscent of the loud 'piping' or 'tooting' that a tūī bird makes. The wenewene vary in their expression of pitch, though none cause the playing to cease when opened, as can happen at times.

There was a high rate of success in this experiment. The use of tutu as a resource, and the push-method as a technique in the making of kōauau is very plausible. The ‘possibility’ of such a flute is high: the result is very functional and was extremely ‘make-able’. The validity of the method is confirmed by copious evidence in both ethnography and museum collections, and the extended relevance of tutu in ethnobotanical use within Māori culture.

The resulting flute created with tutu by the push method has a slightly tapered bore that resembles many of the tapers in pieces in museum collections. The vague curve in the bore can also be found in a number of artefacts in collections. On its own, as a method (without the use of burning), the surface of the bore is relatively smooth and very usable as a flute. The issues relating to cracking could possibly be offset by the high availability of tutu in a traditional forest and traditional methods for branch selection might in some way relate to decreasing the chances of splitting in drying and construction, especially if windward branches have thicker walls in relation to pith diameter. More research into these aspects is highly recommended.

Physical Attributes Prevalent With Tutu and the Push Method:

The Push/gouge method creates certain effects when used with tutu. These include:

- A naturally round ‘grown’ hole with a straight, slightly tapered bore.
- Though this bore is ‘straight’, it has a natural, ‘grown’ curve or ‘bend’ to its form.
- Vertical trench-like striations (‘squaring’) particular to tutu branchwood.
- A slight ‘pinch’ on one side of the bore while the other side keeps a straight line.
- This ‘pinch’ indicates working from both ends, and meeting in the middle.
- Rough bore surface.
- Slight shaggy remnants of pith remain on the walls of the bore.

Construction – Kōauau Poroporo:

There are several important points to consider when using poroporo (*Solanum aviculare, Solanum laciniatum*) for the construction of kōauau. The first of course is toxicity. While it is appropriate to be wary of *any* species that registers with levels of toxicity it should be noted here that poroporo *probably* poses a low risk when used to construct kōauau. Solanaceae is a diverse plant family and characteristically ethnobotanical, being extensively utilized by humans globally as an important source of food and medicine. It may even be the most widely ethnobotanicised plant family on the planet (Solanaceae, Wikipedia, 2010). Often rich in alkaloids, toxicity to humans and animals within the plant family can range from mildly irritating to fatal in small quantities. Most edible members of the family have an aspect to them that is toxic to humans (Solanaceae Source, 2004-2010). Riley notes that with the New Zealand commercial trials, extraction was from the leaves and not the berries or stems (1994: 364), and the ESR report indicates that the toxic principles of poroporo are "present in all parts of the plant in varied concentrations" (Turner, 2005: 146).

In regard to wider ethnobotanical uses by the Māori there were many. The plant was grown in plantations "for the value of their fruit" and the leaves were used upon the stones of the hāngī and in particular were used when cooking moa for their "pleasing flavour to the meat". The berries were used by colonial settlers in jams and pies (Riley, 1994: 361). Riley notes that it was the ripe berries of the poroporo that the tohunga of Tūtānekai was caught eating under a tapu restriction prior to the baptismal rite. It was this incident that led to his being put to death by drowning and that from the arm bone of this tohunga the famous kōauau "was made, which in later years Tūtānekai was to use to charm the beautiful Hinemoa" (1994: 361). I note this as synchronistic to the research; that the most famous of all human-bone kōauau holds, at the least, a symbolic connection with poroporo.

Riley also lists a number of external uses. One use that repeats is that of poroporo soot being used in the process of tā moko/tattooing, whereby it was used to sketch designs prior to being tattooed (1994: 361-363). This was also the case with tutu (Riley, 1994: 486). Again, as in the discussion of tutu, the making of soot from poroporo may in some way bear relevance to the making of kōauau and the use of flutes within pain rituals such as tattoo, though this discussion is more appropriately located in chapter 5.

Kōauau Poroporo was constructed very quickly and very easily. The main tools used for this particular piece were modern yet even so, the principles used in construction were based in tradition. The simplicity of this flute's construction was upheld by the maker as an important tenet of traditional method (Flavell, 2002).

It is relevant to make reference here to a point raised by Richard Nunns, on more than one occasion, regarding the possibly temporal nature of some instruments. He postulates that at particular times the making and use of kōauau may have been something that was done only when required. Once used, the instrument would then be disposed of, either because it was very quick and easy to make, and was no longer needed, or that because cultural or tapu boundaries restricted the transit of the instrument into other geographical areas or cultural zones. An instrument would be quickly constructed, the transitional ritual purpose for which it was made would be performed, and the flute would be discarded or destroyed so the journey could then continue (Nunns, 2002 - 2012). From what I understand this idea of 'single-use' is hypothetical, whereby the expert has intuitively extrapolated his vast experience and knowledge, seeking to broaden the boundaries of understanding in regard to the cultural usages and restrictions of such instruments. It must be emphasised that Richard Nunns has great mana and is highly respected because of his expertise and experience in these areas of understanding, particularly in regard to the cultural relationships of geography and the transport of resources and information, and the roles that music, song and ancient knowledge perform in these fields.

When choosing a poroporo branch the internodes are important and literally define the length of the flute. If a longer flute is desired, either the internode must be plugged up in some way, incorporated as wenewene, or the outside nature of the flute must be left undisturbed and unworked as much as is possible so that the meeting pith cavities do not undermine the flute bore, creating unplayable or disruptive holes along the barrel of the instrument. One highly respected maker I spoke with told me of self-sown poroporo growing wild on a property that were fed with a high nitrogen fertiliser causing it to stretch and elongate, creating longer spaces between the nodes (Flintoff, 2001-2012). I have noticed that trees that grow against buildings develop longer nodal spacing on branches that are on the building side of the tree, as do branches that are shaded from the sun for whatever reason. Longer spaces between nodes means longer flutes with a wider tonal range. Poroporo develops thicker walls with less pith the older it gets. I personally have found very mature trees to be difficult to work with, and prefer plants under a year old for their pith to wall ratio.

Function – Kōauau Poroporo:

The finished flute, Kōauau Poroporo, plays well with a quiet and breathy tone. Made quickly, its function is good for the short time it took to complete. The wenewene all play successfully, though in the reversed, “southern-style” designated by the maker. Without too much fuss in the making of the flute, or in the sizing or spacing of the wenewene, Mr Flavell was immediately able to play a waiata that he knew, first playing, and then singing.

In more recent experiments, I have been successful in constructing kōauau from poroporo that have a clearer, brighter and louder tonal quality. This was obtained by spending more time and effort and working with more intent upon the surface of the bore with sandpaper, and even hot pokers, making it smoother. Working a bore though can be tricky and time consuming, and there is no doubt that a fluffy (shaggy), less smooth bore gives an indefinably traditional quality to the tone of the sound produced: one that is quieter, more gentle, evocative and mournful. I uphold this flute made by Mr Flavell as very special to my learning process as it demonstrated well how very little effort was required to produce a strongly traditional kōauau. Ever since, poroporo has been a favourite resource of mine.

The evidence presented by this experiment is strong in regard to construction and function. While there is clear evidence in ethnography relating specifically to poroporo, the physical proof in museum collections seems less obvious. With the appearance of the artefact 19xx.1.2076 in the Canterbury collection, the validity of this resource/method combination is confirmed more.

Physical Attributes Prevalent With Poroporo and the Push Method:

Pushing poroporo pith to make kōauau creates certain effects. These include:

- A naturally round, ‘grown’ hole, with a predominantly straight bore.
- Longitudinal threadlike strips of loosening fibre down the bore.
- Green shiny external surface if bark is left on.
- Fluffy bore, rough in nature.
- Poroporo is light in weight.

Main Discussion:

The plausibility of pithwood flutes is heightened by the ease with which they can be made and their high degree of function. The validity that such resources were used by Maori traditionally to construct kōauau is backed up by the evidence in museum collections and in ethnography. The strongest evidence in this section of the research is not a singular element, but the combined factors of resource, construction, and function. Flutes made from pithwood are very convenient, easy to make, and excellent to play.

As two of my favoured, even preferred, resources when making kōauau, the factors that exclude me from using poroporo and tutu in a teaching and work-shopping context are not about possibility, validity or plausibility. The risk of poisoning or intoxication are proven scientifically and culturally, and now personally, enough that I am not prepared to risk anyone else’s health, or my own reputation to involve them. These two resources though, are very different and should not be considered synonymous. I have seen poroporo used by other practitioners in a teaching context, and these experts consider no risk in regard to the use of the tree’s branchwood. There is no doubt, that toxicity is very much an issue that needs further research. I have noticed that discussions are on the rise amongst traditional health practitioners regarding both tutu and poroporo and their place in modern-traditional usage. A strong element in this discourse amongst rongoā practitioners is a recognition that these plants were used extensively and that they have become maligned, even colonised, in recent times due to generalised misunderstanding and misappropriation. The broad alignment of poroporo with tutu is one such misappropriation.

One coincidental risk that tutu holds to humans is in honeydew, a sticky substance secreted by aphids and other insects such as plant hoppers. The insects that reside on tutu, in this case the passion-vine hopper (*Scolypopa* species) produce tutu honeydew as they feed on the sap of the plant, which in turn is collected by honey bees and incorporated into their honey. This honey has a poisoning effect on the humans who partake of it. Honeydew honey "cannot be distinguished by taste, sight or smell from other nontoxic honeys. The toxin cannot be degraded by any heating or processing of honey. The toxins are believed to be very stable and poisoning cases have resulted from people eating honey that was several years old" (Sim, 2011). At times in recent New Zealand history, outbreaks have seen many people become affected. Symptoms can include vomiting, delirium, giddiness, increased excitability, stupor, coma and violent convulsions. These are the same direct symptoms of course that Riley lists (Riley, 1994: 484).

In a direct comparison of these two resources in regard to construction of kōauau, there is an ease of collection and use in the less risky poroporo. Construction is swift and the light pith is easy to excavate. The dangers of toxicity are *probably* distant if the unripe fruit is not involved at all. The advantage with the more dangerous and difficult tutu is that it enables much longer lengths to be cut and used as there are no branching growth nodes to interfere with the barrel required for flutes. Though the pith is denser and drying can be trickier and more prolonged, the overall practical outcome with tutu I believe is better, producing larger, stronger, and louder flutes. It is for this reason probably that it was tutu that was used in the example of the longer whio presented by Elsdon Best in Games and Pastimes of the Maori (1976: 253).

As discussed, the choice of resource may have been determined by cultural/ritual aspects not included in ethnographic discussion. Often in the case of traditional forms, construction process becomes defined by the materials used, and these resources are in turn, *directly related* culturally to the function of the object. In other words, a particular material is used in the making of a ritual (magical) object because of the cultural and ritual (magical) value ascribed to the resource. The construction process now becomes a meaningful (and magical) experience, and an important factor in final (ritual) usage, embedded within both the (now magical) object, and the (magic) maker. Tutu may have been chosen because of its magical properties, these becoming realised in the construction process, and then persisting symbolically in the final function and usage of the flute, and the consciousness of the maker/player. Poroporo may have been selected for rites involving human fertility/sterility, or seasonal wild-food harvest, because of its acknowledged applications and cultural relevance in these areas.

Kōauau Tutu

Flute Name: **Kōauau Tutu**

(Figure 2.1) Kōauau Tutu length.

Dimensions:

159 mm *(long, top to bottom)*

27 mm *(wide at top end)*

30 mm *(across at widest mid-point)*

23 mm *(wide at bottom end)*

17 mm wide *(wide at top, inside bore)*

16 mm wide *(wide at bottom, inside bore)*

Materials:

Tutu (*Coriaria arborea*) branchwood (200 mm long), freshly cut. Pith was relatively hard and very juicy.

Tools Used:

Bone awl / stone toki / hōanga / shark-tooth drill.

Physical Characteristics:

Kōauau Tutu is a large strong and deep-walled flute. The bore is virtually straight, tapering by a total of 1mm over its 16 cm length. The surfaces of the internal walls are rough and uneven and show signs of the vertical striations particular to tutu branchwood. In the centre of the bore there is a slight bend on one side while the other side keeps a straight line (in effect creating a 'bowling' effect in the bore). This is evidence of the way that the pith was pushed out from both ends, joining the two bored holes in the middle. A grown bore usually has a slight curve to it. Remnants of pith remain on the walls of the bore which is why the longitudinal striates are still present. If the pith had been completely removed these shallow trenches with pith 'billowing' between them would have been completely removed leaving a relatively smooth, round bore. This was not done for the purposes of demonstrating an obvious tutu bore in the research.

(Figure 2.2) Kōauau Tutu proximal.

(Figure 2.3) Kōauau Tutu distal.

(Figure 2.4) Kōauau Tutu bore surface

Such a feature could also be an indicator towards the use of fire in pithwood flutes, so burning away any remnants of the loose pith and hardening the surface and the sap at the same time. The outside has been formed in a characteristic kōauau shape with a rounded, smooth form that widens by 3mm just above the middle and tapers off at the bottom end to a diameter of 4mm smaller than the top-end (27mm, 30mm, 23mm). Three wenewene have been installed along the flute wall using a shark-tooth drill. Placed (from proximal to distal) at (1)30mm, (2)53.5mm and (3)101mm, they are all the same size, just over 3mm at the top, tapering down to just over 1.5mm, and each sound a different note clearly without any extra manipulation. When overblown the flute is loud and bright. The singular overtone rises in pitch microtonally with the opening of the third (bottom) wenewene. The other wenewene do not respond when overblown, resounding with the same note as that of the third stop, but brightness of tone is somewhat reduced by a loud breathy quality. This flute plays quieter than other tutu kōauau I have made that have had the bore smoothed with sandpaper or smoothed and

(Figure 2.5) Kōauau Tutu.

hardened with a hot, flaming wooden poker. This said, the size of the flute body and bore creates a louder flute than most in this collection.

Construction Process:

(Figure 2.6) Tutu branch.

1. A branch of tutu was chosen for its width, or thickness. This blank was nearly 50mm thick and almost 200 mm long. Choice incorporates overall branch width in ratio to internal pith diameter. This ratio must consider the reduction of wall depth in making the flute (and if carving is to be performed upon the outer surface when being made) and the overall playability of the bore diameter when pith is removed. For a smooth hard bore it is expected that more than just the pith will be removed, but some of the internal wall also. Of course, pith size has to be estimated before the branch is cut.

(Figure 2.7) Tutu and bone awls.

2. Using a bone bradawl the pith from half of the blank was removed by pushing, digging, gouging and scooping. This was not difficult, though at times nor was it easy. With persistence and

rigorous effort this was achieved within about 15 minutes.

3. With the intention of making a single hole by boring from both ends, the blank was turned around and the same again was performed from the other end back towards the first hole. This step was easier than Step 2 as the cavity created by the first hole allowed greater movement from the remaining pith. This process involved more of pushing the remaining pith out through the other end rather than the scooping and gouging of Step 2. This took little more than 10 minutes.

4. With the majority of central pith removed from both ends, the bone gouge was used to clear and smooth the bore to a more refined form. This involved long swift vertical movements of the tool that smoothed while clearing minor inconsistencies to the bore surface. Occasionally a rounded or circular reaming motion was employed as the tool was drawn back out of the hole.

(Fig. 2.8) Refining the bore.

5. With the bore surface complete, the outside bark layer was stripped from the blank using a stone toki. This was achieved by holding the blank (by hand) at an obtuse angle that varied mostly between 110^{o} and 135^{o} and applying the toki in a smooth downward 'chopping' motion, to the lowest half of the blank. As each piece was stripped the blank was deftly rotated in the makers hand by about 20-30^{o}. This stripped or shaved the blank right around its circumference from the middle down.

(Figure 2.9) Shaping the exterior.

6. The blank was then turned upside down and this was repeated upon the other half also.
7. Still using the toki one end of the blank was bevelled. With the pith removed the ends were now without internal structural support, and crushing the ends was now riskier. Greater care was applied with this task. The movements became more precise, the pressure applied was lighter and the cutting actions quicker. The angle that the blank was held at became flatter (around 160^{o}) to respond to the angle of the toki. Again the same turning or rotational process with the blank was applied to create

(Figure 2.10) Bevelling the ends.

the chamfer right around the end edge, this time with smaller rotations of around 10-15^{o}.

8. With one end bevelled, the blank was turned upside down and Step 7 was performed on the other end.
9. The ends were then refined by applying the toki in a knife or scraper like manner across their surface.

(Figure 2.11) Refining the ends.

10. At a point deemed satisfactory the ends were left and the bore was smoothed and further refined around where it opened onto the end surfaces.
11. In the next step the outside of the kōauau was further refined by a sanding process upon a sandstone hōanga. Water was applied intermittently to assist the process.

(Figure 2.12) Large sandstone hōanga/grindstone.

12. Constantly varying between the application of two techniques resulted in the overall smoothing of the outside. One technique applied the piece horizontally in a long and gentle rocking motion across the face of the hōanga. This aided in the overall shape of the kōauau while at the same time rendering it very smooth.

13. Another technique involved the vertical application of the piece against the stone, while moving it in a general circular motion. This circular motion involved tipping the piece at a slight but fixed angle off vertical so that with every full motion the flat end met with the stone face fully for a brief time. This technique rounds the chamfer on the end (becoming radius), while also keeping the very end of the flute flat. This refines the ends while blending the gradient of sanding and angle together with the rest of the body of the piece, resulting in a flat surface immediately around the bore opening and a rounded edge where the chamfer once was that blends perfectly into the rest of the smooth body of the flute.
14. Once satisfactorily smoothed and then wiped dry, the flute was rubbed upon the skin of the arm and the face to apply a natural light finishing oil to the wood.
15. Before completion, three wenewene were drilled using a shark-tooth drill (*Fig. 3.54, p. 135)*. Firstly the wenewene were marked as to where they would go. This was done by laying the flute next to the left first finger and translating the position of the top of the finger to the top of the flute. The first wenewene was marked at the first knuckle, the second at the middle knuckle and the third at the bottom knuckle. The shark-tooth drill was spun with one hand upon the marks until a small hole was drilled right through.
16. The flute was played and the wenewene were expressed. The function of the flute was deemed satisfactory and the work considered complete.

Construction started and completed in 2002.

Kōauau made by Warren Warbrick and Rob Thorne.

Discussion:

WARNING: Working with fresh tutu can be dangerous.

During the making of this flute I experienced physiological side-effects from the absorption of tutu pith juice through the skin of my hands. These effects included light-headedness, sensitivity to light, increased heart-rate, delirium (giggling) and nausea. The experiment was performed with fresh wood in an attempt to assess the difficulty and immediacy of construction, and to see how easy it is to remove the pith, for purpose of drying without cracking. The central pith is very wet and juicy, and solid when the wood is fresh. It is not entirely easy to remove and the process is messy.

Problems arise with splitting during the drying of tutu. This can be managed by: sourcing twice as much as what is needed; cutting lengths that are longer than what is required; drying very slowly in a cool, dark but dry place (under the house is good); and/or by removing the pith while it is still relatively fresh (optional considering the risks). To properly season wood can take months (3 to 6 to 12 months depending), but the pith is more easily removed around the 4 to 6 week mark as it begins to shrink away and separate from the wall of the branch. Catching it at this point, and removing the pith by gouging, can greatly reduce the outer wall from splitting. Waiting for a certain amount of dry-off appears to lessen toxic potential, and research into the seasonal presence, anatomical location (in the tree), biological stability and degradation rates of tutin would be invaluable. Once the pith was removed in this experiment, further side-effects seemed to be non-existent. Consideration of biological stability needs to be considered when it comes to not just construction, but future playing of the instrument, and studies into tutin suspended in honeydew suggest that stability is high, with poisoning still occurring years later (Sim, 2011).

Once hollowed, the finishing of the flute was straightforward and creating a classically shaped kōauau required very little effort. Besides the very real and ever present risks, tutu as a resource for making kōauau is ideal.

Conclusion:

The success of *Kōauau Tutu* as a practical experiment was substantial. Not only did it demonstrate the proficiency of the push method, and the potential of tutu as a resource, it also pitches to the critical issue of toxicity, practically and culturally. That toxic tutu features so predominantly in ethnography as a flute resource cannot go unnoticed, and rather than avoid the issue, this research has sought to confront it. Instead of separating the factors of toxicity and historical prevalence by claiming coincidence or irrelevance, this research instead recommends connecting them, suggesting that one reason that tutu was such a popular material was *because* it was 'toxic': consequently being one important component in a shamanic process that involved states of consciousness, music, and the use of a flute.

Further biochemical, arboreal, cultural and practical research into tutu and tutin would be of great worth to bring a deeper understanding to a much maligned plant that was of great traditional value to the Māori. In fact, the making of kōauau from tutu alone would be worthy of a thesis in itself.

Kōauau Poroporo

Flute Name: **Kōauau Poroporo**

(Figure 2.13) Kōauau Poroporo length.

Dimensions:

158 mm (long, top to bottom)

22 mm (wide at top end)

25 mm (across at widest mid-point)

24 mm (wide at bottom end)

18 mm wide (wide at top, inside bore)

13 mm wide (wide at bottom, inside bore)

Materials:

Poroporo (*Solanum aviculare*) branch-wood, was dried for two months before construction.

Tools Used:

Craft knife / dowel gouge / bench drill.

Physical Characteristics:

This flute is strong with hard walls and a straight bore that has been step-tapered at the top by widening the first centimetre of the opening with a craft knife. The bore is 'fluffy' and rough in nature, with shaggy remnants of wood hanging from it. The bark layer has not been removed giving it a very natural and 'un-worked' appearance. For the purposes of playing, the top-end has been shaped on the outside by whittling, exposing the white wood underneath the bark in a circular rim of about 3mm. For aesthetic reasons the bottom-end has had the same done to it, to match the top end. Three finger holes, or wenewene, have been made using a workshop bench drill along the top edge of the flute, and countersunk by hand using the blade of the craft knife. When the practitioner was making the flute, he clearly defined the top end, stating that the wenewene were to be played in what he defined as "the South Island formation" (Flavell, 2002), with the two holes that are closer together being at the bottom end. When discussing this he spoke of how he preferred this format for reasons of function: that all wenewene worked well in this formation,

(Figure 2.14) Kōauau Poroporo side.

(Figure 2.15) Kōauau Poroporo proximal.

and that often the top hole will not play satisfactorily in the opposing configuration (Flavell, 2002). When played, this kōauau has a breathy, soft tone to the notes. All of the wenewene play clearly without any extra manipulation. When over-blowing, only a singular tone can be produced, with all finger-holes stopped. Though the tones play well, the notes tend to cease when blowing is lessened. This tonal 'fluffiness' and lack of definition is probably a result of the roughly surfaced bore.

(Figure 2.16) Kōauau Poroporo distal

Construction Process:

1. A branch of poroporo was chosen for its size. This sizing included its overall width and an adequate length in between its branch internodes. The blank is cut with extra length to allow for the final instrument to be properly worked at each end.
2. The branch was cured for 2 months in a dry, cool and dark place: in this case the ceiling space of an outside shed.
3. Upon being presented with the prepared branchwood the maker, Mr Flavell, became

motivated by the simplicity of the task required and immediately reached for a piece of dowel to gouge out the pith.

4. In less than 5 minutes the blank was cleared of the dried pith from pushing the dowel through.
5. Using a craft knife he shaped each end of the blank on the outside with a basic whittling technique and began testing it for function immediately to see which end he preferred as the playing end.

(Figure 2.17) Mr Flavell shapes the ends with his craft knife.

6. Upon deciding which extremity he preferred to play through, the maker then tapered the inside edge with the knife in a circular reaming fashion. Widening the mouthpiece increased the function of the flute.
7. When Mr Flavell was satisfied with the basic function of the flute, he marked out where he would place the finger-holes by laying the flute along the length of his left index finger: the distal foot of the flute at the fingertip, and the wenewene aligned to the 3 knuckles.
8. He then selected a 3mm drill bit for the drill press and swiftly drilled three wenewene through the wall of the flute. In doing this, the

top side of the flute and the final playing edge of the flute became defined.

9. To countersink the finger-stops, he deftly used the tip of the craft knife blade and in a circular motion cleared an angled 1mm inverted rim around each wenewene. Poroporo bark tears and runs in strips easily, and he was very careful not to let this happen by using small but smooth cutting movements.

(Figure 2.18) Counter-sinking the wenewene.

10. To finish, Mr Flavell played the kōauau, claiming great satisfaction with the ease and speed of construction and the functioning of all aspects of the flute. To confirm the success of his construction, he then played and sang the traditional waiata "*He Waiata Whaiāipo*".

(Figure 2.19) Kōauau Poroporo wenewene.

Construction started and completed in 2002.

Kōauau made by Dean Flavell.

Discussion:

The speed and simplicity in the construction of this kōauau is testament to the calibre and appropriateness of poroporo as a resource. The two month drying time made for quick and easy excavation of the pith, and the use of the craft knife demonstrated an excellent choice of modern tool. That Mr Flavell saw simplicity and ease of construction as vital principles of traditional method is pertinent to the entire research. Never did he express concern over possible toxicity regarding the resource, speaking casually of its traditional food uses while working.

The plausibility of poroporo being used traditionally to make kōauau is validated in ethnography (though far more briefly than tutu), and in the new found presence of the piece in the Canterbury collection. A (high) lack of toxic risk, with culturally strong food and medicinal connections makes poroporo a safe and powerful holistic resource. The ease in which good flutes, with reasonable acoustic function, can be quickly constructed from it is a final practical confirmation in the research equation.

Conclusion:

Kōauau Poroporo is an excellent example of a flute made quickly with appropriate materials. This resource defines and governs the construction process, and half completes it also, by providing a nearly hollow bore. Poroporo is a fantastic resource for making kōauau. It grows frenetically all over New Zealand, coming virtually ready-to-play. While the toxic risk must be noted, it appears relatively low for the purpose of flute making. Nevertheless, any use of the plant should be conducted with caution. More research into the biochemical nature of poroporo, and its traditional uses and cultural perceptions would be valuable.

Chapter 3

Holes Found Ready To Play

This chapter is a review of kōauau that I have made during this research from materials that presented themselves immediately as playable instruments. The chapter is divided into 3 sections: (i) kōauau made from found wooden materials, (ii) other oblique instruments found ready to play, and (iii) kelp kōauau. I have endeavoured to restrict this discussion to those materials that emerged from out of the natural world as there are many objects and resources, from nature and from the human-made realm, that present themselves in the modern world as playable to those that have a passion for seeking such things and the skill to voice them. I use the term ‘found’ as a way to express the act of ‘seeking and/or discovering’ a musical resource that is ready to be played immediately or ‘nearly’ immediately. This discovery may be accidental, but usually it is intentional in many ways. Often the process involves ‘seeking’ without intention to define what will be found. When a possibility is discovered its potential is immediately tested. Defining criteria usually includes edges, holes, and bores. A good example of ‘seek and discover’ is that of ‘beach combing’. As we comb the beach we seek without definition, we ‘find’ and ‘take’ (select) within the moment according to values that shift within varied criteria and potentials. Finding triggers an immediate creative process that results in the blending of form with function. We learn to beach comb through ‘doing’. The more we do it, the more we find what is successful within our own creative criteria and potential.

To broaden the readers understanding of what is possible, this discussion includes a number of other immediately playable natural items that cannot be defined as kōauau but nevertheless are functional and even credible as instruments in their own right. This further informs the discussion of the ‘found’ kōauau in this chapter, and highlights the ways in which things ‘non-musical’ can be perceived, and achieved, as musical when the will and skill to play is present. In turn, this shift in perception creates an expanding development of thought and skill: a journey of musical innovation grounded in material resource. Throughout this transpositional odyssey, materials become blended and substituted, as applied skill expands awareness of functional form. From this discussion I wish to accent the notion that the world is full of musical resources that are functional at a number of levels, and therefore underscore and explore the proposition that *some* traditional Maori could have resided in a pragmatically musical world that pervaded everyday life: an ever-changing perceptual web of skill, aptitude, innovative material management and functionality that integrated invention with tradition, individual with cultural, material with ideological and profane with sacred. This synthesis might be perceived as the cultural zone where innovation becomes tradition.

When a practitioner enters a journey of discovery with ‘found sound’ they open their conceptual observation laterally not just to what things might be able to be made into, but what things already are. A small cockle shell found on the shore has no longitudinal bore, but when it is realised that it is the playing edge of the flute that is being sounded first, one perceives that the closed corner may be voiced.

When this is achieved, the gull-like sounds that emanate become inextricably connected with the place that it was found. One can immediately conceive of the place, the form and the purpose as holistically unified.

Within this journey of musicality one begins attempting to play everything in reach if it has a hole that can be blown across or an edge that can be closed or sealed against the mouth. One way that I demonstrate this is to lay a wedding ring flat across the palm of my hand to play it (*Fig. 3.20*). When this is done it becomes obvious that such a design is in fact that of the edge and depression that defines what is a karanga manu (*Fig. 3.15, 3.16*). Such an act can also be done with a broken, opened cross section of a shell (*Fig. 3.19*). When considering karanga manu many forms become apparent, and several of these are demonstrated in section-(ii). These natural forms demonstrate the potential for how karanga manu may have originally developed from out of a found-sound realm. Intriguingly, certain language correlations have also been discovered by the research regarding some of the resources featured here, and various known Māori names for them. Language, and from whence it comes, can hold many answers, waiting to be uncovered.

Another discussion that informs the lateral nature of this understanding is that of bird bones as tools and as flutes. Bird bones make excellent gouges and chisels for working wood. Several participants at completely different times and places in the research brought to my attention the multiple uses of such resources when they asked why traditional Māori would have bothered using bird bones as tools to make flutes when they *were* excellent flutes in their own right. This question highlights well the lateral and innovative potentials of resources within this research: that 'one persons (flute-making) tool is (already) another person's flute'. Bird bones were not just obtained through intentional hunting. It was made apparent on a number of occasions that the discovery of a large bird carcass was akin to finding a well-stocked tool box, and I have discovered this to be very true first-hand. Bird bones, singular and as skeletons, are commonly found on beaches around New Zealand. Of course, the difference between 'seeing but disregarding' a dead bird, or 'finding and claiming' a valuable tool resource is a good example of what this discussion is attempting to achieve.

While 'found' karanga manu are important to this discussion by highlighting the musicality and immediate playability of various 'found' resources, they are not kōauau.

Over the ten years of this research I have 'found' many natural objects that fulfilled the tubular, open-ended definition of kōauau and were immediately playable with very little or no further construction required. In the first section of this chapter I include two of these because of the profound potential that they inject into the discourse.

Both *Kōauau Tutu Taupō* and *Kōauau Tutu Manawatū* are included because of their ease of construction and how they resemble several older pieces within collections, and in the case of the second, the wenewene were drilled using tūwiri. That these two are very similar is unintentional yet important, demonstrating prevalence.

In section-(iii) of the chapter I include two more 'found-ready-to-play' kōauau. Though these two pieces are of the same resource, I include them both as they represent the opening and the closure of what I have come to believe is one of the most profound deviations of this 10 year research. Both are very different though made from the same resource material.

The first, *Kōauau Kōauau-Ahuriri*, I believe to be one of the most eminent pieces within the whole research collection. I uphold this piece as one of the best kōauau I have ever made and played. As a musical instrument it is undeniably minimal and simple. It is easy to play, and has a very wide and easily accomplished tonal range that sings with a gentle, beautiful voice. Its relevance and importance is reflected in the name I have given it. This flute is made from an oceanic microalgae organism that could very well be the kōauau kelp from the 'story of old' that I have been told about (Nunns, 2002 - 2012). It is hollow, with a foam-like consistency when wet that is more leathery, or woody, when dry. The second piece, *Kōauau Kōauau-Aotea*, is significant in its validation of *Kōauau Kōauau-Ahuriri* and the nine years of research and seeking between.

The following experiments and instruments in this chapter are diverse and intriguing. Section-(i) inherently implies an element of simplicity in wooden kōauau that tends to be overlooked in ethnography and marginalised in museum collections. Section-(ii) demonstrates the rudimentary requirements and criteria that make a found object immediately playable as an oblique flute while profoundly illuminating an embedded connection between place and found-sound. Section-(iii) brings a whole new element into the research agenda as a new resource is unexpectedly discovered and explored. The acute simplicity of all of these pieces is pronounced. While this is the largest practical section of this thesis, its criteria is in fact very limited, consisting in a very general way of holes, edges and/or tubular bores. 'Holes Found Ready to Play' is in fact the most expansive section of the research as it is encompasses many other areas. Holes that have grown, and then naturally decayed to expose hollow bores, and holes that have been eaten by insects can fall to the forest floor and be found: in fact, any holes (or apertures and edges) that are produced in a natural way that are then exposed to being 'humanly' found, upon which are immediately playable, could therefore be included in this chapter. The key to situating the following instruments within the research is understanding the simplicity that found materials can bring to the construction process. This simplicity adds an implied element of transience to the construction, function and permanence of the instruments.

SECTION-(i): WOODEN KŌAUAU FOUND READY TO PLAY

Construction – Kōauau Tutu Taupō:

This kōauau was made very quickly from a short, thin piece of hollow branchwood found at Mission Bay beach on the south-eastern edge of Lake Taupō. The ends were shaped immediately on a small stone found in-situ. The wenewene were installed with a pocket-knife awl, and the flute was played at the site of origin immediately on completion, within less than five minutes from first discovering the resource. The ease and speed of construction for this beautiful but basic kōauau relied totally on the characteristic qualities of the resource material when it was found. The bore of the piece is extremely round and very smooth and was in fact playable before it was fashioned, so any work was more aesthetic than practical. On the exterior surface of the flute near the distal end is a deep flowing groove made by the action of an insect of some sort (*Fig. 3.2*). I personally find this very appealing as it reminds me of the etymology of the Māori word *whakairo* that translates to mean 'carving' in English. The compound translation of this word actually denotes that the marks found on wood are made by the of boring bugs and grubs: *whaka* meaning 'the action of' or 'the way of', and *iro* being a general term for a borer bug or grub. The beauty of this instrument lies in its simple ready-made state, and that it also has some of nature's own carving already upon it is gratifying. I have identified this wood to be tutu. That the form of the bore is very round with fibrous longitudinal grooves indicates this, as does the 'squaring' present in the external shape of the branch. The silver and grey colours of the exterior makes it more difficult to confirm identification, remembering that this small branch has been through extensive weathering and exposure to water. Exterior colouring still has elements of the tan brown colouring of tutu when it has its bark removed. From experience I now recognise this to be what tutu wood looks like when it has had the bark worn off, and absorbed into it by weathering and submersion. The dark green bark of tutu contains a strong element of reflective silver in certain lights. The overall girth of the piece is thin and the bore is very tapered over a short distance, which suggests it is from the growing tip end of a small branch. The wenewene that were constructed by gouging and the half-turn action of hand drilling using an awl present as shaggy and fibrous, and this also acts as favourably as evidence that it is tutu.

Function – Kōauau Tutu Taupō:

This kōauau plays loudly and sweetly, with a strong traditional air to its tonal tuning and breathy, bright voice. The finger-stop placement is approximately positioned evenly from the proximal end by the width of my thumb, a gap of about 25mm. This places the three wenewene well across the length of the flute, but favouring toward the proximal, with a larger gap from the 3rd (last) stop to the distal end, one of about 35mm. Each finger-stop is about 3mm in diameter. The strong solid construction, small physical size and light weight of this flute, and its accompanying wide tonal abilities, makes it an excellent instrument for travelling with as it slips easily into a pocket without fear of damage. Having survived an undefined amount of physical trauma before it became a flute suggests that it is of a very hardy nature. The function of this flute exceeds many flutes that I have made that involved a great deal more time and effort. Such a flute therefore rates highly on the construction scale of 'make-ability' (effort/time) versus 'playability' (function).

Construction – Kōauau Tutu Manawatū:

This kōauau is very similar to that of *Kōauau Tutu Taupō*. It too was found at the water's edge, but this time the Manawatū River, and though different in appearance, has also been identified as tutu for similar reasons. When found, the resource was immediately playable. Taken back home, one end was shaped on a large hōanga and the wenewene were installed using the light flywheel tūwiri (*Cord-drill Variation-1*), each one taking less than 5 minutes to furnish. Though delicate work, the drilling of these was not difficult at all, due mostly to the very light nature of the drill used. Overall construction took no longer than twenty minutes. The wenewene are very round at the outer circumference, and an excellent example of tapered (countersunk) holes that have been drilled using tūwiri. The middle finger-stop demonstrates a 'squaring-off' in the centre (where it pierces through the bore) that is indicative of working round holes into the fine fibrous anatomy of tutu, and is an excellent example of how tutu can behave when drilled and fashioned. The first and third wenewene also show the shaggy splintering that can occur with tutu (*Fig. 3.8*). The position of these wenewene are spaced in a more classic kōauau form, with the centre finger-stop associating more closely to the proximal hole, creating a wider gap between the second and third placing, and a shorter gap from first to second position. The top wenewene is a thumb width (25mm) distance from the top edge. The strong longitudinal groove down the medial axis of the flute's exterior demonstrates well the 'grooved squaring' of the tutu branch form. As with *Kōauau Tutu Taupō*, the external colouring has a silvery-grey sheen present, but in this case, the dark green shows through from underneath more. Only the proximal end has been wrought to be played and this exposes well the light brown colours of the wood below the outer weathered bark surface. When first found, the edge that was to later become the distal end of the flute was very straight, almost as if it had been cut, rather than broken. I ground this flat more to expose the cellular form of the wood to aid in its identification. I have left it like this to demonstrate this woody structure for the sake of the research (*Fig. 3.6 and 3.7*). As can be seen, the vascular cells are large and positioned in geometric ray-like formation around the centre of the branch. Large, 'loose' cell structures like this are found in pithy branch woods such as tutu and poroporo.

Function – Kōauau Tutu Manawatū:

This flute plays with a bright tone that rings with a strong whistling resonance. The tonal scale of this flute is virtually identical to that of *Kōauau Tutu Taupō* though the top (first, proximal) wenewene voices weakly in comparison to that of Kōauau Tutu Taupō, even though these flutes are basically identical in form and structure. So weak is the voice of this finger-stop, it tends to fail outright the majority of the time. *Kōauau Tutu Manawatū* is just slightly shorter and has a slightly wider bore that tapers outwardly (smaller proximal), the bore growing larger by about 2mm to the distal extremity. The walls are thinner than *Kōauau Tutu Taupō*, creating a sharper playing edge. There are few defining differences between the two that could cause one to play better than the other, and from my experience, I believe a combination of the 'reverse' taper, and the body-length to bore-diameter ratio, to be the reason for this flutes loss of voicing in the function of its proximal finger-stop. The other two finger-stops resound clearly and beautifully. This flute is louder than *Kōauau Tutu Taupō*, and I attribute this to the thinner walls, the wider bore and the reversed bore taper. Though differences between the two flutes are slight, it is evident that such factors are crucial to sound production, quality, volume and tone.

Physical Attributes Prevalent With Tutu Found Ready To Play:

The tutu that made the kōauau in these experiments was found already hollow and had certain physical attributes:

- The external surface has a reflective green and grey silvering to its colouring, with a light fawn brown internal colouring.
- The external form has the tell-tale 'squaring' of tutu wood that is defined by pronounced longitudinal grooves.
- The bore has a natural yet very round form and is slightly tapered.
- The bores in both of these cases are very smooth, having been scoured and polished by the elements.
- The wood has a fibrous, shaggy nature that can be seen to 'splinter' and 'square-off' when drilling round finger-stops into it (*Fig. 3.8)*.
- The cross-sectioned ends of the flute clearly demonstrate the loose and large plant cell structure of a soft pith-wood branch.

When considering identification, chances are that there are not too many native wood materials that exist that would be found tubular in a ready to play state.

Wooden Kōauau Found Ready To Play – Main Discussion:

From very early on in the research, 'found' hollow wooden remnants began appearing, sourced from the forest floor, in public reserves, native tracts of bush on the side of the road, private gardens, beaches and rivers. Unintentionally on holidays and family trips, while working outdoors, during breaks on research trips to museums, while walking the dog; and intentionally when realising I was in a place that was perfect for sourcing found materials. Intriguingly, several pieces that became central to the research were discovered while on trips to visit collections in museums: the *Kōauau Kōauau-Ahuriri* piece was found while visiting Napier, *Kōauau Tutu Taupō* on the way back from Auckland Museum, and *Kōauau Kōauau-Aotea* during a teaching expedition to the island's three primary schools, while on the beach sourcing tumutumu kōhatu, an instrument that I use an example of 'found-sound' when doing workshops.

Found-sound became such an important aspect of the research program that even my children became attuned to seeking and finding. One of the earliest shell flutes that entered my collection was turned up by my eldest son Felix, then 4 years old, while playing in the sand pit. Rushing to me exclaiming "Look daddy! 'Au-au! 'Au-au! Play it, play it!" he held up a small, white pūpū, or cats eye shell, *Turbo smaragdus*, that he had identified as a playable flute because (1) he had found it, (2) it was a shell, and (3) it had a small perfectly round hole like a wenewene (*Fig. 3.35)*. He was correct, it was highly functional, with the finger-stop sounding clearly also, and so it entered my working kete of taonga pūoro where it remains today. Several years later, while staying at a local marae, a young woman became enamored with this shell, and rushing off, returned a short while later with a tiny kete she made especially to fit the instrument so that I might wear it around my neck (*Fig. 3.36*). Zane, my middle-born child, who has just turned 9 years old, has an affection for bone, always being the first on beach trips to find several samples that he collects in the chance that at some point they might be used musically. He has a seal rib in his taonga pūoro kete that he uses as a pākuru (percussion mouth harp). My daughter Alice, who is now four years old, is constantly finding what she perceives as instruments. Though she cannot action the oblique embouchure yet she recognises short tubes to be flutes and lifts them to her lips to attempt a sound regardless, often humming to satisfy her need to play. She has a keen eye and ear for finding objects that she can bang together. Occasionally logs for the fire must be set aside as special for specific reasons decided by her so that they might be carved, drilled and hollowed to construct "a great musical instamint!"

Over the years, I have found so many pieces of already-hollow branchwood that are immediately playable that I am now very selective about what I take and what I leave. Almost everything I find is either tutu or bamboo. Dead, fallen tutu 'driftwood' is everywhere. Whether it be east or west coast, I find tutu almost every time I go to a North Island beach, and especially after a big storm, even though I almost never see it in a living, growing form. As driftwood, I find it more often than not in a broken branch form, often up to 2 metres in length and 60mm diameter at times, with the pith still intact. The pith in this state is hard but spongy and rubbery. Difficulties with samples found in this way usually arise from outer branch-wall damage, where the sample suffers cracks, holes and breaks, or rot, either through decay or wear.

Holes 'made by insects eating' first entered the research as 'found', the first being the thin mānuka trunks with an oval longhorn beetle/kānuka borer hole straight down the middle that were brought to the research by someone who *found* them growing in a Pohangina Valley stand. The flute in the research collection known as *Kōauau Patē Hiwi* which resides in the 'eaten' section of the research was 'found', as were two of the pūriri wood specimen, discovered in milled recycled timber, and generously donated to the research. Although these insect holes were 'found', a more extensive amount of construction was required to give them adequate function. The phenomenon of holes created through the action of insects soon became a much larger, and just as important aspect of the research, and for that reason, this issue takes a chapter for itself.

SECTION-(ii): OTHER INSTRUMENTS FOUND READY TO PLAY

The instruments in this section were all found ready to play, but are not kōauau. It was not intentional that all of them be of the shallow aperture type instrument like that of a karanga manu (*Fig. 3.15)*. I play all of these using the diagonal embouchure and not the (assumed as standard) horizontal method (reverse Helmholtz resonator) (*Fig. 3.17*) that many players use to sound the karanga manu.

Construction – Karanga Manu Karoro:

Single side of a fan-shaped, bi-valve mollusc shell, commonly known as a cockle. Found easily and quickly on the beach, no making required. Playable immediately.

Function – Karanga Manu Karoro:

Played by placing the shell flat against the mouth with the flow of air from the lips projected into/across the apex at the base of the fan shape. These shells change in pitch, tone and range according to their size. A lot of control can be obtained when a low and gentle airflow is submitted. The sound they make strongly resembles that of gull song.

Construction – Karanga Manu Kōhatu:

Volcanic rock found on a beach in Nelson, 2002, with a number of different sized shallow apertures that are playable.

Function – Karanga Manu Kōhatu:

A loud instrument with many voices and a wide tonal range and pitch control.

Construction – Karanga Manu Mānu:

Made from a small, dry, dark-brown kelp pod possibly of *Macrocystis Pyrifera* (Giant kelp) found at Birdling's Flat, Banks Peninsula, Canterbury, November 2010. The pod was removed from the beached kelp and immediately cut in half using a pocket knife. Without smoothing the edge further the instrument was playable. Alistair Fraser during his Rakiura residency also discovered a similar pod on Ulva Island and conceived it to be of value in the same way. He writes about this in his online research blog *Taonga Pūoro* (2011b). The image I have included here is from his field research photos (*Fig. 3.28*).

Function – Karanga Manu Mānu:

An expressive karanga manu that sings with a brittle, dry voice.

Construction – Karanga Manu Tiotio:

These are barnacles that have attached themselves to a larger univalve mollusc. No work is required to make these sing. I have considered removing the best one to include in my kete for playing, but at this stage particularly enjoy the state that they were found in. The larger shell which they are on is also playable. I found these in a basket of shells at my daughter's kindergarten. Alistair Fraser during his April 2011 trip to Rakiura discovered the exact same resource at Mason Bay (2011a).

Function – Karanga Manu Tiotio:

These play superbly with a fantastically wide range and precise control of pitch. The sound they make is piercing and loud, and strongly resembles the timbre of ocean going birds with its bright, shrill sounds. It was during a search for the Māori word that translates as barnacle that I came across one definition where 'Tio' means both "Barnacle" and "Cry, call" and that 'tiotio' is "A bird" (Williams, 2001: 420).

Other Instruments Found Ready to Play - Main Discussion:

The profound simplicity and powerfully functional potential of found-sound instruments and there inherent acoustic relationship to their geographical origin is emphasised with all of the instruments: these instruments 'voice' where they come from. After ten years of research in playing and making, I strongly suspect that a great deal of the traditional instrument pantheon has evolved from out of naturally occurring found materials that were ready to play, such as these, and the linguistic coincidences of *Karanga Manu Karoro* and *Karanga Manu Tiotio* deserve deeper study. Discussion regarding environmental derivation streams throughout this thesis, from the 'grown' tubes of chapter 2, through to the ‘insect-eaten’ bores of chapter 4. Even the instruments of chapter 5 made using fire relate back to the flutes and methods of chapters 2, 3 and 4. Possibly the issue that requires greatest attention in this section of the research revolves around instrument/object categorization. As is so often the case with simple instruments easily sourced from the environment, they are just as easily returned to the environment, and “unless people are seen playing them, they may easily remain unrecognised as an instrument and (go) unregarded” as such (Montagu, 2007: 65). What is required here for greater confirmation of such possibilities is deeper research into the language and oral traditions regarding specific resources and the making of sound.

SECTION-(iii): KELP FOUND READY TO PLAY AS KŌAUAU:

The following section is in regard to a ‘found’ oceanic organism that is presumed to be a large brown algae of some sort, “colloquially” known as “kelp” (Buchanan, 2011, 2012), and probably of the genus/species *Ecklonia radiata*.

Construction – Kōauau Kōauau-Ahuriri:

Found on the beach in Napier in 2002, I discovered this resource wet, and ready to play. The piece was delicate and fragile. Removing the dry, wig-like, tangled mess off the top revealed the playing end. It was highly playable immediately, and this is the reason I continued to keep it, not knowing really what it was exactly I had found. Having already been told a story of hollow kelp by Richard Nunns earlier that year, my consciousness was tweaked as to what it might possibly be. When wet it was soft and frail, due in part probably to its tiny size. On attempting to work or shape the end immediately it began to fall apart easily, and upon drying it seemed to lose some of its playability and voice, and so it was at this stage that I bevelled the playing edge gently on a very smooth sandstone pebble. Working an edge onto the proximal end returned its playability. The 'tangled wig' was in fact the holdfast.

Function – Kōauau Kōauau-Ahuriri:

This kōauau is simple and highly functional. It is a favourite in the collection for these reasons. While wet it was playable immediately, and once dried, and the edge was worked slightly, it retained all of its function. I claim this as one of the best kōauau in this research collection. Though it is small and requires a very fine embouchure which makes playing difficult for some, I personally have no problem with it. It has one of the widest ranges of pitch of any of the instruments in the collection. It plays with a sweet, haunting, but high voice that can be easily affected with tongue and glottal vibrato, creating a very emotive sound. The pitch bends seamlessly from low to high. Its size and shape, and pitch remind me a great deal of small or thin bird bones: like the wing bone of a gannet, or the round radius bone of the albatross. The tone of *Kōauau Kōauau-Ahuriri* though, is softer and smoother than the brighter, more acute timbre of bird bone. From a distance it could easily be mistaken as bone, both visually and aurally. This is an interesting point to note when considering some early ethnographers and the observations they made from afar.

Construction – Kōauau Kōauau-Aotea:

This flute is the most recently constructed in a research collection that spans ten years. Made from a piece of already-hollow kelp stipe found at the high tide mark on a beach on Aotea/Great Barrier Island, in the Hauraki Gulf, in June of 2011, this resource was available all over the island in varying sizes and states of fresh, wet, dry and rotten. In fact, as I became more aware of what it was I was seeking, the more obvious it became. I spoke to a lot of people on the island about it, many saying that they had seen great quantities of this, often mistaking it for, or assuming that it was, driftwood, probably due to its often very white, bleached complexion and size. Many who knew of it had no name for it, but some had differing terms that included sea-grass, crayfish kelp and bull kelp.

In regard to the making of this particular flute, the kelp was found still wet, and not dry. I found many pieces, of varying sizes and condition, already dried and immediately playable. For this experiment though I chose the resource wet so I could ascertain, define and control several variables involved with the drying process. I was intrigued to know how much it would shrink and whether I could control the final shape easily. When wet (and 'fresher') it is larger, the walls are thicker, and the hollow bore diameter smaller. It is also *very* round in its cross-section. I was attentive during the drying process, though it was not labour intensive at all. As it dried on an internal window sill I would turn it over regularly, about 4 or 5 times a day. Noticing that it was changing shape to a more oval cross-sectional contour, and knowing what I had witnessed in well dried specimens on the beach that had almost completely flattened in shape, I would squeeze it lightly back to a round configuration, and return it to the window sill. Within a week it was easily and completely dried evenly, and with a still very round circumscription. The walls had thinned, the hollow bore enlarged (in relative ratio), and the overall diameter and length had decreased through shrinking by about 10 to 15 percent. One end became somewhat crimped and had shrunken closed from the drying process. This was anticipated, from what I had seen in other samples found dry on the beach, so I had made sure to select a longer piece than necessary so the ends could be removed. This technique in selection I learned of course from collecting branchwood, to circumvent the splitting and cracking issues. This rule stands well for collection of all resources: always collect 20 to 50 percent more than is required (longer/wider) to incorporate secondary or coincidental loss from factors such as drying or splitting. With the piece dry, and somewhat stronger, it was able to be transported safely, so I packed it carefully into my suitcase, between layers of clothes and took it home to the mainland to complete construction. Once home I removed the ends with my pocket knife very quickly and bevelled both ends on a smooth, fine-grain sandstone hōanga. As with a lot of pieces I made in my experiments, I became very disinclined to work wenewene into this one for fear of getting it wrong (size and placement), suffering an irrational unwillingness to complete the piece due to it becoming fixed in form once finished. Because of its length (210mm) I decided to construct it as a pōrutu, eventually (2012) placing three wenewene (of 3mm diameter) in the distal half in reconstruction of the discussions in He Kete Taoka (McCallum, 2008: 159).

Function – Kōauau Kōauau-Aotea:

Kōauau Kōauau-Aotea plays magnificently with a gentle but clear voice and a light sense of breathiness to it. It is easy to voice and to manipulate, and has a strong and emotive mid-range tone. Due to its length it has an upper register when overblown that is controllable with the finger-stops. It does not have the same fluid like control that *Kōauau Kōauau-Ahuriri* has, and I assume that this is because of the bore diameter: the wider the bore, the less ability to bend the pitch of the flute up and down. Even though it has a sizeable width and length to the body, this flute is very lightweight. So much so that when certain tones are sounded the walls of the instrument resonantly vibrate in the players hands. This is a special experience when playing a flute. I have felt this with some wooden and shell horns, which might be expected due to the volume and nature of horn tones, and I have also had gourd flutes and some very well made pūtōrino hum in my hands when playing their lower bass flute tones. Feeling the sound in my hands as I play gives me a strong sense of connection with the instrument. This flute takes an important place in the collection, like its sister *Kōauau Kōauau-Ahuriri*, as its simplicity of construction and high functioning impresses upon the research the plausibility of kelp resource being used to make kōauau. The abundant availability of this hollow kelp substantiates plausibility. That this abundance is profoundly regional determines resource availability geographically, and the research results for this section would have looked very different if the research had not proceeded for so long (10 years), and had never ventured to Great Barrier Island/Aotea. Such a resource questions the plausibility of rimurapa (NZ bull kelp/pōhā: *Durvillaea antarctica*) or rimurimu (seaweed in general) stipe as kōauau resource, taking months to dry and still requiring to be hollowed, as Alistair Fraser discovered in his Rakiura experiments (2010 - 2012). Using a fresh *Durvillaea antarctica* stipe he pushed through a hole that he then filled with a piece of supplejack to keep the bore open while it dried over 10 months. In his research, Fraser concludes with doubtful plausibility in the use of rimurapa and rimurimu due to the labour and time intensive requirements for these resources and other subsequent difficulties inherent in their construction. Though he was successful in the construction of a solid stipe seaweed kōauau, he suspects that such an instrument probably was not made due to the other more easily worked and amply available resources present, such as already hollow sea-bird bone and tutu (2010 - 2012). In discussion, Fraser concurs with this research in that rimurapa and rimurimu are not 'already hollow' and so do not abide with the story of a "hollow kelp” being used to make kōauau that I have heard (Nunns, 2002 - 2012). Fraser does suggest that the reference to making flutes from *Macrocystis pyrifera* in Beattie (2009: 77) and later in He Kete Taoka (McCallum, 2008: 159) may refer to the small bladder floats, which are hollow, easily (or often found) dried, sometimes about the length of a human thumb and resemble the standardised ‘cigar’ shape of the kōauau flute, with a widened centre that tapers to both ends. Removing both ends of one of these would render a short kōauau. He also believes that one of the stipe samples he gave to me midway in the research (about 2007) could possibly be a *Macrocystis* stipe (Fraser, 2010 - 2012). That this piece was found by Fraser at Cape Palliser, the most southern tip of the North Island of New Zealand, makes it possible, as this area falls in the geographic zone of that species. In communications with Buchanan, he considers *Macrocystis* to be unlikely for such a use as it has “long, thin flexible stipes” that are “generally much thinner than *Ecklonia*“ that “shrink and wrinkle as they dry”. He also has “never seen a hollow one” (2011, 2012).

There is a strong sense of fragility when using and storing flutes made of this resource. It certainly is not as strong as bone or wood, and yet, when fully dried, there is a degree of resilience to it. *Kōauau Kōauau-Ahuriri* has been in the collection for ten years now, and shows no sign of decay or injury as it sits in the kete with the other heavier and stronger instruments. There is no doubt though that if it was treated roughly, it would crush easily. Further discussion continues below in the *Main Discussion* section. As with many issues relating to much of this research, the making of kōauau from hollow kelp has become worthy of a research paper on its own.

Physical Attributes Prevalent With Kelp Found Hollow:

Most of the description here refers to this resource being found already dead and dried (in varying degrees) on the beach. When alive and growing, *Ecklonia radiata* is a rich dark brown and green colour and can get very large. The stipe (stem) can reach up to 12 metres in length and over 50 mm in diameter (Guiry, 2012). It can also be presumed that when alive it is not hollow, as the two experts I spoke with believe there are no known species of large kelp in New Zealand that have hollow stipe (Fraser, 2010). Buchanan though, expanded on this to say that the field was in great need of wider research and that "members of the same family sometimes have hollow stipes, so it is possible that there is a variety in New Zealand with a hollow stipe" (2011, 2012). According to "*AlgaeBase*" a highly respected, and recommended, online academic resource, of the twenty known *Ecklonia* species (nine of which are accepted taxonomically) the terete stipes are "solid or hollow" (Guiry, 2012). *Ecklonia radiata* is of the same taxonomic order and family as that of *Macrocystis pyrifera*, the kelp discussed in He Kete Taoka as 'kōauau kelp' (McCallum, 2008: 159). Buchanan indicated that the *Macrocystis* species, or 'giant kelp', is the largest of the seaweeds and is possibly the most well-known. According to him, there is little chance that the kelp of my research is *Macrocystis* as it is a "cool temperate species" and in New Zealand does not occur north of Kapiti Island and the southern Wairarapa… [being] found in cooler regions of the southern hemisphere and the North Pacific" (Buchanan, 2011, 2012).

The dried kelp samples I have found (*Fig. 3.53*), presuming all samples are in fact the same species, which of course they may not be, are a combination of both leathery and cork-like in appearance and range from dark brown and light tan through to a bleached, bright white in colour. Some of the larger, dried samples found on Great Barrier Island/Aotea have a very textured external surface. It is soft to touch when found detached (beached) and wet (dead). When alive it is smooth and shiny, but firm and rubbery in a flesh-like way. At first appearing sponge-like and porous when dry, though in fact it is air-tight, this material sometimes looks and feels like wood when fawn of colour. When sun bleached white from intensive beach drying, it can visually resemble bone. Confounding in appearance, it is a favourite trick of mine to show it to unsuspecting people and research participants and ask what they might think it is before I tell them.

The internal bore has short longitudinally aligned fibrous strands that can make work on the bore problematic as these fibres flake away the more they are worked. The external consistency of the material is subject to tearing and demands that very light and gentle work be performed or the maker will find an ever decreasing resource as they work. In one experiment where I was shaping the end for playability I used a sandstone that was too course and ripped the rim of the tube in several places, requiring 7mm off the end of the piece to be removed, whereby shaping recommenced on a much smoother, finer grained sandstone hōanga.

This resource makes and plays best with a minimum of effort. Often, the less construction performed the better, for this material is very easy to overwork, diminishing its functionality and in the end making it unusable. With a small amount of bevelled shaping at the ends, and the gentle installation of finger-stops (if these even be necessary at all in the smaller pieces), a materially simple and powerfully functional flute is achievable.

Kelp Found Hollow & Ready To Play – Main Discussion:

Kelp, as a general term, features frequently within the collected ethnographic works of Beattie - Traditional Lifeways of the Southern Māori - as a resource for the construction of kōauau. What this kelp is exactly is disputable at times, and may in fact be of several forms. For the purpose of clarity and much needed thorough discussion on this specific topic I will cite all of these here. In Murihiku (Southland), one of Beattie's informants personally had heard flutes "made of kelp" (2009: 79) and another spoke of a bone flute probably "being called koauau because it could be made of koauau kelp" (77). A grandmother is referenced as saying that the kōauau "was four or five inches long, had three keys and was made of wood or kelp" (78), while a great-grandmother from Henley is cited as saying that "the koauau was a small flute made of kelp" (79). In Canterbury, Beattie's principal informant is recorded as saying that "Only boys made kelp flutes" (258), and in Nelson, his research records the kōauau as being made "sometimes of kelp" (483), and that kōauau "is the narrow part of the rimurapa and… it was made into flutes", rimurapa being "the kind used to make pohas to put preserved birds into" (499). Pōhā bags are made from *Durvillaea antarctica*, often known as bull kelp. Only in this final reference is the kelp specifically defined. So what type of kelp are these passages referring to?

In Māori Music (1996: 185) McLean cites Beattie's work in that the kōauau "was sometimes made from bull kelp", affirming specifically *Durvillaea antarctica*, and then positing that it may have all "been a confusion as bull kelp is also called kooauau". For me there is no confusion, and so I am in disagreement with McLean on three issues. Firstly, Beattie has a total of seven citations from six different informants in three separate regions regarding this topic. Each citation is clear in respect to the kōauau being made from various materials, including kelp. Secondly, that McLean carelessly generalises that Beattie's citations claim that kōauau were made from *bull* kelp raises issues. This may have been encouraged by Williams definition of kōauau as *Durvillaea antarctica* (2001: 122). Even so, only in the Nelson quote is reference made to this kelp being specifically rimurapa (and even then, only one part of the organism is called kōauau, not its entirety). That only one of seven references using the general term 'kelp' specifically defines it to be (a particular part of the) bull kelp/rimurapa must raise questions regarding the other six citations. Further research into the non-musical kelp references in Beattie's work, especially in regard to a kelp called kōauau being used to make darts (2009: 75) confirms that there many types of kelp with the same, and different names across the South Island. Bull kelp is generally called rimu or rimurapa, and not kōauau. Thirdly, in the footnotes for this tract, McLean uses an example of Beattie's re-telling of an 'urban myth' style fable as confirmation of his confusion, calling into question Beattie's sources and research integrity, and therefore casting doubt upon the entirety of his vast work. Mclean does assure us though, that Beattie reported everything "with scrupulous honesty" (1996: 373). With Beattie's faithfulness to the original source taken on board, another read of the above seven citations confirms for myself that these varied informants from all over the South Island believed a flute called the kōauau was at times made from kelp. I therefore experience no confusion regarding whether or not kōauau were, at times, made from kelp. The confusing issues are in fact *which* kelp was used to make flutes, and what *type* of kelp is the one called kōauau.

Other stories relating to kōauau being made from seaweed are often anecdotal. Very early on in my research, at the beginning of 2002, I was told a story regarding the possibility that a particular species of hollow ‘seaweed’ called kōauau may in fact be the etymological root for the name of the flute, and it was from this resource that the first kōauau might have been constructed, and so named from (Nunns, 2002 - 2012). It was for this reason I attempted to make kōauau from two kinds of ‘seaweed’, both with solid stipes, before finding the first piece of dead, hollow kelp in Napier that was to become *Kōauau Kōauau-Ahuriri*. Certain problems with the types of rimurimu (seaweed) I experimented with arose from problems with drying, and that they had solid fleshy stems (not hollow), so some type of drilling or gouging was required to achieve a bore. This immediately confounded the precept that such flutes were originally made from a seaweed that was already hollow. One type that I unsuccessfully attempted to dry caused much consternation as it stank greatly while it rotted into a gelatinous mess. The other specimen shrank and shrivelled into a solid and hard, curled lump.

On my second research trip to Dunedin, late 2010, I met with a bull kelp (*Durvillaea antarctica*) scientist Dr Ceridwen Fraser at the University of Otago and had the opportunity to show her my tiny collection of small hollow algae specimens. She assured me that these were not bull kelp, and that the stipe of *Durvillaea antarctica* was not hollow. She did note though that in the ocean there are amphipods that are known to eat out the insides of seaweed and kelp stems, rendering them hollow (Fraser, 2010). This may account for the finding of hollowed kelp or seaweed stems on the shore, and especially of algae species that are not usually hollow, but does not necessarily account for a cultural belief in or story of a type of hollow seaweed by the name of kōauau. Dr Fraser had never heard of a species with this Māori name.

In He Kete Taoka (2008: 159), McCallum is very specific in the scientific identification of the kelp known by southern Maori as Kōauau, citing it as (*Laminariales Lessoniaceae*) *Macrocystis pyrifera.* That this species is kōauau kelp seems solely confirmed by McCallum with a reference from Traditional Lifeway's of the Southern Maori which states that "Kōauau is the kelp with 'crackers' hanging in strings, but it is not eaten" (Beattie, 2009: 126). By "crackers" it has been assumed that the person cited by Beattie was making reference to the small pod-like bladders found in string formation on *Macrocystis*. Yet what is confusing is that *Macrocystis pyrifera* is edible and is harvested in parts of the world for eating (Guiry, 2010), and since 2010 has been harvested under the Quota Management System in New Zealand for commercial purposes including human consumption, aquaculture, pharmaceuticals and cosmetics. On the eastern coast of New Zealand's South Island, *Ecklonia radiata* and *Macrocystis pyrifera* cohabitate. *Ecklonia radiata* is recognized as a "major understory species associated with *Macrocystis*" (NZMoF, 2009: 15). Of course, even though there was a very strong kelp culture and knowledge in southern Maori tradition, there is a chance that *Macrocystis* was not eaten, or perceived as edible, for some reason. There is also a chance that residing together in the south, the two different species were at times defined as the same. To prove *M. pyrifera* is kōauau kelp, McCallum submits four brief references, starting with Beattie and the passage about the flute being called kōauau because it "could be made of kōauau kelp" (Beattie, 77), continuing with a reference from The Maoris and Fiordland (Beattie, 1949) about a barometric kelp bulb, in which he admits to personally assuming that it is "made from kōauau due to it being the one with the bulbs" (McCallum, 159), and following through with a singular Beattie (2009: 75) about darts made of kōauau kelp of which there are five on that page alone.

When the already cited "koauau is the kelp with 'crackers' hanging in strings" quote is aligned with a statement made (by the same informant) immediately above it that "weeds cast up by the sea is koauau and was used for nothing that I know of" (2009: 126), a sense of citational misinterpretation arises, while being reminded of the difficulties that arise from language diversities whereby the people in one village call something "by one name and the people at another place one hundred miles distant… (call) it a different name altogether" (Beattie, 2009: 153).

The final evidence that McCallum presents is from a personal communication with Richard Nunns of which there is no date cited, though He Kete Taoka was published in 2008. Nunns is referenced as saying that the "stipe of this seaweed was used to make flutes. It was hollowed out and three holes drilled in the lower end" (2008: 159). This of course is part of the same story that Nunns told me in 2002 (Nunns, 2002 - 2012), but in this version there is an implication that the stipe is not hollow and is rendered that way somehow, and so differs from the story I was told. Unfortunately, McCallum provides no local identification or further wider-reaching ethnographic or linguistic evidence, so his assumed argument and tautological referencing weakens his supposition that *Macrocystis* is the kelp called kōauau.

Looking further into Beattie's various discussions involving kōauau kelp, we discover that it was also used to make throwing darts for sport and leisure. Out of five passages, three in particular make reference to various materials being "inserted through" the kelp, including toetoe stems and reeds, and sticks (2009: 75), while a fourth speaks of "pushing" stalks through the kelp. All the darts are propelled with a throwing stick which remains in the throwers hand. While it can be tricky deciphering descriptions, “inserting” connotes an ease (less so with ‘pushing’) of action, and in my mind implies that the kelp is already hollow. That the dart is propelled off the stick in a sliding fashion also suggests that it is of a tube-like form.

In later discussions with Richard Nunns about kōauau made from kelp, he informed me that he knew of two types: one from the south, which is made from the solid stipe of bull kelp/rimurapa, is called kōauau and needs to be hollowed, usually with the pushing through of a stick while fresh. This model deteriorates over a matter of months, slowly softening and flopping and becoming unusable. The other type he states to be from the East Coast of the North Island, namely Te Kaha. This one is also called kōauau, and is found hollow. Very small, and delicate, it is “about the size of the tip of the little finger” and requires a very fine embouchure to sound it (Nunns, 2002 - 2012). The description of the second type certainly matches well with that of *Kōauau Kōauau-Ahuriri*.

Abundance of a resource will inhibit and redefine experimental research in different ways. If something is spoken of in ethnography or has an indication in oral histories, but cannot be sourced in the practical world, does this make the line of inquiry less valid? I spent the years between 2002 and 2011 with my eyes wide open in search of more of this resource, and yet to no avail. This lack of abundance acted strongly upon the theory regarding kelp kōauau over this time, with doubt and uncertainty permeating this area of the research. Cross-cultural research had confirmed the presence and use of hollow kelps by other coastal indigenous peoples, especially those of the North American west-coast. The people of the Californian coastal islands were known to make a trumpet from the large hollow stipe of a local kelp *Nereocystis luetkeana* that they referred to as bull kelp (Emerson, 1999: 104). The apparent existence of "a story of a traditional story" demonstrated 'smoke' where there seemed to be no 'fire', but with the presence of seven ethnographic references to kelp flutes in Beattie (2009), some from extremely old informants at the time, historical confirmation was registered. Even so, without any profoundly identifiable kelp kōauau in local museum collections the research was further confounded, and with the strong lack of an available resource in the material world to experiment and make with, the small and rare pieces that I had obtained simply seemed to complicate the theory even more. I personally had no doubt that I had discovered something extremely valid to the research with *Kōauau Kōauau-Ahuriri*, while several experts would consistently joke with me over the years, due to its extremely thin and short size, that I was "fooling myself" in regard to it being anything worthy or relevant.

In the first five years of this research (2002 – 2007), I had two more similar pieces brought to me. My small collection was growing, but the actual pieces were still tiny in themselves. One was collected at Palliser Bay by Alistair Fraser and the other by a friend of Alistair's, was found on the Coromandel Peninsula. These small finds invigorated the research and strengthened my resolve that I was on the right path. Of course, the strong way in which *Kōauau Kōauau-Ahuriri* performed as a flute constantly reaffirmed in my own mind that this was a valid line of theory, and all that was needed was to source a sample that was considerably larger, and the perception that 'standard sized' kōauau could be made from it could be endorsed. This made the discovery on Great Barrier Island/Aotea nine years after the first find in Napier all the more thrilling and inspiring.

The seemingly perishable and transitory nature of this material as a resource for constructing kōauau features strongly in my psyche as a maker and a player. I am extremely conscientious when playing these two instruments that I do not drop them or pack them away carelessly. This temporary disposition could also be seen as decreasing its validity as a resource. In regard to this, I must raise the issue further. All of the materials used in the construction of taonga pūoro that arise from out of the natural world suffer from this impermanence. Stone is brittle and can shatter and crack when dropped, which due to its weight and usually very smoothed, polished surfaces, is made all the more possible. Bone is very partial to cracking, especially the wing bones of albatross that have a mechanically structural attribute that has them 'unwind' and fall apart over a period of time. Wood can crack and split before construction is even completed as the grain that was once contained within large weights of pressure when inside a tree opens up as it is released. Shells are extremely fragile and will chip, crack and even smash at the slightest misplaced knock. My early work with branch wood taught me very quickly to accept and respect the frailty of natural resources. I now perceive a large part of their beauty and value to be contained within this vulnerable state. All of the instruments I work with have a state of fragility and transience that reflects the greater natural world from which they come. It is an honour to be their caretaker while they are suspended in their brief musical form.

The issue of impermanence is important from another perspective. Temporary, but readily found or available resource is therefore by nature, easily replaceable, and may even encourage a style of making that incorporates this dispensability. If an instrument is able to be quickly made, discarded, and replaced, material fragility becomes a non-issue, as does physical aesthetic. What becomes important in such a situation is the sound produced, and the playability (function). If such a cultural style or attitude did exist, the presence of discarded flutes could be expected to be prevalent in archaeological finds of today, especially maybe in midden sites, which often involve a coastal aspect. This obviously is not the case, as there have been no hollow kelp flutes found anywhere within New Zealand archaeology that I am aware of, nor have I seen any in museum collections. If there were any already (or to be) found, my estimate would be that they lie dormant within the extremely large, and as yet undocumented, archaeological collections residing back-of-house in the Canterbury and Otago Museums. Of course, due to the extremely impermanent, even fragile, nature of the resource, if such an instrument were to be 'discarded' it would probably decompose very quickly, or dissolve back into the land or sea, and thus slip from archaeological recognition. As discussed in chapter 2 regarding transitory resources, there is a theory that such a device of temporary or singular purpose could have a cultural justification that involved the practice of ritual magic or tapu, such as with garden fertility, or transit, whereby the instrument may then have to be destroyed after use (Nunns, 2002 - 2012). This dissolution could have been with fire, a customary tool of sacred practice, or as was often the way in Māori tradition, the item would be buried. Kelp would quickly breakdown if buried, and not stand a chance of being found even one year later, let alone a hundred. Coincidentally, and maybe even relevant to this discussion, both *Ecklonia* (Guiry, 2012) and *Macrocystis* (Guiry, 2010) are harvested commercially in some parts of the world for use in fertiliser because it is rich in nitrogen and various minerals and trace elements.

HOLES FOUND READY TO PLAY - MAIN DISCUSSION:

Besides the physical act of finding these resources ready-to-play, a strong conceptual element of 'found sound' is brought into play in this section of the research. According to the New Zealand Ministry of Education Curriculum, 'found sound' can be defined as sound made from 'everyday' objects (2007). While there doesn't seem to be much academic discussion publically available in regard to Maori practise of 'found sound', there no doubt seems to be a great amount of actual resource available to produce 'found sound' within Aotearoa. I do know that some educational courses involving taonga pūoro are including units focussed on this aspect.

I have heard of 'old stories' regarding caves and hole-filled cliffs and rocks, making sounds, though have not been able to confirm these. There is evidence in ethnography that 'found sound' from out of the natural world was seen traditionally as very special, at times as foreboding and ominous, and in other instances, magical and beautiful. Evidence of 'found' shells as instruments does exist, such as with the shell horn, the pūtātara/pūmoana. Beattie refers to shells being collected for instruments in Canterbury (2009: 259-260), some for horns, and some as flutes. The leaf being used as a bird caller, such as the "patete" in Canterbury (Beattie, 2009: 342) can be categorised as found sound. Elsdon Best states that "the Triton shell was occasionally found on the northern coast of New Zealand, and... converted into... shell horns or trumpets" (Best, 1929: 80). He goes on to recite the magical story of Hine-mokemoke from Waiapu, who was known to sing a song that could be heard from the depths, until one day she was successfully fished up. "From that shell was fashioned the famous horn known as Hine-mokemoke (the Lonely Maid), which was looked upon as *tipua – i.e.,* as something uncanny. Ever that shell sang weird songs, but as to what those songs spoke of, and what was the origin of the strange powers of the Lonely Maid who sang them in the darkling waters, no man may now say" (Best, 1929: 80, 81). This story confirms the use of 'found sound' within Māori musical instrumentation. An intriguing element of this story is the purposeful acquisition of the shell through persistence, even though they did not exactly know what it was they were going to find. On the same page Best continues with an intriguing story of a shell that is used to convey love magic by allowing itself to be found by the recipient (1929: 81). Though not obviously musical, this is an intriguing story about the ritual power of intention and a recurring rule of love magic that demands that the subject 'consent' (in this case 'find' and 'choose' to pick up the shell), for the enchantment to be successful. Another example of tipua sound is that of echoes and the stories that accompany this phenomenon. In Maori Lore of Lake, Alp and Fiord, Beattie discusses two stories that approach the strange nature of echoes, the story of 'Rona', and the story of 'the children of the girl facing the cliff' (1945: 78 - 80). In each case there is a strongly supernatural aspect imposed upon unexplained natural sound phenomena. The echoes in these stories become personified characters embedded within the geography. Of course, the multiple recurring theme of unseen fairy people who play exquisite flute music that lingers long on the land registers in this category also (Beattie, 2009: 214).

The point I submit here is that 'found-sound', whether made with or without human intervention, is often personified in some way as well as being considered to be from the spiritual realm or *tipua*: supernatural and strange. The story of Hine-mokemoke highlights the way that such sound impacted upon listeners, and how the object of that sound was then maintained in the style of a talisman, as meaningful, even while explanation or human reason remained unresolved. This is an important issue when considering any Māori music made from natural, environmental materials, whether they be ‘found’ or sourced through ‘intentional skill or action’ and then ‘fashioned’. Not only then do these materials reflect or embody the sound of the environment from which they have come, what Nunns refers to as “acoustic emanations from the landscape” (Beatson, 2003: 19), but they do it in a ‘strange’ way that has implications of the occult: a way that is bewitching - that manifests the unknown. Hine-mokemoke the shell was a lonely maid who sang songs of and from where she came – “the darkling waters” (Best, 1929: 81). If one was able to harness, utilise or understand these tipua sounds, one might enter a collaboration with the supernatural.

That the place of origin is embodied in the resource to the extent where the sound produced by the object is considered a ‘voice’ of that location is of vital consideration within a culture that profoundly relies on a spiritual connection with the land. Belief extends to a point where land is personified as a living ancestor from which all descend. Hirini Melbourne articulates this understanding further, explaining that whakapapa “is not just about identifying yourself as a beneficiary of a particular tribal authority. It’s also about relating yourself to other beings sharing the same space. Birds and insects are seen as brothers and sisters through the same progenitor... They’re not hierarchical links. They’re lateral ones.” (Shieff, 2002: 145). These embedded sounds then, can be considered as living or incarnate voices, representative or manifest utterances of ancestors passed, and the instruments that make these sounds as ‘pathways’ or tools for accessing an understanding of unseen realms for those who have the ability to ‘journey upon them’ or translate and decipher them. Such things are of course the realm of the *tohunga ahurewa*, the specialised spiritual priest. Richard Nunns elucidates: “Spiritual information and illumination were thought to come to the tohunga through songs from the spirit world” (2003: 19).

Kōauau Tutu Taupō

Flute Name: **Kōauau Tutu Taupō**

(Figure 3.1) Kōauau Tutu Taupō length.

Dimensions:

112.1 mm *(long, top to bottom)*

14.8 mm *(wide at top end)*

16.3 mm *(across at widest mid-point)*

13.2 mm *(wide at bottom end)*

8.1 mm wide *(wide at proximal inside bore)*

6.5 mm wide *(wide at distal inside bore)*

Materials:

Made with a short, thin, already hollow, piece of branchwood found on the shores of Lake Taupō. Probably tutu (*Coriaria arborea*).

(Figure 3.1a) Kōauau Tutu Taupō proximal.

Tools Used:

A small, flat sandstone pebble / Pocket knife awl.

Physical Characteristics:

Short, grey and brown branch that shows signs of decay and wear, and a small amount of rot. Indications of damage caused by insects eating the wood, probably while still alive as a tree. Both ends of the piece are very flat, with only slight shaping at the edges. Three small (3mm) finger-stops are installed in a line down the axial surface. Though the branch has a very round internal bore, externally it is not perfectly round in cross-section, showing signs of 'squaring' that is indicative of tutu.

(Figure 3.2) Kōauau Tutu Taupō.

Construction Process:

1. Found on lake shore just above waterline.
2. Branch was tested and played immediately.
3. Small sandstone pebble found in same spot.
4. Playing ends bevelled on pebble to shape.
5. Finger-stops installed using pocket knife awl.
6. All *wenewene* were tested and voice strongly.

(Figure 3.3) Kōauau Tutu Taupō distal.

Discussion:

Kōauau Tutu Taupō is an excellent example of how a good sounding flute can be made with very little effort. As a player, I favour this flute for its sound and tone, and the melodies that it is able to achieve. The large 3-semitonal step that the bottom finger-stop renders when opened has a strong traditional flavour about it that turns heads and often raises exclamations of “ātaahua!” (“beautiful!”) from those listening.

Conclusion:

I rate the construction method of *Kōauau Tutu Taupō* as traditionally very plausible. That it was constructed simply and quickly and plays with a high degree of function are issues of evidence that are confirmed by the presence of very similar looking flutes in museum collections. Leaving nature to render tutu wood hollow would have been a very safe option traditionally, and the sheer abundance of ‘driftwood’ (river and coast) would have provided the maker with a high standard of resource. That this piece is not of a high standard aesthetically was not the intention of this experiment.

This experiment was about availability and effort, and on these issues it was highly successful, being completed within five minutes from start to finish. With a wider time frame, a piece of much higher quality (less wear and decay) could be sourced and made with the same ease. This piece then could also be fashioned in a more intricate manner, with further work on the external surface, and even the introduction of some carving. If size were an issue (such that *Kōauau Tutu Taupō* might not be perceived as of the usual traditional size) in construction, I consistently find much larger (wider/longer) branches on the beach that still have some of their pith remaining that would make fine kōauau with a modicum of effort and skill. Practically, *Kōauau Tutu Taupō* is actually an excellent size as it fits well inside the palm of the hand, and slides effortlessly into a pocket, making it easy to transport, conceal and then reveal, when needed.

Kōauau Tutu Manawatū

Flute Name: **Kōauau Tutu Manawatū**

(Figure 3.4) Kōauau Tutu Manawatū length.

Dimensions:

107 mm *(long, top to bottom)*

14 mm *(wide at top end)*

15.4 mm *(across at widest mid-point)*

15.5 mm *(wide at bottom end)*

7.9 mm wide *(wide at proximal inside bore)*

10.7 mm wide *(wide at distal inside bore)*

Materials:

Made with a short, thin, very hollow, piece of branchwood found on the shores of Manawatū River.

Probably tutu (*Coriaria arborea*).

Tools Used:

Large sandstone hōanga / tūwiri, stone bit.

Physical Characteristics:

A very short, lightweight and thin-walled, hollow piece, with a very round bore, that has stripe-like shallow grooves longitudinally down its exterior, indicative of tutu (*Coriaria arborea*) branchwood. Grey external colouring with a fawn brown internal hue. The walls are so thin that the shaped playing edge is fully bevelled and could be considered almost 'sharp' in comparison to the 'blunt' ends of *Kōauau Tutu Taupō*. Intriguingly, the width of these walls actually lends a similarity of resource to that of bamboo, which one expert suggested that it might be. This factor also confused another expert, who identified the material as possibly that of Himalayan honeysuckle (*Leycesteria formosa*). This is understandable as the hollow centre of *Leycesteria formosa* is very round and wide in relation to wall thickness. I am familiar with Himalayan honeysuckle, and have a pōrutu that I have made from it, and the external nature of this plant is quite different in appearance to that of tutu as it has a

(Figure 3.5) Kōauau Tutu Manawatū.

(Figure 3.6) Kōauau Tutu Manawatū distal.

very round external diameter and does not have any longitudinal grooves, or 'squaring' features that identify tutu.

(Figure 3.7) Kōauau Tutu Manawatū oblique view.

Construction Process:

1. Resource was collected at rivers edge.
2. Tested immediately, the piece was playable.
3. Taken home, one end was chosen as proximal.
4. This end was shaped easily on the big hōanga.
5. Three wenewene were installed with a tūwiri.

(Figure 3.8) Wenewene detail.

Discussion:

This flute is almost identical in circumstance to that of *Kōauau Tutu Taupō*. Though slightly different in some dimensions, it is made from the same resource, and found in a very similar circumstance. Tutu grows well on river banks, and is one reason why it is found so prevalently on the coast, being washed down stream and out to sea. I struggle to source tutu in a living state inland. Because of its incriminating toxic reputation it is often mindfully eradicated, especially on farmland, around stock and bees. I do find it on river banks, in smaller form such as this piece, but the coast probably acts as a final catchment for all of the tutu that is left to grow up-river and then falls in larger storms, floods, and snow melt. Finding 'beached' tutu (whether coastal, lakeside or river bank) as opposed to cutting it fresh, is a safe option for working tutu. The toxins have been all but washed from the wood, and the pith is either gone, or can be easily removed with a quick push and a shove. Beached wood has the advantages of being both well-seasoned, and hardened. The biggest disadvantage is aesthetic, in that it is often very aged in its appearance. With a keen eye, and a relaxed disposition, it really is just a matter of time before an excellent sample that suits the maker's criteria is sourced.

Conclusion:

Beached tutu is an excellent option when wanting to specifically use this resource. Public accessibility to growing tutu is greatly reduced now due to eradication. With this option, toxic threat is reduced, and the difficult pith is often already removed. Selection of sample size is less available immediately, but with time and patience, this can be overcome. Environmentally hardened tutu sings with a loud, ringing tone that is sweet and clear.

Karanga Manu Karoro

Flute Name: **Karanga Manu Karoro**

(Figure 3.9) Karanga Manu Karoro back.

Materials:

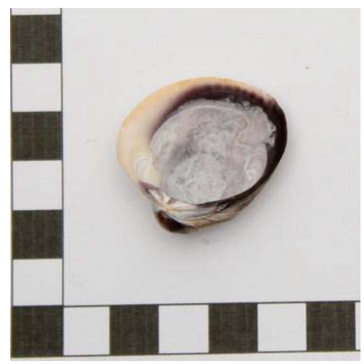
Kota Tuangi / Bi-valve shell

Hūai - NZ Cockle *(Chione* or *Austrovenus stutchburyi)*

Karoro - Ribbed Venus shell *(Protothaca crassicosta)*

Kaikaikaroro - (*Spisula aequilateralis*)

Many similar species found on NZ beaches.



(Figure 3.10) Karanga Manu Karoro front.

Physical Characteristics:

Single side of a small, thick-walled, fan-shaped, or triangular bi-valve mollusc shell. Often found empty and separated from its paired partner on the beach in various zones.

Playable immediately by placing flat against the mouth with the flow of air from the mouth projected into or across the triangular corner or apex at the base of the fan shape. These shells are very easy to find and very easy to play. The sound they make strongly resembles that of gull song.

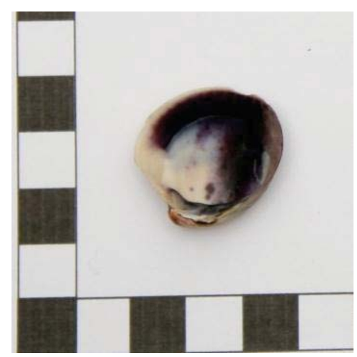
(Figure 3.11) Karanga Manu Karoro variations-1a.

Construction Process:

1. Search for and select shell from off beach.
2. Open and separated (eaten/empty) bivalves are usually found at the high tide line.
3. Only one side of the bi-valve is required.
4. A quick clean out of any sand and debris by blowing or washing in the tide is often not necessary.
5. Size of the shell creates changes in pitch and tone.

(Figure 3.12) Karanga Manu Karoro variations-1b.

(Figure 3.13) Karanga Manu Karoro variations-2a.



(Figure 3.14) Karanga Manu Karoro variations-2b.

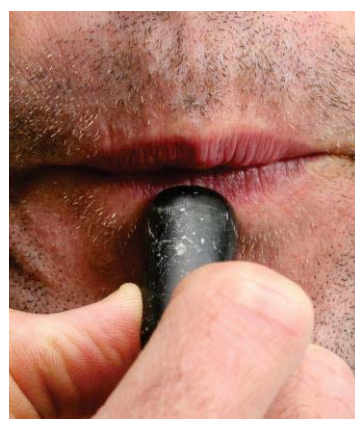
Discussion:

I have listed 3 types of bi-valve shell for a particular reason. The NZ cockle (*C.* or *A. stutchburyi*) is unique to these shores, and one will soon find on exploration that many differ in size, colour and even shape. These changes can literally redefine their classification, listing them as another species altogether. On further research I soon discovered that a shell I had often assumed as being that of the NZ cockle (*Chione stutchburyi* or *Austrovenus stutchburyi*) in fact strongly resembled a number of other species under immediate visual classification. One of these is the Ribbed Venus shell (*Protothaca crassicosta*) that Williams classifies under Karoro as "*Protothaca erassicosta"* (sic) and more generally as the cockle (2001: 102). Williams classifies the hūai as *Chione stutchburyi*, and cockle also (Williams, 2001: 65). One immediate difference between *Chione/Austrovenus* and *Protothaca* as cockles is in their size.

(Figure 3.15) Soapstone Karanga Manu.

The Ringed Venus shells on average are smaller, making the hūai probably more popular in general as food. I have listed *Protothaca* here as a point of interest directly relating to the research because the Māori name for the Ribbed Venus cockle is in fact Karoro. This word is also one name for the Black-backed gull (*Larus dominicanus*). Of course, one obvious reason for this is that this cockle was food for the gull, as in the Williams extended definitions where the same is listed as *kaikaikaroro* (2001: 102), but it is noteworthy that it *sounds* like the Black-backed gull. Two other molluscs are listed under its own definition at *kaikaikaroro*: *Spisula aequilateralis* and the univalve *Struthiolaria papulosa* (also known as *totorere* and large ostrich foot) (Williams, 2001: 87). The *totorere*, though quite a different type of shell altogether is also very playable.

(Figure 3.16) Soapstone Karanga Manu proximal.



(Figure 3.17) Playing a karanga manu horizontally.

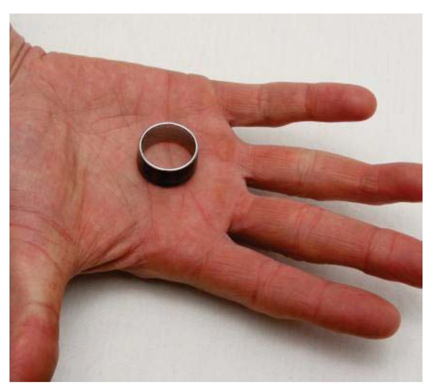
Conclusion:

This is a fantastically simple flute that never fails to please or surprise. A powerful instrument for educational workshops because of abundant availability and high function playability that allows for a high rate of success with people learning to achieve the oblique embouchure.

Flutes cannot be shared for health reasons and this instrument allows a learning experience to happen without the need for making, or the use of human-made materials. Abundance means that the sharing of flutes is not required. That the geography of origin is so strongly embedded in the sound of the resource does well to impress upon the student the significance of place within resource. I greatly suspect that this instrument would have been played in a traditional setting, at least by children in a playful sense. A question I often pose to children when demonstrating this instrument considers whether or not it would be categorised as a musical instrument if it were to be discovered by archaeology. Of course, the resounding answer is always "No!".

(Figure 3.18) Playing Karanga Manu Karoro diagonally.

(Figure 3.19) Found broken shell.



(Figure 3.20) Playing a finger ring by closing the bottom against the hand.

Karanga Manu Kōhatu

Flute Name: **Karanga Manu Kōhatu**

(Figure 3.21) Karanga Kōhatu.

Materials:

Igneous rock, found on a beach in Nelson.

Physical Characteristics:

(Figure 3.22) Karanga Kōhatu.

Green in colour, with a number of rounded pits and holes made from the sudden cooling process of molten volcanic rock probably landing in water.

Discussion:

(Figure 3.23) Large hole in found mudstone slab, top.

Holes occur in rock and stone for many reasons. I have included this piece as an example because I found it very early on in the research, and it is still a part of my collection as a playing instrument. I have viewed a number of different kinds of holes in stones since. One type that I see often is that of a sandstone type rock that is full of small holes probably caused by several kinds of boring bivalve mollusc known as the 'angel wing' clam (*Barnea similis*), or piddock (*Pholadidea suteri* and *P. tridens)* (Wassilieff, 2009). The holes found in these stones are easily playable. I have included a photo of another specimen I had brought to me during the research. This is obviously a softer, mud type stone, but is very playable (*Fig. 3.23*). There is no doubt that with a solid time investment the outside of this could be shaped into a more classic kōauau shape, but nevertheless, it is still very playable without any further work required. A friend, Jeremy Hantler, recently found a fantastic stone with a long hole the length of his hand right through it, which is immediately playable (2012). I have not seen this in person but have included a photo of it here that he took and sent to me (*Fig. 3.26*). This is a fantastic specimen of how a bore through stone can exist. It is obvious how the length and diameter of the bored hole is ideal as a kōauau. As with the other specimen above, the hardest work of drilling a bore is already complete, and Jeremy says it sings with a strong and loud voice that would be expected from stone.

(Figure 3.24) Mudstone, bottom.

(Figure 3.25) Bivalve, probably angelwing, in mudstone.

(Figure 3.26) Stone found by Jeremy Hantler (photo J. Hantler).

(Figure 3.27) Hole through stone (photo by J. Hantler).

Conclusion:

The presence of holes of varying sizes and kinds within rock is a fascinating and elusive aspect of the research. I have spent 10 years hoping to personally source a specimen like the one found by Jeremy Hantler. This demonstrates well how a kōauau might be produced in a traditional setting, with external shaping being the only (though still comprehensive nevertheless) task left to complete a fantastic instrument.

At one point of the research it was explained to me by someone that sometimes, traditionally, the forces of nature were intentionally manipulated to drill a hole through a stone by lodging it in a fast flowing river current and then somehow depositing a tiny pebble against the stones surface in a way that it might pummel and grind, and bore a hole through. Such a concept intrigued me for some time, especially as I began to see evidence of how it might be done, witnessing indentations and even short tunnels in river rocks where a small stone had been caught in a small eddy against the face of another rock. Never again though did I meet someone who repeated the story to me, and neither have I seen evidence that it was done as a practice. I must state though, that the only traditionally made stone flutes I have seen are nguru, and the physical evidence in these suggests that these were drilled using tūwiri.

Karanga Manu Kōhatu is a very practical and playable instrument. I enjoy the challenge that it offers for seeking voice from a number of the different and smaller holes that I would not usually play. It also doubles well as a smudging appliance, where I will sometimes burn white sage within the larger pit, for special ceremonial circumstances.

Karanga Manu Mānu

Flute Name: **Karanga Manu Mānu**

The second mānu (maanu) in this name translates 'to be afloat' and is a pun on the material it is made from, a small kelp float sac or pod, and the instrument it is, the karanga manu, a bird caller.

(Figure 3.28) Karanga Manu Mānu as made by Alistair Fraser (photo by Alistair Fraser).

Materials:

Made from a small, dry kelp pod possibly from *Macrocystis Pyrifera* (Giant kelp) found at Birdling's Flat (beach), Banks Peninsula, Canterbury.

Tools Used:

Pocket knife.

Physical Characteristics:

Half of a Paper thin, dry, brittle, dark-brown kelp pod.

Construction Process:

1. Pod cut in half with pocket knife.

Discussion:

Very simple to make, this experiment alludes to the reference in He Kete Taoka (McCallum, 2008: 159) regarding the use of *Macrocystis pyrifera* kelp, and also the suggestion by Alistair Fraser that larger pods could have the ends removed to fashion short kōauau (2010 - 2012). I agree with this intuition by Fraser, though the pods found on my sample of kelp were nowhere near large enough. The moment I discovered this resource I realised it was hollow and that a karanga manu was achievable, and all that was required was to action successfully the design concept without destroying the fragile resource. Other construction possibilities might include making with fresher and therefore softer, more resilient kelp pods that could then be dried, or the sectioning being done by gently grinding away the upper part of the pod, rather than cutting and damaging the material.

Conclusion:

The southern Māori had a strong understanding of kelp utilisation. According to McCallum, *Macrocystis pyrifera* was a kelp that was utilised by these people (2008: 159). While I am unresolved about the pragmatic or efficient use of *Macrocystis pyrifera* stipe for the making of kōauau (see chapter 3), this experiment makes obvious the possibilities that lie within the use of the hollow pods, and I am in accord with the suggestion made by Alistair Fraser (Fraser, 2010 - 2012) that the larger the pod, the more potential for success in constructing a short, tubular, open-ended diagonal flute. As a resource for karanga manu, these pods would have traditionally been abundant and with an ease of fashioning, the retention of the instrument as valuable would have been unnecessary, probably resulting in their being discarded when their intended use was complete.

Karanga Manu Tiotio

Flute Name: **Karanga Manu Tiotio**

(Figure 3.29) Barnacles found on the back of larger univalve shell.

Materials:

Barnacles: possibly of the ‘acorn’ or *Balanus* variety. Made with found materials: sourced out of a shell collection at Hokowhitu Kindergarten, Palmerston North, NZ, December 2010. While there are several words that mean barnacle including *koromāungaunga* and *werewere*, I have chosen *tiotio* as a name because of its profound onomatopoeic similarity to the sound that the instrument makes, and that the Williams dictionary defines *tio* as “*piercing*, of cold” or as “*cry, call*”, and *tiotio* as both “*Barnacle*” and “a bird” (2001: 420).

(Figure 3.30) Karanga Manu Tiotio.

(Figure 3.31) Karanga Manu Tiotio.

Discussion:

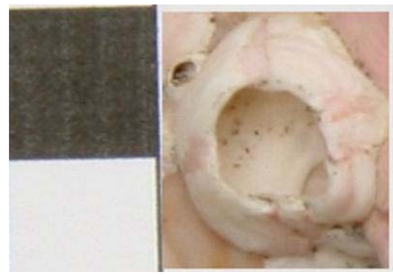
This resource was not found in its natural home, but at my daughter’s kindergarten in a basket amongst a number of other different sea shells.

Without any consultation regarding this particular instrument, Alistair Fraser and I both sourced barnacles as karanga manu around the same time, his being found during his residency on Rakiura in February 2011.

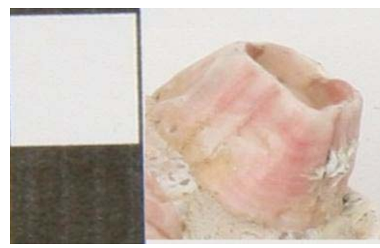
Fraser reports his using both the transverse and oblique method, though claims he has more sonic success using the diagonal technique.

Such coincidence is significant as it confirms the intuitive and improvisational principals of 'found sound' within taonga pūoro research, and illustrates how different practitioners arrive at similar outcomes. The 'found sound' experimental process is strongly controlled by the playing technique or method (in most cases the diagonal, or oblique, flute embouchure for this research): this technique achieves a sound in many situations, but when it does, the physical aspects, or form, of the playing resource (flute) are basically the same – the presence of a playing edge, that can be closed or sealed against the face, that extends to and ends in an open or closed tube/vessel: i.e. a sealable edge on top of a (short or long) open or closed tube.

(Figure 3.32) Karanga Manu Tiotio.



(Figure 3.33) Karanga Manu Tiotio.



(Figure 3.34) Karanga Manu Tiotio.

(Figure 3.35) Karanga Manu Pūpū.

(Figure 3.36) Karanga Manu Pūpū and tiny flax kete.

This specific criteria, derived from the playing method, therefore becomes defined and limited by the resources available to the practitioner. When a practitioner is skilled in improvisation, sonically (playing) and materially (making), certain possibilities become available to them, but in a ‘natural’ world (i.e. not humanly constructed) these resources are in fact very limited, and it is only a matter of time before similar discoveries are made regarding the same resources by different practitioners.

Conclusion:

Barnacles make excellent karanga manu with no more effort than simply finding them. I strongly suspect that these were used traditionally, and would like to look further into the etymology of the Māori word *tiotio*. I am very interested to find out if they were ever employed by people of other cultures, including old time sailors, as bird callers. Yet again, the shape of the *tiotio* is remarkably like that of karanga manu. Of course, this physical similarity (form) is undeniably central to the ‘discovery’ and ‘execution’ of it as such.

Kōauau Kōauau-Ahuriri

Flute Name: **Kōauau Kōauau-Ahuriri**

(Figure 3.37) Kōauau Kōauau-Ahuriri length.

Dimensions:

89 mm *(long, top to bottom)*

9 mm *(wide at top end)*

10.9mm *(across at widest mid-point)*

8.7 mm *(wide at bottom end)*

5.6 mm wide *(wide at proximal inside bore)*

4.2 mm wide *(wide at distal inside bore)*

Materials:

Dried, hollow kelp stipe, found on Main Beach, Napier. Probably *Ecklonia radiata*.

Physical Characteristics:

(Figure 3.38) Kōauau Kōauau-Ahuriri enlarged.

A very small, thin, light-fawn coloured piece of soft hollow algae. Distal end is jagged and torn, being found this way. Exterior surface is not smooth, having marks and slight pocking on it. Uneven, oval shaped cross-section, and slightly curved trunk form.

(Figure 3.39) Note how tiny this flute is.

Construction Process:

1. Found at high tide mark.
2. Shaggy, wig-like holdfast was pulled off.
3. Playable immediately.
4. After the piece became drier, the proximal end was gently bevelled for a playing edge.

(Figure 3.40) Kōauau Kōauau-Ahuriri proximal.

Found and constructed in 2002.

Kōauau made by Rob Thorne.

(Figure 3.41) Kōauau Kōauau-Ahuriri distal.

Discussion:

There is a strong element of functional aesthetic with this flute. Even though it is capable of exceeding other flutes in sound and ability, it certainly does not look like the usual kōauau. Perhaps then, the biggest problem with this flute is its appearance. Because of its tiny size, its torn distal end, and strange leathery surface, it might not be defined as a kōauau. Many experts who have seen it struggle to refrain from outright laughter, and it often becomes the butt of some demeaning remark or joke.

(Figure 3.42) Kōauau Kōauau-Ahuriri distal detail.

Such reactions to a flute certainly do not engender respect for the player, regardless of how it might sound or perform. It was only through its strong performance abilities that it convinced me of its worth. Personally I struggle to perceive of this flutes physical prowess, and often find myself reaching for the dominating beauty of a long albatross bone flute even though *Kōauau Kōauau-Ahuriri* exceeds these in performance and tone. As I have struggled with the validity of this flute due to its physical form, so do others. Rather than perceiving its worth through its sound and function, it becomes marginalised because of its form. There is no doubt that a great deal of defining criteria for kōauau is about form, that includes standard size and material, and that a number of flutes within the Māori instrument battery are very similar in sound or function, at times even indistinguishable. Often, for this reason, their chosen usage at particular points in composition and performance are for ideological, religious, symbolic, intentional or personal reasons. These reasons can often be defined by the 'place' that the resource is believed to embody. An example of this might be that *Kōauau Kōauau-Ahuriri* would be chosen particularly to be the embodiment of Tangaroa (god of the sea) in a prayerful invocation that seeks success with catching crayfish: especially in regard to the kelp forests being a home to the desired catch.

Conclusion:

Even though this flute looks strange, and does not fit the standard physical mould of a kōauau, in my opinion there is no doubt that this is exactly what it is: a short, open-ended, tubular, diagonal flute. It certainly sounds like a kōauau, and like the found tutu kōauau of this chapter, its small size allows it to be easily concealed while being played, which is a traditional playing style of Māori flute virtuosity that possibly references *ororua*, a spiritual disembodiment of sound, such as that practiced by tohunga (Beatson, 2003: 19), or the famous practice of acted musical performance of non-players such as with Tūtānekai and Tiki (Beatson, 2003: 20), or in some way the mysterious and unseen flute playing of the Patupaiarehe, or fairy people, who were renowned for their sweet music (Cowan, 1925: 9). *Kōauau Kōauau-Ahuriri* is a profound and humble instrument. I believe that if it were found archaeologically it would probably be miscategorised or even discarded as irrelevant and insignificant, as it simply does not fulfil the physical attributes of a standard kōauau. Nevertheless, it resides here as one of the most important. As a kelp stipe that is hollow and easy to fashion, I believe this may be the mysterious *kōauau* kelp in the stories of old.

Kōauau Kōauau-Aotea

Flute Name: **Kōauau Kōauau-Aotea**

(Figure 3.43) *Kōauau Kōauau-Aotea length.*

Dimensions:

210 mm *(long, top to bottom)*

16.5 mm *(wide at top end)*

17.7 mm *(across at widest mid-point)*

18.2 mm *(wide at bottom end)*

12.8 mm wide *(wide at proximal inside bore)*

11 mm wide *(wide at distal inside bore)*

Materials:

Dried, already hollow, kelp stipe found at Schooner Bay, Aotea/Great Barrier Island, June 2011.

Tools Used:

Pocket knife / Hōanga / Sharks tooth hand-drill.

Physical Characteristics:

A large, long, lightweight, fawn-coloured, hollow tube with thick walls and a partially flattened (oval to kidney shaped) round bore that has a foamy, leathery consistency to its appearance, though is hard and dry to the touch. Small patches of whitish/grey and black mould are present on the slightly rough external surface. Both ends are roundly bevelled the whole depth of the flute wall, from the outer edge to the internal bore, creating a sharpened edge. Three slightly tapered, 3mm finger-stops in a row are present at the distal end, and are an excellent example of what holes fashioned with a small sharks tooth hand-drill look like.

(Figure 3.44) Kōauau Kōauau-Aotea Distal.

(Figure 3.45) Proximal detail.

Construction Process:

1. Found still wet, but not fresh at high tide mark, the sample was placed on a window sill to dry.
2.]Dried over a short week, the sample was turned regularly, and squeezed and encouraged to maintain it roundness.

(Figure 3.46) Shrunken end of kelp.

(Figure 3.47) Cutting the kelp.

3. When sufficiently dried, the collapsed, crimped distal end was removed with a pocket knife to reveal an almost round hole.
4. Both ends were shaped to a playing edge on a very smooth, fine grained sandstone hōanga.
5. The roundest end was chosen as the proximal playing end and the dominant edge selected according to wall thickness, quality of sound, and the consideration of where finger-stops might be installed.
6. The piece was kept in this state, as a 'harmonic flute', for some time, while I pondered how I might install wenewene to complete it.
7. When the courage was finally summoned to complete, three small wenewene were installed in the lower half of the piece in the style of a pōrutu using a small shark-tooth hand drill. This was completed easily within minutes.
8. The lowest position wenewene was installed first: measured, marked and then drilled, being tested intermittently for pitch as it was drilled.
9. The middle position was drilled next in the same fashion, finally the top position was installed.

(Figure 3.48) The cut kelp.

(Figure 3.49) Shaping the ends.

(Figure 3.50) Shaping the ends.

(Figure 3.51) Drilling the final wenewene.

Found in 2011. Construction completed in 2012.

Kōauau made by Rob Thorne.

(Figure 3.52) Drill detail.

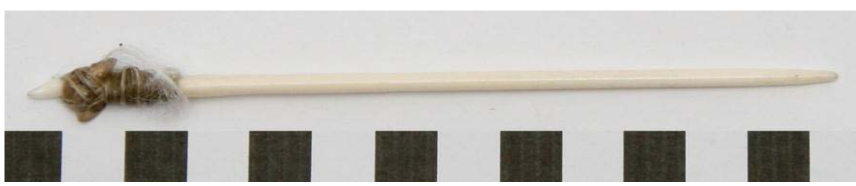
Discussion:

The functional quality and simplicity of form and construction give this flute a great deal of research plausibility, and the possibility that such flutes existed traditionally is heightened by the brief, but nevertheless present, ethnography. Further research is required to deepen understanding of Māori kelp utilisation, in both the south and the north, especially in regard to *Ecklonia radiata*. A search into oral history, and myth and legend could reveal information also. I met an expert at the beginning of 2012 who spoke of a rich and ancient collection of Māori musical instruments within his family. These instruments have been kept within the personal confines of his family, and so little is known about them to the wider public. This person, who wishes to be unidentified, spoke of two horns relevant to this research: a short pūkāea that had been hollowed by burning during its construction, and a large pūkāea that was made from the long, already hollow stipe of a kelp that ended with a flared structure (gas bladder?) that formed the distal bell of the horn (Participant"N", 2012). This is astounding as it matches well with cross-cultural data, and yet there is no record in ethnography that I have found (yet) of such an instrument. As illustrated by this example, further cross-cultural research would assist in researching what is historically achievable with kelp. As a resource, the abundance of this kelp (of course only in some places) works well for experimentation. Length and width of flute and placement of finger-stops could all be tested thoroughly and quickly with an abundant and safe resource. Much safer in fact than many human made resources that are proving to be of high health risk, such as PVC tubing. It is my desire to return to the island to not just collect more of this resource, but to work with the locals specifically in respect to instruments made with kelp collected from their shores.

Conclusion:

Kōauau Kōauau-Aotea is one of the finest examples in this collection of how a found resource can provide great potential for the construction of kōauau by immediately suiting the form and criteria required. While *Kōauau Kōauau-Ahuriri* opened a door of prospect, this promise remained unfulfilled for nearly ten years. This final discovery seemed to confirm the years of intuitive speculation and hypothesis that had been encouraged by thin strands of evidence, suggesting the potential for more. In no way does this confirm that such a flute *did* exist, or that this resource was used traditionally. As with a large amount of this research, and the wider study into reviving and revitalising taonga pūoro as an art form and practice, these are transactions into potential realms of possibility. What is being attempted with this cultural renaissance is the restoration of a 'broken' tradition, where lines of historical knowledge and action have been severed. Within the tradition of Māori musical instrumentation a large cultural fissure has been wrought by colonialism between the past and the present, at times requiring giant perceptual jumps of speculation to reach the other side. The research achieved here with kelp, from 2002 to 2011, illustrates how such a gap might be straddled. Even if it wasn't a traditional form, *Ecklonia radiata* kelp stands out as an excellent natural resource in the modern Māori world because of its sustainability, availability and safety, and of course its functional abilities. I look forward to further research, and discoveries in regard to this specific resource.

(Figure 3.53) Different sized pieces of hollow kelp.



(Figure 3.54) Shark-tooth drill.

Chapter 4

Holes Made By Insects Eating

This chapter presents a discussion of kōauau that were made from holes that were found already in existence, though have been isolated as different from those in chapter 3 in that they were made particularly through the action of insects eating wood. Flutes that I have seen in museum collections that indicate possibilities of the bore deriving from entomological origin include 1940.24.37 from Whanganui Museum and the small thin kōauau that resides in Murray Thacker's collection at Okains Bay Museum. While these holes are virtually ready to play in many instances, I believe that they are worthy of separate discussion as a number of issues arise during their analysis.

These holes and the flutes made from them are intriguing and become more significant the greater their relevance becomes considered within the discourse. A number of cultural and physical elements intertwine to enhance the importance of these holes in the discussion of how kōauau were, or might have been constructed.

Before the possibility became apparent, I had never even imagined that such a thing might be conceivable, let alone potentially credible.

This part of the research had many experiments, but the three examples featured in the results reported here demonstrate the most powerful examples of how insect made tunnels are functional as bores for kōauau and why this approach might be considered legitimate as a "realm of possibility" (Warbrick, 2001 - 2012) within this study of traditional method.

From the arrival of the first 'eaten' hole, in a length of mānuka, the research took a whole new direction. With an oval shaped hole, the issues that revolved around form became less fixed as the conceivable became more diverse; the world of function became much wider, and I began exploring what other objects and holes might be playable.

The intuitively relaxed ratification by Warren Warbrick of this oval shaped bug tunnel suddenly established another whole category of criteria, and not only was the world of insect construction revealed, but the immense issue of found-sound lurched into reality. That Warren casually assumed such resource as valid to the research was at first startling to me, but once the playing of *Kōauau Mānuka Pītara* commenced, I became convinced, and the real adventure began. The research was no longer just about how kōauau were made, but now, how kōauau were conceived and where kōauau might be 'found'.

It is probable that of the two types of insect holes discussed in this chapter, the round one is made by the pūriri moth caterpillar (*Aenetus virescens*), while the one that is more oval in shape is made by the larva of either the kānuka longhorn (*Ochrocydus huttoni*), or the lemon tree borer (*Oemona hirta*). While these observations might be considered as obvious it should be remembered that there are many insects that create holes in living, dead or dying trees. Holes found in the Putaputawētā tree (*Carpodetus seratus*) are often thought to be made by the wētā, though research indicates that in fact the holes are originally made by something else, usually the caterpillar of *Aenetus virescens* (pūriri moth), within which the wētā then takes up secondary residence, widening and maintaining the tunnels and allowing for the further development of such things as wood rotting fungi (TERRAIN, 2011). A number of insects and their grubs, such as the huhu (*Prionoplus reticularis*), appear to generally reside in and consume rotten wood. This discussion will not include these, as rotten wood makes unsuitable instruments due to its wet, flaking and crumbling structural inconsistency.

This discussion showcases three examples of kōauau made from wood with 'found' holes created by insects. *Kōauau Mānuka Pītara*, which shows an excellent example of a tunnel made by the larva of a longhorn beetle, probably *Ochrocydus huttoni*, is profound for demonstrating the function of a hole that is not round, and the notable similarity in bore shape to many pūtōrino by way of the flattened oval. The tunnel is created by the larva, which is then inhabited and maintained by the adult beetle, and other species of insect. Although I have not witnessed such a style of hole in any kōauau from museum collections, nor do I think these necessarily make good resource for kōauau, I have included it here as a conception piece for the expansive stepping-stone effect it had upon the research and my ability for enacting the oblique flute embouchure.

Kōauau Pūriri Ātaahua is fantastic in its form and beauty. Made from wood possibly over 200 years old, the perfectly round aperture, curved bore and certain facets of its internal surface structure mirror exactly the criteria presented by many kōauau found within museum collections.

Kōauau Makomako Anuhe is presented as an example of a kōauau that has been shaped from out of a cut tree trunk using an adze, and illustrates how round tunnels probably made by *Aenetus virescens* occur in trees other than pūriri (*Vitex lucens*). In opposition to *Kōauau Pūriri Ātaahua* it is a recently produced hole, and it demonstrates well some of the intriguing issues that become central to this discussion and make this section so fascinating.

Construction - Kōauau Mānuka Pītara:

The making of *Kōauau Mānuka Pītara* occurred very early on in the practical research. It was the piece that literally opened a whole new realm of possibility in regard to what is required to achieve function and how kōauau might be borne from out of the natural world. The simplicity of the construction process accelerated an understanding of how sound could be 'found' and made with very little human intervention. In the *Practice/Significance* section of my research notes I have written "doesn't have to be round, is actually maybe just an edge that is being played" (2002). It was this realisation regarding the edge, and that the bore was in some way actually *closing the edge*, that led me within weeks of the mānuka discovery to experiment with playing finger rings (*Fig. 3.20*) and then cockle shells (*Fig. 3.18*).

This mānuka resource was donated to the research by Marcus Buroughs who had collected it in a grove up the Pohangina Valley near Ashhurst. The stand of trees was growing very closely together, the trees being very tall (upward of 4 metres) and thin (no more than 50mm diameter) with branches growing only at the very top. When taken, he said it broke away easily at the base, suggesting that the tree was already dead, probably from the actions of its inhabitants. Coming with the shaggy bark still intact, one piece had a stopped tunnel that turned 90-degrees to a small round entrance way (*Fig 4.6*). The lemon-tree borer (*Oemona hirta*) can be recognised by these round holes which they cut for the expulsion of bore dust (Hosking, 1978b). One of the two main native hosts for *Ochrocydus huttoni* (Kānuka beetle) is mānuka (Hosking, 1978a), which is why this research assumes that this is the probable perpetrator of this tunnel. This L-shaped form was evocative of a nguru with its lower finger-stop. The ends were trimmed off with a band-saw and the bark was removed by scraping with a pipi shell (*Paphies australis*) māripi (scraper). Shaped to its current form using a blade toki, some finishing was done on a hōanga and then pumice. The piece was left in this state as an excellent example of how work looks when completed with an adze. Small channels made by other smaller types of wood borer occur across the body of the flute, including trail-like grooved channels and some very small round holes that look remarkably like wenewene. These of course do not pierce the wall of the flute right through, otherwise they would function in the same way a finger-stop would. The three wenewene were installed down the anterior surface of the kōauau using a small, sharp, long-tipped, shark-tooth twist drill. The whole flute took about twenty minutes to complete.

Function - Kōauau Mānuka Pītara:

This kōauau plays at a medium to high pitch with a breathy, almost muffled tone. The proximal finger-stop does not function at all, and a great deal of breath and focus is required in general to make the flute play well. There are several things that could be performed to achieve greater function, including sharpening the bevel on the playing edge, and opening up the internal proximal section of the bore into a more round shape, and so step tapering the bore at the same time. This could be achieved with a hot ember. None of these suggestions have been performed for this piece, as the principle of the experiment was about achieving a kōauau from this resource with very little human intervention. The diameter of the raw wood blanks made the creation of the flute very easy as there was little shaping required, to the extent that function was actually available immediately. This function was weak though, and with shaping the playability increased.

Construction - Kōauau Pūriri Ātaahua:

The flute known here as *Kōauau Pūriri Ātaahua* was constructed from out of a pūriri fencepost that was riddled with caterpillar holes. The tunnel and wood were donated by Detlef Klein, who was working at Te Manawa Museum as the Conservator at the time. On seeing the holes, and knowing the research that was being undertaken, he immediately perceived the holes as potential flute bores. A flute known to the research as *Kōauau Pūriri Waka* had already been constructed from a pūriri tunnel that was found in a recycled floor joist that was also donated by Klein. This tunnel was not long enough to create an instrument that conformed to the shape of a standard kōauau, but was nevertheless very functional, somewhat resembling a nguru but with one very large, singular wenewene on its upper surface that is expressed with the palm of a whole hand instead of a fingertip. When Klein recognised that these new tunnels were longer, he brought them to the attention of Warren Warbrick, who located the longest complete hole, and then quickly extracted it from the post using a table saw. Once extracted the flute was shaped on a hōanga and given a quick finishing on pumice. I was not present when this occurred, and on my next visit to Warbrick at the museum he presented me with the finished piece. Klein was in possession of the pūriri wood because of a repair job that he had been contacted about regarding a piece of furniture in residence with the British royal family. He explained how pūriri was very popular for furniture and the use of veneers because of its extreme durability and the way the wood could be sliced thinly because of its cellular strength. Humoured discussion between us considered the whakapapa of this flute now including a cousin in the Royal family at Buckingham Palace.

The grain of this piece is indicative of wood that has been milled, and serves well to illustrate the difference between a length of branch and a section of cross-sawn timber. The use of modern, powered, steel tools served to hasten a job that would have taken some time using traditional implements, such as with the construction of *Kōauau Makomako Anuhe*.

The tunnels of these caterpillars generally run vertically in the tree, with an entrance way that runs outward from the top on a downward angle to the trunk edge, giving an overall form of the number '7' in design (*Fig. 4.18*). Tunnels can be upward of 120mm in length and while active in the tree, the caterpillar camouflages the entrance way with a tough, silk-like web that is remarkably similar to the shape of the butterfly. The life-cycle can be upward of 4 years, in which the eggs are dropped in random fashion on the forest floor, hatched within 2 weeks, and the new larva moves off the ground and onto living material from around 3 months to start on the tunnel. In this the caterpillar feeds and grows, pupates and then metamorphoses into the butterfly. Caterpillars are usually found in young stems and branches up to 30cm diameter, and tunnels found in larger growth are more often than not the residual of work from which the inhabitant has already left (Alma, 1977).

Classic in external shape, the bore of *Kōauau Pūriri Ātaahua* has a taper of 2mm diameter over the 121mm length with a smooth light curve in its descent (*Fig.4.17*). The wider proximal opening is pronounced by a short, stopped, secondary tunnel that can be seen from the proximal aperture (*Fig. 4.18*), and gives the bore a stepped feature to its line. The walls are thick (6-8mm), and the wood is hard. If I had not known that this was a pūriri caterpillar tunnel, I might have estimated that it was bored using fire and that the short secondary tunnel was pitted as the result of a misdirected hot coal. This may have then been mistakenly confirmed by the black and grey mottled appearance of the tunnel walls, and the rough uneven surface that accompanies it. So well-formed and round is the hole that any unknowing researcher might even say that it was created using a drill of some type. There would be no reason to consider the action of a moth caterpillar if there was no preconception for it, or evidence in the culture of deified moth worship, or if the physical existence and style of the tunnels had never been witnessed. A 12cm long kōauau with a 15mm to 13mm tapered and curved bore is of almost ideal proportions: that the bore of this one was constructed by a pūriri moth makes it near perfect.

Function - Kōauau Pūriri Ātaahua:

Kōauau Pūriri Ātaahua is a solid, weighty flute that plays loudly with a high, bright, ringing timbre, and a faint breathiness to its tone. The relatively short length lessens pitch control, and a small crack from the proximal end of about 38mm in length decreases the purity of tone and control. Even though this fault breaches the depth of the wall and the playing edge, the flute continues to play. With the introduction of wenewene, and a proximal playing edge of a sharper bevel, this flute would match any kōauau for sound and function, particularly for volume of sound. It is these shorter kōauau that stand out in their bellow that bring a better understanding of one of the particularly dominating functions of kōauau. The tonal ring, and resounding peal of the kōauau allows it to be heard clearly over a distance. This is the restitution for an open-ended instrument that renders much less emotive pitch control than that of the gentler, sweeter, closed nguru. That *good* kōauau players were respected reflects also on the difficulty that can come with bringing a tonal warmth and melodic sensitivity to the instrument in a way that can be more readily achieved with closed-ended flutes. The kōauau traditionally was a very public instrument, and fantastic at being heard: for signalling, welcoming, beckoning, inviting or announcing, it excelled. *Kōauau Pūriri Ātaahua* is a fine looking flute of high function that houses a beautiful secret within. That the bore was dug over a long period of time by a direct descendent of Tāne-mahuta, god of the forest - and a sister of Hine Raukatauri - gives it a very special voice.

Construction - Kōauau Makomako Anuhe:

The final construction of *Kōauau Makomako Anuhe* was a very lengthy and involved process. When a section of makomako tree trunk with a pūriri tunnel in it was donated to the research, I decided to see how achievable it was to extract the hole using traditional techniques. Using my small, steel-blade adze, I began to remove the majority of the wood from off the log. After three days, about 12 hours, of focussed effort, I had reduced the whole round to what appeared to resemble a large cigar-like piece of wood with a round tunnel running through it. Work slowed here as I became worried of going too close to the tunnel wall and striking through, rendering all of my hard work useless. With another day of less vigorous adzing I had reached a form that I was relatively happy with and gave the piece a good sand on a large, heavy grain hōanga that smoothed the outside to the form that it is today.

The shape of the posterior belly of the flute follows the curve of the tunnel (*Fig. 4.24*). During work I gambled that a bore that curved downward would play better than one that did the opposite. Whether this makes a difference I don't know, but the analysis of it as a possible issue demanded that I make a choice about how I was going to shape the flute, and where the finger-stops would be located. Once decided, the curve of the bore then formed the overall shape of the flute, giving it a beautifully contoured posterior surface that resembles a traditional form often seen in the older kōauau. The top, or anterior surface is predominantly flat, and as yet I still have to install wenewene. Two main issues prevent me from doing so. The function of this flute is magnificent, due mostly to its very round bore, the curve of the tunnel and the predominant taper (from not fully releasing or opening up the distal port), all of which create an excellent back pressure within the instrument's chamber. Because I can draw so much range from the instrument without the presence of finger-stops I am therefore uninclined to have them. That the curve of the bore swings quite a distance away from the anterior surface of the flute would also require a wenewene (that was placed in the centre of the piece) to be very long/deep, in the vicinity of half the flutes depth (15mm). While this may not actually cause any problems, the risk of rendering wenewene that might then be ineffective seems too great for me, and as yet I have declined from issuing any onto the surface of what I perceive to be an almost perfect playing, already completed kōauau.

The tunnel has always had a smell of smokiness about it, though not as strongly as when it first arrived, this smell persists.

Function - Kōauau Makomako Anuhe:

Kōauau Makomako Anuhe is a magnificent flute. Its tonal range is wide and the timbre is full, with a deep undertone that is often not heard in kōauau. A lack of breath sound when playing the flute is noticeable, and this gives it a pure tonal quality often not found in short, open ended tube flutes such as the kōauau. By closing and opening the distal end with a free hand, the player can bend notes up and down in a sliding fashion. The length of the flute allows for a higher over-blown note to be issued, and the bright ringing quality of this is reminiscent of a chiming kōkako. The heaviness of the piece delivers an assuredness that can be lacking in smaller and lighter flutes. The hard wood and the thickness of the body give this flute a loudness of volume and a purity of tone. The smooth consistency of the bore surface I believe is another reason behind this purity.

Physical Features Prevalent With Holes Made By *Aenetus virescens*:

Features consistent with both tunnels present in *Kōauau Pūriri Ātaahua* and *Kōauau Makomako Anuhe*:

- Tunnels are *very* round in cross-section.
- Tunnels are curved along their length.
- A delicately pitted surface is present.
- The overall consistency of the tunnel surface is smooth.
- Tunnels are tapered to some degree.
- Tunnels look to have been burnt in some way.
- Fresh tunnels smell smoky.
- Fresh tunnels are dark-brown.
- Older tunnels are lighter brown with a dusty grey colour present in places.
- Both tunnels play easily and loudly with a ringing quality.
- Complete tunnels are usually singular and ‘7-shaped’.

Prevalent Physical Features Made by *Ochrocydus huttoni / Oemona hirta*:

- Oval hole/tunnel.
- Round porthole-like side entrance ‘windows’.
- Loose frass shows adult insects have been present.

Holes Made By Insects Eating - Main Discussion:

The possibility that insects might be involved in the construction of kōauau had not been conceived within the research agenda prior to a series of coincidental practical reveals that brought about the construction of a number of highly functional flutes from insect tunnels. From this experimentally grounded approach, an academic consideration that sought to establish potential cultural validity was engendered. These three flutes clearly demonstrate that insect tunnels can be easily manipulated into a kōauau form and that sonically, they are highly successful. Why though, besides the suitably round, tapered tunnel and the beautiful sound it produces therefore, might have traditional Māori considered having a flute made by an insect or the grub of a moth?

Correlations between the insect world, particularly moths, and flutes, are strong within Maori understanding. The pūtōrino symbolises and embodies the native bag moth (*Liothula omnivora (Fereday)* or *Oeceticus omnivorus*), that is recognised in Māori culture as the goddess of flute music, Hine Raukatauri (*Fig. 6.1, p.221*). This belief lies within a complex web of myth and legend, some particularly specific to music and entertainment, such as in the story of Tinirau and Kae, where her role as a main protagonist is perceived as the genesis of Maori performing arts. These stories of Hine Raukatauri have experienced strong revival in recent times. There remains a great deal unknown as to the function of the pūtōrino (as with many other instruments), and this mystery in itself can be seen as metaphorical of the modern renaissance and its quest to restore broken tradition. While varying versions of these legends are available in many formats today, I strongly recommend the summary academic analysis of the role and importance of Hine Raukatauri in performing arts, music and flute culture, by Jo'el Komene in his MA thesis (2009: 27-35). Komene delves into the depths of regional word and name usage through historical literature. A notable quote he includes is by John White (cited in Gudgeon, 1885: 172-173) that upholds Hine Raukatauri as the goddess of "the powers of the air" to which "all sudden and unintelligible noises are attributed". As the goddess of music she "used formerly as her flute [a] cocoon which may be found… upon the mānuka and other trees; but having thus lost her flute, she confines herself to aerial noises" (Komene, 2009: 34). Komene also indicates that the cicada is known as Raukatauri as well (2009: 32).

Within Maori culture the connection between the natural, the human and the mythological world is fluid and complex. As noted by Melbourne already (Shieff, 2002: 145) in chapter 3, and demonstrated by the stories of Hine Raukatauri, the connecting web that is whakapapa is spatially lateral and inter-dimensional. In one variant of the legend I first heard told by Brian Flintoff in 2003, a strong connection is drawn between the bag moth, the kōkako and Māui in his mythological quest for fire (2001-2012). After enraging the goddess Mahuika, and then escaping from her as a hawk while the whole world was set alight, Māui wishes to change back to his humanoid form and requires water to break tapu and relinquish the magic of his shape-changing spell. All of the animals are too afraid to help him, except for the kōkako who negotiates a deal with Maui that he will teach her how to sing like the tūī in exchange for her fetching water. After the task, carrying the water in her wattles, Maui offers that the kōkako should eat of the bag moth, who possesses the finest song of the forest. The only published rendition of this variation I can find is in Flintoff's own book (2004: 65), but I do know that the kōkako was already experienced in the carrying of water for Māui, doing this for him in his quest that involved the slowing of the sun, in which he rewards the bird by lengthening her legs. So often such beautiful and important details remain hidden or excluded from translated textual publication. In <u>Wild South: Saving New Zealand's Endangered Birds</u>, Hirini

Melbourne speaks of a formative conversation with a Tūhoe elder about old ways of communing with nature and the lessons to be learned from traditional stories and proverbs (Morris, 1988: 218). One such story included how the "kōkako stole its voice from the bag moth. So in order to get the heavenly sound of the flute to beautify its own voice, the kōkako ate the bag moth… the little flutes hanging from the branches. In this way, the kōkako has kept the secret and become the guardian of flute-music for life" (Morris, 1988: 218). One analysis I have heard of this suggests that instead of swallowing though, she must hold the moth in her throat upon which its voice is amplified up and out of the birds mouth, almost as if the bird were playing the bag moth like a flute (Nunns, 2002 - 2012). Of course, both Nunns and Flintoff knew Melbourne very well.

This traditional story is profound when considering the interplay in the discussion of this thesis between the significant factors of musicality, flute construction, fire, and the bag moth. The inter-relating issues of tapu (ritual), magic (spirituality), and water (natural resource) cannot be ignored, as the culturally multifaceted nature of fire as a natural resource utilised within ritual, spirituality and magic. The significant mythological connection between flute music, the bag moth, the kōkako and the use of fire, tapu and ritual, necessitates further research. Places to begin this work would be in the depths of oral tradition and mōteatea (traditional song and chant).

A similar correlation between insects and flutes occurs within other cultures also. An example of particular interest in this discussion is that of the Cubeo *pâmiwâ* (people) of the northwest Amazon who believe the sound of their sacred flute, the '*ta tara ta tara*' is that of the butterfly, a "shamanistic animal because of its metamorphosis from a lowly larva" (May, 1980: 381). Another point of relation (particularly relevant to the pūtōrino) is that these flutes are played in pairs to represent male and female.

A very well-known example of flute music linking to the insect world is that of *Kokopelli*, the gnat-like god of flute music of the Hopi people (South-western United States). Kokopelli has strong links to love and fertility magic, and is often recognised as a flying insect, sometimes having an involvement with locusts, and on other occasions deemed to be the devious robber-fly of insatiable sexual enterprise that steals other flies larvae. This though may not be entirely accurate, and in Kokopelli: The Making of an Icon Malotki argues that a number of current beliefs around Kokopelli are in fact acculturated and not traditional, suggesting in one place that it was in fact the cicada that carried a flute (2004: 24).

According to Kathleen Joyce-Grendahl, an ethnomusicologist and renowned expert on the indigenous North American courting flute, in an internet article that summarises flute origin tales, termites are advocated as the agents responsible for the already-hollowed branch upon which the woodpecker then drills holes so that the wind might give voice to the first flute (2009). This of course also relates to chapter 3, and the use of already hollow branches. In regard to source ethnography and the plethora of origin stories for the indigenous North American courting flute, I strongly recommend reading The Origin of the Courting Flute, a Legend in the Santee Dakota Dialect by Ella Deloria (1961).

Of course, probably the most widely known instrument that is traditionally constructed using the action of masticating insects is the Australian didjeridu, though it is not a flute. Hollowed already by the action of termites (May, 1980: 158), a standing tree trunk is sourced using particular selection criteria that involves local knowledge of termite presence, with tapping and listening to ascertain ('sound-out') the resonance of the wood, before it is felled and finished (Buku-Larr\gay Mulka Centre: Yol\u individuals and Clans, 2006).

As noted earlier, during the practical research a number of factors regarding entomologically generated bores began surfacing in relation to other sections of the study. Experiments with kōauau bore created by insects manifested a number of physical indications similar to those brought about during burning experiments.

The smell and surface appearance of the tunnels produced by the pūriri caterpillar strongly resembles a hole made by fire. The darkened brown and black surface appears rough and pitted, possibly even sooty at times, while the smell is reminiscent of smoke. This suddenly made the question of burning in museum pieces more difficult to resolve. Was a bore that might be presumed burnt actually a bug hole? With ten years of experience, I am now able to deduce the difference, though at times, the issue can still be perplexing. Problems with identification early in the research arose from earnestly (i.e. subjectively) *seeking* criteria that may not be present, rather than (objectively) *recognising* fragments of evidence that are obvious. With experience comes an impartial confidence that recognises key signs and filters out inapplicability.

While this chapter is a discussion of entomological indicators, a brief understanding therefore of burn indicators and museum artefact issues becomes necessary to comprehend research difficulties that emerge from this intertwining trifecta of bugs, burning, and museum evidence. An obvious indicator with burning is the presence of soot, yet this becomes difficult to identify in artefacts of age and wear with the indication of a similar looking manifestation in museum pieces that a number of experts termed 'institutional dust'. This dust is the result of artefacts not being cleaned (in hard to reach places on the object, in this case on the inside), and some museum staff insisted that its presence was as important as the artefact itself. This dust may also be the residue of an historical institutional practice that involved the use of arsenic sprays to protect the artefacts. This is just one confounding factor with the keeping of taonga pūoro in institutions, and touches on the very important discourse of 'living' function in museums. The culture of reconstruction in the current Māori renaissance has partly arisen out of the prohibition of musical taonga being played in New Zealand museums. Some reasons for this appear more valid than others. One argument is that playing threatens the survival life of the artefact. Another relates to provenance and tribal ownership, such that viewing, handling, photographing (publishing) and of course playing, requires respective iwi permission. Often a researcher has personal reasons for not wanting to play, maybe even handle, particular instruments due to these issues, or a specific acknowledgement of tapu. Such personal regard can occur in instances where playing may be allowed because there is no known provenance of an artefact. While this may be considered a boon for the researcher, the unknown affiliations and history of a piece can actually lift the tapu stakes even higher.

Of course, in public collections, it is not possible to employ destructive research methods, and this includes rubbing, polishing, scraping, scratching and chipping. The gentle removal of institutional dust in order to view the internal surface of an instrument is also perceived as destructive research. Destructive sampling from artefacts for scientific identification of wood type or construction method (such as indications of fire or entomological evidence) enables a definitive aspect to the research that cannot be fully achieved through intuitive estimation. This does not have to be the case in private collections, and Murray Thacker of Okains Bay Museum was able to work with Dr Rod Wallace of Auckland University Department of Anthropology in the 1990s to establish the wood type of a large nguru in his ownership, that was apparently collected during one of Cooks voyages, as made from “the elbow of a kauri branch” (Thacker, 2002; 2010). This was achieved by shaving a tiny slice of wood about 10 microns thick from the outside of the instrument for viewing under a microscope. Dr Wallace insists that “kauri is very easy to identify under a microscope” (Wallace, 2012). It should be noted that many respected museums around the world do allow for instruments to be played, and handled *without* the wearing of gloves. It is admirable that the institutions of New Zealand endeavour to engender a full and proper respect for all things Māori. This esteem of course arises from a functional acknowledgement of the Treaty of Waitangi, and a working relationship and collaboration with tangata whenua. The revival of taonga pūoro is greatly indebted to the hard work and co-operation of New Zealand museums making their collections accessible for research, yet the ‘lifeless’ inertia and inactive nature of taonga in museums is considered an important issue from a Māori perspective that perceives these treasures as still retaining *mauri* (life force), and so is a much debated topic amongst practitioners, and definitely one that would be worthy of further academic discourse.

In regard to the appearance of institutional dust on museum artefacts, it forms a white/grey speckled film or layer upon the surface of a museum flute bore that seems very similar to that of *Kōauau Pūriri Ātaahua*, a bug hole from timber that was probably milled over a hundred years ago. According to several wood experts, this could easily put the age of the wood at over 200 years, as it was more than likely at least 100 years old at the time of felling. The whitish surface of *Kōauau Pūriri Ātaahua* could be attributed to an aging dust that is similar to that found in museums, as the more recent *Aenetus virescens* tunnel of *Kōauau Makomako Anuhe* does not have this same film. This said, similarities (and therefore differences) may occur in types of dust forming on variously constructed surfaces. The dust that forms on the bore of *Kōauau Pūriri Ātaahua* may be different from the dust that collects and binds to surfaces that have been burned. Such a topic may prove to be worthy of further consideration in regard to future projects seeking to identify instrument wood and construction type.

Another strong feature that occurs with burning is what this research terms as 'hour-glassing'. This is the physical presence of rounded bowls and ridges in the tunnel that create an effect reminiscent of the waist on an hourglass. This will be discussed further in chapter 5 but an excellent example (probably the best) of this effect is in the flute known for being a member of the infamous 'Little Fakes' collection, that resides in Canterbury Museum, E177.54. 'Hour-glassing' is very similar to the effect in pūriri moth tunnels where a bore stops and changes direction slightly. These effects are not identical in appearance, but similar enough to cause the potential for problems in identification.

The immediate wall surface of a pūriri moth grub hole is very unique. Different from the surface left by the actions of a beetle or wētā, and different from one that has been burned. Nevertheless, the appearance of this surface has an effect that could easily make a person 'think' it had been burned. The dark brown colour with black fleck and evenly bubbled pitting may contribute to an assumption that the surface has had fire upon it. I tested this assumption on a number of occasions with unwitting participants, asking them to consider how the holes of both *Kōauau Pūriri Ātaahua* and *Kōauau Makomako Mokoroa* were made. Most concluded, after consideration of varying criteria that included smell, colouring, surface form and configuration, and hole shape, that these holes were formed by using fire in some way. Some even contended that maybe the hole had been humanly drilled and then had a burning poker passed through it.

It should be noted that often burned holes have a number of human indications that include gouging, turning and scraping. These can result through 'finishing', or secondary work that includes the removal of soot, charring, 'hour-glassing' and pitting. The act of burning creates great irregularity, while the action of bugs is far more consistent. The process of eating by the moth caterpillar is performed biochemically, through a combination of saliva that dissolves the wood and mouth parts that suck, gnaw and regurgitate. This creates a very smooth surface overall, that has a melted or liquefied, reconstituted quality about it. Destruction by a beetle or adult insect is caused through biting, chewing and leg scraping, so creates a much more uneven, nibbled and scraped, pitted surface, without the smoothly meshed effect of wood cells that have been liquefied and regurgitated. Beetle destruction also creates a dust known as frass. Frass is the excrement of a bug that eats plant material. Of course, frass is not very likely to be obviously present in older artefacts residing in museums, though I am convinced that a certain residual element would be existent in any hole made by bugs no matter the age, but the utilisation of fire, and other human action would again lessen any chance of finding such evidence. The oval hole of the longhorn grub would make an excellent pilot hole for the action of hot coals or pokers, but this combination was not an experiment I performed. This flags a notable point: that a great deal of museum evidence suggests that a multiplicity of methods were often performed on a single piece to achieve a bore. Even without an actual practical test, the combination of pre-existing oval hole and hot coal (or burning poker) to make a round bore seems very possible.

As noted already, the oval hole acts as an excellent abode for the wētā that continues to excavate and maintain the tunnel into a round state. Wētā are renowned for their scraping and clearing of tunnels in trees and the noise (and musical inspiration) they produce whilst doing this (Shieff, 2002: 140). One piece in this section of the research, *Kōauau Patē Hiwi*, was made from a wētā gallery, being found with a very dilated and rough tunnel and large amounts of frass and loose debris. The branch broke easily when collected and was dead and very rotten, though dry. One physical indication, a small, very round hole through the wall of the branch, suggests that it was first created by lemon-tree borer, though this inhabitant had long since departed, and wētā had done a large amount of renovation and excavation since. During construction, this round hole was incorporated into the flute as a lug-hole. The process of utilising pre-existing resources from out of nature requires a degree of improvisation in construction.

The flutes constructed in this section of the research function very well, even *Kōauau Mānuka Pītara* with its spiralling, oval bore. The round tunnels of the *Aenetus virescens* grub present in *Kōauau Pūriri Ātaahua* and *Kōauau Makomako Mokoroa* are stunning in their perfection of form and sound, while their profound implication within moth mythology embeds them in the heart of Māori musical instrument culture; a tradition that has experienced a great loss of detail and nuance. A deeper understanding of the Raukatauri aspect through research on oral tradition, mōteatea and myth is required to explore this avenue further.

Kōauau Mānuka Pītara

Flute Name: **Kōauau Mānuka Pītara**

(Figure 4.1) Kōauau Mānuka Pītara length.

Dimensions:

129.8 mm *(long, top to bottom)*

22.9 mm *(wide at top end)*

27.1 mm *(across at widest mid-point)*

22.8 mm *(wide at bottom end)*

14.7 mm *(wide at top, inside bore)*

Oval hole - 7.7 mm *(wide at top, inside bore)*

15.1 mm *(wide at distal, inside bore)*

Oval hole - 7.5 mm *(wide at distal, inside bore)*

(Figure 4.2) Note the other borer markings.

Materials:

Mānuka wood (*Leptospermum scoparium*)

Pre-existing tunnel made by longhorn / kānuka beetle (*Ochrocydus huttoni*).

(Figure 4.3) Kōauau Mānuka Pītara.

Tools Used:

Pipi shell scraper / adze / Heavy-grade hōanga Pumice slab / Hand twist drill with shark-tooth point.

(Figure 4.4) Kōauau Mānuka Pītara.

Physical Characteristics:

Hard, dark red-brown wood with golden white fleck, typical of mānuka (*Leptospermum scoparium*). Flattened oval bore that twists 45-degrees (approx.) along its length that has been created by the action of boring insects. Small randomly positioned etched markings, grooves, gouges and pin-holes on exterior surface that are the workings of various kinds of boring insects. Roughly hewn finish, indicative of work completed with an adze. A thin but heavy piece for its size: mānuka is a very hard, strong wood.

(Figure 4.5) Note the twist in the bore.

(Figure 4.6) Kōauau Mānuka Pītara was made from the piece on the right.

Construction Process:

1. Bark removed by scraping with a pipi shell māripi (scraper) (*Paphies australis*).
2. Shaping was performed using an adze.
3. Further shaping and finishing was done on a hōanga.
4. Final sanded finish was done with pumice.
5. Three wenewene installed using a shark-tooth drill.

(Figure 4.7) Shaping with adze.

(Figure 4.8) Shaping end on hōanga.

Construction started and completed in 2002.

Bore made by *Ochrocydus huttoni*.

Kōauau made by Warren Warbrick.

Discussion:

Kōauau Mānuka Pītara was the first bug tunnel to enter the research, and within 20 minutes, a fully playing flute had changed the research, causing a leap in consciousness in regards to what defines a kōauau, how kōauau might be played and why kōauau were played.

(Figure 4.9) Finishing with pumice.

While the bore of this flute is not ideal, the shape brings to mind a number of questions regarding the oval bore shape of the pūtōrino, especially considering that the bag moth is in fact longitudinally round (cylindrical) and not flat.

Further research into the excavating of oval tunnels with hot coals, plus the presence of these insects in more renowned flute-making woods such as tutu and poroporo is required.

Conclusion:

Mānuka is not a wood that is listed as commonly used for the construction of kōauau specifically, or taonga pūoro generally. The hardness and strength of the wood saw it commonly used in the construction of taiaha and other weaponry, paddles, and kō (digging sticks). It is well known as an excellent wood for the making of fire, its solid form leaving good embers, and it was for this reason that the research used mānuka as the wood for building embers to excavate bores in chapter 5. The grain of mānuka is known to twist, making it difficult to work with when carving, and it is for all of these reasons that it is probably not preferred regarding taonga pūoro construction. Of course, its hardness lends qualities of durability and loudness to the final product that are hard to beat.

While I personally do not have preference for playing this shaped hole in a roughly worked state such as this, I do get a great deal of functional and aesthetic satisfaction from playing the flattened oval bores of the pūtōrino. With more constructive intervention on an oval hole produced by an insect that might include reaming and sanding, and maybe even burning, I see no reason why a kōauau such as this cannot be more functionally responsive.

In regard to *Kōauau Mānuka Pītara*, the very lack of human construction required to achieve a functioning wooden kōauau is a statement in itself for the power of insect involvement in the making of musical instruments.

(Figure 4.10) Tree with pūriri moth holes.

Kōauau Pūriri Ātaahua

Flute Name: **Kōauau Pūriri Ātaahua**

(Figure 4.11) Kōauau Pūriri Ātaahua length.

Dimensions:

121 mm *(long, top to bottom)*

28.5 mm *(wide at top end)*

3.8 mm *(across at widest mid-point)*

24.6 mm *(wide at bottom end)*

15.7 mm *(wide at top, inside bore)*

13.7 mm *(wide at distal, inside bore)*

Materials:

(Figure 4.12) Kōauau Pūriri Ātaahua proximal.

Pūriri wood (*Vitex lucens*)

Pre-existing tunnel made by pūriri moth caterpillar (*Aenetus virescens*).

Tools Used:

Table saw / Adze / Hōanga / Pumice.

Physical Characteristics:

Classically contoured, short cigar-shaped kōauau, dark-brown in colour, with lighter brown and black streaks present. Colour, weight and hardness are consistent with that of pūriri wood (*Vitex lucens*). Bore excavated by an insect, probably that of the pūriri moth grub (*Aenetus virescens*). On one side a small black pit occurs (9mmm across / 1mm deep) that looks as if it has been burnt. Next to it is another pit that is smaller (5mm across), yet this is not black but is obviously 'filled' with something inconsistent to the rest of the wood present (*Fig. 4.16*). These appear to be the result of another secondary caterpillar tunnel that is directed towards this part of the wall of the flute from inside. From the proximal (wider) end a crack runs from the edge, along the wall of the flute about 40mm, diminishing in severity. The bore has a light-brown colouring to its crusty like surface, which has changed over time since first

(Figure 4.13) Kōauau Pūriri Ātaahua distal.

(Figure 4.14) Kōauau Pūriri Ātaahua.

(Figure 4.15) Distal view.

construction (2002-2012), presumably from playing as a result of saliva and breath. This colour was more white/grey when first made, and evidenced a dustiness to it. This white dustiness shows more under a microscope (*Fig. 4.18*). The bore has a curvature to it (*Fig. 4.17*), and as already noted, a short, secondary (incomplete) tunnel can be seen from the proximal aperture (*Fig. 4.18*).

(Figure 4.16) Note black pit and smaller brown pit beside it.

Construction Process:

1. Tunnel selected for length and completeness.
2. Tunnel extracted from fence post with table saw.
3. Kōauau shaped with toki and hōanga.
4. Finished with pumice.

(Figure 4.17) Curvature of bore.

Construction started and completed in 2002.

Bore made by *Aenetus virescens*.

Kōauau made by Warren Warbrick.

Wood donated by Detlef Klein.

(Figure 4.18) Secondary pit. Note the white dust.

Discussion:

When this flute was first made, a certain amount of discussion went into whether the grub holes were made after this wood was milled and while it existed as a fence post.

According to Alma (1977), *Aenetus virescens* only inhabit and tunnel in living wood. That the piece was absolutely riddled with holes is probably one reason why such a stout and worthy construction wood was being utilised as a mere fence post, though pūriri was renowned for its ground durability, lasting for 50 years or more without treatment. Its strength made it popular for use in shipping, as railway sleepers, and even bridges. While I wasn't present when the piece was made, the simplicity and brevity of construction are yet again testament to the powerful raw resource that such holes provide.

An important point to recognise is the change that has occurred in the colour of the bore over the ten years since it first became a kōauau.

This instrument has had a varied life since the raw material was first extracted from the fence post and manipulated into becoming a flute. It has been on display for months at a time in several museums, resided in storage between two exhibitions five years apart, lived in a filing cabinet drawer in an office at Massey University awaiting thesis completion, and often been part of an active playing and demonstration kete that has travelled around New Zealand to various locations. Predominantly, it has been played as a flute. It has had saliva and breath (of different people) projected down its inside. It has been handled, sniffed, and even had uninvited (and therefore ill-mannered) fingers mine its depths out of curiosity.

When it first arrived on the research table, the predominant colour inside the tunnel was a dark grey-white, that appeared to be very dusty in form. As the years have passed this colour has blended to what is now a light, milky brown, yet the form seems to have remained one of a thin, pithy, mash-like crust that is reminiscent of papier mache. Even so, under the digital microscope, this grey colouring can still be seen (*Fig. 4.18*).

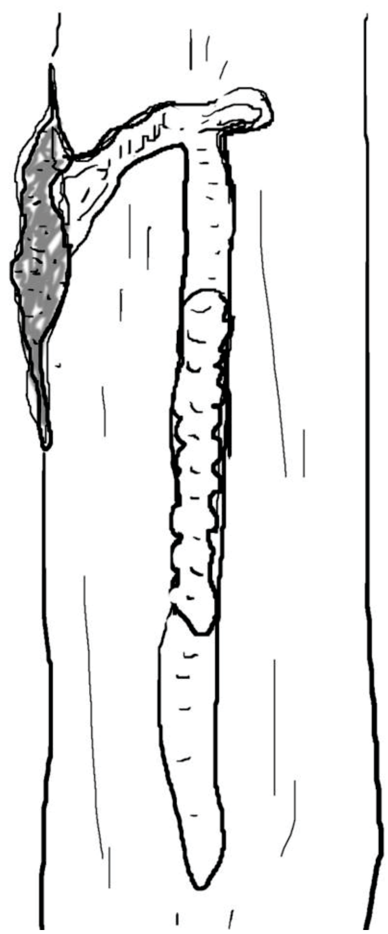
Of course, this is extremely relevant when considering the study of bores in museum flutes, as these have undergone lives that are just as strangely active in their apparently dormant institutionalised existence. Even before residing where they rest now, these instruments could have been submitted to a number of climatic and environmental changes that would alter the general colour and surface of their bore. Once in museums, where apparently they are *not* being played, this doesn't always hold true, and with climate control being something of a latter 20th century issue, may very well have been affected by a number of environmental conditions in its overall life.

During my research in museums, I have witnessed a number of pieces that have had foam plugs, wire display stands, or lengths of nylon line forced into and situated through their centres for suspension and display purposes. Such treatment is indicative of an institutional style that prioritises the visual merit of an object (i.e. for viewing) rather than its actual purpose which might actually be unseen. So often with Māori art, the age, carving and patina are the criteria of value. Of course, museums *are* all about looking, and beautiful things certainly lift the 'wow' factor, but again we enter the discourse regarding what is important for the patron, rather than what might be of relevance to the object: and so these taonga mauri (living treasures) sit lifeless, even intrinsically injured in places that are of actual importance to what defines them. One particular piece I viewed in a museum had been suspended with nylon fishing line strung through its bore. While this seemed innocuous enough, when it came to ascertaining how this bore may have been made, thin gouged lines were down the length of the bore from the years of being suspended on the line. Another flute (in a different museum) had a round foam plug that was pushed snugly into the very centre of the bore. This plug supported a wire leg stand through its middle, which ran out from the inside of the bore down to the display base. When this plug was removed, a small amount of the surface of the bore, and a whole lot of dust, came with it, and the internal surface suffered signs of what could only be described as scraping. In defence of both of these institutions, this research awakened them to several issues regarding taonga pūoro, one of course being the importance of the internal bore to a musical instrument, and to its later research, and the other being matters of mounting for display. Both immediately sought to rectify the issue by using external mounts. One museum even turned one piece around inside the display case so that patrons might look down the bore for themselves.

Conclusion:

Kōauau Pūriri Ātaahua is an excellent example of how fine kōauau can be created from an entomologically generated resource. Pūriri wood (*Vitex lucens*) is very hard (one of New Zealand's hardest), creating a loud, bright flute, and the darkness of the wood and form of the bore is evocative of 'classic' kōauau I have seen in museums.

This experiment operates as a good comparison to the younger insect bore of *Kōauau Makomako Anuhe,* demonstrating the differences in appearance between holes made over a century apart. As a research piece, the experiment continues, demonstrating a change from just ten years ago. Coincidentally, and unintentionally, these recent changes have become a testament for how older flutes in collections can be affected in their appearance from years of institutionalisation. How years of trading and movement, climatic variation, action and inaction, display and storage, well-meaning care (or abuse) and of course research (those ill-mannered, probing fingers and sneaky players without permission) affect the condition of a kōauau internal bore. The change over a short 10 year period in the bore of *Kōauau Pūriri Ātaahua* is an excellent example of this. Unfortunately, I did not yet recognise this to be a potential issue when this instrument was first made, and I do not have an image of its bore from 2002 for comparison.



(Figure 4.19) Diagram of Pūriri moth tunnel cross-section.

By Eris Newson, (after Alma, 1977).

Kōauau Makomako Anuhe

Flute Name: **Kōauau Makomako Anuhe**

(Figure 4.20) Kōauau Makomako Anuhe length.

Dimensions:

155 mm *(long, top to bottom)*

23.2 mm *(wide at top end)*

43.1 mm *(across at widest mid-point)*

16.7 mm *(wide at bottom end)*

15.3 mm wide *(wide at top, inside bore)*

10.7 mm wide *(wide at distal, inside bore)*

Materials:

Makomako trunk (*Aristotelia serrata*)

Pre-existing tunnel made by the caterpillar of the pūriri moth (*Aenetus virescens*).

(Figure 4.21) Kōauau Makomako Anuhe. Note secondary holes.

Tools Used:

Steel blade toki / Hōanga

(Figure 4.22) Kōauau Makomako Anuhe.

Physical Characteristics:

A lumpy, unsophisticated flute, that is heavy and unwieldy in form. A large, very round, dark-brown, curved tunnel runs through the centre that has been produced by the action of a pūriri moth caterpillar (*Aenetus virescens*). Effects of adze use across the surface are evident as the form is roughly hewn. Small polygonal shapes cut by the adze interconnect across the surface of the wood, with occasional stacked groups of short horizontal bands in places where the adze has lodged rather than slicing the wood (caused by a blunt blade and poor adze skills on my part). The wood is a beautiful golden blond with dark brown streaks across the length of one side. This colouring appears to be staining, a symptom of the caterpillar tunnelling. In this area of dark-brown there are 3 small holes and 2 smaller pits that are also the result of insects eating (*Fig. 4.21*). None of these holes traverse the depth of the wall into the bore, so do not affect the function or tone of the flute. The two larger holes on the side of the flute are in fact a single tunnel and connect to each other. This becomes obvious when it is blown down and the air escapes out the

(Figure 4.23) Note dark staining.

(Figure 4.24) Curvature of the bore follows the upper surface of the flute in this picture.

end. The smallest pit is very similar in appearance to the smallest pit on the side of *Kōauau Pūriri Ātaahua* (*Fig. 4.16*). The tunnel is a dark brown in colour with a strong, smooth curve across its length and the surface of the tunnel is minutely rough and pitted (*Fig. 4.26*), but firm. Because of the consistency of the pitting and the nature of the biochemically rearranged surface, the overall effect is a surface that is relatively uniform and homogenous (*Fig. 4.33*). This surface texture gives the flute excellent functional qualities.

The wall surface of the bore has the appearance of being burned or melted. It has a reconstituted, shiny appearance to it as if it has been liquefied and reset. Considering the wood is very light in colour, the tunnel colour is a very dark relatively. Black speckling adds to the suggestion that it has been incinerated.

A strong smell of smokiness existed in the tunnel when it was fresh, and though not as strong, still persists today.

(Figure 4.25) Note curve of bore.

(Figure 4.26) Proximal detail.

(Figure 4.27) Distal detail.

Construction Process:

(Figure 4.28) Beginning to excavate the bore from a trunk.

1. A section of trunk with a grub tunnel is sourced.
2. Using my adze, I began to remove the majority of the wood from off the log.
3. With persistence, the log is reduced to a kōauau shape of manageable size.
4. The piece is further reduced and shaped on a large, heavy grain hōanga.
5. Further work might continue on the shape and the surface finish by reducing the grain of hōanga.

(Figure 4.29) Finishing excavation.

Construction started and completed in 2002.

Bore made by *Aenetus virescens*.

Kōauau made by Rob Thorne.

(Figure 4.30) Shaping on hōanga.

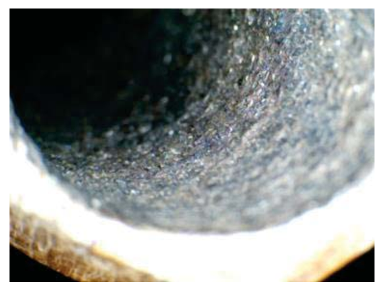
Discussion:

Kōauau Makomako Anuhe is a profound instrument in form and function. This function, coupled with near perfect bore form excites the research toward a desire for traditional plausibility.

(Figure 4.31) Finishing on hōanga.

That the experiments demonstrate possibility does not determine validity, and without strong co-validation from a Māori historical context, the research cannot conclude with any certainty that such methods were used traditionally. Such validation might arise from oral tradition, or mōteatea, or even from a museum collection through rigorous physical testing of a particular piece, but until then, there is a requirement for the research to insist on indeterminacy. Such historical discoveries can be attained through connections that have been previously considered irrelevant. Considering that Hine Raukatauri is also culturally perceived as a cicada, perhaps a connection might be discovered that links her, for example, to all moths, and that her unearthly powers of music are intrinsic to the shamanic processes of metamorphosis and flight.

(Figure 4.32) Bore surface detail.



(Figure 4.33) Bore surface detail. Note the overall smoothness.

If such connections were rediscovered, in whakapapa or traditional song or myth, one might be able to use this conjecture to develop a strong rationale for the use of moth grub tunnels in the construction of kōauau. Sometimes the raising of such suppositious discussion can bring seemingly unrelated strands of discourse together in a way that renders newfound meanings to previously lesser understood or unrealised perceptions, resulting in new paradigms of cultural comprehension. It is for these reasons that I have included this chapter. As a Māori who is a musician, I might imaginarily contextualise myself in a historical environment and presume that, if I were back then, that I would use such a tunnel to construct a kōauau simply for its sheer functional brilliance. In a scientific context requiring certainty such intuitive but imaginary thinking is of course considered questionable. What I am aiming to do in this discussion therefore, is construct a potential web of possibly related, and often seemingly disconnected, signifying factors and issues for appraisal in the hope that future research might unveil some pertinent applicability.

In regards to remodelling culture when reconstructing the broken tradition of taonga pūoro, I particularly find the act of sourcing, extracting and playing a moth grub hole for kōauau as very culturally engaging. As with the act of using a traditionally-modelled cord-drill, the prolonged employment of a traditionally-modelled adze activates issues of identity for me as a Māori at a physically embodied level.

The inherent meanings that arise for a player who has made their own instruments with traditional techniques similar to those utilised by their ancestors are sincere, and with the accumulating feature of commissioning further conjoined elements of nature and divine totem into the operation, a profoundly meaningful and dynamically plural act of physical, cultural and spiritual communion and identity is achieved.

Conclusion:

The making of *Kōauau Makomako Mokoroa* was not difficult, involving more time and effort than skill. Not to say that proper and masterful use of an adze is not difficult to achieve, but this task is an excellent way to practice using this tool, and I rate this as an entry-level task. Once the basic use of a toki is achieved (recognising that it is basically a mallet-less, reverse hafted chisel that only removes small slithers of wood at a time) the job became easier. I had already had a lot of practice with my toki, but relished the opportunity to use it in a concerted and prolonged way that involved the removal of a number of wood layers. Such reductive labour, where one 'removes' something in order to 'achieve', makes for positive work, as the progress is easily perceived as it happens. The task, as with using the tūwiri, is one of protracted and concerted discipline. Several days to make a kōauau from solid wood is a long time in comparison to some of the instruments made in this research from found holes or pithwood, though not as long as one might take using a tūwiri. That this flute has the voice of New Zealand's largest moth embedded within it singing a song of its metamorphosis makes such a unique task all the more fulfilling.

Regardless of the conclusion of traditional indeterminacy, I highly recommend the use of (sustainably sourced) *Aenetus virescens* caterpillar tunnels in the construction of kōauau in a modern context because of the environmentally and culturally meaningful elements that intertwine within their application. I personally look forward to teaching my own children the practical skill of the toki when I present them each with a tunnel for extraction from a timber round. For them, this process will embody within their flute, and themselves, a sense of identity that amalgamates a respect for nature with totemic practice, tradition, myth, skill, physical discipline, and musicality. Such an object is far more than just a flute, and the sound it produces, more than just music.

Chapter 5

Drilling With Fire

It was stumbling upon this method at the very beginning of my research journey, that originally tweaked my interest in its use in the construction of kōauau. Not at that time being in possession of a power-drill, I was interested in finding out how the Māori traditionally made them, pondering the possibility that if they were able to achieve such tasks without power tools then so might I. To discover that fire was used and that not much else had been recorded historically about this sparked a sense of mystery around it. When I began asking various experts about the hot coal method, it became apparent that many did not actually believe it was done, or that it was even possible, and they expressed a commonly widespread mistrust of Elsdon Best and his work. This deepened the sense of intrigue and I was hooked. Was it done? Or was it (what I began to term) a '*Best-ism*': a figment wrought by Best's methods and style of research that saw him being apparently misled in the field. The result was that I was being overtly encouraged to be very wary of what appeared to be the only 'genuine' source on the matter. This led me to seek out more specialised practitioners and experts in the field of traditional Māori musical instruments, who may have either tried the method out for themselves, or known someone who had. The more I looked the less I found. No one I met had tried it, or knew anyone who had. One person I spoke with could recall her grandfather doing it, though his method involved tiny heated stones. Often when questioned about it, people would ask questions themselves, such as "why would it be done?", the technique appearing to them as troublesome, overcomplicated and even clumsy. The pattern was definitive. No one had tried it, and many believed it wasn't possible. Soon I began asking experts if they would consider attempting the technique for the purpose of my research, of which the answer was more often than not "No! If you want to know, why don't you try it?" So I did, and here are the results.

This chapter is a discussion of experiments conducted during the research that involved the use of fire as a tool to drill with. Several experiments were undertaken using two methods that manipulated the use of fire in different ways. One method involved the use of a burning wooden stick as a poker to gouge and burn, while the other used a glowing hot ember, lifted from the fireplace with tongs. This ember, at times called a coal in this research, was manipulated to intentionally burn away an area of wood, creating a hole. Specifically mentioned in ethnography (Best, 1976: 237) as being used for hollowing tutu (*Coriaria*), it was vital to experiment with this particular resource, and this resulted in *Kōauau Tutu Ngārehu*. With a lack of cord-drill evidence in ethnography, I assumed that this method might have also been used for the boring of solid wood kōauau, so experiments were done with mataī, resulting in *Kōauau Mataī Ahi Kōmau*, and swamp maire, resulting in *Karanga Kaka Ahi Kōmau*. The first fire experiments conducted were with kōrari / flax flower stem because I had been told that it was known to be used traditionally, and that because of its cork-like structural form, fire seemed an obvious way to achieve a bore that was quick and easy. The hot poker method is recognised as a modern adaptation of the traditional live-coal technique, though in this case the research used a flaming wooden poker rather than a red hot metal one. This experiment resulted in the kōauau known here as *Kōauau Kōrari Ahi Horehore*. James Herries Beattie refers to flax flower stem being used to make pōrutu with “four, five or six holes”, though in a southern dialect calls it “koari” (2009: 78).

The act of using fire to drill a flute is an intriguing methodological option, and is validated by ethnography with a singular but often repeated, brief description. Both Best in Games and Pastimes of the Māori (1925) and Andersen in Māori Music With its Polynesian Background (1933) speak of the method in an almost identical manner, which is of no surprise as they were peers in the field. These are the two most complete descriptions of the method, and it could be assumed that the Andersen text is already secondary in its sourcing, being published eight years after Best. For reasons of clarity I will cite both tracts in full:

> Tuta Nihoniho contributed the following notes: Fire was employed in the process of hollowing out a *koauau* flute, and the small holes were formed with the *tuiri* or cord drill. These flutes were often made of a piece of *tutu* stem (*Coriaria ruscifolia*), a section of the same being dried and the pith was destroyed by fire in a curious manner. Live coals of *manuka* or other hard wood were used in the process. One such was placed on the dry pith at the end of the section, and the operator blew the coal to keep it alive and to cause it to burn the dry pith below it. When the coal deadened, it was replaced with a fresh ember (Best, 1976: 237).

> The *kōauau* was made also of *tutu (Coriaria sarmentosa),* or *houhou (Nothopanax arboreum),* the hole being made by laying a red ember on the central pith, and gently blowing, causing the ember, renewed from time to time, to sink through the wood (Andersen, 1933: 237).

As is obvious, Best has obtained this information first-hand from a field participant, the highly respected Tuta Nihoniho, Ngāti Porou warrior, leader, diplomat and author (1850-1914). While the description is brief it is nevertheless complete. Andersen doesn't cite a first-hand source, providing a somewhat paraphrased procedural outline: and for this reason I contend that Andersen is in fact citing Best. Throughout ethnography since, any mention of the 'live coal' method I believe has stemmed from Best's original publishing of it.

Is this method an isolated usage of fire as a woodworking tool or did the Māori practice it in other situations? In The Stone Implements of the Māori, Best mentions Kimble Bent using fire to assist in the felling of a tree. Utilising axially hafted adzes sometimes called *poki* or *toki tītaha* in a giant chisel style scenario, square holes were chipped into the trunk of the tree, and "fire kindled in the hole was fed with dry pieces of *manuka* wood and *totara* bark" (1974: 144-145). The charring was then punched away using the poki and the fires reset, until right around the tree tunnels had been burned into the trunk. This technique is called *ahi kōmau*. The tree was finally felled with the removal of the alternately interspaced remains of the trunk. This is confirmed also by another informant who also explained that the poki was more about bruising, and the work of the fires was what did most of the work (143). Various references continue across subsequent pages regarding tree-felling and fire, including one by Rev. T. G. Hammond and another which featured in the *Auckland Weekly News* in 1909 (148-149). Kimble Bent felled a tree to build a canoe, and in the construction of this he also used fire (Best, 1974: 144-145). This practice is discussed in depth by Best (1925) in The Māori Canoe whereby "as the log lies on the ground, a row of small fires was kindled along the trunk" and after "burning for some time these fires were removed and the charred wood was chipped away with stone adzes”. Fires were reset, and the process repeated. Specific woods that were appropriate to the task of charring are listed as rewarewa and “kaiwhiria”. Another system of tree felling that Best calls the ‘Fire-rack’ is also discussed whereby rods of firewood were stacked and maintained across a rack system feeding a kerf in the trunk. In finishing, an old informant is quoted as saying that “the adze employed was a stone one; the other adze used was fire” (Best, 1925: 84 - 93). This is a fantastic quote, as it recognises fire as a formal tool, another kind of adze, for hewing and excavating wood.

Williams defines the term “Kōmau” as “Keep fire alight by covering it with ashes” and “Ahi kōmau” as “a fire so covered used for hollowing a canoe or felling a tree” (2001: 132), and Beattie took note in Murihiku/Southland that once a tree was felled for construction of a canoe “little fires of chips were used to reduce the trunks. This burning (tahuna te ahi) charred the wood and the adzes were used to chop out the chars (taraitia ka karehu) and so hollow the trunk” (2009: 103). “Karehu” are defined as embers (291).

In an email I received from Mervyn McLean, he wrote briefly of his work with Mrs Paeroa Wineera (Ngāti Raukawa and Ngāti Toa), the famed ‘last remaining kōauau player’, who learned to play kōauau in 1895 from her uncle. He states that the “person who made her instrument used No.8 fencing wire as a variant of the hot coals, but she had no other information to impart”. This detail is also recorded in his article in *The Journal of Polynesian Society*, “*An Investigation of the open tube flute or kooauau*” (McLean, 218). In his email to me he recognised a lack of significant discussion on kōauau construction in the literature, suggesting it is “possible there is something buried in Māori MSS [Māori Archives and Manuscripts, at The University of Auckland Library]” (Māori MSS

Archives Online) though also doubting that such a search would be fruitful. He outlines that the biggest problem of fieldwork is “that practitioners were very thin on the ground” even from 1958 when he began his fieldwork (1869).

In an interview at her home in Hamilton in 2002, Rangiiria Hedley, a renowned practitioner and teacher of taonga pūoro, spoke to me of how she could remember her grandfather drilling wooden kōauau by using hot stones he had heated in the fire. She said that it had been her task as a little girl to collect the tiny pebbles from out of a river near her family home (Hedley, 2002). This is a technique known to be utilised with some First Nations flutes that are made of a singular piece of branchwood rather than being split, carved and bound (Audlin, 2006: 195). On returning from India, Lorena Gibson, a friend and motivating force behind my conducting this research, brought me a gift of a short, end-blown notch flute made from a dark, fibrous, grassy looking wood. Purchased from a road-side stall, the reason for the gift was that it had obviously been made using fire, though she had not seen it being constructed. The bowl-like top chamber of the flute wreaked of fire, was black in colour and it was still issuing soot when I rubbed my finger inside it. As yet, I have not been able ascertain exactly what this instrument is called, so have not been able to find out any more about it.

The practical experiments for this section of the research involved building a fire, and picking up, transporting and manipulating glowing embers. The wood of choice for the fire was mānuka. This wood is recommended in the description by Tuta Nihoniho, probably for reasons of its hardness. It is renowned for hot fires and long-lasting coals, that, as the research discovered, stay intact when removed from the fire. Mānuka is recommended throughout the literature in places when it comes to fire, as already noted with the felling of trees and construction of canoes. The embers were picked up with metal kitchen tongs. This was done out of convenience, and the research certainly recognises these as non-traditional. Traditional style tweezers or tongs could have been made from supplejack (*Rhipogonum scandens*), or various techniques similar to chopsticks or scooping could have been used, but that was not the case in this research. I also wore a leather work glove on the hand that was constantly working in the fire for the purpose of safety, and I would recommend safety glasses to protect your eyes. The building of the fire is always the first step in this process, and then once blazing, regulating the feed so that hot embers can build up but the fire doesn't die. Usually, I would establish the fire, allowing it to burn heartily for the first hour, and then start on the experiment, letting the fire die back to a degree, feeding minimally. While mānuka is ideal, often because of its sheer availability, I have used a number of woods, including recycled rimu, totara and eucalyptus. The harder the wood the hotter and more dense the ember, and the longer it 'lives' out of the fire. During the experiments, I improvised on a number of levels, and made some very interesting discoveries along the way, especially in regard to the dual-purpose possibilities of some traditional tools that I had already become familiar with throughout the research. The improvisational aspect again excited various points of departure in the work and sparked the consciousness of the research into new *realms of potential*. The act of utilising fire as a focussed tool of construction is purely and elementally exciting, yet extemporising tradition is a different matter, one that raised new questions about cultural reconstruction in regards to methods and resources.

Construction - Kōauau Kōrari Ahi Horehore:

This flute was made from a sample of flax flower stem/kōrari found on the banks of the Manawatū River by Cleland Wallace and donated to the research. Because of its time in the river, it had become very hard and heavy, and over dried, almost petrified. I had made several kōrari pieces prior to this, and with that experience realised that not much fire or effort was required to achieve a bore. For this piece I located a broken drumstick that had been discarded by my wife Sarah, and on the back porch of the house set fire to it easily with a *Bic* lighter. The tattered end of the drumstick ignited and reignited very easily. Once burning, I began pushing the poker into one end of the blank, upon which the flame went out immediately, but the stick still continued to move through the kōrari slightly. After approximately ten re-ignitions of the poker off the lighter, I was half way through, so began the process from the other end. Within twenty minutes I had joined the two halves and pushed a tunnel through the 15cm piece. This process was slowed a great deal by the use of a hand held lighter, and re-ignition of the poker was at time tedious. A slight twisting movement was included on the extinguishing of the flame as the poker entered the stem each time, and this acted in a screwing way to drive it further in. This overall process resulted in a very round bore (following the shape of the drumstick poker) that is brown/black in colour. The ends were cut off with a craft knife heated with the *Bic* lighter. This hardened them, in a way that I describe as 'corkified'.

Function - Kōauau Kōrari Ahi Horehore:

This flute plays well with a sweet tone that is breathy. It sings with a high pitch that can be easily bent a whole note up and down. Further exploration into making longer pōrutu, perhaps with the use of a metal poker, would be worthwhile. I suspect that the metal would seal out the breathiness of the resource even more, and make for a much cleaner, smoother bore.

Construction – Kōauau Mataī Ahi Kōmau:

The construction process of *Kōauau Mataī Ahi Kōmau* was the first live-coal experiment performed in the research. The main resource was a section of mataī fence post donated to the research by a saw doctor who was a friend of Lorena Gibson's father Adam. The grain ran longitudinally through the wood, as mataī splits well, and is one reason why it makes for good fencing. Done on the beach outside my parents' house in Whangārei over a two-night period with help from my nephew Daniel Alexander and my father Dennis Thorne (including the taking of photos), a fire was built on the sand, and various techniques were experimented with. Appropriate embers were selected and introduced to the wood, and held down onto the burn site with metal kitchen tongs. Drilling progress moved surprisingly quickly, relative to the fact that I was expecting the process to be very slow. Within two hours a 40mm hole had been dug with countless embers. As the hole deepens the coal becomes trapped, and the application of a breath stream causes the smaller, nearly spent embers to bounce around against the walls. This turns the ember over on itself, exposing sides that are beginning to deaden, and turning re-enlivened parts back onto the wood. This bouncing gives less control and I soon began discarding embers when they got too small and replacing them with larger and heavier, more alive coals. With the deepening of the tunnel, it became apparent that blowing down upon the coal was only invigorating the upper surface of it, and not the more crucial underside that was required for downward burning. The underneath of the coal was in fact dying, trapped without air to feed it. Enlivening the upper surface was also tending to cause the work to burn outwardly and around, on the wall surface. One idea considered was to find a way of rolling the ember over after blowing on it, so that the freshly reactivated ember surface could then reach the burn area. A thin twig was used for a period to achieve this, but still did not seem to gain the desired result. Realising that what was needed was a way of getting breath to the belly of the ember while in situ with the burn site, discussion amongst those present happened upon the idea of a straw being used. Reaching immediately behind me I found a dried grass sheath and began using it in a straw-like fashion. This was adequate for a time, though the straw would quickly diminish from catching fire, and when this happened the inhalation of its smoke was unpleasant. Of course, the breath action with the straw is outward and not inward, but inhalation would still occur because of the sudden and random flammability of the grass straw. Conceptually this was a breakthrough. The ember was able to be kept alive in the one place that was necessary, underneath, and the downward progress of the fire-drill continued well. Retiring after about 210 minutes of practical research, a hole of about 22mm wide and 60mm depth had been achieved. Grass sheaths were running out fast as a resource, and the risks involved in their use had been taxing upon the energy of the project. The next day I collected a number of dried grass sheaths in preparation, and more beach-wood to enable the fire. Research began at 9pm again, with the lighting of the fire, and by 10pm, work was back underway. As the work from the previous night was about half way through the block, the piece was inverted and a new tunnel was started at the other end with the intention of joining the two in the middle to create a single bore. Almost immediately on starting back in, my father Dennis recognised that the albatross bone chisel that I had in my tool kit was in fact hollow. He took it up to the house and cut the remaining knuckle off with a hacksaw, and in so doing fashioned a chisel, gouge and scraper that could now be used as a straw also. Risk was still there regarding inhaling the fumes of singed bone, but these were less, as bone is far less flammable. In hope that the final hole created might turn out tapered, it was intended that completion of this first burn-test would be achieved without scraping and picking the ash and char away. With the new tool engaged, I soon defaulted on this agenda, and quickly learned that the chisel/straw was an excellent multipurpose tool for achieving almost all tasks required in the project: enlivening, rolling, positioning and holding the ember, and scraping and clearing waste from the burn site. Scraping advanced the process to another level, enabling the coal to interface with fresh wood, and progress accelerated. In less than 2 hours, the second tunnel was upward of 50mm and had met with the first. Notice of the breakthrough came with the sudden ignition of a blue flame in the bottom of the hole as a flow of air current rushed through with the creation of an open tube. The bone tool was used for clearing away this central join, which presented the problem of no longer being able to hold, or house, a live coal to enable the outward burn to continue to match the overall diameter of the conjoined tunnels. This created a 'waist' in the middle of the tunnel in the form of a small raised wall, or ridge (stepping and hour glassing). In less than 5 hours, a tunnel 112 mm deep and 25mm radius had been bored using nothing but live coals from the bed of a fire. On returning to Palmerston North, Warren Warbrick took the square section of wood and with an adze fashioned around the bore in the shape of a kōauau. It was during this task that it became obvious that the cracks had reached further than what was hoped. He also cleared the bore of a large amount of burn debris - ash, char and soot, using a braid stretched on a piece of supplejack: a tool that suits the description as resembling a bow and arrow (and is in fact his strung percussion mouth harp, an instrument known as a kū).

Function – Kōauau Mataī Ahi Kōmau:

Kōauau Mataī Ahi Kōmau has two large cracks that occurred (probably) during the construction process and does not sound. As a flute, it does not play. Its function now stands as an example of how boring deep holes with the use of live coals is achievable. Even though this project didn't achieve a flute, the experiment was successful simply because it demonstrated that the live coal method is very possible. It raised a number of issues regarding resource, skill and method, that deserve further research.

Construction - Karanga Kākā Ahi Kōmau:

With the donation of a piece of 20,000 year swamp maire to the research mid 2002 by Wayne Ross of Ngāruawāhia, it was decided that a small test would be done into 'solid' wood using burning embers. Swamp maire is one of the hardest woods available. With a mānuka fire burning in a tripod charcoal barbecue, a large bed of embers was prepared. Using kitchen tongs, an ember of an appropriate size, about 12mm radius, was selected and dropped onto the flat surface of the wood. Soon this coal was scorching the wood, and with a slight amount of breath, as per Nihoniho's instructions, while holding the coal in place with the tongs, a small trough was hollowed. As embers died, they were replaced with new ones. In less than half an hour a bore 20mm deep was formed.

The most obvious difficulty with this method, as discovered by the earlier mataī experiment, is in the selection of an ember *small* enough. Solid, live embers are by nature big. Soon enough though, one develops an eye for the smaller ones sitting in between, and under the larger ones in the fire bed. If embers are large, a wide radius hole will be excavated, and this is not necessarily what is wanted. Generally, a hole grows wider the deeper it goes, so starting with embers that are small is key to digging a consistent hole.

The hole is also widened slightly when it is cleaned on completion, such as with this one that has had its internal surfaces vigorously scraped clean of char and ash with a bird bone chisel/straw. The straw wasn't really needed for this shallow cavity, but was used regardless to maintain the live-state of the underside of the ember, and to scrape and clean. Initially intended as a simple test, this cup shaped 20mm x 20mm x 20mm hole was perceived to be very similar to a giant karanga manu. At this time in 2002, I had not seen the karanga kaka in the Otago collection so had no idea that such a form might actually exist. In fact, the soapstone relic in question was sitting unrealised in a personal collection, not to enter the Otago Museum back room for another seven years.

Function - Karanga Kākā Ahi Kōmau:

This is a fantastic flute. From the external shape that Warren Warbrick has finished it in, it becomes easy to perceive how hot coals could be used for the fashioning of nguru. Even though the aperture is not round, the piece plays well, and is very loud. The sound is remarkably akin to the voice of a kākā, and with practice, a player can generate very realistic mimics. A range of voices exist within, covering 4 complete registers, from a low sombre tone, right up to a very high, piercing whistle. Light and easy to play, with a strong visual aesthetic and sonic range of abilities, it would work well to be worn so as to be available to be played in almost any situation required.

Construction - Kōauau Tutu Ahi Ngārehu:

Hollowing a section of tutu (*Coriaria arborea*) with hot coals is a much simpler task than achieving the same thing in a piece of solid wood. This experiment involved drying the tutu section under the house for about 3 months, and this was a tricky task in itself, as several pieces I had cracked. The piece that did not crack appeared to be no different to the others. This was the one section that survived the drying process. So that I wouldn't have to vigorously fashion the outside of the blank after the hollowing process, and risk damage to the flute in its weakened state, I removed the bark and pared down the outside into a kōauau shape prior to burning. For the purpose of reconstruction, I sourced mānuka and burned a fire solely of that. Using metal kitchen tongs, I selected a very small ember, about 8mm square, and introduced this to the surface of the pith. Immediately the ember sank as the wood released a thick plume of smoke. Being very careful not to inhale the fumes, I began immediately with the straw, so that I could maintain a distance from the potentially toxic exhaust. In less than five minutes, and 3 embers, the live coal had descended about 50mm into the barrel of the branch. Progress continued rapidly, and with the reach and focus of the bird bone straw, I had no need to invert the blank and begin again from the other side when achieving half-way. Constantly being aware of choosing the appropriately sized ember, I attempted to reduce the size of each replacement in the hope that I might finish with a tapered bore. The last ember was about 6mm across. The ember burns very quickly downward through the dried pith, but not so quickly that it doesn't cause an outward burn. The ember was seemingly cutting a hole about two times bigger than itself again. This meant that a 6mm coal was excavating a hole of about 12 mm radius. Within less than twenty minutes I had achieved the full length of the piece, and the remaining ember simply dropped out the bottom of the blank. On completion of the bore I tied a piece of wet rope to the nearest fence and, covering it with sand from my children's sand pit, slotted the now hollow blank on to the rope, imitating the technique that Buck describes in The Coming of the Māori (1966: 263). Pulling the rope tight, I slid the flute up and down the rope, twisting the piece slightly each time. Checking the progress of this was easy, as it simply involved removing the blank from the free end of the rope (the end I was holding), and then returning it back onto the rope to continue. After 3 or 4 minutes of this, the rope had become black with soot and I was satisfied that the bore was cleaned enough of its fiery debris. I then took the whole piece and washed it under the tap, rinsing away any sand and loose waste that remained from the whole process. I have chosen to leave it in an unfinished state for now, but I do plan to eventually drill wenewene with the flywheel tūwiri (*Variation-1*).

Function - Kōauau Tutu Ahi Ngārehu :

The finished bore of *Kōauau Tutu Ahi Ngārehu* is highly functional. It has a great deal of tonal control, with a very bright and loud ring to its sound. Tutu is a good resource for making long flutes and these give a loud, overblown upper register.

Physical Features Prevalent With the Use of Fire:

Particular features become obvious when tunnels have been made using hot embers:

- Blackened surfaces.
- Black and tan colouring.
- A visual effect that can be described as random patches of layered shiny and dull.
- Charring.
- Presence of ash and soot.
- Circular scraping effects, longitudinal gouging.
- A bowled internal shape.
- Sometimes very rough, billowing, humps down the bore, coupled with…
- Rounded depressions.

- Hour-glassing - the combined effect of the above effects: billowing humps, bowled depressions, waist and walls.
- Strong smell of smokiness and burnt wood.

Main Discussion:

These four experiments demonstrate quite clearly just how achievable the drilling of kōauau bore is with the use of fire. Several issues must be discussed when considering the use of fire culturally and practically. The use of fire is widespread within Māori culture. To quickly summarise, fire was both a practical and spiritual tool. Used in the act of cooking in many ways, including the use of smoke, flame, hot rocks, embers, ash beds, and of course the earth oven, it was also highly ritualised, and for that reason very specific in regard to the purposes intended for its particular use each time. Fire usage and manipulation was often defined by status and gender. Fire was cosmological, held in high esteem in the mythology as a personalised manifestation of particular Atua, and an important ingredient in the creation of the universe, this world, and the existence and maintenance of humanity. Further applications involved its use in warfare, hunting, to control and fertilise forest and gardens, fell trees, shape canoes and of course, drill holes. Fire kept people safe, warm and protected. Often specific fires, defined by ritual purpose, would be maintained and transported, kept alive by those whose special task it was to do so. Fires were required to be lit and disposed of in a certain way. Fire was vital to the livelihood and wellbeing, physically and spiritually, of traditional Māori. In this discussion, it must be recognised that because of its highly specific ritual usage, fires often had singular purpose, for example tapu fire could in no way, under *any* circumstance, be used to cook, and *vice versa*. Fire had rules.

Cross-culturally fire has had similar spiritual and practical applications, many of which relate to the more esoteric roles that are often ascribed to it. Prometheus was known to steal fire from the gods (as did Māui) in a hollow tube (a kōauau perhaps?). A near cultural universal is the belief in fire as a cleanser, and this has been proven both scientifically and medically. It is antiseptic, and often smoke has been perceived to have this effect also. Heat causes many changes in the structure and function of things, and so down through the ages and across the planet has been used in ceremonies that involve spiritual and physical metamorphosis and ritual transition. Fire is also often understood to revitalise, having the ability to bring new life, while dissolving the old. Fire is an element that is to be feared, revered, respected and harnessed. The human control and use of fire is about the survival and success of humanity and civilisation.

So why might fire have been used by Māori to drill holes for flutes. Practically, it is very efficient. As demonstrated by this research, burning holes in wood does not involve the need for a specialised tool and the skill to use it. It does well what is intended, and can incorporate a myriad of meaningful and ritualised aspects while doing it. Hot coals can bore very deep holes (in my research I have dug as deep as 500mm in a single tunnel), something that can be difficult to achieve with a cord drill. The use of fire is faster, requires less technical skill, is more available and accessible, and probably more exciting and meaningful than the drudgery of a drill.

One very plausible reason for the use of fire might be in regard to the toxic aspect of certain woods. The presence of fire may in fact counteract the chemical structure of certain toxins, rendering them ineffective. Flame and heat are also known to change the cellular structure of wood, hardening and drying sap, while changing the timbre of the instrument.

Culturally, that a sacred fire used in construction would result in a sacred flute also seems a very valid possibility. That such a highly ritualised culture as that of the Māori should use a powerful tool of ritual like fire for little or no reason seems unlikely. I suspect that the actual reason fire was used to bore kōauau was cosmological, seated within mythology, and hidden within a now veiled pre-colonial oral tradition that was communicated in song, and then expressed in the practical method. This would have embedded the very reasons for its cultural existence within its physicality, and communicated them every time the instrument was sounded.

That holes made by fire strongly resemble in so many ways the tunnels produced by pūriri moths might also be seen as potentially congruent. After all of my research and experience, I have developed a strong desire to intuitively weave these two strands together. I theorise that holes may have been made with fire to mimic and therefore symbolise the tunnel made by the moth. Both are very round in diameter, with similar colouring and wall surface features, and both smell of burning. Moth tunnels as a resource are inaccessible. Certainly they are available, and probably more so in ancient times, but excavating and rendering a tunnel to flute form is a large task in comparison to burning a hole through a piece of tutu. As discussed in chapter 4, the initial discoveries of moth tunnels were profound for the immediate recognition of the similarities to holes made with fire; in other words, the connection was made immediately, and continued to be made by others when asked to unknowingly identify these moth tunnels. The strongest elements in this equation are olfactory and visual: moth tunnels smell and look burnt. As a Māori, my research discoveries invariably shape my identity and I am drawn to recognising connections. These are intuitive and shape my understanding of what being Māori means to me. That fire and moths both have metamorphic aspects is another confirmation to me of this connection.

This section of the research has raised a number of issues regarding resource, skill, method, ritual, and culture. These are opening indicators for the requirement of more research, and I look forward to the widening journey of discovery that this will involve.

Kōauau Kōrari Ahi Horehore

Flute Name: **Kōauau Kōrari Ahi Horehore**

(Figure 5.1) Kōauau Kōrari Ahi Horehore length.

Dimensions:

144 mm *(long, top to bottom)*

22 mm *(wide at top end)*

23 mm *(across at widest mid-point)*

23 mm *(wide at bottom end)*

12 mm wide *(wide at top, inside bore)*

12 mm wide *(wide at distal, inside bore)*

Materials:

Flax flower stem, kōrari.

Tools Used:

Broken drumstick poker / *Bic* lighter / Craft knife

Physical Characteristics:

A very lightweight, long and thin flute, which is silver and green in colour. One end has a slight crack that descends from the rim. This end does not play well. Both ends are in fact very rough and uneven. The bore has not been worked since burning and is very messy and shaggy, and the walls, being covered in ash remnant, are very dark brown and black of colour. The tunnel appears bent in the middle, though this in fact a 'step' caused by the construction process whereby two separate tunnels were pushed through, one from each end, to meet in the middle.

(Figure 5.2) Kōauau Kōrari Ahi Horehore proximal.

(Figure 5.3) Kōauau Kōrari Ahi Horehore distal.

Construction Process:

1. A drumstick with the tip broken off was selected to be a poker.
2. This was lit with a *Bic* lighter until the tip was on fire.
3. The flame was pushed into one end of the flower stem and the poker was twisted as it went in.
4. The poker was removed and relit and the process was repeated.

(Figure 5.4) Made from flax flower stem using a hot poker.

5. When halfway was achieved, the piece was reversed and steps 2 to 4 were repeated, until the second tunnel was made to meet the first.
6. The ends were trimmed with a craft knife that was also heated in the flame.

Constructed in 2002. Kōauau made by Rob Thorne.

Discussion:

The use of kōrari was first brought to my attention in a talk I heard in 2002 by Richard Nunns and I later found a citation in Beattie that refers to the “flax-stick” being used (2009: 78). Of interest also is an artefact that resides in the Whanganui museum that is listed as being made from kōrari in its notes, of which this has been crossed out, and changed to tutu. This piece is listed under the acquisition number 1940.24.36, in the Goffe Collection.

Conclusion:

This flute was very quick and easy to make. Kōrari as a resource is ideal for construction by hot poker. I have used hot flaming (i.e. wooden) pokers with tutu, poroporo and whau, all with good success. Kōrari changes consistency when it is burned, and the heat works well to sear shut the open nature of the plant cells.

Nowhere in ethnography does it say that kōauau were made with kōrari using hot pokers. Nevertheless, under recommendation, I have discovered it to be an excellent resource. *Kōauau Kōrari Ahi Horehore* functions well as a flute that was made very quickly using improvised methods based on post-contact traditional techniques.

Kōauau Mataī Ahi Kōmau

Flute Name: **Kōauau Mataī Ahi Kōmau**

(Figure 5.5) Kōauau Mataī Ahi Kōmau width.

Dimensions:

112 mm *(long, top to bottom)*

37.8 mm *(wide at top end)*

42.4 mm *(across at widest mid-point)*

36.4 mm *(wide at bottom end)*

25.4 mm wide *(wide at proximal inside bore)*

24.1 mm wide *(wide at distal, inside bore)*

Materials:

Mataī fence post (section).

(Figure 5.6) Kōauau Mataī Ahi Kōmau.

Tools Used:

Live coals from fire / metal kitchen tongs / grass sheath straws / bone straws / adze / kū.

Physical Characteristics:

A wide, short object which has been finished roughly on the outside with an adze. Two large cracks run with the grain, one for over ¾ of the length of the body. A wide bore and thin walled flute, it is obvious by the cracks that it doesn't have sound function. The bore is very large in radius, not usual for a kōauau, though I have seen nguru with bores this wide. Bore surface is black and charred, showing obvious signs of burning. A light residue of ash remains on a finger when it is rubbed inside the hole. A strong smell of smokiness and burnt wood still remains in the pit, even now, after 9 years. Rugged and uneven, the bore has three large humps, near to evenly interspaced by round bowl-like depressions between. This effect I term as *hourglassing*. This is a symptom of the use of hot coals. Upon the surface of the black char are vague, thin longitudinal grooves, or scratches. These have been formed by the cleaning process after the bore with the thin braid from the kū.

(Figure 5.7) Kōauau Mataī Ahi Kōmau bore showing 'hourglassing'.

(Figure 5.8) Blowing on the ember.

(Figure 5.9) Scraping the char from the bore.

Construction Process:

1. Using tongs, hot embers were selected and issued onto the surface of the wood.
2. As the ember descended deeper into the hole been burned, it became more difficult to keep the coal alive.
3. After experimenting with hollow dried grass sheaths, hollow bird bones were introduced as straws to enliven the ember and scrape away debris and char.
4. Burning was done from both ends with these holes meeting in the middle to create a single tunnel.
5. 112 mm hole bored in under 5 hours.
6. On completion, the inside bore was cleaned using a braid strung across a piece of supplejack, very much like a bow and arrow. The outside was also shaped to resemble a kōauau.

(Figure 5.10) Using the bone straw to enliven underneath the ember.

(Figure 5.11) Bone straws, scrapers, chisels.

Constructed in 2003. Bore made by Rob Thorne.

Assistance by Dennis Thorne and Daniel Alexander.

External finishing by Warren Warbrick.

Discussion:

Even though this is not a successful flute, the act of using live coals and the final product works well as a significant indicator for how burning is possible, and what burnt and scraped surfaces look like in flutes. Several cracks were noticed in the wood before work began, and even though these were not central, or in the vicinity of where the tunnel was being bored, they should have acted as a significant indicator for the inferiority of the chosen resource in general. As work progressed, I noticed that the burn would sometimes follow what seemed to be the line of the grain, burning out across a radial line, or working its way in to what soon appeared to be fractures, or splits in the wood that travelled longitudinally. By half way through the task I began noticing thin cracks on the edge of the bore being made, but as it was all a learning experiment I ignored them, hoping that they might not turn out as what they were threatening to be. The billowing in the bore seems to be from the coal becoming trapped in the tunnel and burning outward rather than down.

As scraping incites burning into newly exposed fresh wood, one method might be to either consider undertaking no scraping at all, or scraping only at the bottom of the hole. A lack of scraping stifles a burn. This said, I believe the key would be to only scrape and clear away the bottom of the hole. This would stifle burning to the side but incite new burning downward. The choice of wood is obviously vital. Research I have done using branchwood indicates control is greater in a downward manner, with less outward burning. With branchwood, often the central growth line is softer and this also seems to entice a downward (rather than outward) burn. One element of this experiment that I have developed since with the practice of this method is to intensify blowing to encourage the actual wood of the blank to ignite. When this happens, the coal can be tipped out, and the burn can continue on. At times, with this method, the glow will become so intense that a flame will occur. This technique greatly increases progress, but this can backfire with a burn getting out of control. Too much causes the direction of the tunnel to burn outward rather than downward, creating bowl-like depressions and humps in the hollow, which is not ideal for a flute. When enticing a burn without a coal in the bottom of the pit, work needs to be stopped at stages to extinguish and clear the char. This involves using another coal to re-ignite and start over. Another problem, which may be one of the causes of this experiment's failure, is the need to keep the blank relatively cool. Too much heat can cause cracking. Control of heat is exercised through controlling the size of the burn site. A more focussed, smaller site that has a consistently downward action is far less likely to cause cracking in a blank that has a wide burn site, with burn occurring in all directions. This is where the value of the straw comes to the fore. With the straw, the burn can be extinguished at the edges through picking and scraping, and excited in the centre by very directional blowing. Sand was used in this experiment to extinguish burning when things got really out of hand. It is not often nowadays that things get out of hand when I am burning, as I am able to control the burn through picking, scraping and *not* scraping.

Conclusion:

Though unplayable, *Kōauau Mataī Ahi Kōmau* brought the research to a new level in regards to realising the use of fire. With this first tunnel taking less than 5 hours to complete I was greatly encouraged, and have since continued the practice of making kōauau using hot coals. In terms of time and effort, this method is more efficient than the use of a cord drill. Of course, in a traditional setting, fire would have been ever present, fulfilling a number of roles. Cooking, warmth, landscaping, solidarity, protection, ritual and magic were all roles of fire that were utilised constantly by Māori. That sacred fires may have been used to bore sacred flutes, and that the use of fire may have been utilised at times as ritualistic, or symbolic, appears possible also. After enacting the method, I have come to realise how obvious the use of fire is to dig wood. That it is faster, requires less technical skill, and more readily available than many other methods practiced in this research for boring solid wood, seems to lend even more weight to the possibility of it being used. I have seen a number of kōauau in museum collections that appear to have indications that they have been burned through using hot live coals. These include in Canterbury E177.54, E150.554, E138.475, E85.4, in Otago D21.58, D29.1274, 050.014, and in Whanganui 1940.24.37, 1940.24.33, 62.15. Evidence in museums suggests that this technique was used in conjunction with other techniques, perhaps to widen a pre-existing hole, or the opposite, develop a hole that can then be widened using scraping and gouging. Though drilling solid wood with fire is something I am now able to achieve, I actually prefer the use of this technique in the hollowing of pith woods such as poroporo and tutu. That method is slightly different practically, but identical in principle, and can be seen in the experiment listed last in this chapter, *Kōauau Tutu Ngārehu*.

Karanga Kākā Ahi Kōmau

Flute Name: **Karanga Kākā Ahi Kōmau**

(Figure 5.12) Karanga Kākā Ahi Kōmau length.

Dimensions:

72.7 mm *(long, top to bottom)*

37 mm *(wide at top end)*

38 mm *(across at widest mid-point)*

8 mm *(wide at bottom end)*

20 mm deep (from top edge to bottom of 'cup')

20 mm wide *(wide at top, inside bore)*

20 mm wide *(wide at bottom of inside bore)*

(Figure 5.13) Karanga Kākā Ahi Kōmau side view.

Materials:

Swamp Maire / Maire tawake (*Eugenia maire*)

Tools Used:

Live mānuka embers / kitchen tongs / adze /

bird bone straw, scraper, chisel.

(Figure 5.14) Karanga Kākā Ahi Kōmau.

Physical Characteristics:

A small, egg cup-style, end-blown vessel flute, fashioned to a distal point in a teardrop shape, with a small hole so that it can be tied around the neck.

(Figure 5.15) Bore detail.

Aperture is not round, with 6 straight edges in a polygonal design. The internal trough seems to swell out from the top edge, creating a bowl effect.

Evidence of burning: blackness, though no loose ash or char as this has been scraped away. Horizontal scraping can be seen 'around' (not up and down) and across the walls of the hole. The external wood has a beautiful dark golden and brown grain that runs in horizontal bands around the body of the flute.

(Figure 5.16) Note charring, scraping and black colouring.

Construction Process:

(Figure 5.17) Holding the ember with a bone straw.

1. Once the fire was lit and a bed of embers was allowed to build up, the task was started.
2. Using tongs, an ember was selected and held on top of the wood.
3. Breath was directed onto the belly of the ember so that the bottom was inflamed.
4. As the ember died, becoming nothing more than wispy ash, another fresh ember was chosen and returned to the burn site.
5. When the hole was completed, a small bird bone scraper was used in a circular motion around the walls of the hole to remove any loose char and ash, and this was blown free of the site. The whole task to no more than half an hour.
6. Sometime later the piece was shaped in pendant style.

(Figure 5.18) Ember detail. This experiment is with a tītoki branch.

Wood donated by Wayne Ross, Ngāruawāhia.

Constructed in 2003. Bore made by Rob Thorne.

External work completed by Warren Warbrick.

(Figure 5.19) The wood has ignited and the ember has been removed.

Discussion and Conclusion:

This piece was an exciting step forward in the research after the splitting failure of the previous mataī experiment. With very little effort, a fully playing hole was achieved that then became a flute. The dense, hard nature of swamp maire saw more control being able to be exercised on the burn process than with the mataī experiment. The smell of the wood burning was extremely fragrant, an old world smell that reminded me of incense, maybe frangipani. The speed of construction with successful function indicates a higher level of plausibility than the previous experiment. The difference between these two live coal experiments is the choice of resource. The more work I do with solid, hard woods and fire, the more I conclude that branch-woods were used, as I have greater success with that resource as the grain holds the direction of the burn.

Karanga Kākā Ahi Kōmau is a great example of how drilling solid, hard woods with fire is very possible. That it was quick and plays well with a huge tonal range suggests that such a technique could have been done traditionally on solid wood, especially if it was being used with pithwood flutes. After working with a cord-drill and then with fire, I conclude that the live-coal method requires less skill (tool use), time and preparation (tool manufacture). This little flute is a window into the physical features that occur when burning is used, including the actions of hard scraping to clean the surface of soot and char. I have witnessed these very attributes in pieces in museums, including the layered dull to shiny, black and tan colouring, the circular scraping effects, and the bowled body form. Flutes that appear with these characteristics or similar include in Canterbury E177.54, E150.554, E138.475, E85.4, in Otago D21.58, D29.1274, 050.014, and in Whanganui 1940.24.37, 1940.24.33, 62.15.

Kōauau Tutu Ngārehu

Flute Name: **Kōauau Tutu Ngārehu**

(Figure 5.20) Kōauau Tutu Ngārehu.

Dimensions:

15.5 mm *(long, top to bottom)*

28.3 mm *(wide at top end)*

32 mm *(across at widest mid-point)*

27 mm *(wide at bottom end)*

17 mm wide *(wide at proximal, inside bore)*

14 mm wide *(wide at distal, inside bore)*

Materials:

Dried Tutu (*Coriaria arborea*) section.

Tools Used:

Live mānuka embers / kitchen tongs /

bird bone straw / rope / sand / water.

(Figure 5.21) Kōauau Tutu Ngārehu proximal.

Physical Characteristics:

A long, simple, classically shaped flute, that is unfinished on the exterior, with five green longitudinally facing indented streaks that indicate that it is made of tutu. A very fibrous, loose grained wood, that is yellow of colour. With a relatively straight bore that has a 3mm taper that shows signs of burning. If I had not done this myself, I might have assumed that it had been performed with a hot steel poker because it is so smooth. Just off the centre of the bore there is a slight step that circles the entirety of the bore, and I presume this was caused by the middle ember being somewhat smaller than the others, as I was making an effort to considerably reduce their size in hope of tapering the tunnel. No remnants of pith remain on the walls of the bore nor any thick ash or char remains, though a slight layer of black soot still lingers. Lack of debris is due to the final action of a braid being run

(Figure 5.22) Kōauau Tutu Ngārehu distal.

(Figure 5.23) Kōauau Tutu Ngārehu.

through the bore, and this is evidenced by longitudinal scratches and markings in the black wall up and down the bore. A strong smell of still burning lingers within the bore.

Construction Process:

1. "a piece of *tutu* stem…
2. dried…
3. Live coals of manuka…
4. placed on the dry pith at the end of the section…
5. the operator blew the coal to keep it alive…
6. to burn the dry pith below…
7. When the coal deadened,
8. it was replaced with a fresh ember"

(Best, 1976: 237)

9. "A round cord… was charged with sand,
10. the tube threaded on the cord
11. which was stretched…
12. The tube was moved to and fro on the sanded cord…"

(Buck, 1966: 263)

(Figure 5.24) Note the longitudinal bark lines denoting tutu branch-wood.

Discussion:

The drilling of this bore was surprisingly easy, and the experiment had a very high rate of success. The issues of 'possibility' are strengthened by an experimental result that was very quick and easy to achieve and is very functional. The 'validity' of this method is confirmed by ethnographic evidence, and even though there only seems to be a singular, but oft repeated reference, this information has been given by a highly respected Māori from Best's fieldwork.

The resulting flute created from tutu with the live-coal method has a classically tapered bore with a slight curve in it. After cleaning the bore with a sand-charged cord, and then running water, the internal walls present as very smooth. Even though the tunnel was created from a single direction (not two opposing tunnels that meet), some slight stepping has still been created in the bore. I have to guess that this is a result of the uneven burning action of different sized coals as they are introduced to the process. That a small dead ember is then replaced with a larger, very hot one, makes a certain amount of uneven burning unavoidable. The issues relating to cracking during drying need to be addressed. I suspect that at certain times of the year, the sap of the tree will be receding, making it less likely to split when drying. The slower the drying process happens, and the cooler (but dry) the environment is, the less likely that it will crack. This flute is showing signs of cracking, with two small cracks eliciting from the proximal end, and these, as is often the case with tutu, follow the squared gullies of the wood shape. Thicker branch walls, with a smaller diameter pith cavity may begin to solve this problem, but tutu should be recognised as a wood that has a tendency to split fresh, and crack when dry. More research into these aspects is needed.

Conclusion:

This experiment provides strong evidence toward the achievability of the live-coal method in pith wood such as tutu. Personally, after solidly researching ethnography, and then practically experimenting for myself, I am under no doubt that this method was used traditionally by Māori to make kōauau. After further study, I have come to the conclusion that there is no reason to doubt the integrity of Tuta Nihoniho, the first hand source who explained this method to Elsdon Best, as he was a sincere and genuine citizen of great standing among the Māori and wider community. While the use of tutu may have been chosen for a number of cultural reasons, practically it was very easy to work with and the results were quick and highly functional. The use of fire in the process makes working with tutu even quicker, and safer, and also gives much better results functionally. A *kōauau tutu* made with live-coals plays very well, has excellent tonal range and pitch control, and is loud. This will certainly not be the last one I construct, as now after the completion of the entire research, it presents itself as the quickest and easiest of all the methods that require a bore drilled, has fantastic function, and has proven traditional validity.

Conclusions and Recommendations

This concluding chapter presents a summary of outcomes achieved by the research, and recommendations arising from it for further study that have been raised throughout, that are seen as vital to continuing the discourse opened by, and partially developed in this thesis. Included in this discussion is a general look at the process and methodology of the work and how it impacted personally on the researcher. These processes and wider issues are perceived as an important overarching result of a project that has taken upward of ten years and will continue on in different ways long after this thesis. One consequence of the work has been the migration from an *etic* (observers) perspective, to an *emic* (participants) one that has resulted in a personal life changing identity shift for myself, the researcher. As the work progressed, I gained a greater understanding of myself culturally, while the learning and application of practical traditional skills unlocked connections from out of the past that empowered newly discovered strategies for how I might exist as Māori in a modern world. Considerations regarding the difficulties encountered in the analysis and representation of the research data are raised to indicate future directions that have been unrealised in this thesis, and flag problems that are associated with defining and articulating a large body of acquired knowledge gathered in a multiplicity of fields that has become embedded and assimilated as one's own through years of learning, analysis and synthesis, and the self-actualisation associated with it. A great deal of evidence gathered from the physical handling and viewing of museum objects is presented in this thesis, which is actualised in the practical work, analysis, discussions, conclusions and recommendations for further research.

In no way is this thesis a total representation of all the research conducted or learning achieved. A number of sections were deprioritised and omitted for the sake of thesis proportions. Many other methods and resources deemed relevant to the research were experimented with, and the conclusions attained in regard to these, have not be presented here. While these are not irrelevant to the discourse, the sections presented here were more obviously valid for the specific purposes of this thesis.

A great deal of the museum research which was undertaken and informed the practical aspects of the project has not been fully presented in this work either. The museum work was extensive, a total of ten museums were visited, some twice, and upward of seventy artefacts were examined that were relevant to the outcomes of this thesis. While I regret that there simply was not the room to honour this museum research visually with the quantity of images taken, or statistically with the large amount of data collected, I am in no doubt as to just how much the act of doing it informed the analysis and conclusions on many levels. When possible, I have made mention of relevant artefacts that relate to the practical research as a way of flagging, and encouraging, future research that may be undertaken. A number of pieces that were viewed twice, some seven years apart, resulted in differing field conclusions as to what I believed their construction method and resource to possibly be, and this has only encouraged me to want to go back again and again to revisit the actual pieces. There is much more to learn, and so any data that I have collected that might be later contradicted, by myself or others, I see as inevitable and will be welcomed. Such discussion can only foster the truth. I am more than prepared to share and discuss my research with anyone who decides to look further into any of these outcomes and expand upon the issues raised within these pages. I encourage those people to please contact me.

One of the predominant intentions of this research was to expand the knowledge around traditional Māori instruments and develop wider discussion and thought into areas that until recently had not been considered or encouraged. For this reason, I do not see this thesis as the end, but as a stepping-stone into more research. The research recommendations made throughout the body of this thesis has already indicated this. Because I have not been able to honour the large amount of museum research in the way I had first hoped, a future task will be to complete a paper that sees this work expressed, visually, statistically, and analytically. This will function as a supplement to accompany this thesis, in which relevant museum pieces can be seen visually in their entirety, and then compared to the experimental conclusions presented here. I am very grateful to all of the museums which took part, and in particular the staff who organised visits and supported the research. The passion and professionalism of these people is one of the reasons why and how such reconstructive journeys of broken tradition as this can occur and contribute to greater knowledge, increased understanding, and ultimately the improvement of the human condition. The situation of traditional Maori instruments, would not be what it is today without museum collections and the people who maintain them. As part of the ethical requirement for viewing the collections in those institutions, I agreed to collate and organise the data I collected from them, and give it back to them. While I was hoping that this thesis might do that, it has taken a slightly different direction, and for that reason~~,~~ my next task will be to complete this analysis for each of the museums which participated in this research, so that it can be archived and available for people to view alongside their back-of-house collections, as was agreed. I strongly encourage anybody who has an interest or cultural connection to these instruments to seek them out. Our identities are carved by the *personal* discoveries we make and the *connections* that these develop. Seek knowledge from the source: book a time to visit the instruments that reside back-of-house at your local museum and come to understand for yourself what these taonga have to teach *you*.

The research has developed within me an understanding of who I am and can be as a Māori in a way that nothing else has ever been able to. This project has become more than a study of musical instruments and traditional methods, it has been a journey of identity and meaning. Through this work I have become connected to who and where I come from, while realising who and what I can and will become. What began as an academic project has grown to become a personal responsibility to my tamariki (children) passed down from my tīpuna (ancestors). This journey of 'becoming' has permeated all aspects of my life, and calls on me to honourably pass on the knowledge that others have passed to me. At the beginning of the research, as a musician with only a simple connection to who I was as a Māori, my perspective was mostly an *etic* one. The agenda was to find someone who could demonstrate methods of construction so that I might record them for the research, with the vague personal intention of perhaps putting some of those into practice to make myself a kōauau that I could then have and play. Within a short time, I was being expected by my participants to discover, experiment and put into practice the methods that they had no experience of themselves, which I might learn for all of us.

I have come to realise that it was through the playing of the instruments as a musician that first propelled me into a fully *emic* perspective. As a mildly capable multi-instrumentalist, I am able to sound most instruments, whether technically correct or not. That the simplest instrument in form that I had ever sampled posed one of the largest functional dilemmas I had ever experienced was profound. With fixed determination I set out to conquer this little flute that I could not play. Of course, the challenge was now set. Soon I was playing the kōauau in the beautiful native gardens around the university, developing a collaborative rapport with the many native birds who came to rest in the trees above my favourite roost, instead of attending to my studies. Playing was all I wanted to do now. I wanted to call in the birds, listen to the trees, commune with the wind. I was '*in*'. No matter what happened now, with great learning or not, my kōauau had given me a way to *be* Māori. The breath, te manawa ora, the intoned intention, te whakaaro, the embedded connections, whanaungatanga, all gathered together for me in that short wooden flute - tihei mauri ora! This personal plunge into truly being Māori gave me the first *emic* right-of-way into researching a Māori topic without even realising it. That I had a personal connection wasn't a conscious validation, it was the causative grounds: I truly wanted to know more and had appropriate cause and a legitimate birth-right to call upon. Years of latent subconscious desire to be *more* Māori surfaced to meet with a new consciousness that now *was* experiencing itself as more Māori. As this was happening, I was being personally encouraged by respected insiders to develop my skills in research from a participatory perspective, and *become* an insider myself. The result then is not just a research project with objective outcomes, but a subjectively holistic, genuine learning and enriching life experience.

As a lifestyle event, I am the sole character that has always been there throughout the entirety of the research process, actively researching and constantly analysing. I have become therefore, my own main participant. The conclusions throughout this thesis are therefore a synthesis of a variety of experiences that have involved hours of subjective learning, listening, discussing, reading, thinking, making, playing and *be*ing. These periods have been motivated by moments of precognition and fed with flashes of insight. Occasionally, ideas developed into theories over periods of years that were then empowered through unexpected, but always related affirmation. The research conclusions consequently are a somewhat blurred attempt at subjectively being objective when considering a very wide variety of data across an array of fields, but I cannot and will not remove the subjective context from which these decisions were made simply because often I cannot actually point at any particular moment when I was being strictly, and only, objective. This is not to say that these conclusions were not 'caused' or encouraged by other participants involved in the research, of which there were many.

Consenting participants were often very definite about their opinions, and unmoving in their beliefs regarding method and probability, as opposed to unsuspecting participants who were more inclined to make helpful suggestions, or offer sage advice without realising. Volunteer assistants shared the intrigue, developing their own lines of thought and so expanding my own before retiring to continue their own research. Including the wisdom of children, while in the role of teacher, parent or friend yielded a powerfully intuitive knowledge and skill base. Hot-coal workshops I hosted with children were some of the most enlightening in regard to experimenting with the method, children offering up unfettered opinions and instinctive resolutions for achieving success and circumventing difficulties. Donors were many, offering resources that captured their own imaginations that then repositioned the entire research perspective and agenda. Assorted pieces of wood, stones, shells, bones, all with holes, tunnels, and edges flooded in over the years, some of which ended up creating entirely new sections of the research. And then there were the lead participants. The experts who constructed kōauau who are acknowledged and documented in this thesis. These people were generous beyond compare with their time, resources, and knowledge. A culture of sharing, insightful perception and comradery was offered that fostered affability, benevolence and goodwill. To all of these people I am grateful, and hugely indebted, for not only did I learn, and receive material gifts, but I was taught in the ways of how to learn by doing, in the ways of how to pass the torch and accept the responsibilities that come with such gifts: the ways of the culture and world that is modern taonga pūoro. Of course, this teaching invariably shaped my cognitions, interpretations, perceptions and conclusions. Such learning cannot be achieved in an unbiased and impartial way. Many I have met and worked with along the path are now good friends. This work has become my life, and my life is now this work.

Analysis of practical experiments was at times highly subjective, involving a learning curve of cumulative experience and understanding. At the commencement of the research, I had little experience with regard to assessing museum pieces, but the only place to start was at the beginning: so I went, looked, and made intelligent guesses. Before too long, coupled with the results of experiments, I developed new frameworks from which comparisons could be made between visual indicators and practical applications, and an array of criteria began to be established. With thesis write-up came a self-imposed requirement for an analytical standard in which the experiments could be compared conclusively in some way. With the formulation of the Plausibility Equation, I sought to compare possibility with validity to determine plausibility so that probability and likelihood could be discussed in a relative way. While this worked very well in some instances, it was clumsy at times, and continuing to operate in the future successfully with this paradigm would require further development. Conclusive proof was not one of the research aims, though I do have to admit that establishing an explicit and unequivocal substantiation would have been very exciting. It was not intended for the practical experiments to prove or conclude that these methods or resources were used traditionally, but rather that they simply provide a scale of possibility and probability that could be set against a context of ethnographic and historical validity, on which they could then all be assessed in relation to each other.

Each chapter and its respective experiments are host to specific conclusions, theories and recommendations that need not be reiterated here. Each conclusion and recommendation exists within the context of the chapter in which it resides. Objectively summarising the entirety of the practical research outcomes is possible though, and simple. That all of these methods are achievable is obvious. That some are more *possible* than others is clear, while others are conceivably more *valid* traditionally and historically. I conclude that all are *plausible* in varying degrees, that some are convincingly more *probable* as genuine traditional methods, but that all, as methods for constructing kōauau, are *legitimate in a modern context*. Often museum evidence displayed the use of more than one technique to successfully excavate a single kōauau bore, indicating the use of drilling, fire and gouging together. What I believe to be one of the most important outcomes of this research is the thoroughly consistent recognition throughout the work that more research is required. Some of it is very specific, some very academic and some more practical. I wish to encourage anyone who wishes to pick up on any issues or recommendations where this thesis leaves off to please do so. The key to the revival and survival of these truly amazing musical instruments is in their use, the understandings that enable them, and their accessibility. Any research that encourages these keys should be considered highly worthy, in fact vital.

To finish, I wish to refer to a recurring issue within the practical research that I have experienced and noticed with others that relates to acquiring and achieving new skills and the human aspect that prevents us from attempting the unknown for fear of doing something wrong. The more I work toward understanding indigenous and traditional method, and experience these ways of being and doing, the more I become aware of repeating patterns of uncomplicated ingenuity. What is important to recognise is how simple and easy the making of these instruments actually is. *Go...* make and play so that you can *be*!

(Figure 6.1) Bag moth / Hine Raukatauri.

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