Knowing the Honey bee: A Multispecies Ethnography

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Abstract

Multispecies scholarship argues that the non-human has been relegated to the background of discussions about who and what inhabits and shapes the world. This thesis engages with this discussion as an experimental multispecies ethnography with honey bees in Manawatu, New Zealand. I aim to centre the honey bee in ethnography through engagement in the practice of fieldwork as well as the representation of the findings of this engagement. The honey bee is commonly known as an introduced, domesticated species, kept by humans in beehives in apiculture. This conceals the agency of the honey bee, rendering it passive, productive and compliant to the desires of humans, or in need of human intervention for survival. To view the agency of the bee I undertook embodied, performative ethnography, interviewing beekeepers and becoming one myself. My methodology, which was shaped by the bee, traced the networks that honey bees were enrolled in. Encounters were awkward, one-sided, and sometimes dangerous.

The representation of honey bees demands an approach which attends to multiple, distinct accounts of honey bee worlds, because the bee is a lively agent, contributing to, experiencing, and communicating about the multiple networks in which it is engaged. As such, the findings of this thesis are presented in three accounts of encounters with honey bees. These accounts are distinct, capturing the honey bee in different networks, but are also distinct in their narrative styles, progressing from a description of honey networks in the spirit of Actor-Networks, to writing with honey bee narrator in poetry. Ethnographic representation is inevitably partial and an act of imagination. However, becoming sensitive to the 'bee-ness' of the bee; the waggle, hum and sting, and employing narrative inspired by the multisensory apiary, in other words, shaping representation with honey bees in mind, is an act of privileging honey bees in writing, and exploring what more can be said of, and with, the bee.

Keywords: honey bee, agency, ethnography, multispecies, representation, New Zealand

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1. Introduction

Meeting at the hive entrance **[1]**

I wait with other worker bees at the entrance…some are here to guard…only those who belong here will be permitted…not the bumble…or the spider…nor the bees that smell different…

I am waiting for the returning forager…waiting to receive…the returning bee will pull yellow grains from her body…scraping pollen with her legs…forward and into my own legs…or I will receive syrupy nectar…both I will take inside…passing it to another and another…to be stored in cells…

Incoming…it flies like a bee…looping and circling…positioning itself to land at the entrance…the guarding bees shift forward to meet it…it is a bee…but does she belong?

The returning bee meets the guard…and the guard makes her assessment…scenting her…antennae meeting…she is recognised…she belongs…and moves to meet me…to pass on her bounty to the colony…

At the centre of this thesis is this question: what is a honey bee? This research engages with the ongoing multidisciplinary investigation around what and who comprise the

world, and how we come to know about these materials and beings. I aim to contribute to this project through engaging with the honey bee in Manawatu, New Zealand, exploring how humans know the bee and how this knowledge, and different modes of knowing, shape what the bee is for humans. It is also a matter of how the honey bee is represented.

The honey bee is commonly known as an introduced, domesticated species of bee, kept by humans in beehives. Honey bee husbandry is undertaken to meet the human desire for honey and to pollinate crops. From this desire the New Zealand apiculture industry emerged, where the labour of bees is harnessed by beekeepers, and beekeepers and the apiculture industry work to safeguard and facilitate bee labour. In this world the honey bee is constituted as an object, to be mastered or protected by humans. This understanding of the honey bee, as a productive and passive insect, is a common representation.

Recent scholarship argues that non-humans do not just exist in the world, they are unruly agents which experience the world in particular ways. This scholarship has opened pathways of inquiry that explore how we know and engage with non-humans, and how modes of knowing and engaging shape them. This mode of inquiry views the passive, productive honey bee as one representation of an insect which exists in, experiences, and communicates about multiple worlds. However, while this opens the worlds of non-humans for viewing, questions remain concerning how to work with insects, as well as how to represent this knowledge and different modes of knowing, in text. How can we be less human-centric in studying honey bees?

This question relates to both fieldwork with and representation of honey bees. The challenges of engaging with honey bees include navigating the differences between bee bodies and human bodies; that the bee can fly away from the human means that there may be no engagement at all. Encounters may be one sided or dangerous.

Additionally, differences in modes of communication mean that the human researcher must draw on other information, such as the sights, sounds and scent in the field, to know the bee. Fieldwork with honey bees is not a given, and even if it is possible, the question remains, how can I represent the findings from such engagement? I cannot quote a honey bee.

To address these questions I undertook participant observation with beekeepers as human interpreters of bee behaviour. I also undertook auto-ethnography, where I became a beekeeper. The bees that I transferred to hives on my parents' property were collaborators in my fieldwork. I learned to observe the honey bee, and through this saw the potential for this to be the basis for a bee-centred ethnography. The movements, sounds, and physical contact of bee bodies that I was able to experience at the hive were encounters that I had not found in other representations of honey bees. My experience with honey bees over a three-year period, where I researched with honey bees for my postgraduate studies in anthropology and became a beekeeper myself, gave me insight into what was being captured in the current accounts of beekeepers, and what was being overlooked. My methods respond to bee agency, noticing the acts of bees and relationships between them and other actors in the apiary. As such, this thesis is an attempt to make theory from the bee.

This experimental ethnography contributes to multispecies scholarship by engaging with the honey bee, a non-human which while not a companion to human is positively regarded as interesting and productive. Although it is domesticated, the honey bee does not rely on humans for survival. There is also danger in engagement with honey bees in that they can kill allergic humans. Moreover, as an insect the honey bee has particular qualities - although it may be encountered as an individual, it exists in and as a colony and only lives for a matter of weeks. Engaging with non-humans demands a consideration of the particulars of that non-human: being bee-centric entails becoming sensitive to the ways bees are known, and how this knowing shapes my understanding of them. In regards to the practical knowledge of bees, this research is a challenge to

re-evaluate taken-for-granted aspects of human-honey bee relating. That is to say, the human keeping of bees is more fragile and contested than it appears: the inference of the term 'beekeeping' is that flying insects can be fixed within hives, but this is not necessarily the case. The honey bee is not only a compliant link in agricultural chains, but has agency and does more than make honey and pollinate plants for humans.

This ethnography with honey bees presents multiple, distinct accounts of honey bee worlds, because the honey bee is a lively agent, contributing to, experiencing, and communicating about the multiple networks in which it is engaged. As such these varied accounts cannot be integrated into a whole or contained within a single narrative. These accounts are enabled by a methodological practice which is based on the particularities of the bee: I followed the honey bee to learn how it interprets and communicates about the world, and based my engagement with it on these considerations. In doing this I learned about the challenges and limits of multispecies ethnography, as my human body could not follow the small, flying bee body, I could only garner partial knowledge of honey bee worlds. The challenge of engagement with the bee also applies to representation: language as text, particularly the language of an academic thesis, cannot adequately represent honey bees. Representation in forms other than, or in collaboration with, written language is needed, to allow for different honey bee worlds to emerge.

1.1 The structure of the thesis

This thesis is an experiment in how to centre the honey bee in fieldwork and how to represent the outcomes of such research in text. As such, both the structure of the thesis and the writing within chapters are experimental. The structure of this thesis is unusual in that the following chapter is an empirical chapter, rather than a theoretical or literature chapter. This chapter, titled, "Coming to Know the Honey bee through Apiculture in New Zealand", provides what I call a conventional account of honey bees, i.e. a history of apiculture in New Zealand centred around the human experience of the

honey bee. This kind of material is what is often presented as background or context, but I interpret it as one representation of the honey bee.

I begin with a standard account of the honey bee in New Zealand to provide an initial point of contrast for the different accounts that will come. Contrasting representations with this chapter show the limits of the industry account of honey bees: such accounts cast the honey bee as a comparatively unproblematic collaborator in processes defined by the beekeeper. The bee is represented as having limited agency, where what agency it has (as a worker producing honey and pollinating crops) is harnessed by humans to meet their desires. However, the honey bee is not simply a pacified insect, working with and for humans. To examine what more can be known about honey bee worlds I open up and explore these questions of agency and representation in the chapters which follow.

In Chapter Three I outline and discuss the theoretical ideas I use in this thesis, in particular multispecies theory, assemblage theory and Actor Network theory. I use ideas from these theories because they allow me to view multispecies worlds by understanding all beings and matter as equally important as potential agents in the world.

Chapter Four presents my methodological approach, which entails tracing honey bee assemblages in participant observation and autoethnography. The following three chapters present alternative honey bee narratives based on this methodology. In these chapters I examine honey bee agency, how it can be viewed, and show how it might be presented in bee-centred ethnography.

Chapter Five details honey production through two distinct but interlinked networks, that of the honey bee and that of the human beekeeper. In this chapter I deploy concepts from Actor Network Theory to describe the different elements that

constitute the different networks. The first network describes the entanglement of plant and honey bee that initiates the process of creating honey for the achievement of each being's reproduction. The second network is described from the perspective of the human beekeeper, who aims to harness the honey bee colony to collect honey. I trace these two networks to begin to privilege the insect within ethnography and to highlight its existence and action beyond its entanglement with humans.

Chapter Six describes the seasonality of honey bee life, illustrating that neither the hive nor the bee is stable, but transforms throughout the year. It makes visible the multiple actors with whom the bee and the hive engage over time, and, through showing when and how bees and humans do interact, it points to the asymmetry of that relationship, and that the human is peripheral to much of bee life. It shows relations of competition and relations of collaboration, illustrating the messy, lively nature of honey bee networks where multiple desires intersect. This account emerges from my practices of beekeeping, where I came to know bees as a responsible carer and a co-participant in honey production, as well as an interested researcher. This knowledge was embodied, and as such this chapter reflects my sensory experiences of the apiary, including the smell of beeswax and the taste of honey.

The final chapter of the thesis, "Swarm", aims to represent honey bee action from bee point of view. A swarm event is when honey bees leave their original hive in order to find a better space for their colony. It is an aspect of honey bee behaviour which has multiple meanings for different beings. From the bee point of view swarming is a positive act: they swarm in order to survive when they do not have sufficient space within their existing hive. From the human point of view swarming is more negative: a nuisance for a beekeeper losing their bees, and a potentially frightening incident for someone who encounters a swarm. In this chapter I use poetry to present the swarm event from the perspective of the honey bee, to further decentre the human and show what different kinds of writing can reveal about honey bee worlds.

1.2 How to read this thesis

My textual representation of the honey bee entailed experimenting with different narrative forms, including creating hybrid bee-human narrators, poetic narrative, and presenting sensory details of honey bee life, such as images, video and audio. In this thesis, the meaning of text is more-than-language, by which I mean, the visual shape of the individual and grouped words, as well as the punctuation that organises words gives meaning. To achieve this I have used different fonts to represent different data. Aside from direct quotes from participants, which are embedded in the text, I share my own experiences in the form of field notes. These pieces of writing are presented in the '*Lucida Handwriting*' font, which visually represents the notes written by my hand during fieldwork. Fieldnotes are indented and dated to demarcate them from the main body text.

The writing which aims to capture the bee-perspective, what I term 'bee writing', is presented in a font called 'Beehives are sticky'. I chose this font because it looks less rigid and uniform than the font used for the body of the text. Additionally, these pieces of writing do not follow the rules of punctuation and grammar. In other words, the sentence length relates to the feeling I wanted to create in text; a shorter sentence might represent clipped, quick action. I also narrate an encounter with honey bees from the perspective of a beekeeper, and for this I use another font, '*Segoe print*', to signal that it is a change in narration. In the final empirical chapter, 'Swarm', I have written a poetic representation of honey bees in a swarm. This is presented in 'Calibri' font, but it is a distinct shape to the main text. I chose to present this piece of writing, which describes a dancing bee and the interpretation of her dance, in poetry to disturb the formality of the main text language and try to capture a feeling of movement.

1.3 Companion materials

This thesis is inspired and informed by the hum and movement of the honey bee. I tried to capture sensory aspects of my engagement with honey bees in audio and video recordings as well as pictures, taken during my fieldwork and taken from

beekeepers who have published these materials online. I have created a blog to hold these materials, which is meant to be read alongside the written document. The blog can be found at this address: jluttrellmassey.blogspot.com. In order to access the online resources there will be signals in the text to direct the reader to the blog content when they are linked to the text. A number in square brackets, **[X]**, will represent the cue to refer to the blog. All links were functioning at the time of thesis submission; however, it is possible that videos in particular may become unavailable over time.

I present these materials to show my performative, experiential engagement with honey bees in the apiary, which involved noticing sights and sounds which are not aptly captured in written form. These are examples of the way that the honey bee itself inspires this thesis, but it also shows that this is one take or representation of honey bees. Additionally, these materials show that the honey bee acts: that the honey bee experiences and communicates about its environment, and does not rely on a human to write about it in order for honey bee worlds to be known.

2. Coming to know the Honey bee through Apiculture in New Zealand

In this chapter I present a standard account of the apiculture industry of New Zealand, from the historical development of industry to the current mānuka boom. This account is the conventional way of knowing the honey bee. It contributes an understanding of the honey bee as a productive, domesticated insect, but it is only one possible way of knowing and representing the honey bee. This chapter illustrates the limitations of knowing the honey bee in this way, specifically that through this human-centric framing the bee is known as something kept, to be managed, cared for, and made unproblematic. I then present four alternative accounts of beekeeping, each of which challenges the standard honey bee narrative and shows that more can be said for, and by, the honey bee. I do this to begin to open up the question of honey bee agency.

2.1 The history of beekeeping in New Zealand

The honey bee was introduced to New Zealand in the late 1830s, and the practice of keeping bees within hives was taken up as a hobby until the introduction of a specific style of hive that had moveable parts, which allowed honey and other hive products to be removed. This enabled the emergence of a beekeeping industry in New Zealand. The beekeeping industry, made of hobbyist and commercial beekeepers with various styles and philosophies, was transformed by the identification of antibacterial properties in a honey made from the mānuka bush. Mānuka honey, once the last pick of New Zealanders, became a high value crop which also utilised marginal farm land. The honey bee is an important insect in apicultural and horticultural production, valued for its production of honey, beeswax, pollen and propolis, and also for its role as a pollinator of terrestrial plants. As a pollinator, the honey bee serves the horticulture industry, enabling crops such as kiwifruit, which have export value to the New Zealand economy.

2.2 *Apis mellifera* in New Zealand

The European honey bee, known also as *Apis mellifera*, meaning 'honey bearing bee', is a small golden-yellow and black-striped flying insect which lives in colonies of tens of thousands of bees. Colonies are made of mostly female bees, which are organised by caste. There is a single fertile female, the queen bee, who is larger than others and has a shiny, slightly darker abdomen without striping. The remaining females are called worker bees, and they perform various tasks within the hive depending on how old they are. **[2]** Newly hatched workers will be tasked with cleaning the hive, older bees will work as nurse bees, caring for and feeding others, and the oldest workers forage outside the hive for nectar and pollen. There are males within the colony, called drones, who provide genetic material to the queen bees of other hives in mating, which occurs once in the queen's lifetime. A newly hatched queen is a virgin, and leaves the colony within the first weeks of her life to mate. She does so only a couple of times, until she has all of the genetic material needed to fertilise all eggs she will lay in her lifetime (Matheson & Reid, 2011).

Each honey bee performs a role within the hive for the purpose of growing and feeding the population within it. Foraging honey bees provide food and building material for the hive. Foraging is the collection of nectar and pollen from flowering plants. The collected material is taken back to the hive, and stored within the cells of the hive and used to make different kinds of food. One form of food is 'bee bread', which is a mix of pollen and nectar that has been fermented. Another is honey, which is created by 'ripening' nectar, which involves removing the water and altering the sugars (Matheson and Reid, 2011). Aside from being a food source, honey is consumed by bees to produce wax, which is used to make comb, the main building material of the hive. In their foraging, the honey bees perform pollination, which is the process of transferring pollen, the sexual material of plants necessary for reproduction, from one plant to another. Foraging involves the collection and transfer of materials which contribute to the hive, but also enables the proliferation of many plant species and has led to the domestication and spread of *Apis mellifera.*

Apis mellifera was introduced to New Zealand in the late 1830s. The species was brought to Hokianga Harbour from England by Mary Bumby in 1839 (Matheson and Reid, 2011). A number of settlers also brought the European honey bee to New Zealand in following years, including Reverend William Cotton, who wrote in 1842 that bees should be introduced "to confer on the natives of New Zealand the pleasure and profits of bees of their own" (Gillingham, 2008) Later, it was recognised that *Apis* mellifera was key for the pollination of an important introduced pasture crop, white clover. Thus, the introduction of the honey bee was for the pleasure of beekeeping and eating of honey, as well as the pollination of introduced plants.

The introduced honey bees were kept in the backyards of beekeepers on a small scale. Large scale production of honey restricted by the type of hive available for us at the time, such as straw skeps or wooden boxes, as they made collecting comb difficult. It was the invention of a new type of hive, created by an American L. L. Langstroth in 1851 and introduced to New Zealand in 1876 that made the collection of honey for profit possible (Matheson & Reid, 2011, p. 27; Tsing, 1995, p. 124). The design of the Langstroth hive is based on the idea of bee space, which is the amount of space a bee leaves itself for moving in the hive while filling the surplus with comb (Matheson & Reid, 2011). Using measurements to create the optimum space for bees means that they can more efficiently produce brood to increase hive size, and therefore have more workers producing honey. Collection of honey is also made easier by creating hive units that can be removed and replaced with little interruption to the productivity of the hive (Matheson & Reid, 2011). The Langstroth hive enabled beekeepers more control over the bees and the products made within hives.

2.3 Knowing the honey bee through beekeeping

Beekeeping, or apiculture, is the husbandry of honey bees, usually *Apis mellifera*, which are kept within hives. Beekeepers apply an understanding of the biology and behaviour of bees in order to harness their labour and mitigate pest and disease which

threaten the species. Specific tools and equipment aid beekeepers in this, including protective clothing and chemical treatments. In New Zealand, the European honey bee is most common in beekeeping, usually either the Italian or Carniolan bee subspecies, which are considered docile and thus easy to handle (Matheson & Reid, 2011, p. 45). There are other subspecies of honey bee, like the Africanised honey bee, which might also be kept in hives. The documentary *More Than Honey* (Imhoof, 2012) interviews a beekeeper in the United States of America who collects the unwanted, aggressive Africanised honey bee, valuing the characteristics which made others fearful of the species (Tsing, 1995). The Africanised honey bee, which is a hybrid of *Apis mellifera,* is known to have an aggressive nature, which makes it difficult to work with, but it is also thought to be better at resisting and managing the pests and diseases that afflict bees and beekeepers. One participant, a commercial beekeeper, remarked on behaviour and preference:

> "there is a darker variety that is particularly aggressive. So you try and breed any aggressive queen or hive out of the business. Before the Carniolan bee came in, it was the Italian bee, the yellow bee, that's generally used for breeding queens because they're a lot more docile. But yeah, a darker colour bee is definitely more aggressive"

Beekeepers prefer certain bees depending on their behavioural characteristics, such as being easier to handle like the Italian Carniolan, being prolific honey producers, or resisting pests through genetics or more aggressive cleaning behaviours[1] **[3]**. Aggression is often 'bred out', by killing the queen of an aggressive hive and replacing it with a queen who is more docile.

The reasons for keeping bees are varied. Participants in this study noted some reasons for becoming beekeepers, such as being interested in bees, feeling a need to contribute to strengthening or protecting the species, an interest in where food comes from, or wanting to make honey, and as a means of making money. Beekeeping in New Zealand is becoming increasingly popular. The most recent *Annual Apiculture Report*,

[1] Honey bees groom by licking and using their legs to scrape their bodies (Matheson & Reid, 2011)

undertaken by the Ministry for Primary Industries (MPI) (2017a) notes an increase in registered beekeeping enterprises by 21%, from 5551 to 6735 from 2015 to 2016.There are two different types of beekeeping, domestic or hobbyist, and commercial. Hobbyist beekeepers are defined as those with less than 50 hives, and commercial beekeepers are defined as having more than 350 hives, for whom it is their source of income (Ministry for Primary Industries, 2017a). Beekeepers that operate between 50 and 350 hives might be considered part time, or small scale commercial beekeepers. There are a range of styles for operating as a beekeeper, so while definitions of beekeeper type serve to understand scales of beekeeping and address the subsequent differences in concerns, some beekeepers don't fit neatly within these two categories. One participant beekeeper fits the definition of hobbyist in terms of the number of hives he has, but he earns money from offering advisory services and some equipment. Another distinction was made in 2015 by the National Beekeepers Association, now Apiculture New Zealand, who coined the term 'Mega Commercial' to describe a business with more than 3000 hives (Ministry for Primary Industries, 2017a).

2.4 Knowing the honey bee through the apiculture industry

There are varying scales and ways to capture profit from bees, including the honey, pollen, and beeswax produced by honey bees in hives, the pollination foraging bees provide, and the bees as stock themselves. There are consulting services, beekeeping equipment, treatments and even hive rental. The knowledge of beekeeping itself is capitalised on in the form of written guides, presented tutorials, and social media. These are all aspects of the apiculture industry of New Zealand. The two that I will focus on are the production of honey and the honey bee as a pollinator.

The honey bee was domesticated for its ability to make honey. Following its introduction to New Zealand, the Langstroth hive made the collection of honey for profit possible. Beekeeping innovations made handling bees and harvesting hive products easier. The honey bee itself changed; the species developed a larger exoskeleton (enabling the carrying of more nectar and pollen and flights of longer

distances), bees are bred to be more docile (so that they can be more easily handled. Queen bees are eliminated if they are aggressive), and they hibernate for shorter periods (hibernating bees don't make honey or pollinate crops) (Kosek, 2010). In New Zealand, the discovery of antibacterial properties in honey made from the nectar of the mānuka bush, changed the economic potential of the honey bee (Van Eaton, 2014).

> "New Zealand might not be the biggest supplier of honey by volume, but this value comes from mānuka. The quality of mānuka, given its desirable abilities in food and medicine application, makes it valuable" Jo Goodhew, Minister of Food Safety for the Ministry of Primary Industries, Apiculture New Zealand conference, 20 June 2016, Apiculture New Zealand Conference, Rotorua

The current value of mānuka honey ranges from NZD $12 per kilogram of honey, to NZD$148 per kilogram of honey, based on price paid to beekeepers for bulk honey (Ministry for Primary Industries, 2017a). In supermarkets and online retailers mānuka honey can cost up to NZD $82 per kilogram. *Consumer* magazine compares the cost of mānuka honey to champagne: "A 500g jar of mānuka honey. At $73, the jar we picked up from the supermarket was $5 more than a bottle of Piper-Heidsieck and $8 more than Veuve Clicquot." (Harrison, 2014). The wholesale and retail price of this honey depends on the status of the mānuka as monofloral (containing only mānuka) or multifloral (in combination with other types of honey). This is detected through laboratory testing for pollen and chemical indicators of the plant. The value of the honey is also dependent on measures of 'strength' or 'quality' of the honey, the most common grading system is UMF or Unique Mānuka Factor, which is a rating based on the amount and stability of the chemical compound Methylgloxal (Ministry for Primary Industries, 2017a; Peters & Harman, 2017). Other single-source honeys such as Clover, Rewa Rewa, and Pohutukawa, are graded on the colour of the honey and priced between NZD$8 per kilogram to NZD$14 per kilogram, as paid to beekeepers for their bulk honey. The retail values of these types of honey are around $25 per kilogram.

Honey bees are important pollinators of terrestrial plants in New Zealand (Newstrom-Lloyd, 2013). As it forages on a flowering plant, the honey bee collects pollen on its body and transfers it to the next plant it visits (Matheson & Reid, 2011). Renting hives to sites in need of pollination, such as kiwifruit orchards, is a source of income for beekeeping enterprises, with the Annual Apiculture Report noting the price per hive for pollination services ranges from NZD$60 to NZD$400 (Ministry for Primary Industries, 2017a). MPI also reports that the demand for pollination services has increased in 2016 with growth from the horticulture sector, however "there is reluctance by several beekeepers to supply hives for pollination, particularly amongst the corporate beekeepers who do not see pollination services as part of their core business" (2017a, p. 8). Landcare Research Associate Linda Newstrom-Lloyd researches pollination in New Zealand and explains that the honey bee is relied upon in New Zealand for its pollination of many of the commercial crops grown here including pasture legumes (Newstrom-Lloyd, 2013). She explains that this dependency increases the vulnerability of managed honey bees to four major threats: "diseases, pesticides, a limited genetic base for breeding varroa-resistant bees, and declining floral resources" (Newstrom-Lloyd, 2013, p. 408). Varroa, a parasitic mite that infests the colony was found in New Zealand in 2000 (Matheson & Reid, 2011). Varroa mites feed on larvae, transferring disease. Breeding varroa resistant bees is one avenue for addressing the issues associated with the parasite. Other pollinators, such as the bumble bee, are being investigated for managed pollination services to mitigate the risk of dependency on honey bees as pollinators.

2.5 Knowing the honey bee through research

Threats to the honey bee are threats to apiculture and horticulture, so there is considerable scientific research into how to solve these particular problems. The major threats are threats to the health of the bee, caused by pests and disease. Knowing the honey bee through research highlights a particular set of problems and concerns, which science aims to solve. Humans seek to know the honey bee in this way so that the bee can be managed to continue to provide products and services.

2.5.1 Honey bee health

A key area of research about honey bees and beekeeping is the prevention and treatment of pest and disease. In New Zealand there have not been reported cases of Colony Collapse Disorder (CCD) which is a term used to describe unexplained large scale colony loss (Matheson & Reid, 2011, p. 176). However, there are a number of other pests and diseases which do afflict bees here. The two which concern beekeepers most are the parasitic Varroa mite, which attaches itself to bee larvae and is a vector for harmful bee viruses and American Foul Brood (AFB), which is disease caused by bacterium (Matheson & Reid, 2011). The Varroa mite is a pervasive pest in New Zealand but it can be managed with a variety of treatments. AFB is a highly transmittable and untreatable disease, and New Zealand beekeepers must destroy any hives that become infected. It is also mandatory for beekeepers to conduct, or hire someone to conduct, an annual disease check. The concerns for honey bee health have led to research being conducted in the form of a Colony Loss Survey (COLOSS), which collected information about colony failures to evaluate bee health, and a Bee Pathogen Programme initiated by the Ministry for Primary Industries to identify honey bee diseases and parasites in New Zealand (Ministry for Primary Industries, 2017a, p. 12). The Apiculture Industry allocate resources for research to support the honey bee population in New Zealand.

2.5.2 Honey bee behaviour

To study the honey bee, its environment is either simulated within a laboratory or aspects of its environment are controlled for observation in apiaries. An example of this is the simulation of nectar sites in the experiments of Karl von Frisch, who studied dance communication. In von Frisch's studies, feeding stations were set up and bees were followed and observed in their foraging journey (Crist, 2004; von Frisch, 1967). Some studies have been conducted in simulated environments in laboratories, such as the work of Biologist Thomas Seeley to understand how bees judge a source of nectar as worth reporting to the hive (1994). Observation hives, which are frames of bees with a glass exterior for viewing the bees inside, were used to view the ways bees

communicated about feeding stations the researchers set up for the experiment (Seeley, 1994, p. 52). This study viewed the behaviour of the bee as an individual when foraging, and as an agent of the colony. Another study, aiming to understand pheromone communication between the honey bee guarding behaviours at the nest entrance, studied individual bee behaviour alongside its impact on the collective hive (Nouvian, Reinhard, & Giurfa, 2016). In order to study the impact of deformed wing virus (DWV), a disease which stunts the growth of the wings of bees (Matheson & Reid, 2011), on foraging behaviour and survival, bees were tracked with radio-frequency identification (RFID) technology (Benaets et al., 2017). Honey bees were infected with the disease and their foraging behaviour studied against that of a healthy bee. Studying the honey bee commonly involves creating or altering the environments of honey bees, rather than studying them in their 'natural' environments, , and honing in on behaviours or events in bee life which are important to humans.

2.5.3 Defining mānuka honey

The 2016 MPI Annual Apiculture Report notes that another key concern for industry is the standard and labelling of mānuka honey, (Ministry for Primary Industries, 2017a). This was also an area of interest at the 2016 Apiculture Conference in Rotorua, where a standard definition of mānuka was promoted as an important part of protecting the reputation of the New Zealand honey brand, which is known as an authentic, safe, trusted and sustainable product (fieldnotes, 20 June, 2016). This has been a focus of research within the industry over the last few years, with the issuing of a Mānuka Labelling Guide by MPI (2014), and culminating in a definition of the characteristics of mānuka in 2017. The definition identifies key characteristics of mānuka honey, including the genetic markers of the plant, pollen and chemical compounds in the honey, Leptosperin, Dihydroxyacetone and Methylglyoxal (Peters & Harman, 2017). The creation of a standard definition is designed to overcome the variability present in quality testing methods currently used in the industry. This is a means for the industry to protect the high value and status of mānuka by defining it as a product unique to New Zealand and providing quality assurance.

I have presented an account of the honey bee as a domesticated insect which provides the basis for the practice and industry of beekeeping. Apiculture in New Zealand revolves around the capacity of honey bees to produce hive products and provide the service of pollination. The honey bee is a producer and a provider, with its potential is harnessed by the human. The beekeeper houses honey bees in hives, tended to with tools and processes designed to aid the honey bee as a productive insect, and to make it possible to extract the fruits of its labours. The industry concerns and regulations are for the sustainability of the honey bee as a producer; how to manage pest and disease, and also how to produce higher quantities of a high value honey crop. The honey bee is a critical part of the process, and scientific research and the apiculture industry aim to make it pliable: the honey bee is an object for human use, and its agency is harnessed and limited to fulfil human desires.

2.6 Knowing the honey bee through alternative social science accounts

More recently, social science has considered different accounts of honey bees, which attend to the agency of honey bees as more-than-honey-producers. The accounts that follow contrast with a presentation of the productive honey bee in that they view the honey bee as an agent, and undertake research that centres the bee methodologically, studying bees less unnaturally, either modifying the bee nor it's environment in order to undertake research. These accounts explore the multiple worlds of lively, wild bees and seek to interpret the ways in which the insects experience and communicate about their worlds.

Anna Lowenhaupt Tsing writes about domestic animals and their relationship with humans, with specific reference to the honey bee. Tsing explains that *Apis mellifera*, the European honey bee species commonly used in beekeeping, is held in the minds of Americans as "emblematic of domesticity" (Tsing, 1995, p. 115). That the honey bee dwelled within a hive, with a queen fixed there for her lifespan and seeding new generations of workers, the production and storage of honey, pollen and beeswax to sustain the colony, all spoke to an ideal of domesticity. She writes, "The biggest problem with bees, as far as domestic-minded people are concerned, is their

independence" (Tsing, 1995, p. 120). Here, she explains that the harmonious beekeeping that seems to mirror ideals of family, home and productivity, is really a practice where no matter what the beekeeper intends, there are a variety of ways the bee can work against them. Swarming from the hive is one example employed by Tsing to illustrate this. In pointing out the tension between the symbolism of the bee as a domesticated insect and the bee as an agent refusing human expectations, Tsing shows that giving more attention to bee worlds gives a fuller picture of the co-existence of human and honey bee. This co-existence is more complicated and contested than the seemingly reciprocal creation and collection of honey and pollination of plant life.

In an investigation into bee worlds, sociologists Mary Kosut and Lisa Jean Moore, undertook ethnographic research on urban beekeeping in New York City (Moore & Kosut, 2013, 2014). Kosut and Moore challenge the standard conception of the honey bee as producer of honey and agent of pollination, dependent on the human for survival, explaining that:

> "Bee colonies are networks made by the bees; they intra-act with the human world, yet they are sustainable without human intervention…They create all they need from their environments and grow their own homes through producing beeswax made from secretions from their abdomen. They design living spaces of hexagonal cells that are multi-purposed – used continuously for reproduction and storing honey" (Moore & Kosut, 2014, p. 2).

The authors take the honey bee seriously as an non-human informant in their work (Moore & Kosut, 2014, p. 3). The result is a consideration of the way that we come to know about honey bees through the observations of others. The bee worlds that the authors first learned about were created and translated by human participants. As they became more knowledgeable and spent more time around bees, Kosut and Moore (2013, 2014) saw that the honey bee communicated about bee worlds, filling out the information garnered through human observation. The honey bee is not a

passive object of study, but an actor in a network, sharing knowledge of itself (Moore & Kosut, 2014). The authors acknowledge that collaborating with honey bees in ethnography is partial: they didn't claim to know how to interpret bee communication or that their interactions with bees were reciprocated or even noticed (Moore & Kosut, 2013), but attending to the honey bee as a participant in research as opposed to a passive subject of research meant that the honey bee was not limited to the dominant industry-centric representation.

In a similar vein, Ginn and Green (2014) explore the tension between species in human-honey bee meetings. Ginn and Green (2014) interviewed beekeepers who reject standard beekeeping practices. These beekeepers practice alternative apiculture based on principles of biodynamic agriculture as put forth by Richard Steiner. This practice of beekeeping views honey as 'sacred' and 'medicinal', consumed only in small amounts for specific purposes and bees are kept in hives made from natural materials, such as dung and straw, which aren't made for observation or the collection of honey or beeswax (Green & Ginn, 2014, p. 155). This approach is based on the consideration of how beekeeping might distress and disrupt honey bees. Green and Ginn (2014) use Judith Butler's concept of vulnerability as a shared condition to explore the approach of alternative apiculturists to the relationship between honey bee and beekeeper. Concerned that traditional methods of beekeeping are exploitative, these beekeepers consider reciprocity in beekeeping. Honey and venom are examples of bee-products which are exchanged between bee and human. Honey is viewed as a gift to beekeepers, but the bee doesn't give it willingly, and the exchange of venom is painful for both bee and human, and results in the death of the honey bee. The alternative beekeepers interviewed by the authors view the pain of the sting and venom as a reminder not to take the gift of honey for granted (Green & Ginn, 2014). Recognising the vulnerability of the bee, and making oneself vulnerable to the bee, is a way for these apiculturists to achieve a more ethical interaction with bees. Green and Ginn (2014) present a beekeeping that strongly opposes the traditional treatment and presentation of the honey bee as simply a pollinator and producer of honey and

beeswax. They also show aspects of the relationship between human and honey bee which are not always pleasant or reciprocal.

Another example of alternative accounts of bee worlds comes from the thesis of Geographer Roseanna Spiers (2014). In her thesis, Spiers challenges the popular honey bee context as presented by and within the New Zealand beekeeping world and industry. She writes, “Bees emerge from these narratives as a passive species under attack; at best threatened, at worst endangered and dependent on human intervention for survival” (Spiers, 2014, p. 12). Instead Spiers argues that this representation of honey bees be understood as partial and situated, and aims herself to present another which captures the diversity and nuance of the New Zealand honey bee. Spiers’ representation of the hive is a “risky co-fabrication”, the creation of intra-active agents: honey bees, humans, materials, climate and more (Spiers, 2014, p. 24). The interactions of these agents are not always straightforward. As in the other accounts of apiculture, Spiers speaks to the autonomy of the honey bee, writing about the use of standardised measurements for hive frames: “This exemplifies practices of human mastery of nature in the hive. Yet the bees resist and subvert imposed hive measurement. In colonizing the hive humans have not suppressed all ‘menacing’ insect performances. Bees will construct burr comb between frames (especially if they are not evenly spaced), fill crevices and cement frames to boxes with propolis, and form drone and irregularly shaped queen raising cells” (Spiers, 2014, p. 26). In this case the resistance of the honey bee further illustrates that popular accounts of the honey bee and beekeeping are partial.

These are four key social science musings on the world of the honey bee. I present these as examples of challenges to standard representations of the honey bee as a compliant productive insect, industriously making honey for humans to collect, package and either eat or sell. More than that, the honey bee is a part of a larger story, which includes the human, but with many more beings, materials, and challenges.

These accounts of the honey bee present what a human-centric representation might miss.

2.7 Conclusion

I have presented one representation of the honey bee, which I consider the normative view, where the honey bee is seen as providing services and creating products for agriculture. The value of the honey bee is calculated from the reliance we have on the bee in its role as a pollinator, and the profit to be gained through marketization of honey, especially mānuka. The history of the honey bee and beekeeping in New Zealand, the creation of industry and the change that the antibacterial properties of mānuka honey brought to it, as well as research conducted in the industry over recent years, is based around the protection of the productive bee, and ensuring confidence in and the value of high value mānuka honey in New Zealand. The productive honey bee is an important honey bee to New Zealand, and understanding the honey bee in this way allows for apiarian potentials to be recognised and harnessed, but the productive honey bee is a product of human desire. The productive honey bee is framed within manipulations of beekeepers and the definitions of industry. Alternative accounts of apiculture, such as those visited above, view the honey bee differently. Each aims to challenge the standard representation of the bee, seeing it as an unruly agent in its behaviours and its interactions. The apiary is not a space for beekeeping, but for bees. It is a site for honey bee worlds which don't always involve human beekeepers. Sometimes the honey bee doesn't collect mānuka. Sometimes the bees need more than what their hive provides, and they abscond. Sometimes bees aren't productive. In viewing the honey bee only as a pollinator and producer of hive productions to be harnessed in apiculture, it is easy to miss the complexities of collaboration, or to reduce the honey bee to a compliant companion insect.

3. Theoretical approach

In this thesis I investigate honey bee worlds by centring the honey bee as an analytical category, guided by several key theoretical challenges to mainstream thinking in anthropology: undertaking ethnography with non-humans, as well as speaking for (or, in my case 'with') the non-human. These challenges are inspired by three theoretical approaches: multispecies, actor-networks, and assemblage theory. Each literature is inspired by theoretical viewpoints which recognise the non-human as a living being, active, and co-constitutive of its and human worlds. These allow me to challenge the human-centric notions of the honey bee and take seriously the transformative agency of the bee to determine its own lifeworlds and potentially shape the lifeworlds of those it encounters.

Chapter Two presented four alternative accounts of apiculture which contrast with standard presentations of the 'productive honey bee'. These alternative accounts are examples of multispecies theory. A multispecies approach does not privilege one being over another, instead recognising the world as created, experienced and communicated about by multiple beings, human as well as non-human. I draw on multispecies theory to privilege the honey bee in ethnography. Specifically, I view spaces which are traditionally considered 'human', like the home and garden, as spaces which contain multiple species. These spaces are sites for viewing complex multispecies relations. In viewing multispecies space, I also explore communication and boundaries between species. Multispecies theory drew my attention to the ways that the honey bee has been framed by human-centric concepts, for example that the honey bee is busy, making honey within a hive, or needing to be protected from pest and disease by beekeepers. A multispecies approach reframes the honey bee as an active participant, experiencing and communicating about the world in its own terms.

In addition to multispecies thinking, this thesis draws on assemblage thinking and actor-network theory (ANT) as theoretical frameworks for understanding and

representing the honey bee. Assemblage thinking argues that different species are just one kind of entity which contributes to making the world: materials, concepts and events matter too. Assemblage thinking is an approach that aims to capture the variability which exists in the arrangements which make the world and draws attention to the fact that worlds are not stable or guaranteed. Assemblage thinking demands "attentiveness to the transformative potential of the world" (Dewsbury, 2011, p. 152). The honey bee that is assembled is an active participant in world making, which it achieves through its relationships with other entities.

I also utilise ANT as a theoretical framework and descriptive methodological guide for the task of knowing and representing honey bee worlds. ANT describes how elements, termed 'actors', come together to form networks, which hold together for a time but are also fragile and contingent. I trace the networks of the honey bee within the apiary (bee space), describing the actors the honey bee meets, connects with, and disconnects with, as well as what these connections produce. ANT is useful, particularly the terminology it has for describing networks. However, it tends to limit itself to a description of single networks. In the apiary the honey bee is not working in only one network, and as such, I do not constrain this project to viewing one honey bee network. To view the particular relations of the honey bee to others, such as when the honey bee is enrolled in beekeeping (both commercial and non-commercial) and external influences which shape networks, I extend ANT with assemblage thinking. Both approaches help me to understand and present the honey bee world as constituted by diverse actors and relationships in which this world is emergent, contingent and uncertain, with the honey bee itself as a central actor.

I begin this chapter with an overview of multispecies thinking, a theoretical approach which sparked my initial interest in the honey bee. Following this, I detail assemblage thinking and actor-network theory, and discuss how they can be used together as tools for practicing multispecies ethnography with honey bees. I then explore multispecies

literature particular to the honey bee to contextualise my own work. I close this chapter by outlining how I understand and represent honey bees in this thesis.

3.1 Multispecies theory

During a postgraduate course on anthropological theory I learned about the 'multispecies turn' in anthropology. Multispecies theory argues for attentiveness to the multiple beings that make up the world. This approach critiques social theory which views non-human 'others', such as beings and matter, as simply resources for human thinking and use. Non-human others have agency and their own lives independent of humans. Multispecies approaches have explored how non-humans inhabit environments such as urban landscapes (Hinchliffe, Kearnes, Degen, & Whatmore, 2005), fringe or human-disturbed landscapes, such as the matsutake mushroom which thrives in marginal forest in the Pacific-Northwest of the United States of America and sites of radiation such as Hiroshima (Tsing, 2010, 2015), and also the environments which are closer to domestic human life, but might be taken for granted as sites of interspecies meetings, like the compost heap (Abrahamsson & Bertoni, 2014). What we learn from these studies is that spaces are lived in, experienced, and co-created by multiple species. Re-imagining spaces as places of multispecies meetings led me to reconsider where and how humans and honey bees meet. I investigated this through beekeeping – which I came to see as a meeting of human and non-human. I questioned how I knew the honey bee, and how representations of the honey bee had been created in beekeeping. This led me to ask how the honey bee interprets and communicates about bee space, and how I can understand this form of communication. I turned to Eduardo Kohn's (2013) usage of Peircean semiotics[2] as a framework for understanding non-human communication which has been key to my thinking about and presentation of the honey bee in this research (Kohn, 2007, 2013). I also draw on examples of human-animal ethnography in social science to situate this thesis within the context of multispecies theory.

[2] Charles Peirce's theory of signs is a typology which defines three categories of sign (icon, index and symbol) (Deledalle, 2001; Kohn, 2013)

Donna Haraway is called upon often for her work about the ways that beings are entangled in the world. The underlying idea of her work is that realities are co-created (Haraway, 2003, 2010). She focuses on beings which come together for mutually satisfying ends, such as the dog and dog trainer which become attuned to one another through the process of learning and teaching behaviour and rules (Haraway, 2003). The dog and human are understood as 'companion species' (Haraway, 2003, 2006). Haraway's work is important for understanding how different beings come together, for example, the reasons behind the human meeting the bee in the practice of beekeeping, and then considering the inverse of a human-initiated relationship. How might the honey bee utilise the human? In a similar vein, Michael Pollan writes a 'plants-eye view of the world', arguing that it is the desires of all beings that causes things to happen in the world (Pollan, 2003). This perspective doesn't favour one being or species over another. Instead, it calls for an examination of all components of an effect, and understands how the effect came to happen based on the desires of the beings that contribute. Pollan challenges his reader to consider the role of the plant, or the honey bee, in the production of fruit where it once was thought to be the work of the orchardist. These examples of multispecies approaches illustrate ways of thinking about and with non-human beings and assert that they should not be confined to human frameworks of description, such as language. Informed by these multispecies theorists, I agree that there needs to be space for a honey bee to be other than what I might think of it. When I examined human/honey bee relating, including how I relate to the bee myself, I considered the imposition of human assumptions and the capacity of the honey bee to act in ways other than what I expected.

Eduardo Kohn explores the ways that different species relate in the Ecuadorian Amazon including the Runa people, their dogs, and animals in the forest (Kohn, 2007, 2013). Humans are not always involved in these relationships, and if they are, they are not always at the centre of the scene. Kohn argues for the decentring of the human, specifically he asserts that non-humans interpret and communicate about their surroundings, just not in the same symbolic form as that of humans: "My claim, in

short, is that an anthropology beyond the human can rethink relationality by seeing it as semiotic but not always and necessarily languagelike" (Kohn, 2013, p. 84). A framework based on the work of linguist Charles Peirce is used by Kohn for understanding forms of communication. Language, Kohn explains, is communication based on symbols which connect things which would not usually be connected (Kohn, 2013). A word is a symbol of its meaning, linked arbitrarily by the system of language. Non-humans, by comparison, communicate through icons and indices. My understanding of iconic and indexical communication is informed by my experience with honey bees, and so examples of icons and indices are from this context. An icon is a sign that shares a likeness with what it represents, for example, facial expressions: a frowning face representing displeasure. There are also words that are icons, such as the representation of sound in onomatopoeia: "buzz". Indices are signs which are in some way affected by or otherwise correlated with what they represent, such as the pheromone a queen bee emits to attract a male drone in mating, or the smoke a beekeeper applies at the hive entrance signalling a fire to the bees. The pheromone is a sign of readiness to mate and an attractant to the male required in mating. The smoke is a danger itself as well as an inference of danger. While these examples demonstrate non-human indexical communication, humans interpret indices as well. A human may recognise a cluster of bees moving to and fro on the surface of the beehive as a sign that they are too hot. Conversely, when a human stands too close to the entrance of a hive, a guarding bee might surmise that it is an intruder and attack. Indexical communication is used and interpreted by both non-humans and humans, and as such, it is how understanding is reached between species.

Undertaking multispecies ethnography involves considering the boundaries between researcher and participant, such as different modes of communication and physical characteristics. How do you explore relationality with another being in a way that gives that being the room to be, as well as change, as it would without your presence? Matei Candea writes about these considerations when working with the Kalahari Meerkat Programme (KMP) researchers and Meerkat subjects (2010). Candea undertook participant observation with both human and animal participants, viewing the ways

that they interact in the specific context of a research site. The researchers aimed to disappear into the scenery of the Meerkat habitat because they wanted to observe without interfering with the animals, in other words, they maintained the boundaries between human and meerkat. This meant that they sought detachment as opposed to engagement, as in the work of Haraway. Another point of difference between Candea's meerkats and Haraway's companion dog, is that meerkats are wild, undomesticated mammals that reside in family groups, and as such, the boundaries between species are quite different to that of a human training a dog, which is a domesticated, companion animal that lives with humans. What Candea's work tells us is that the human desire to engage with another being is not necessarily shared, and engagement can be an imposition on the non-human. This sets up an ethics which considers that it might be better not to engage. Ethical engagement with non-human others requires a consideration of boundaries and questions human desire for connection (Candea, 2010, p. 254).

The relationship between KMP researchers and Meerkats draws attention to the different kinds of human-animal relationships, and the consideration of meetings which do not involve reciprocation or closeness (Candea, 2010). Franklin Ginn (2014) criticises the focus of animal studies on positive relationships with likeable others, such as dogs and cats, and instead looks into human relationships with the less likeable non-human, such as insects or viruses. Ginn argues that Haraway's multispecies approach, while attempting to open the discussion to include all beings, excludes the less harmonious encounters that occur. Ginn states that in the multispecies world, encounters are not always about relating or engaging. At times species meet and do not relate or engage with each other, but withdraw and disconnect. The result of a meeting of beings is not necessarily positive or productive. This was the key idea in Ginn's study of the meeting of human gardeners and slugs. The two beings shared garden space, but the former did not welcome the latter. The human-garden space was threatened by the slug that desired the plants growing there. As such, Ginn's gardener participants practiced detachment when they killed the slugs who they considered invaders, viewing slug death as necessary and justified. In presenting this

multispecies encounter Ginn (2014) shows that there has been a bias in the literature towards studying non-humans that are beneficial to humans, or pleasant to look at or be with. There are also awkward encounters, which might end badly for one or both parties. I found this work useful for thinking about interactions with honey bees. It was a reminder not to assume that my meetings with bees were equal, positive, or wanted by the honey bee. I might be interrupting the colony, damaging the nest, or even killing bees. The honey bees I watch at the hive entrance might not pay me any attention, the encounter might be one-sided. Meetings of different species are not symmetrical in the reasons for initiation or what is created as a result of said meetings.

Multispecies theory reimagines the world as a space for thinking and being with the non-human, in opposition to human-centred conceptualisations of the world. Proponents of this approach have explored how beings communicate and relate to one another in space, as well as how this space is habituated, contested and negotiated. This approach informed my aim to centre the honey bee in this thesis. However, the honey bee did not fit easily into the mould of 'multispecies participant' as a companion bee, reciprocating the attention given to it by human researcher. Authors of multispecies literature which focus on the encounters which are unwanted, awkward, or have the potential to cause harm, better capture the asymmetry of encounters in practice. The world is experienced and communicated about by many beings, but this is hardly ever a harmonious co-habitation. Following a multispecies approach, I came to know the honey bee through encounters which were painful (stings), one-sided (observation at the hive), and more dangerous for the honey bee.

3.2 Assemblage thinking and actor-network theory

Multispecies thinking draws attention to the non-humans which compose, experience and communicate about the world, raising the methodological question of what kind of research can be conducted, and how these theoretical ideas can be applied in practice. Doing ethnography differently requires tools for understanding how the world is co-created by non-humans. Assemblage thinking and actor-network theory

provide operational methods for exploring networks and systematically understanding what is happening in them. Both approaches describe the multiple, heterogenous elements which come together for a time to form networks. In ethnography, actor-network theory provides a framework for identifying, describing and thinking with the elements and the wholes they form. As such, I utilise ANT as a method for investigating honey bee worlds. However, as a theory it is purely descriptive and confines its analysis to the network it is focusing on. In contrast, assemblage thinking considers the history of the actors, in other words, an actor is changed by engagement in networks, and these changes are carried through in future networks, shaping them accordingly. This illustrates that actors and the networks they are enrolled in are specific and always in process.

3.2.1 Actor-network theory

Actor-Network Theory (ANT) is a theoretical approach which focuses on the connections made between individual actors, how these connections are made, sustained for a time, or discontinued, and what effect they have. Founded by Bruno Latour as a critique of the authority of scientific knowledge, and the objective, 'real world', observations made in scientific method (de Vries, 2016, p. 22). ANT rejects the idea that humans are the sole agents that make things happen, arguing that any being, material or idea has the potential to be an actor, ally itself with other actors, and form a network (Munro, 2009, p. 351). The focus of ANT is the actors and relations which coalesce to produce a network. ANT is a tool, as much a method of investigation as a theory, which leads a researcher to follow actors to view how networks are created, how they emerge, how they are maintained, how they compete with other networks and are made durable over time (Latour, 2005). This approach involves the description of what happens in the moment, as opposed to motives, interests and intentions:

> "Don't try to shift description to explanation: simply *go on with* the description. What your own ideas are about your company is of no interest whatsoever compared to how this bit of the company itself has managed to spread" (Latour, 2005, p. 150).

The method of ANT emerges as actors and networks are elaborated. As Mol (2010) explains, ANT is a tool "to tell cases, draw contrasts, articulate silent layers, turn questions upside down, focus on the unexpected, add to one's sensitivities, propose new terms, and shift stories from one context to another" (2010, p. 262). ANT follows the actors in a network wherever they lead.

ANT has a concrete conceptual and methodological apparatus, with terms which clearly define actors, networks, and the processes of forming and dissolving networks (Müller, 2015). I utilise key terms in the ANT vocabulary for talking about the components of the networks. One of these core ideas, 'problematization', describes a problem or event which makes an actor indispensable in a network (Higgins, 2006). This is useful for understanding the enrolment of the beekeeper, who becomes indispensable to the colony because they treat pest and disease which have elsewhere decimated honey bee populations. Following problematisation, the 'enrolment' of an actor into a network is initiated (Higgins, 2006). An actor is enrolled when mutual desires meet: the honey bee may enrol the lavender flower for its nectar, which feeds the hive and the reproduction of the colony, but the bee becomes the agent of flower reproduction, carrying lavender pollen from one flower to another. 'Enrolment' and 'problematisation' are terms which are part of the process of 'translation'. Translation is the process that describes how and when connections are made, as well as the endurance of a connection and network (de Vries, 2016; Latour, 2005). In the description of assembled actors, there are two key distinctions: 'mediators' and 'intermediaries'. The former describes an actor which has a transformative effect within a network (Latour, 2005, pp. 38-39). The queen of the honey bee colony is a mediator as the actor which enables reproduction. If the queen were to die and not be replaced by a new queen, the colony would also die. Mediators are complex actors which are necessary for a particular network to exist. An intermediary, in contrast, is effective within the context of the network, not as a result of its individual properties (Latour, 2005, pp. 38-39). The role of the intermediary is to bridge, attach and detach components of a network. A beehive without bees is a wooden box, but when it is enrolled in the honey production network it becomes a place of honey storage, and

allows the beekeeper to access the honey stored within. In the context of the beekeeper's honey production, the beehive acts, connecting human and honey. In contrast, the bee could nest anywhere, building comb on a tree branch for the storage of honey and brood. Thus, the hive is an intermediary in the network as opposed to a mediator. ANT is a useful conceptual tool for thinking about honey bees, allowing me to describe honey bee networks, how they are formed and broken, and what they achieve.

ANT is a useful tool for thinking about and describing honey bee worlds, but in its strictest application is limited to the workings within a network and not between them. As Mol (2010) explains, "these days most ANT researcher no longer unravel singular networks but attend to co-existing ones in tension" (p. 260). Additionally, ANT does not attend to external forces and power relations, and it has a limited understanding of agency: it is the network which acts, not individual actors (Müller, 2015; Müller & Schurr, 2016; Routledge, 2008). ANT has also been critiqued for the potential for networks to be described with no conclusion: an endless description of associations which emerge even as a network is in view (Müller, 2015, p. 30). The components of a network are described in regards to the network, but given no context or character exterior to it, in the words of Latour (2005), context is "simply a way of stopping the description when you are too tired or lazy to go on" (p. 148). However, this deliberate focus on description and the exclusion of context prevents any viewing of the multiple, co-existing and contingent networks that bees act within. There is relationality between honey bee networks. To overcome these critiques and speak to the different transformations and effects of honey bees in singular and multiple networks, I use assemblage thinking to extend ANT. Assemblage thinking offers a means of thinking about the characteristics of entities within networks as well as the external forces which can shape them.

3.2.2 Assemblage thinking

Assemblage thinking is a philosophical perspective based on the work of French philosophers Gilles Deleuze and Félix Guattari (B. Anderson, Kearnes, McFarlane, &

Swanton, 2012; Müller & Schurr, 2016). Assemblage thinking is an ontological undertaking, arguing for a re-articulation of what makes up the world: "a whole is re-theorized as a diverse and diffuse field of co-constituting elements thrown together into an assemblage in and as events" (Stewart, 2014, p. 549). In other words, everything is assembled, or, made of connections between potentially disparate things, including beings, materials, ideas and events. These assemblages are relational: the whole is more than the sum of its parts and actors have autonomy outside of the connections they forge within a particular network (Müller, 2015). This means that entities are shaped by the connections they have made historically in networks: a bee that has survived a varroa infestation may adapt to become resilient to the parasite in future, repeating the behaviour which removed mites from its body, the bodies of other bees, or contributing to the survival of their colony, continuing any genetic resistance to the mite. Viewing the history of actors gives context to the connections it has forged, and enables different potential connections in future. Another characteristic of assemblages is that they are always in motion, forming and dissolving in different contexts. Additionally, assemblages emerge in order to achieve the aim of actants, thus they are desired (Müller, 2015). Entities come together to make something happen, holding together for a time, termed 'territorialisation'(Müller & Schurr, 2016). The counterpoint this is deterritorialisation, which describes the dissolving of an assemblage. Elements come together in assemblages, and are "subject to continuous centrifugal forces at the same time" which cause connections to "mutate, transform and break" (Müller, 2015, p. 3; 29). This approach traces the possible arrangements and organisations of elements that form wholes (Dewsbury, 2011). Assemblage thinking is the consideration of possibilities.

3.2.3 Thinking together actor-networks and assemblages to know honey bees

ANT and assemblage thinking can be brought together in the project of knowing honey bees. These theoretical approaches are distinct, ANT provides a descriptive methodological tool for viewing actors within networks and assemblage a mode of thinking about connections that comprise the world, but they share common assumptions about the beings and things that connect for a time, and attend to the effect of these connections (B. Anderson et al., 2012; Müller & Schurr, 2016). Both

theoretical approaches insist “that materials experience an emancipation from their role as passive recipients and start to co-articulate agency and shape political practices.” (Müller & Schurr, 2016, p. 34). However, the ability to act and what may be achieved by a network is viewed differently in ANT and assemblage thinking. Both ANT and assemblage thinking are in agreement that an actor never acts alone because it does not exist in isolation (Sayes, 2014). However, where ANT is a method to open a network for viewing it, assemblage thinking examines connections and relations, within and between assemblages, including external influences that may shape assemblages (Müller & Schurr, 2016). The term assemblage is an idea of an entity or whole, viewed in the connections that constitute it, whereas a network is a flow of relations between actors, and the whole may never be viewed. Assemblage thinking posits that there are indeterminate possibilities that emerge from combinations and interactions.

Agency is the capacity of individuals to act, without constraint and with free will. A central facet of ANT is the argument that humans are not only beings that act. Instead, ANT argues that all actors have agency within a network. Agency is distributed across the network, not attributed to a particular actor. As Mol states: “against the implied fantasy of a masterful, separate actor, what is highlighted is the activity of all the associated actors involved. A strategist may be inventive, but nobody acts alone” (2010, p. 256). In order for action to be taken, entities must form an alliance. In the spirit of ANT, I view honey bee agency through its enrolment into a network. Centring the honey bee in ethnography means attending to ways that it acts within networks with ANT. Extending this with assemblage thinking, which views agency as the work of situated individuals (Murray Li, 2007), I consider the alliances which enable action and the difference between the individual bee as an actor, and within the context of the colony of bees, and the European honey bee species. This has been particularly useful for viewing the differences between bees enrolled in networks with myself, a hobbyist beekeeper, as opposed to commercial beekeeper participants.

ANT and assemblage thinking follow the connections and flows, and flexible arrangements of beings, matter and ideas, identifying how these connections are

made and remade and what this impacts within the network and without. ANT and assemblage thinking are companionable tools for thinking about honey bee worlds, and as such, both approaches inform my approach to enacting honey bee research. There are key similarities between the theories, specifically the potential for any being or matter to have agency within a network, and the focus on how these connections are made, endure or are dissolved. On the other hand, there are points of contrast which make each suitable for different aspects of this work. ANT is a useful conceptual tool for drawing out components of networks, whereas assemblage thinking considers the context and character of elements both within and outside of the assemblage wholes they constitute. In doing so, an assemblage approach enabled the viewing of different assemblages that make up honey bee worlds, such as the way I relate to the honey bee as a researcher, and the different assemblages which form when commercial or hobbyist beekeepers are enrolled. Bee agency is shaped differently in these cases. I utilise the theoretical concepts of ANT in this thesis, extending it with principles of assemblage thinking to explain important aspects of bee worlds, such as desire and agency. I utilise assemblage thinking to ask questions about how the assembling and disassembling of beings and materials impacts what exists outside of the network.

3.3 Studying honey bees in social science

The following section discusses the work of researchers who re-imagine the honey bee in social science research. These accounts show the different ways that the honey bee is constructed as domestic, productive and compliant from the human perspective. While these accounts contrast with the general presentation of the bee within the New Zealand context, which sees the bee as a producer of honey and an often taken-for-granted component of the honey industry, they limit their view to a human centred perspective: the beekeeper, the industry or the bee researcher. I argue, through the drawing out the agency of the honey bee, that there is more to be said for the bee itself. I draw from the way that honey bee agency has been written of in these examples to guide my attempt to centre the bee in my research.

In presenting the domestic imagining of the honey bee, Tsing (1995) introduces the idea of tension between an idealisation of multispecies relating and the agency of the being. The agency of the honey bee is erased in narratives which put forward a gentle, homely or productive bee. In contrast to this, Tsing (1995) emphasises bee agency by sharing accounts of bees thwarting human endeavours, including an Anglo-Saxon chant spoken to keep bees from absconding. I aim to create a honey bee centric narrative where the tensions of co-existence are brought into focus, utilising examples of honey bee agency similarly. In regards to method, Tsing (1995) drew from a range of sources, including art and culture, historical and contemporary, as well as beekeeping texts and entomology studies. Tsing presents storied accounts of honey bees and shows the importance of having multiple, varied presentations of bees. In her writing the honey bee is not confined to one narrative, and the multiple ways of knowing the insect are presented: from beekeeper, to witness of a swarm, to scientist determining genetic characteristics of bee species in a laboratory. The knitting together of a range of sources to conceptualise the honey bee is an approach I will use, but I also aim to consider how the honey bee communicates itself. Through visual, auditory and physical (sting) cues the bee interacts with other beings in the apiary in order to achieve their goals, including reproduction and protection of the colony.

While Tsing (1995) synthesised information pertinent to bees to emphasise tension between bee narratives, the authors of the three remaining accounts observed beekeepers. Green and Ginn (2014) spoke with beekeepers who follow an alternative approach to beekeeping based upon the thinking of philosopher Rudolf Steiner. Steiner believed that the products of the hive were special, and not to be wholly taken from the bees. Additionally, hives should mimic the ways that bees form their own hives in the wild “such as in logs or trees, where naturally built comb forms an egg-shape” (Green & Ginn, 2014, p. 151). There is no use of chemicals, and quite often protective clothing is partly or mostly forgone (Green & Ginn, 2014). Alternative apiculture is practiced in opposition to standard beekeeping practices, which were seen as exploitative of the honey bee. This narrative illustrates opposing honey bee narratives in beekeeping. It is important to consider and present varied accounts of

beekeeping because the experience of bees cannot be confined to a single, standard, and often human-centric account. This study presents an example of human-bee meetings where the human is more sensitive to honey bee lifeways, but it remains centred around the human experience. It is a key example of openness to the honey bee other, but it still reduces the bee to an object of description.

Similarly, Kosut and Moore (2013, 2014) investigated the perspective of beekeepers and spoke to people who practiced urban beekeeping in New York. This study illustrates the varied environments which humans and bees share and interact within. What differs from previous studies is that Moore and Kosut (2013, 2014) engage with the honey bees as well as the human participants. The authors practice a methodology they term 'intra-species mindfulness', which considers the impact of research on the honey bee, as well as the information that can be drawn from the honey bee as a participant. The authors take the honey bee seriously in research, as a source of information that can be interpreted through attending to the bee. They learn to keep bees themselves and aid participants in the work they do with their hives. Through this, the authors noticed how bees expressed themselves: buzzing, flower preferences and stinging threats to the hive (Moore & Kosut, 2013). The authors considered that for the bee, the sting which is deployed in defence of the hive and results in the bee's death, might not be the sad, sentimental death that it is thought of by humans:

> "could it not be true that bees see honor in their death and relish the opportunity to pierce the flesh of another creature as a means of creating a heroic narrative of their lives? Or could it be that bees transmit their venom through a stinger in some flourish of an orgasmic rush leading to a little death?" (Moore & Kosut, 2013, p. 4).

The work of Moore and Kosut (2013, 2014) showed me the importance of actually engaging with the honey bee in my research, not just beekeepers. This motivated my desire to become a beekeeper and to develop a methodology that takes the honey bee seriously as a participant.

Roseanna Spiers (2014) studied New Zealand beekeeping, viewing the honey bee as "more-than-human labour", considering the bee-human-material relations that compose bee worlds and the harnessing of bee potential in apiculture. Spiers (2014) explores how the honey bee is framed in a standard productive narrative and subverts this with an alternative narrative of a co-framed bee-hive-beekeeper. Spiers is entangled with honey bees herself, observing the beekeeping operations of her family, participating in the performance of tasks such as constructing hive ware. Although situated within the context of bees-viewed-by-beekeepers, the co-framed narrative illustrates that sites of human-bee interactions and components of beekeeping which appear static, such as the hive, are actually lively, and more than what they appear: "The hive is always already categorically more than a mere box of bees." (Spiers, 2014, p. 145). This is an exploration of ways of knowing the honey bee, set in the world of the beekeeper, but illustrating how there are many iterations of this. The alternative narrative Spiers (2014) puts forward is based on situated performances of beekeeping. Spiers (2014) argues that honey bee worlds are too lively to be contained to one presentation. I agree, and like Spiers aim to challenge the traditional bee narrative, presenting an alternative. The alternative I aim to produce will use a synthesis of bee encounters and behaviours in the apiary, which I access through becoming a beekeeper myself and hearing from other beekeeper participants.

These examples draw on multispecies theory to understand the honey bee. Each has informed my work, presenting varied accounts of honey bees across multiple contexts, including historic, in beekeeping practices of varied extents and aims, and within social theory. I was inspired to consider the multiple framings of the honey bee, and the effect of these on how I know the honey bee. Although varied, these takes on honey bees share an ethnographic approach which explores the relationality of the bee through the human beekeeper. In contrast, I consider the honey bee in non-human contexts, such as pollination and swarming, which do not necessarily involve human actors or framings. Further, the honey bee is a lively agent in human/honey bee

worlds, the representation of this being an important and ongoing challenge for me. These authors show that understanding the honey bee is inevitably an act of imagination, such as Moore and Kosut (2013) imagining the death of the honey bee from its perspective. Imagination is a facet of all ethnography, required in the interpretation and presentation of data by the ethnographer. The particulars of non-human ethnography, such as the different modes of communication used, highlight the imaginative element of generating ethnography. Textual representation can be limiting, and other modes might better represent non-human others. I argue that while these authors take the honey bee seriously in their ethnography, they do not take it seriously in how the honey bee is represented in text.

3.4 The challenge of representation

The question of representation features in each of the theoretical approaches drawn on in this thesis and is also a key challenge in ethnography. A multispecies ethnography explicitly asks how to represent the 'other'. Representing the honey bee is a consideration for Moore and Kosut (2013) who find their textual format restrictive. This is an important point for my own research with the honey bee. The form I use to communicate about the honey bee is also textual. The honey bee does not use this form of communication, so there is an inevitability in lapsing into imposing human characteristics on honey bees. There is also no means of feedback between the bees I write about and myself as author. This is a consideration of Kosut and Moore, who suggest audio and visual presentations as another mode of representation, but the authors do not engage with them, arguing that they rely on human explanation (2013, p. 215). I consider audio and visual materials, such as images, video and audio recordings, to be a useful means of non-textual representation which is more similar to the modes of communication honey bees actually use. My observations of honey bees throughout this research involved seeing the bee body move on flowers, frames within the hive and in flight. I also heard the sounds made by bees, the buzz and hum of one or many bees, and noticed the alterations in volume and proximity of the buzzing. There were many audio and visual signals expressed by bees, and none based on language. The forms of communication used by honey bees informed my actions as a researcher and a beekeeper, as well as what I present and how I do so.

My observations were of the communications of honey bees not directed towards humans, in other words, my observation was an act of eavesdropping. I captured these examples bee agency in pictures and recordings I took during fieldwork. A recording of buzzing at the hive entrance might need interpretation, but it is a form of honey bee communication to be taken seriously, as any beekeeper knows. Audio and visual representations of the honey bee also aid my textual interpretation of honey bee behaviour: the sensory material of a hive opened by a beekeeper cannot be shown in text alone. I apply sensory ethnography as an approach that helps to explain the more-than-text nature of engaging with honey bees in ethnography. This methodological approach aims to present empirical data in an engaging manner, which is achieved through the presentation of sensory information, such as audio and visual recordings, and scents and tactile materials (Pink, 2015). The key tenet of sensory ethnography is that encounters in research are multisensorial: meaning does not emerge only from the speech and sight between participants, the perception of experience is also comprised of other sounds, scents and touches (National Centre for Research Methods UK, 2015; Pink, 2015). Representations of sensory ethnography include photograph, film and audio recording: forms that capture sensory engagements. Analysis and interpretation of these materials might be mediated through human explanation in-text, but they also stand alone, to be interpreted by the reader. This is the purpose of the additional information located online at: jluttrellmassey.blogspot.com. References to this will be given throughout the thesis. The online material is intended to be viewed in conjunction with the thesis so that readers may experience the multisensory communication of the honey bee. I would also have liked to include a jar of honey for tasting, or beeswax for scent, but it is not practical to do so for this thesis. These are ways to further engage with the multisensory experience of the apiary.

Multispecies fieldwork and representation are shaped by the particulars of other species. In other words, the bee-ness of the honey bee is central to the kinds of engagement that are possible and the kinds of representation that this produces. In order to think with the honey bee, I consider its lifecycle, habitat, body and behaviour,

and the implications of these characteristics on my engagement with them. The first consideration is the that the honey bee is not a solitary insect, it exists within a colony, the needs of which dictate the individual acts each bee performs, such as foraging for nectar. So, the honey bee differs from examples involving mammals and solitary beings, such as the family dog, and the colony of tens-of-thousands of bees outnumbers the family groups of meerkats. When do I identify the individual bee and when do I signal to the colony? Do I identify an individual bee when it might not act as such? I address these questions by referring to individual bees by the role they perform within the context of the colony. I also understand my relationship with honey bees as being between an individual human and a colony of bees.

In addition to this, the size difference between the honey bee and human researcher is a significant consideration. This is a consideration of vulnerability: I can do harm just by deploying my larger body in a clumsy way, stepping on bees or squashing them under tools in beekeeping. It is easier to kill a honey bee than a larger animal. Honey bees are also mobile. This is a key difference in previous examples of multispecies engagements, for example a mushroom like the matsutake is arguably immobile and Haraway's dog might elude being put on a lead or into a kennel, but it is still able to be captured, or bring itself back. The size and flight of the honey bee means that it is harder to sight and follow. Furthermore, the life of the bee is short, at most six weeks for the worker bee, even shorter for the male drone, and approximately four years for the queen bee. Honey bee participants are dying as my research is undertaken. This means I will never know an individual bee, except the queen, who I recognise but do not have a relationship with.

3.5 Conclusion

My coming to know the honey bee through my own practice of beekeeping, as well as through commercial and hobbyist beekeeper narratives of bees, emphasises the multiple dimensions of the Manawatu honey bee and extends the efforts of other researchers to better present, enliven and know the non-human. A key aspect which

distinguishes my work from others is bringing together multiple narratives: I come to know the bee across commercial, non-commercial and scientific networks. These narratives are different – as the bee is acted upon and with differently. My own bee-keeping is formative of embodied knowledge production rather than just honey. I bring this together with knowledge and experience from commercial and non-commercial bee networks, to present multiple bee worlds. Multispecies scholars have not tended to follow the bee (or the non-human) through different worlds which have different actors and relationalities. In the chapters that follow, I draw on ethnography, narrative style and actor networks to highlight the complexity and agency of the honey bee (and others) in the Manawatu apiary. The honey bee is an active agent in the constitution of its multiple networks; whether it be in commercial honey production, non-commercial bee-keeping or my own bee-keeping for knowledge production – the bee actively shapes each network. The aim if this thesis is to know the honey bee across these networks, present its agency and enact social knowledge of the honey bee that transcends more-traditional accounts of honey bees as passive or controllable.

The importance of inclusion, openness, and a decentring of the human, have been influential to my understanding of multispecies collaborators in life and in ethnography. Multispecies thinking invites empirically grounded and theoretically informed research into the agency of honey bees to shape its particular worlds. It directs my attention to the being of the bee and its relational constitution of its worlds with others. It makes visible the life-world of the honey bee without deferring to humanistic terms which have traditionally framed the bee. While there is the inherent contradiction that I am narrating the bee as a human, a multispecies approach challenges dominant humanist narratives which render the bee as passive.

Actor-network theory and assemblage theory provide tools to position the bee within multiple honey bee contexts (i.e. commercial and non-commercial) and to understand its agency and relationships (and how these change) across different bee networks. These tools share a post-structural sensitivity with multispecies in seeing the world as

relational, emergent, messy, uncertain and co-constituted by humans and non-humans. These ideas help me to distinguish and bring together the different bee networks, to read for actors and relationships that matter and change across different honey bee networks.

Most significantly, by becoming a beekeeper myself, I am able to position myself within the research and with the honey bee. I do this explicitly in order to enact knowledge according to non-human scholarship principles (e.g. Candea (2010); Moore and Kosut (2014)) and my own personal concern over the survival of the honey bee. I draw inspiration from the efforts of other authors to better know the bee and to enliven the non-human in more-than-human terms. By becoming a beekeeper I have learnt of the bees agency first-hand (including being stung multiple times). This getting to know the honey bee provides me with an embodied reading of multispecies, actor-network and assemblage theories.

4. Methodology

One of two key aims of this thesis is to centre the Manawatu honey bee in ethnography. This is the methodological challenge of the thesis, specifically, how to privilege the honey bee in encounters in the field and how to centre the honey bee in its ensuing textual representation. In this chapter I give an overview of the key methodological ideas I applied in undertaking ethnography with honey bee participants, specifically, practicing participant observation with multispecies participants (human and non-human), tracing honey bee networks, and conducting autoethnographic and sensory ethnography. I approach the production of ethnographic text as an experiment in finding a style of writing to represent the sensory aspects of honey bee worlds: the hum, the scents, the physical movement of bees in flight or the venom that the stinger injects.

This section describes my engagement with multispecies ethnography, extended with actor-network theory and assemblage thinking in fieldwork. I detail my practice of fieldwork where honey bees are taken seriously as sources of information, communicated through indexical and/or iconic signs, which I notice in encounters within the apiary. I trace the honey bee in networks, beginning with the insect and following where it may lead as connections and nodes emerge. I also engage with the honey bee in beekeeping, which I document in autoethnography. The representation of the honey bee in ethnography is a key consideration of this research, and as such, I pay particular attention to forms of ethnography other than language in order to do so in this thesis. Specifically, I draw on deliberate use of language in poetic narrative as well as taking inspiration from the sensory experiences of fieldwork in the apiary in my written presentation. The resulting ethnography consists of three presentations of honey bee inspired narratives, to be viewed as discrete accounts, but which are three parts of a body of varied, potentially unresolvable honey bee narratives which capture the liveliness of the insect.

4.1 Background

My initial encounter with the honey bee came about from an interest in ways that people produce their own food and alternative food production, like organic food culture and raw milk. I learned that beehives could be kept in urban backyards, and that some people did this to connect with their environment and produce food, such as honey and through the pollination of the crops in their gardens undertaken by bees. As I learned more about what the honey bee contributed to food systems I came to appreciate the honey bee and want to keep bees myself. In my honours research project I followed beginner beekeepers as they came to know the bees they kept and their own identity as a beekeeper was forming. I learned a lot about beekeeping through this. I interacted with beekeepers and bees in beekeeping classes, local beekeeping club meetings, and at their apiaries. I became what an Auckland Beekeepers Club member called a 'wannabee' or 'bee enthusiast'. I completed my honours project with a better understanding of becoming a beekeeper, but felt that my experiences with honey bees were based on the human perspective: the honey bee was present in theory and research, but absent in the creation and presentation of the text.

The aims of my honours thesis were to understand beekeeper identity, the process by which beginners entered the beekeeping world, and what the bee contributed to this. Another aim was to understand the role of the honey bee in beekeeping, which I investigated by attending to how participants spoke about the bee, where their knowledge of the bee came from, and how they related to the bee, for example as a parent or protector of the bee. I gathered information about the practice of beekeeping, but aimed to centre the bee in this by understanding the role it played in the beekeeping of participants. I came to know bees from the perspective of the beginner beekeeper. I picked up on the basic vocabulary of beekeepers, from describing the roles bees take on within the hive to distinguishing between buzzing that signals that the bees are calm or agitated. For example, Nicole, a hobbyist beekeeper I spoke with for my honours research project, recalled an experience of angry bees:

> "I had to open the hives without smoking them, and it's just, it's noisy. They buzz, they're kind of, you can just, they're angry. When you smoke them they are, they're still going about their business; they don't really care that you're there, but without the smoke they're like, 'someone is in, someone is having a go at us' (…) So they're just, they're 'buzzier', they're swarming around you a little bit. I checked a few of the frames but I didn't really muck around"

My honours project captured the enthusiasm of beginner hobbyist beekeepers, and the ways that you come to know bees when you become a hobbyist. Encounters were new and exciting, and took place in the backyards of participants, where they had set up their hives.

I was living in Auckland at the time, renting a small house in a central suburb, and couldn't commit to the cost of beekeeping and did not have the space to accommodate a hive of bees. I shared the desire to keep bees, providing shelter and care through beekeeping practices, with participants, but I didn't have the space or resources to become a beekeeper. I was disappointed that I could not form my own relationship with honey bees, and answer questions such as 'do you recognise individual bees?' and 'what does it feel like to lose a queen bee?' from my own experiences. This meant that I relied on the accounts of other human beekeepers. I had few interactions with the bee itself. Although I had centred the honey bee in my enquiries, I wanted to centre the bee in my method. I wanted to involve the honey bee in multispecies research.

This lack of honey bee contact informed my Master of Arts thesis. What I learned from the beekeepers I met with previously was a human interpretation of honey bees. The beekeeper initiated their relationships with bees, and related their experiences based on their role as someone responsible for bees. Now based in the Manawatu, I started with the honey bee, thinking about where it exists, and what it does in that space. I started to learn more about the biological and behavioural characteristics of the bee. I viewed space as 'bee space' and thought of the other beings which enter this space

and interact with the bee from what I imagined was the point of view of the bee. Interviews were conducted with beekeepers, because humans are still an important source of information and a way to know the honey bee, but I spent time with honey bees without any other human presence, watching bees as they collected resources from flowering plants. I had moved back in with my parents in rural Manawatu, and this enabled me to become a beekeeper. In the spring of 2016 I purchased two nucleus colonies (nucs) of bees, and these grew into two full beehives. I spend time performing beekeeping with the hives, inspecting frames of bees and changing hive components to achieve my aims in beekeeping, but also spend time observing the bees from a distance.

As a beekeeper, I see how honey bees interact with the apiary environment first hand, also noticing that interactions between the honey bees and I are sparse and always initiated by me. I am a perch for bees, or a nuisance to them. I can hear the bees at different times, when they're vibrating within the hive on a cold morning (an electrical current kind of sound) and when they're annoyed at being invaded by white suited humans (a scary, loud, close buzz). I smell the musky comb and honey, and taste the honey they make from the nectar of dandelions, thistles and clover from the farm. I see the bees in flight, the wobbly take off and landings at the hive entrances, and notice their reactions to potential invaders (bumblebees, wasps, mice, spiders as well as foreign bees). I have also inadvertently killed honey bees. I've stepped on them, squashed them between heavy beehive boxes, and annoyed one so much that she stung me, causing her death. I've smoked them, trying to keep them placid to work on them, but knowing that in doing this I am signalling impending trouble, causing distress. I've also happily killed wasps, because I know them to be aggressor to the bees, sometimes invading hives and robbing honey and nectar. These encounters are another way of knowing the honey bee. These are the sensory observations that show me that there is more to be said for the bee than representations of productive bees.

4.2 Participant observation with honey bees

To centre the honey bee in methodology, I asked where bees existed in the Manawatu and what they did in that space rather than beginning with the human beekeeper. My methodology revolves around encounters with honey bees in 'The Manawatu Apiary'. The Manawatu Apiary is a description of regional bee space, where iterations of honey bee life can be viewed. I aimed to see the Manawatu from 'a honey bees eye view' (Pollan, 2003). To do this I began with the honey bee, learning what is known about its biology and behaviour through experiments and research, which helped me to interpret bee behaviour. The work undertaken by experimental physiologist and bee researcher Karl von Frisch (1971) identified the dance communication bees use to share information about floral resources (Munz, 2016). This research gave me insight into one way that honey bees communicate about their world, particularly what they notice as important about floral resources. This allowed me to draw contrast between what the honey bee views as important in pollination (abundance and quality) and what the human orchardist cares about (the production of a cherry crop). Other examples of honey bee research include placing microchips and using tracking technology (radio frequency identification, RFID) to view how disease affects foraging behaviour (Benaets et al., 2017) and viewing guarding behaviours at hive entrances to investigate the way bees from one hive respond to foreign bees from another (Nouvian et al., 2016). Each of these examples aided me in understanding how the honey bee experiences and communicates about their worlds.

I also draw on encounters in the apiary as viewed by beekeepers. In these instances, some behaviours are more easily and widely observable, like swarming behaviour, and others are seen and speculated about, like the behaviour known as 'bearding', where bees form a beard-like cluster on a beehive **[4]**. One beginner beekeeper participant in my honours project observed her bees flying about their hive, and as a beginner she wasn't sure whether the bees were swarming or whether it was something she had not seen her bees do. She described it to me:

> "[There] was a huge amount of activity around the hive, and I could see it from the kitchen, so it wasn't the box obviously, it was just all of this stuff happening in the air, and I thought, 'now that I haven't seen before'. Why that was probably happening was because of new bees and the weather. So, there was a one hour window of opportunity for the new bees to come out and do their orientation thing. I'd never seen that before. There were large numbers of them. Really large numbers of them for me anyway. And it was really neat, there was all of this amazing stuff happening above my hedge"

In this example a human participant viewed and interpreted honey bee behaviour. It shows how the beekeeper takes cues from the bees and their interactions with the apiary. It places the behaviour within the context of honey bee husbandry, the identification of a behaviour and a solution which keeps the bees in the hive. In learning to keep bees myself, I am learning to interpret in this way and find solutions. This is an interpretation specific to beekeeping, which shows that the beekeeper-bee relationship creates particular frameworks for viewing bee behaviour. This is also true of the scientific framing of honey bees which interprets honey bee behaviour in terms of research hypotheses, such as interpreting dance communication. Beekeeping narratives are one key avenue for understanding of the Manawatu honey bee, but they are anchored in the practice of beekeeping, revolving around human intervention. I pay attention to the kind of explanations humans provide about honey bees, which gives me an understanding of how human beekeepers know and relate to the honey bee: responding to the particular behaviour of the insects.

Additionally, I view behaviours within the apiary that do not involve humans. Using knowledge of honey bee sensory capabilities and biology, I attempt to write about these behaviours from the perspective of the bee. Pollination is an example of a behaviour which is important to humans, in food production for example, but does not necessarily require their involvement. Pollination, the transferral of pollen from one plant to another in fertilisation, is carried out by the honey bee, lured to flowering plants by the promise of nectar. Another example is the sting of the bee. I have been stung, and my experience was of the pain and panic of venom that lingers, itching for

days. From the perspective of the honey bee, this defensive act causes the stinger to be torn from the abdomen of the bee, causing its death. These are examples of my attempts to understand the agency of the honey bee in events within the apiary. Doing so centres the bee in my writing and provides an alternative to the passive and productive bee of many accounts of beekeeping. The pollination provided by hives of bees in an orchard might seem to be the desire of the beekeeper, but it is the plant and bee which interact with desire for reproduction and for nectar, respectively. Viewing the bee in non-human contexts is a way for me to highlight the partiality of human interpretations of bee behaviour. Contextualising accounts of honey bees is important for understanding the elements that co-create honey bee worlds.

I consider the honey bees I encountered participants of the ethnography. The honey bee is a source of information in and of itself, although its modes of communication are not the same used in human communication. As such, attending to the way the bee shares information about a source of nectar or approaching danger offers insight into bee words. My fieldwork was therefore undertaken in apiaries, but also in my garden where I saw bees collecting from jasmine, or in the house where a honey bee had strayed, flying around the windows eager to be released (or so I assume). There are challenges in undertaking research with multispecies participants, such as using different modes of communication (Moore & Kosut, 2013, 2014), navigating attachment and detachment (Candea, 2010) and encounters that are awkward, one sided, or make one or both species vulnerable (Ginn, 2014; Green & Ginn, 2014). Following Kosut and Moore's (2013) 'intra-species mindfulness', I aim to consider the way that my research methodology impacts the honey bee, and view the beekeeper as one source of bee knowledge. Furthermore, my knowledge of the honey bee will always be partial and filtered through my humanness. However, there is also partiality in ethnography involving human participants, as Fassin (2014) notes a participant "remains definitely opaque to the viewer, as their subjects always are, in the last instance, to the ethnographers" (Fassin, 2014, p. 70). Partiality is not an issue solely within multispecies ethnography.

Another source of information on beekeeping was the Manawatu Beekeepers Club (MBC), a local organisation that holds monthly meetings aimed to share beekeeping practices and experiences, as well as facilitating sharing of beekeeping resources. There is a library of beekeeping texts and audio visual resources, honey extracting equipment for hire, as well as equipment for sale. There are also club hives, maintained by members, and sometimes used for demonstrations on field days. Field days, which are meetings that take place during the weekend, offer practical experiences of beekeeping. I attended a handful of meetings, including an annual general meeting (AGM) where I learned about the way the club worked and who made up the membership. I also attended two field days. The first field day I attended was a workshop for utilising hive products where we used beeswax to make furniture polish, candles and beauty products, and honey to make sweets. The second field day was dedicated to opening the club's hives in spring for a check and the application of treatment. Dad and I went along to this field day, and it was the first time he had suited up and opened a beehive. During these meetings and field days, I learned a lot about beekeeping, including the handling of bees, the way that hobbyist beekeepers learn and share information about the bee and the practice, as well as the products of the hives, particularly honey and beeswax.

I also attended the 2016 New Zealand Apiculture Conference in Rotorua. The conference, held at the Rotorua Energy Events Centre in June, was a three-day gathering of beekeepers. There were stalls on site which demonstrated beekeeping products and services, as well as industry information on beekeeping regulations, pests and disease. I attended one day of the three, where I listened to presentations from a range of industry stakeholders. The focus of this day was the impact of mānuka on the apiculture industry, particularly how to protect the authenticity of mānuka honey. The conference was an invaluable source of information about the apiculture industry, particularly in the identification of industry concerns and the key actors in the commercial honey world.

At the time of my research the Ministry for Primary Industries (MPI) was in the process of creating an official definition for mānuka honey and deciding how the definition would be regulated. I attended a presentation of the definition produced by MPI and its Mānuka Science Programme, which was held at a public meeting in Palmerston North in May of 2017. Presented by the MPI, meetings were held across New Zealand to explain the process of defining mānuka honey. MPI researchers Dr. Claire McDonald and Dr. Suzanne Keeley explained the markers they identified as reliable attributes of mānuka, and the process of identifying them. This meeting was attended by commercial beekeepers from the region, as well as the Chairperson of Apiculture New Zealand, the industry body for beekeepers, to represent the concerns of the beekeeper. It was a valuable experience of the interactions of industry stakeholders, particularly, how the regulatory bodies of the New Zealand industry communicate with the beekeepers who make up the industry.

The sources of information I have drawn upon, namely, honey bees, hobbyist and commercial beekeepers, honey bee researchers, organised groups of beekeepers such as the local beekeepers club, and apiculture industry stakeholders, are contributors to the Manawatu apiary which represent the varied pathways for knowing the honey bee. From each source there are differing purposes and concerns for knowing the bee in these distinct ways. In engaging with these different sources, I viewed different actors and arrangements in networks, such as the difference between the honey bee enrolled in pollination network by the plant, and the honey bee enrolled in pollination by the beekeeper. The former network sees the honey bee lured to the plant by the promise of nectar, whereas the latter emphasises the intervention of the beekeeper who places the beehive near a grouping of plants. The same process is taking place, but different aspects of pollination are able to be viewed.

4.3 Autoethnography

Autoethnography is a qualitative research methodology where the researcher is also participant and subject. It is an acknowledgement of the role of the researcher as a

creator of the process and product of research (Ellis, 2004). I became a beekeeper during my research project, and included myself and my beekeeping partner father (John) as participants. I took note of the beekeeping acts we performed, including feeding the bees with sugar syrup, applying treatments for pest and disease, and changes made to the hives. I reflected on these performances, how Dad and I felt about the bees, what we learned as we went along, what we hated and enjoyed. Talking to Dad was a way for me to compare his experiences with my own, to see how doing ethnography with bees and beekeeping with bees was different. Practising autoethnography as a beekeeper provides an explanation of the way that the lines between researcher, beekeeper, and daughter blurred in this research. In this project, autoethnography has been a tool for understanding relating to another being in different but inseparable roles, which don't end when I finish writing about them. This approach treats the log book of beekeeping activities we kept, the early morning conversations about wasp bait, and the reflections on calling the bees 'mine' or 'ours' as data. I insert myself explicitly as a participant of this research, coming to know the honey bee in the practices of beekeeping, with first-hand experience of human-honey bee encounters. What follows is a reflection on purchasing honey bees, which shows the process of coming to know honey bees as a beginner beekeeper and my personal endeavour to become sensitive to the honey bee. The following account is an example of my own knowledge of honey bees, and the data from which I craft this ethnography.

4.3.1 I become a beekeeper

In 2016, while I was researching the Manawatu honey bee, my parents bought a house on ten acres of farm land in central rural Manawatu. There are ten acres of pasture with a network of small ponds within a gully. The house is set back from the road and elevated from it, overlooking the Ruahine Ranges to the east and looking to Feilding in the west. We are exposed to strong winds. The only shelter to be found on the farm is at the dam where flax and toi toi are growing. I had wanted to keep bees since I began my honours project on beginner beekeepers, but I didn't have a space that suited until this point. This was my opportunity to keep bees.

I started to think about sourcing bees in August of 2016 after settling into the new house. This happened to be the end of winter, when beekeepers would be assessing their hives and getting ready for spring, which is the start of the new beekeeping season. I thought it was a good time for my father and I to start, and it would be when beekeepers were likely to sell bees. I kept an eye out on forums, trading websites like Trade Me, and notices posted through the local beekeeping club. The options for starting to keep bees were to purchase a full colony of bees which are normally established in a hive, purchase a smaller colony of bees, a nucleus colony (nuc), made of 5 frames of bees with a queen, or to capture a swarm. The MBC manage a 'swarm capture list', where beekeepers could offer to be contacted to collect swarms when they were reported. I thought to sign up to this list, but found out that it was not intended for beginners. In September Dad and I found a local seller on Trade Me, who was listing nucs at what we thought was a good price. After some thought, we bought two nucs and became responsible for two honey bee colonies. It happened quite fast from this point:

> *So, we have bought 2 nucs from a beekeeper in Marton. We will hopefully be picking these up next Wednesday. And then we will be 'real' beekeepers. Very interesting to think about the way that having actual bees in a hive changes the way I think about myself as a beekeeper, and my relationship to bees. As soon as we won the auction I felt responsible for the bees in my research. I purchased participants. Fieldnotes, September 21, 2016*

Knowing that we were about to get beehives, we needed to think about where they could be located. The process of finding, or creating, a good space for an apiary involved going on a 'farm walk' to assess our options. We talked about what honey bees need, including floral resources, with shelter and sunlight, and what we needed for when we tended the hives, like a flat working space and easy access. We talked about a few options – West facing near some pine trees? No, access was tricky. Near

the house? No, the rest of the family were wary of being close to the hives because they were mildly allergic. In the end, we decided to prioritise shelter, because there were few places that hives would be protected from strong winds, and settled on a spot on the other side of the gully to the house on the bank of the dam, between established flax plants. As well as the shelter it provided, this spot got sun for most of the day and could be seen from the house.

On Saturday the 24th of September, Dad brought the nucs home (*figure 1. below)*:

> *The nucs, or nucleus hives, are held within boxes made of white corrugated plastic. The corrugated plastic can't be chewed through by the bees. The boxes are rectangular, ventilated, and have a lid to be lifted off the top, held in place by Velcro. They are also held shut with tape. There is a circular piece of plastic at one end of the rectangle, which has an opening for bees to move through, but this can be covered/closed. When Dad transported the nucs from Marton they were securely closed. Fieldnotes, September 24, 2016.*

We set the nucs in the apiary atop the pallets we've set up for them, as pictured below (*figure 2)*. We open the entrances of the nucs so that the bees can come out and get acquainted with the space. A few bees came through the entrances and hung out around the nuc.

Figure 1. The arrival of the nucleus colonies (nucs). Authors own.

Figure 2. The nucs at the apiary on top of pallet bases. Authors own.

The following Monday, the components of our beehives arrived in the mail (*figure 3. next page).* The equipment, from a beekeeping equipment supplier in Nelson, included two wooden boxes, which are 'full depth' and inside them are frames. The plastic trays to the right of the wooden boxes are the feeding trays. The feeding tray sits on top of the top most hive box and through a couple of access points allows the bees to consume sugar syrup (or other feeding material) with their proboscis. The plastic base board is at the bottom right. It sits beneath the boxes. This kind of bottom board is a kind of all-in-one, with ventilated bottom and two entrances with teeth that can be manoeuvred to either increase or reduce the space, to allow for higher flows or bees to defend the hive from intruders more easily. There are a variety of styles in hive ware, including styles of hives and the sizes of hive components within each style. There are also tools for handling the bees and hives, including protective gear and equipment for feeding sugar syrup to the bees when there are less floral resources around. For our beekeeping, we decided to use commonly used styles. This is the reasoning behind our choice of hive, the Langstroth hive. It is the most commonly used hive in New Zealand, which meant that we could easily find information about it, as well as the hive ware itself, in lots of places.

We prepared the hive boxes by painting them to weatherproof the wood. The colour of the hive is how we decided to refer to and differentiate the hives as physical beekeeping units, as well as the colonies which reside within. We painted the hive boxes sunshine yellow and pastel purple.

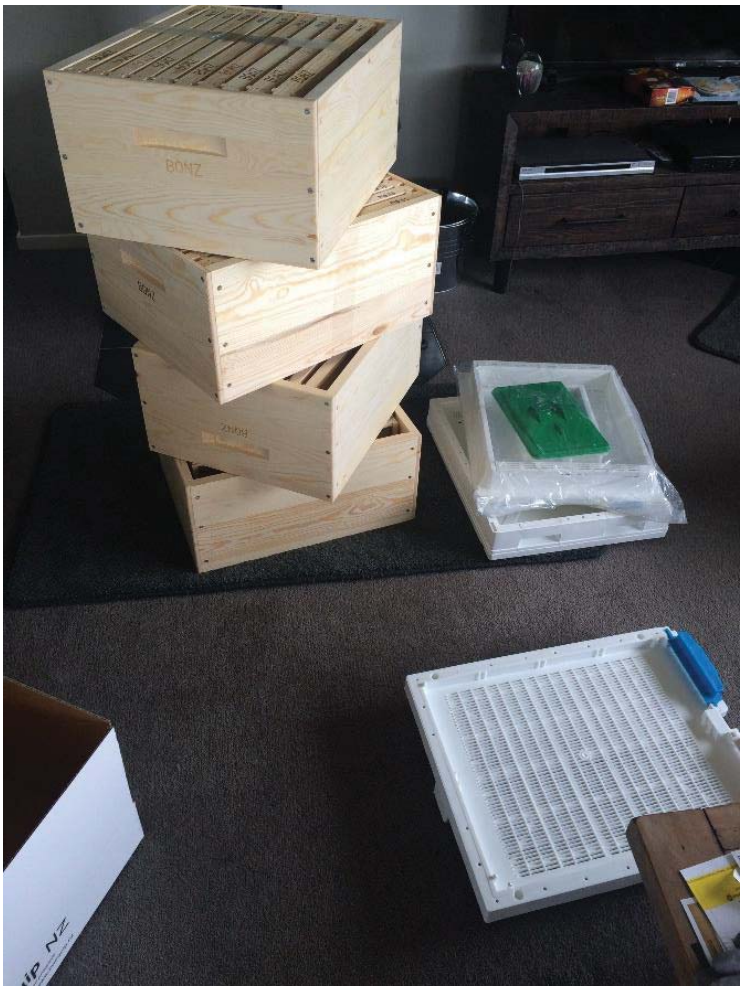

Figure 3. The langstroth hive components purchased online. Authors own.

In the pictures below (*figures 4. and 5.*) are the hives, as seen from the bank of the dam. The first image shows the process of placing the frames from the nucleus colony and setting them within the hive boxes. Empty frames are placed on either side of the ones from the nuc to fill it. The image on the right (*figure 5.*) was taken after the transferral of nuc frames to hive. We put some bricks on top of the hives to weight the lids to prevent them blowing off. The next few weeks are dedicated to planting 'bee-friendly' trees around the dam. We inspect the hive every two weeks to see how the bees are doing in the hives.

Figure 4. The transferral of bees from nuc to hive which took place on the 27th of September, 2016. Authors own.

We continue making up the apiary by planting Cabbage Trees, Mānuka and Kanuka, we finish painting the hives, we install the bees in the evening. We inspect the hives as best we know how. We see the queen bees from each! The hives are quite different. One is darker and quieter (the yellow hive), with less bees. Dad and I think they are lovely. The purple hive is much more active, more are airborne, they're a bit lighter in colour. Fieldnotes, 27 September, 2016

Figure 5. The hives, post transferral from nuc. Authors own.

This was the process of establishing our two beehives within the apiary site, from purchase of bees to the first hive check. What I learned during my honours research informed this process, especially in the choices we made with regard to equipment and site. I progressed from 'bee enthusiast' to beekeeper by getting bees and becoming responsible for them. I enlisted our bees as participants, and became a participant myself in autoethnography.

Becoming a beekeeper changed the way I connected with the bee and human participants I had enrolled in this project. I had created a scenario where I could have my own relationship with two hives of honey bees, and was responsible for them in the way that beekeepers are. My mismanagement of the honey bees might lead to their death, and so I might be responsible for the death of participants. I also had access to honey bees at home, so I could view their seasonal, daily and weather-related rhythms. I observed the bees in the hive (*figure 6.).* Moreover, when I spoke to beekeeper participants I had a better grasp of the beekeeping vocabulary as well as experiences to share.

4.4 Ethical considerations

With human participants, I undertook semi-structured interviews, attended meetings and demonstrations of the local beekeeping club, and hung out in apiaries. The selection of participants was based on the aim of finding a range of experiences of bees to represent the different types of beekeeping undertaken in the region. Initially I found participant beekeepers through personal connection and thereafter used a snowball method. I interviewed four beekeepers based in the Manawatu, two commercial beekeepers and two hobbyists. The number of beehives kept by participants ranged from one to 350, the location of the hives differed, with some hives kept to a single location and other spread over the region in multiple apiary sites. The experience levels of beekeepers were also varied, from beginner hobbyist beekeepers with less than a year of experience to seasoned hobbyist who advises others in the region. I organised to meet with participants at local cafes, public meeting spaces or either of our apiaries and asked questions about their experience of bees and beekeeping in the Manawatu. Although I had a set of questions for these interviews, they were almost always informal 'bee chats' where we would talk about our experiences. Some questions were specific to whether the interviewee was a hobbyist or commercial beekeeper. Interviews were recorded on my cellular phone using a dictaphone app. Recordings were later transferred to my computer for transcription and analysis. I obtained informed consent from participants, upholding confidentiality and anonymity in this thesis using pseudonyms and avoiding the use of personal information which might identify the individuals.

Each human participant of this research was given an explanation of the research, its aims and what their participation would entail. Participants were ensured that their responses would be confidential, all names would be changed for anonymity, and that they could withdraw at any point. The recording of interviews was informed and agreed to. Participants gave verbal consent or signed consent forms to take part in this research. I also gave participants the option to review the transcribed recordings if they wished to. In regards to my participation in the Manawatu Beekeeping Club, I applied to the Chairperson of the club for permission to share what I learned there.

The key ethical considerations for carrying out this research have been considered by the Massey University Ethics Committee.

Multispecies ethics in ethnography are contentious: the basis of human ethics, like gaining informed consent, cannot apply in research with honey bees. A multispecies ethics should take into consideration the impact of research on all beings involved. In my practice I came to know the behaviour of non-humans in the apiary, particularly the honey bees, and based my engagement on interactions that were not harmful. My intention was to take the lives of all actors in the apiary seriously, and so viewed all non-human beings that resided in or visited my parents' property as potential research participants. The absence of shared language meant that there is no informed consent for the participation of the honey bees of the purple and yellow hives, the flowers I planted there and that the bees foraged from, or any other being I encountered or observed. In human-insect research, the size difference makes the much smaller insect much more vulnerable, regardless of the intention of the human. I did not find a way to counter or compensate for this in my research. Through my beekeeping, I came to know some of the cues by which honey bees communicate when they are distressed, and when I recognised them, I withdrew from interactions. I have been stung twice during the research, killing two bees. In this process, I have inadvertently killed bees in beekeeping by crushing them between parts of the hive or underfoot. As I am also a beekeeper, I privilege the survival of the honey bee, particularly the ones I keep. For example, I directly killed as many wasps as I came into contact with, also applying bait to kill whole nests of wasps. I explain my reasoning in later chapters (specifically, "Chapter Six: Season"), but it stands that this does not describe an ethical research project.

4.5 Ethnographic representation of honey bees

My representation of the honey bee is chiefly in the form of text of this thesis. This is different to the ways that I encounter and experience the honey bee, and a form of representation that the bee does not use for itself. What I felt was missing in the

written representation of the honey bee was the sensory information of the honey bee: the sounds the bees make in different situations, the smell of the comb within the hive and the variance of smell and taste in different types of honey. One way that I wanted to address this is through experimentation with different narrative forms. As a mode of presentation of research, narrative forms show "purposive engagement with the world" (Polkinghorne, 1995, p. 5). Using narrative to represent the honey bee acknowledges my part in creating ethnography, as well as the imagination employed in bridging the worlds of the honey bee and the human in this. My use of narrative is the creation of pieces of writing which have honey bee narrators. I also draw on Laurel Richardson's use of poetic narrative (1990, 1994) as examples of thoughtful, deliberate presentations of ethnography. Inspired by sensory ethnography, I also embedded sensory information within the language used in the written parts of the thesis. The key tenets of sensory ethnography are the view of ethnography as multisensorial: meaning does not emerge only from language, the perception of experience is also sensory (Pink, 2015). The narrative elements are imaginative acts based on the ways that honey bees sense and interpret the world. Noticing and interpreting these sensory experiences was a key aspect of my method of getting to know bees as a beekeeper and researcher. I captured some of the sensory information of encounters with honey bees in pictures, videos and audio recordings, which I share in this thesis, online in a blog. I aim to create writing that acknowledges the role of the honey bee in its creation. Although the thesis is inevitably human, I will experiment with poetic narrative to represent the honey bee in ethnography.

The resulting writing is three narrative accounts of honey bees. Each is distinct, representing different networks of honey bees, and written in different narrative styles. The first, "Chapter Five: Honey", is written as a network analysis of the honey production network. I have described the actors within this network, using examples pertinent to honey bees in the form of pictures and poetic narrative. The purpose of this chapter is to explore how honey bee worlds are constructed. The next chapter, "Chapter Six: Season", is a collection of honey bee narratives describing the different combinations of actors which come together at different times in the bee's seasonal

life. I draw from my personal experiences as a beekeeper for these narratives, the purpose of which is to demonstrate how I came to know the honey bee in this research. The language used in this section is influenced by the sights, scents and sounds that I experienced in my encounters in the apiary. The final empirical chapter, "Chapter Seven: Swarm", is a narrative representation of an event in the life of the honey bee. This chapter is the most experimental, drawing from the ideas of poetic narrative and inspired by a 'bees-eye-view' of the world. I created a hybrid narrator to describe the swarm event, because the swarm holds the most meaning to the honey bee. It is an act of reproduction for survival which doesn't involve a human, and yet it may impact the human beekeeper by disrupting their practice, even ending it altogether if the swarm of bees is not recaptured. The differences between these chapters in their focal points, narrative styles, and appearance are deliberate. The disjunctures in the writing captures disjunctures in bee worlds: honey bees are unruly agents. Each empirical chapter attends to a different honey bee network. These chapters are not easily or necessarily reconcilable, which is a reflection of the state of honey bee worlds, which are complex, messy, and constantly being reordered. The empirical chapters of this thesis are parts of a whole in that they are iterations of aspects of honey bee worlds.

4.6 Conclusion

My methodology is based around privileging the honey bee. I began with the honey bee as a participant and source of information through encounters in the apiary, which sometimes exclude the human as anything but observer entirely. I investigated ways of knowing the honey bee, including the interpretations of honey bee information which beekeepers offer, and the science and honey industry perspectives of honey bee biology and behaviour. Autoethnography allowed me to acknowledge my biased, limited human perspective, and in doing this shows that any account, with human or non-human participants, is partial. Reflexivity goes some way to address the problems of representation, but does not resolve the dilemma of representing something in text that does not represent itself through symbolic language. These representations of the

honey bee act as a standard from which I reimagined encounters from the point of view of the bee.

5. Honey

I know honey as a product and an ingredient. Honey is something produced by beekeepers and the hives of bees they tend. What does it look like when the honey bee is centred within the production of honey? What connections does the bee make in making honey? I apply actor-network theory and assemblage thinking in my method, tracing networks to view the beings which act in the apiary. I began with the honey bee, describing the agents that the colony enrols in making honey. The flower and the hive are enabling agents, and the intruders thwarting agents in the production of honey. I then describe the honey network of the beekeeper, which is reliant on the colony for honey. A comparison of these two distinct assemblages illustrates the agency of the honey bee. The production of honey is not a straightforward process. While there are similar agents in each network, interactions create different outcomes. Making the honey bee more visible in honey production shows the tensions between bee and beekeeper which might not be seen otherwise.

Figure 6. A honey bee foraging. Authors own.

5.1 The honey bee network

The honey bee body *(figure 6.)* is a network formed to perform tasks that benefit the honey bee colony. The desire of this network is to forage, process and store food, as well as maintaining and guarding the residence of the colony. The honey bee, a flying insect, has translucent wings and a body coloured in shades of gold and black. The worker bee has a fuzzy body, comprised of head, thorax and abdomen. Attached to the

head are two antennae, two sets of eyes and a mouth. From the latter extends its proboscis, a tongue-like appendage which sucks the nectar from flowers **[5]**. The wings of the bee are joined to the thorax. Also found on the thorax are three sets of legs. The hind set have what are called 'pollen baskets' which collect the granules from flowers when the bee forages. The latter section of the bee body, its abdomen, is striped gold and black. At the end of the bees' abdomen is the stinger. The worker bee has a barbed stinger, which catches on the recipient of any sting, pulling from the bee and causing its death. There are many thousands of worker bees within a honey bee colony, all female, but without the ability to reproduce.

I describe the anatomy of the worker bee, listing the constituent parts of the honey bee and the way parts are used by the bee. I disassemble the bee to describe it in a particular way. The honey bee is an actor, and each anatomical aspect of the bee body listed here is also an actor in a network. The tongue-like proboscis collects nectar and the hairy body of the bee is a surface which pollen sticks to. Each part of the bee body is a part of how the honey bee makes contact or use of parts of the honey making network. Understanding the body of the bee and how it is used by the bee in the process of making honey is explanatory of how the insect experiences and interacts with its world.

5.1.2 Enrolment of the plant

Pollen, nectar, propolis and water

The flower of the plant is the part which has contact with the bee in foraging, and thus enables the flower to be enrolled in the honey network. It is the pollen and nectar, key materials that honey bees collect from flowers, which are desired by the bee to make honey. Pollen, the reproductive material of flowering plants, is a granular, sticky substance found on the stigma of flowers, as well as where it has fallen from the stigma. Honey bees collect pollen to feed larvae, but they also pick it up when foraging for other materials. Pollen sticks to the body of the bee when it is foraging within the

flower of the host plant. Matheson and Reid (2011) describe the set of movements the honey bee performs to collect this pollen:

> "The first pair of legs gathers the pollen deposited on the head, mouth-parts and antennae. The middle pair of legs gathers the pollen from the thorax and takes that gathered by the first pair of legs. The pollen now on the second pair of legs is removed by the 'pollen comb', a special structure on one of the joints of each hind leg. The pollen is then transferred to the pollen basket or corbicula, a flattened area on the tibia of each hind leg with a single hair around which the pollen is pressed" (2011, pp. 58-59)

The bee carries the pollen on its body as it visits vast numbers of flowers, depositing and picking up pollen as it goes, fulfilling pollination. Pollination is the desire of the plant, and the event which requires the enrolment of the bee as a mobile agent. The bee is a mediator in the plant pollination network, lured into the connection by nectar. The plant uses its flowers to attract the honey bee with form in shape and colour, scent and the promise of nectar (Pollan, 2003). The honey bee collects nectar from flowers with their proboscis. Each flower has its nectar stored in a different place relative to its structure. Honey bees also collect propolis and water, the former is a resinous substance used to seal holes in the hive, and the latter is mostly used for diluting honey or cooling the hive (Matheson & Reid, 2011, p. 61).

In addition to nectar, honeydew is a raw material collect by honey bees to be used in the production of honey. Honeydew is produced by insects that have fed off the sap of plants. Like nectar, the honeydew is collected, chemically altered and stored for ripening by the honey bee (Matheson & Reid, 2011). One example of honeydew is that created from the sap of the tutu bush by the passion vine hopper. The tutu bush, *Coriaria arborea*, is a shrubby plant endemic to New Zealand (Orwin, 2007). It has bright green waxy leaves set in pairs along branches. In spring, it produces branches full of small spiky flowers, which in late summer and autumn, ripen to long arms of dark purple berries. The passion vine hopper, *Scolypopa australis,* is an insect which lives in woody plants, such as the tutu bush (Matheson & Reid, 2011, p. 239). The

passion vine hopper feeds on the tutu plant, taking in its sap and secreting through fine tubes on its body. When the weather is hot and dry, and there are few preferable sources of nectar, the honey bee will collect the honeydew (Matheson & Reid, 2011, p. 194). Honeydew is enrolled as a material for honey production when there are no available sources of nectar. The honeydew first needs to be made available by the insects that feed off sap, and it needs to be more accessible than a nectar source for bees to choose it.

Sources of nectar

Before the honey bee lands on the flower and draws nectar and carries away pollen, the bee selects the resource. The honey bee colour vision and sensitivity to ultraviolet (UV) light is a factor in the recruitment of a particular flower, for example, the UV markings called 'nectar guides' of some flowers, such as the dandelion, guide the honey bee to the nectar source (nectary) of flower (Reece et al., 2011, p. 850) . The honey bee will also attend to the form of the flower, visiting flowers with nectaries that are accessible to their proboscis. Another example of form attracting the honey bee is the Ophyrs orchid, also known as the bee orchid, which resembles a bee in the colour and shape of its inner petals (Pollan, 2003, p. 72). These attributes of flowers are means to attract pollinating insects such as bees, catering to the sensory capabilities of the honey bee, and thus speak to the preferences of foragers. The idea of the honey bee having floral preferences is illustrated in the many 'bee-friendly flower' seed packets and plant bundles for sale at nurseries and garden centres, and 'Trees for Bees', an organisation which provides information about planting specifically for the needs of honey bees (McPherson, Newstrom-Lloyd, Gonzalez, & Roper, 2016).

Preference is not only based on the consideration of a flower form. Floral sources of nectar are assessed by honey bees based on the profitability of a source. Profitability is a measurement made by foraging bees based on the variables of accessibility, or, distance of the site from the hive, as well as the amount of material to be gained from the source , and it's quality (Seeley, 1994; Seeley, Camazine, & Sneyd, 1991). The bee,

having assessed the source then returns to communicate about it, the decision to take up this foraging venture is then based on the needs of the hive (C. Anderson & Ratnieks, 1999; Seeley, 1989). Returning from foraging, a honey bee will pause to pass on the material she has collected, and before communicating via dance and the smell of the source left on her body, she interprets the needs of the hive: if the hive is well stocked, only the best sites will be collected from, and thus the communication of a less profitable source will be less important (Seeley, 1994). Honey bees see and interact with floral resources as individuals and as a colony. The bee may be attracted to an individual bloom for its form, but the source profitability is of more importance to the forager. This is how bees select which plant to enrol in the honey making network to meet the needs of the hive.

Dance communication

A bee who has returned to the hive having scouted for floral resources communicates what she has found through what von Frisch (1967) described as dance language. The purpose of this dance is to recruit more bees to forage from this source, thus it is an intermediary in the network, connecting foraging bees to enrol more bee actors; without an audience of bees, the dance is just a set of movements made by a bee. There are two kinds of dances: the round dance and the waggle dance. The round dance is utilised for sources nearby, and the waggle dance is performed when the floral resources are further from the hive (Matheson & Reid, 2011; von Frisch, 1967). The round dance is named for the circular movements the dancer moves in. The first part of the circuit is roughly circular, with a smaller secondary loop, to form a misshapen figure of eight *(figure. 7).*

Figure 7. Diagram of a round waggle dance.(Grüter & Farina, 2009)

The dance will be performed in a specific direction and speed to communicate detail of the source. The waggle dance can be thought of as two parts, one to describe orientation, describing the angle to travel from the hive, and a 'waggle' section, the duration of which tells of the distance of the target from the hive. From her origin, the dancer moves her abdomen from side to side, 'waggling' down a line. She then curves back towards the starting point, and waggles again. She will then curve back in the opposite direction (Georgia Tech College of Computing, 2011; Matheson & Reid, 2011; von Frisch, 1967). The dance will be repeated in different areas, recruiting more bees to foraging. The following text is a description of a waggle dance:

> Moving from side to side the scout shimmies from her origin upwards and to the left, taking a diagonal path. She moves for forty beats of the wing. How far we must travel.

Turn. 90 degrees. The scout curves. Working her way back to the starting point. More sisters pause to watch. Here. She says. Turn this way. From the bright-warm.

From the starting point, she moves along the diagonal path again. As she moves, foragers memorise her choreography. This is our path. Follow. This time, right. The dancer turns right after forty wing beats. Move this way. Away from home. Away from the hive, the others.

She has laid down her dance. And we take it up. She moves to another part of the hive, continuing to dance. Others join in. Circle each other. Here. This far, we say. There, follow the bright-warm this way. This way from the nest. I move away to the exit, remembering scent and instruction, and following.

The watching bees interpret the dance, and travel individually to find the source of the danced information. Sometimes the bees use the scent of the returning dancer alone to find the source. Other times the bee might take the dance as a call to forage, like an affirmation of the need for this task to be undertaken, and go out without the knowledge of the dance (Crist, 2004; Grüter & Farina, 2009). The body of the bee is used to interpret the particulars of navigation based on the hive, sun and source. For example, bees have an internal mechanism for knowing where the sun is, based on ultraviolet light, which is how they see:

> "Several potential problems associated with using the sun as a reference point are neatly overcome by honey bees. The sun's movement through the sky and its seasonal variation would result in new foragers missing the food source by a

> wider and wider margin, were it not for a 'sun-compass reaction' that automatically compensates for these changes" (Matheson & Reid, 2011, p. 57)

The dance communication of the honey bee is also performed variably depending on the needs of the hive:

> "When a colony is well nourished, its foragers exploit only highly profitable patches of flowers, but if the colony is near starvation, the foragers exploit highly profitable and less profitable flower patches" (Seeley, 1989, p. 551)

Additionally, there may be multiple dances taking place at the same time, as each foraging bee returns and shares her information. The interpretation of the dance is a sampling of the dances being performed at the time (Seeley, 1994). Communication between bees through dance and pheromone recruits bees in the production of honey.

5.1.3 Enrolment of the hive

The hive, the man-made structure which honey bees are kept within in beekeeping, is an actor within the honey network. It is the fixed location of the colony where shelter is found and the collected raw materials are stored. It is a reference point for the waggle dance. However, it is an intermediary in the honey bee network, as a wooden box which may or may not be enrolled as a nest for the colony. Honey bees exist without hives building comb which is attached to any surface, including cave wall, tree trunk, and sometimes the space between the internal walls of a building. One research participant noted that one of the colonies she kept came from the wall of a bathroom at a local primary school. Wherever the colony is based, hive or bathroom wall, the site is a reference point for bee navigation and the communication of nectar sources in dance communication. As I mention above, the vertically oriented hive is the starting point of all dances, and the duration of the central 'waggle' portion dictates the distance from this point (Georgia Tech College of Computing, 2011). The hive provides storage for honey, shelter for the colony and a barrier to intruders. The interaction of honey bee and attempts to enter the hive impede the honey making network.

The hive is either a vertical stack of wooden or plastic boxes, capped with a lid and set upon a base. The propolis that bees produce is employed to seal any gaps in the hive: between boxes, or to attach the frame to the box. Sealing these gaps weather protects the hive and aids in keeping intruders out. At the juncture of the box and base is the entrance of the hive. Another kind of hive, called a top bar is a rectangular box, oriented horizontally, closed with a lid, and set on legs **[6]**. This hive has an entrance at the centre of the longest rectangular plane. Regardless of the style of hive used, the honey bee interacts with the frames set within each of the boxes, and the entrance. The hive entrance, the thoroughfare of bees foraging, undertaking orientation flights to become familiar with the apiary, and for the queen bee and drone, leaving the nest via the entrance for mating. The honey bee colony fills the boxes, building beeswax cells upon wooden or plastic frames. Honey bees build comb from beeswax, secreted from glands on their abdomens (Matheson & Reid, 2011):

> *Beeswax is a very interesting building material. It tears like clay, mixed with cardboard or something kind of paper like. It holds brood, honey and the raw materials of nectar and pollen. And as a beekeeper you pay a lot of attention to the beeswax cells and comb itself. Is it the right shape? Is that right shape regular in regards to what it holds? Is it the right colour? Is it perforated? Is it perforated in the right way? Fieldnotes: October, 2016*

Comb is composed of hexagonal cells, set at a slight angle so that when vertically oriented nothing can come out of the cavity (Matheson & Reid, 2011). All that is collected and made by the honey bee is stored in these cells. In the production of honey, cells hold the collected nectar, pollen and water, as well as the products they contribute to, such as ‘bee bread’ and honey. Honey is also ripened within cells (Matheson & Reid, 2011). The hive is a site of shelter and storage. Interaction with the hive depend on the season and the needs of the colony. In the spring, the cells are

filled with brood, the egg, larvae and pupa stages of the honey bee lifecycle. The cells are tended for this purpose, and the bees feed the brood, and then cap it so it will develop into a bee, and then hatch **[7]**. The reproduction of the colony produces numbers for the production and storage of honey in Summer and Autumn. In the winter, the queen does not lay as much brood, the bees cluster around and inside of the cells to keep warm, also feeding from the stores of honey and pollen.

5.1.4 Actors that intrude

The hive is the contained site of the products of the colony; for storage, reproduction and communication. This may be breached by intruding pests and disease. In entering the hive, pests and disease are actors that thwart the production of honey by redirecting bee efforts from honey to defence, weakening or destroying the honey bee, or taking honey from stores. Wasps, varroa, beekeepers, viruses such as deformed wing virus (DWV) and disease such as American Foulbrood (AFB) are always present in the apiary. Although they do not always directly impact the colony in the honey making network, they impact the activity of the hive. The honey bee centred honey assemblage revolves around the sustenance of the hive, and so threats to this can indirectly affect honey.

Wasps

The common wasp and the German wasp are black and yellow flying insects that antagonise honey bees. Both types of wasp are larger than the honey bee, but have similar anatomy with head, thorax and abdomen. The head and thorax are black and the abdomen is patterned with black and yellow stripes (Matheson & Reid, 2011, p. 182). These wasps prey on honey bee hives, robbing honey and killing both larvae and bee to carry back to the wasp nest. Wasps are most aggressive in autumn, which is when the honey bee colony begins to prepare for winter. Wasps deplete the store of honey as well as the population of the hive, which can cause the death of a colony. The honey bee guards the hive to prevent the intrusion of wasps. However, the wasp has

the advantage of a stinger that is not barbed and so will be used many times, whereas the honey bee will die after it has used its stinger.

Varroa

The parasitic varroa mite enters the hive by jumping from one bee to another (Nordhaus & Miller, 2011). Carried by its bee host, the mite enters the hive and then a cell with bee larvae. It lays eggs in the cell, which hatch and feed on the incubating larvae. Feeding on the hemolymph ('blood') of the larvae, the mite can transmit disease and viruses, and weaken the bee so that if it does emerge from its cell it will likely die or be forced from the hive by other bees (Matheson & Reid, 2011). One of the viruses that the varroa mite is a vector for is Deformed Wing Virus (DWV) which is the cause of deformed wings of honey bees. The bees can no longer perform tasks for the colony and they are subsequently killed or abandoned. Furthermore, infected or weakened colonies do not produce honey. The honey bee can remove the mite through cleaning behaviours, or enrolling the beekeeper to apply miticide treatments, but an infestation can lead to death from starvation or contracting disease.

American Foulbrood

American Foulbrood (AFB) is a disease caused by spore-forming bacterium that affects the brood of honey bee colonies (Matheson & Reid, 2011, p. 156). The spores of this disease are passed from bee to bee via actors in foraging, and infiltrate the hive. The honey bee encounters this in the hive, specifically, the bees nursing larvae will notice in their assessment of brood cells, scenting the bacterium or finding the capping of a cell has is deformed, sinking inwards. The nurse bee will chew the capping of diseased brood, and remove any malformed or dead brood from the cell (Matheson & Reid, 2011, p. 157). There is no bee behaviour that could eradicate AFB. The colony, once infected, only serves to spread the spores until it dies.

The beekeeper

The invading layer of smoke, seeping in through the entrance of the hive and moving through the hive, disorients bees. Following this, the roof is lifted off, and the colony is opened to the bright sun. A white suited shape starts to pull comb cells from the colony, bringing the structure and the bees upon it close to it. Moving it about, towards the sun, away from the sun. The beekeeper breaks apart the hive-become-colony. Bees fly about, investigating the beekeeper. With each fresh wave of smoke the bees share messages of danger and panic, and collect what they can from the cells, ready to escape the hive if they need to. The beekeeper is a being of smoke and suit and tools, prising apart the hive for inspection, treatment, or honey extraction. Fieldnotes, October 10, 2016.

These are all processes undertaken by beekeepers, but the beginning of each begins the same: with smoke, panic and disassembling. The beekeeper is an agent in the honey bee honey network in the upkeep of the hive, which supports the health of the colony. The colony keeps the hive sealed with propolis, arranges themselves to maintain the optimum hive temperature, and through cleaning behaviour keeps the hives clear of debris, pests and disease. The beekeeper assesses the work of the bees and makes sure the hive is aligned to maintain the seal, also adding layers of insulation inside and around the hive in winter. The beekeeper reduces the size and amount of hive the colony has to work, taking empty frames away, to make sure the colony can cope with the upkeep. To prepare for this season the beekeeper treats the hive for pest and disease.

The colony and the beekeeper work to make the hive a space to produce and store honey. However, the extraction of honey is a less convivial process. There are different kinds of beekeeper honey removal: some might take small amounts over a period of weeks, and others might take most of the honey stores of a hive at one time. The kind of harvesting that beekeepers undertake is based on many variables. However, the intent of the smoker-wielding, suited being that opens and pulls apart the hive, is not important to the honey bees. The beekeeper is thwarting the production of honey by bees, taking what is meant for sustaining the colony.

5.2 The beekeeper network

The human beekeeper is enrolled in the honey production network to fulfil the desire to harness honey bee labour. The purpose of the beekeeping is as varied as the beekeeper. Health, honey, livelihood. This section describes the honey network of the beekeeper.

The beekeeper, human, with head and neck set centrally on shoulders of the torso, an arm protruding from each side of the torso, and a pair of legs beneath. The body of the beekeeper lifts boxes of bees and honey, the latter of which can reach 40 kilograms (Matheson & Reid, 2011). At the end of each arm is a hand of four fingers and a thumb. As well as being useful for manoeuvring equipment, the fingers are employed in pointing at, brushing away, and picking up bees in the hive. Fingers are used with particular care when handling the queen bee. The head of the beekeeper has a pair of eyes, which are essential in the task of noticing the queen bee, the eggs she has laid, as well as any warning sign of pest or disease, such as the ragged misshapen wings of bees with deformed wing virus (DWV). For improved vision, the beekeeper enrols a pair of glasses or a magnifying glass in this task. In the centre of the face, beneath and between the eyes, is the beekeepers nose. The two nostrils of the nose house scent receptors, which are employed in the detection of odours within the hive. The nose is the tool that enables the beekeeper to identify the scent beeswax, a musky sweet smell, and the spores and decay of American Foulbrood (AFB) disease, a putrid and

sour smell. Below is the mouth of the beekeeper, with a tongue full of taste buds for interpreting the taste of honey. Also located on the head, one on each side, are a pair of hearing appendages: ears. The ears of the beekeeper hear the noise of the honey bees, used to interpret the mood and health of the hive.

The anatomy of the beekeeper, an actor in the honey network, is described here with particular regard to the components with which the beekeeper knows and experiences bees and honey. The sensory appendages of the human body; fingers, eyes, nose, mouth and ears, allow the beekeeper to observe and manipulate the honey bees and hive in the honey network. One participant noted that “experienced beekeepers will know what the honey is within the comb by its colour, the cappings’ colour as well, its texture, and taste”. The beekeeper attunes its body to the honey bee and honey in the honey making network. The beekeeper is a human, performing tasks with the intent to keep honey bees within hives.

5.2.1 Enrolment of the honey bee

The honey network of the beekeeper does not exist without the honey bee. The beekeeper does not collect the nectar and pollen from the flower, but instead enrols the honey bee in this task. The creation of honey also requires the bee body to digest these raw materials and then store the honey within the hive. It is not the beekeeper who performs these aspects of honey production. In this section I examine the beekeeper centred honey network, asking how the beekeeper knows honey, and the connections the beekeeper must make for its creation. The beekeeper enrols materials to mediate the connection between bee and beekeeper *(figure 8.)*. These materials include protective clothing and smoke, the hive, specifically the hive that can be altered to suit the performance of beekeeping for honey, and tools which aid the alteration of the hive. I will also describe the difference between hobbyist, or backyard beekeepers, and commercial beekeepers in relation to honey.

Figure 8. Honey bees on beekeeper's hand. Authors own.

5.2.2 Enrolment of the plant

For the raw materials that honey is made from, the beekeeper needs the plant: it is a mediating actor in honey production. Collecting nectar from the flower is something a human beekeeper body can do, but not nearly so well as the bee. Additionally, the bee must process the nectar through digestion, and store it in the cells of the hive before the beekeeper can access honey. The beekeeper is reliant on the bee for this. The beekeeper enrols the plant, or the knowledge of plants, to assess the potential for honey, and capture a specific type of honey. Unlike the bee, the beekeeper desires specific floral resources for the production of honey, and enrols knowledge of which plants are attractive and available to bees in the beekeeping honey network. David, a commercial beekeeper, spoke to me about different honey varieties that commercial beekeepers might be trying to focus on and noted that:

> "The kanuka flower has usually two weeks, or towards the end of the mānuka flowering, or basically two weeks afterwards. And I'd say it's pretty much at the same time as the clover. So, unless it's a good kanuka block, with no clover around, then you'll get some kanuka. But if there's any clover around, bees prefer clover. Always clover first…you're watching the bees. A kanuka block

that I had, it was only fifty percent kanuka and fifty percent clover, and you could see the bees pretty much just fly past the kanuka and go to the clover"

In this statement, David describes the preference of honey bees for clover, a pastural crop planted by farmers for its nitrogen fixing properties, over kanuka, which is a native bush like mānuka. He suggests that there would need to be mostly kanuka in the apiary for the bees to ignore clover. The reason for the preference of clover, whether it owes to a more pleasant scent or more easily accessible nectar source, is not of consequence. For the commercial beekeeper to capitalise from surplus honey, enrolment of specific plants is necessary. The beekeeper does this through having knowledge of the seasonal nectar flow of specific plants and the behaviour of the bee in foraging.

5.2.3 Enrolment of the hive

The hive is the structure where beekeepers keep honey bee colonies. Without the hive, the beekeeper would have great difficulty harnessing the labour of honey bee colonies, and the beekeeper network of honey production would not exist. The New Zealand beekeeper will likely use either the langstroth or top bar hive. The materials used to construct the components of the hive are likely wood or plastic, but the beekeeper decides which best suits the goals of their beekeeping. The plastic components would last longer, one participant said to me, but if you found AFB and had to destroy a hive, the plastic would be problematic. Wooden boxes need to be weather proofed. We painted our wooden boxes to this end. The main components of the langstroth hive are a base or floorboard, and this is usually where the entrance of the hive is located. Upon the base board are boxes, also called hive bodies, which may be 'full-depth', 'three-quarters' or sometimes 'half-depth'. The size of boxes is determined by the beekeeper, but the main reason for enrolling smaller depth boxes in the beekeeper network is to do with the weight of the box: a key concern for beekeeper bodies which lift boxes full of brood or honey. The number of boxes depends on their size, use (brood or honey) and the goals of the beekeeper. The boxes are topped with an inner cover, sealing the bees, and further a lid. There are also various additions to this, including feeding frames or trays, used to feed sugar syrup to

the bees, and queen excluding mesh sheets made to allow the bees to move through the hive and not the larger queen. These are the components of the hive which may be enrolled: wooden and plastic parts, additional paint and various materials for weighing down the structure or holding it together in a tower.

In describing the hive I have chosen the langstroth style, because it is what I use and am therefore more familiar with. Another reason for this is that it is the style of hive used specifically for the production of surplus honey by commercial beekeepers. Each component of the langstroth has a specific use for the beekeeper, to the end of creating honey. The floorboard seals the hive and lifts it off the ground, to protect the honey producing bees. The hive entrance can be opened, to allow a larger flow of bees in honey production, or incrementally closed to help the bees in the defense of the hive. The boxes and frames hold bee and bee product. They are also interchangeable, so the beekeeper can assess the hive, take honey and replace removed frames with empty ones to encourage more honey production. As with the floorboard, the inner cover and lid seal the hive for protection. The hive enables beekeepers to produce honey and assess the health of colonies. Without the hive and its components, the beekeeper could not collect honey in the quantities required to access the honey market.

5.2.4 Enrolment of tools

The beekeeper uses tools to connect the human body to the bee and hive in the honey network. Tools are enrolled as intermediaries in the network as extensions of the beekeeper body, like the protective clothing used or the bee brush, which is a long-handled brush used to move bees. The beekeeper attaches the bee brush to its gloved hand *(figure 11. Below)* and directs the bristles over the bees to remove them from the hive or the suited body.

> *The suit is an overall of thick material with a beekeeping veil attached at the neck. The ankles and sleeves are elasticated, and the veil zips onto the suit and is sealed*

with a square of Velcro at the collarbone in order to keep the bees out. We also wore long gloves, also elasticated, that were thicker around the hand. These were to be pulled up past the elbow to seal the arm completely. The elasticated ankles slipped over our gumboots. We were sealed off from the bees. Fieldnotes, September 9, 2016

Like the brush, the smoker is an extension of the beekeeping arm. The smoker is a metal, cylindrical furnace, with a spout for the smoke to escape and bellows to stoke the fire inside *(figures 9. and 10. below)*. This smoker has a hook or handle, curved over the side but only connected at the base. An 'r' shaped addition that allows me to hold or hang the smoker. There is a cage around the cylindrical body of the smoker which acts as a barrier between the hot metal body and the human body. The smoke that comes from the smoker should be cool so as not to burn the bees. The metal, cylindrical, spouted pot with bellows attached does not work as a smoker until there is fire within that can create smoke:

I light a fire inside the cylinder. I have a small piece of old sack. It smells a bit musty. I put this inside the smoker, adding some dry bark or newspaper. I light these materials, using the bellows to feed it oxygen. The fire will probably go out at least once in this process. Once you have a good fire going, you then take some more sacking and smother it. You could also use pine needles or grass, anything that is at hand and produces a cool smoke. Fieldnotes, September 9, 2016

Figure 9. Dad lighting the smoker in his bee suit. Authors own.

Figure 10. Lighting the smoker. It takes many matches. Authors own.

The smoker-beekeeper applies smoke to the bees during hive checks. The smoke is said to calm the bees, or simulates fire, and the bees react by hurrying to try and salvage honey and leave the hive (Moore & Kosut, 2013). This enables the beekeeper

to invade and manipulate without alarming the bees to the point where they would become aggressive (in theory). In contrast to the way that the hive enables the honey collection of the beekeeper, the equipment used to work with the hive is more a mediator in the honey network. The equipment is useful, but the network holds together in its absence.

Figure 11. Beekeeper's glove covered in propolis. Authors own.

5.2.5 The Apiculture Industry actor

The ability to collect honey in surplus amounts with the introduction of the langstroth hive created a market for honey in New Zealand. Commercial beekeepers collect and sell honey through various means which I have detailed in earlier chapters. Demand for specific types of honey, such as clover and rata, changed the beekeeper honey network, calling for specialisation. In particular, the antibacterial properties of mānuka honey created a niche market for this high value honey variety (Van Eaton, 2014). I aim to explain the way that the market influences the honey network from the perspective of the beekeeper. How does the beekeeper capture the single varieties of honey, particularly mānuka, in the honey making network? In this section I explain the role of

the mānuka plant in the honey network. I also consider tutu honeydew, a variety of honey which is undesirable because of its toxicity to mammals (Ford, 1910). In both instances the contingency of the beekeeper honey network is shown: the honey bee is not an unproblematic agent.

5.2.6 Enrolment of mānuka

The mānuka plant, *Leptospermum scoparium,* is a scrubby bush with dense branches of small pointed oval leaves and peeling bark. Mānuka grows on marginal land, and it grows quickly. The antibacterial properties of mānuka honey have enrolled this plant in the commercial beekeeping honey network, as well as created a specific mānuka honey network. In order to produce Mānuka honey, the beekeeper enrols the Mānuka plant and honey bee, as well as the owner of land with Mānuka, and attempts to mitigate the risk of a bad season, pest and disease.

Mānuka is a desirable type of honey in monofloral and multifloral iterations. The plant is a valuable source of nectar for the beekeeper, one participant, a commercial beekeeper, had been told that: “your worst year on Mānuka will still be better than your worst year on clover because of the value difference”. He also explained that it “likes wet feet”, and although it doesn’t grow in large quantities in the Manawatu, he has “hives spread during the mānuka season in Wairarapa, down Wellington way, and up towards Ruapehu, and over Whanganui way” in order to access it. The mānuka season, when the flowers bloom and nectar is available, occurs in late December, although any flowering season is approximate and contingent on weather. I also found that the ability to judge the time when Mānuka was ‘on’ was a skill of commercial beekeepers developed with time and experience.

Commercial beekeepers desire the enrolment of Mānuka in their honey network. To achieve this, the beekeeper accesses mānuka growing on public and private land. There are a number of ways to access land, including conservation land through an application to the Department of Conservation. This was spoken about during the

Apiculture New Zealand 2016 conference in Rotorua, where formal land use agreements were discussed as the industry approved. However, participants noted that there were many different approaches to attaining sites, and agreements made with landowners could range from a per-hive basis to a percentage of the crop. Securing Mānuka sites is competitive and most beekeepers were secretive about their sites. Commercial beekeeper D, spoke to this, "some of the farmers will actively look for other beekeepers to see what they will pay towards the Mānuka crop". For the beekeeper, access to Mānuka is the main way to enrol the plant and remain within the specialised Mānuka honey network.

5.2.7 Myrtle Rust and Tutin: Actors which thwart the beekeeper

At the time of writing this, there has been an outbreak of a fungus pest called Myrtle rust in New Zealand (Ministry for Primary Industries & Department of Conservation, 2017). Myrtle rust is recognised by a yellow and rust-orange powdering residue or pustules found on the leaves of plants. The fungus attacks the myrtle family causing deformed foliage and plant death. The myrtle family includes New Zealand native species such as pōhutukawa, rātā, kānuka, and mānuka, as well as guava, feijoa and eucalyptus (Department of Conservation, 2017). These species are all floral resources for honey bees: the native species for honey production and the three latter for pollination and fruit production (McPherson et al., 2016). At the time of writing, there were 20 reported cases in New Zealand on private gardens, nurseries, and distributors (Ministry for Primary Industries, 2017b). The Department of Conservation (DOC) reports that in international cases myrtle rust has been difficult to control, and it will not be eradicated now that it has been introduced to New Zealand (2017). As the beekeeper depends on the cultivation of Mānuka by others, myrtle rust is a threat to the mānuka network. The beekeeper has no control over the impact of myrtle rust in the honey network. The impact of myrtle rust is an example of the contingency of the honey network, because it is an assembly of beings which are unruly and problematic which can enter and exit suddenly, disturbing, and perhaps devastatingly.

Another problematic actor in the honey network is tutu honeydew. The collection of tutu honeydew occurs mainly in times of poor nectar availability during drought (Matheson & Reid, 2011). For the beekeeper, tutu honeydew is undesirable as it contains the poison tutin (Ford, 1910; Matheson & Reid, 2011). Tutin is present in the sap which the passion vine hopper consumes and secretes, creating honeydew, a material which bees can enrol in the honey making network when there are no better sources of nectar. For the commercial beekeeper, tutin can be avoided through a careful removal of bees from sites near tutu, or dilution with uncontaminated honey. There are tests available, and these are required before any sale of honey collected during the tutu flowering according to the Ministry for Primary Industries Tutin Food Standard (Ministry for Primary Industries, 2016). The hobbyist beekeeper who does not want to sell their honey is also advised to test their honey. Tutin contamination was discussed at a Manawatu Beekeeper's Club meeting where it was suggested that you could instead feed contaminated honey back to the bees, who are unaffected. For the honey bee, the enrolment of tutin in the honey production network is sometimes useful, but for the beekeeper it is dangerous.

5.3 Conclusion

A network analysis, which flattens the agency of actors in networks, draws attention to actors which might not have otherwise been noticed. The first network presented is centred around the bee itself; beginning with the honey bee and understanding how and to what end the insect connects with other actors. This is an account of honey bee agency in the production of honey. The second network is human-centred, and instead traces the agency of the human actor who aims to harness the labour of bees for the production of honey. Through viewing the honey bee network, we know it differently than through a human-centred honey network. The contrast between these representations shows not only that bees exist differently in different networks to achieve various aims, but that there is no standard honey bee network. While the honey bee can be known as a productive insect that humans collaborate with to produce a honey crop, it is also an agent working to meet the needs of the colony.

Tracing the honey network from the perspective of the honey bee and the beekeeper allows for comparison between the different agents in each network, and the different translations that occur with similar agents. The key points of contrast are in the enrolment of plants in the production of honey and the mediating effect of the hive. In the honey network of the honey bee, the plant was enrolled in the process of foraging. The anatomy of the honey bee collected from the anatomy of the flower the necessary raw materials for making and storing honey, including future bees which will use their bodies in the network. The beekeeper network also enrolled the plant as a source of honey, but this was through the honey bee. In this case, the commercial beekeeper attended to the type of plant more carefully, because the market for honey is an agent within the beekeeper honey network.

In both the honey bee and beekeeper network there were also thwarting actors. For the honey bee, the beekeeper was a thwarting agent, removing the honey stored for the future use of the colony. The honey bee also contends with pest and disease, which rob honey or weaken the colony to the point where honey cannot be produced. These thwarting agents remain for the beekeeper, who must access the honey through bees. However, the commercial beekeeper wanting to capture Mānuka is significantly impacted by threats to the plant, whereas the honey bee can find an alternative. In calling attention to the two different networks I aimed to show the shared condition of the honey bee and beekeeper: the precarity of the network. Networks are not permanent or stable. The thwarting agents described in both networks create tension which disrupts and potentially ends the production of honey. The production of honey is not a given for bees or beekeepers: it is contingent on a variety of actors which can contribute to, or thwart, the work of these networks. However, the fragility of these networks means different things to the bee and beekeeper, in other words, it is survival for the honey bee colony and enterprise for the beekeeper. Contrasting the two networks shows that the desires of bee and beekeeper may align, and the beings may collaborate in the production of honey, but the relationship is not a given, and it shapes each actor differently.

6. Season

Over the course of my fieldwork I viewed the ways that seasons organise the lives of bees and shape their lifecycle and the activities undertaken by them in the apiary. The bees take cues from seasonal variances, such as temperature and wind strength, for acts such as leaving the nest for foraging. Season also impacts the lifespan of the bee, and workers who usually live for around three weeks, will live for longer during winter. The tasks beekeepers undertake to maintain a hive of bees are also influenced by these seasonal variances. As one beekeeper explains:

> "Trouble arises because we look at the seasons in a different way than bees do. Here in the northern hemisphere, many of us are celebrating the first day of summer. Clear skies, warm water, t-shirts, and sandals. But bees respond differently. For them, the summer solstice signals the long slow slide into winter. The amount of daylight decreases, spring bounty is followed by weeks of drought, nectar sources disappear. Your bees notice these changes right away, even if you don't." (Burlew, 2017)

In the Spring of 2016 I bought two small parcels of bees, each with a queen bee and a few thousand bees. Over Summer and Autumn, I observed these small colonies as they grew larger, built comb, raised bee larvae, made and stored honey. Winter is the upcoming season as I write this thesis, and we are preparing for a relatively quiet time, whereas the bees will be working hard to regulate the temperature of the hive and feed themselves on the stores of honey and pollen they have produced. Viewing the seasons of the colony shows the contrast between beekeeper experiences of the apiary with that of the honey bee, specifically that there is more to the honey bee than what is written in beekeeping guidebooks. Seasons are more than weather conditions, or the way that beings interact in time and space within conditions. The seasons play out in the as an actor in apiary network. Furthermore, a seasonal narrative demonstrates the ways in which representations of honey bees are co-constructed and provisional:

Later the bees were very active. The afternoon had become warmer, clearer and less windy. There were many bees coming and going. Totally different from the morning. The different level of activity is noticeably dependent on the weather. Which doesn't surprise me, it's well known that bees prefer and need certain conditions, but seeing it over one day was really interesting.
Fieldnotes: 13 March, 2017.

This chapter presents the different forms of relating to bees from my point of view as an ethnographer and a beekeeper. It is simultaneously an experiment in de-centring the human and an acknowledgement of my partiality in presenting the honey bee in this thesis. In the spirit of autoethnographic method, I lay my own assumptions, feelings and ideas out in the apiary. I use images collected throughout the beekeeping year, showing my view of the apiary and the process of coming to know two hives of honey bees. The meaning of these images for me has evolved over the period of time this research has been undertaken, and I reflect on this accordingly.

6.1 Spring

Spring is the beginning of the new beekeeping season and was our first beekeeping season. These beginnings are contingent on the milder weather, which signals to the bee that it is a time when nectar and pollen are again available. As the weather grows warmer and more resources become available to the bees, the hive grows, and more workers emerge to provide for the next generations. Over this season we learned about the bees as practitioners of the beekeeping practices learned in books, on courses, from mentors, and from researching online. As an ethnographer, I learned about how to observe bees. Coming to know the honey bee involved learning about its body and behaviour. I share two key actors in the spring honey bee network: the queen bee, which is a key signifier of colony health, important to locate during beekeeping inspections, but not always seen; and the varroa mite, which I describe as dreaded, concerning, and invasive. Viewing each of these actors in the apiary network

shows tensions which may exist between the existence of the colony, and the expectations and assumptions which might be placed on the colony by the human beekeeper.

6.1.1 First encounters with bees

The box of bees

The bright warm should be coming now...we move to the entrance...to see if the outside is ready...confusion...blocked in...

Alarm is raised...We have been sealed inside...Inside with the towers of cells that house us...What to do...we tend to the towers of cells, housing food and the young larvae...

Later, when the bright warm would be down over the other side of the hive... picked up...And then placed down again... There is a musky, oily beast smell here...And metallic smells...like the fog that comes before the white suits show up. There is a growl and a lurch...Still there is no way out...

Lifted up...placed down...It's cooler now. The metallic smell remains...but now also green near and further there is nectar...I move down...Can we leave?...Still we are blocked

Again we are lifted...carried...bobbing movement...and the scent of green and dirt comes stronger...then movement slows, and stills...A noise, a snap or click?...

There is light coming through near the bottom of the frames...from the entrance...The scent of grass and nectar is stronger now...clover? Thistle? Sisters investigate...send signals to the rest of us...Release...Flight...They leave the colony...I move down to follow.

This bee-writing is a representation of the transferral of a box of bees from one apiary to another. This is the process by which I came to keep bees. In September, 2016, we purchased two parcels of bees from a beekeeper in Marton. Dad picked up the bees, which came in two nucs of five frames each. As I detail in Chapter Four: "Methodology", we had set up a base of pallets on a part of the property near a dam. We carried the nucs from the house to the apiary, leaving the nuc entrances closed overnight to keep them protected. The next morning, we opened the nucs, leaving them there for a day or so to become oriented in the space. I took a day or two to prepare the hive equipment, and thereafter we transferred the bees into hives. We then started to talk about and work with the bees, learning what we needed to be doing when. Making mistakes. Overthinking each decision and potential outcome:

As soon as you have hives and are looking after bees, reality sets in and you become more conscious of everything you do with honey bees. It has made me quite nervous. Dad and I have been checking the hives once or twice daily. Instead of looking to try and see their behaviours, I find myself checking on them. Fieldnotes, 26 September, 2016.

Spring is a time that marks the beginning of the growth of the honey bee colony, and the start of the beekeeping year. What follows is an account of this season which details how I came to know the honey bees I keep, noticing the behaviours of the colony at this time of year.

6.1.2 Coming to know the queen bee

Learning about the honey bee as beekeepers meant discerning the different castes of bee. The nuc contained many worker bees, and one queen. The reproductive work of the hive is performed by the queen bee, *(the central bee in figure 12., pictured below).* The queen bee is larger than the worker and hairless.

Figure 12. The queen bee among worker bees. Authors own.

The queen has a longer life than the worker bee, potentially living for between two to five years. A newly hatched, virgin queen must mate with the male bee, the drone, who carries the male genetic material. This involves the queen leaving the hive and attracting drones from different colonies in the area. The queen mates with many drones, storing the sperm in an organ designed for the purpose, called the spermatheca. The sperm collected during mating flights will serve to fertilise all eggs

laid in a queen bee's life. The queen doesn't often leave the hive after her mating, unless she is part of a swarm, or has been killed by the hive, which might happen in the raising of a new queen.

During my honours research I found that being able to spot the queen was a sign of competence and understanding of the practice of beekeeping. I remember feeling like I was missing something. For Matheson and Reid (2011) spotting the queen bee is understandable the first task of queen care, and one of the key indicators of hive health.

> *A group of beginners stood around the hive, passing around frames full of bees. The instructor challenged us to find the queen bee. I wasn't sure what I was looking for. "She's larger than the others", somebody shared. Then another student spotted the queen. Even knowing she was there, I didn't recognise her. I remember feeling inadequate at not being able to distinguish her from surrounding bees. Fieldnotes: honours, 21 May, 2015.*

Now, having two hives to work with as a beekeeper, spotting the queen bee isn't only a fun and novel challenge, it's necessary for assessing the colonies. The queens of the yellow and purple hives are also familiar. I feel relieved when we see them. To locate the queen, I first look at what the bees on the frame are doing. Mostly the worker bees will be working by themselves, walking over the comb with purpose. I look for a cluster of worker bees that doesn't move very far or fast. These bees are the queen's attendants, and I usually see the queen among them **[7].** Marking the queen, where a spot of paint is placed on the thorax of the queen, makes the process of locating her easier. The purple and yellow queens were marked by a local beekeeper using the device shown in the picture below (*figure 13)*. The queen is caught inside the plastic tube and carefully brought to sit below a grate, through which a paint pen (or similar

implement) can reach her body and apply its mark. **[8]** If the age of a queen is known, the colour of the paint will indicate this.

Figure 13. Queen marking apparatus. Authors own.

There have been at least two occasions when we haven't been able to sight the queen of the purple colony:

> *Both Dad and I had said, "she'll be on the next frame I think", or the next box, or, less optimistically, she's fallen out. Dad was always careful to hold brood frames over the boxes to catch bees in case we shook them off. When we didn't see her, we were both worried and disappointed. After the visit, we wondered what might have happened. Was it the wasps? Could they have come in and killed her? Maybe she was an old queen. Are the others raising a new queen? She could still be there though… Fieldnotes: 15 May, 2017.*

The absence of a queen in a beehive indicates to the beekeeper that there may be something wrong. The times when we have not sighted the queens of our beehives have caused both Dad and I distress. As in the example above, we tend to list all possible reasons for her absence and where else she could possibly be. What this shows is an assumption that the queen must be viewable in a hive, whereas really the queen has no interest in presenting herself to the humans staring down. She might even be hiding herself for safety.

6.1.3 Coming to know the Varroa mite: awkward encounters

About six weeks into our beekeeping I was learning what to notice within the hive. The shape of the bee, it's movements, the sounds it makes when I saw it out and about foraging from flowers, and how this compared to the hum of the colony when I intruded on it in inspections. During an inspection in October I noticed something was wrong:

> *I saw a worker bee emerging from a cell. It's now my favourite thing to watch. The newer bees are lighter and whiter. Almost fluffy looking. Unfortunately, I noticed a bee with deformed wings. And then another. This is concerning. Bees with deformed wings are an indicator that something is wrong. A bee might have contracted a virus from a varroa mite, a drone might carry a virus, or something more serious and less treatable might be going on. Coupled with the patchy brood pattern, this was a bad sign. I closed up the hive and decided that we needed advice from someone more experienced.*
> *Fieldnotes: 23 October, 2016.*

A follow-up inspection in the following week confirmed my worries when I met with the small, oval blood-red parasite, the varroa mite:

I scraped away the comb, trying to avoid hurting the bees around it who really didn't want to let it go. A red-brown crab-shaped spot moved away from the frame and into the hive. I had been checking the bees for the mites, but had not yet seen anything. I expected the varroa to be too small to spot, but it was there. It stood out against the black of the frame. I felt dread. Fieldnotes, 21 November, 2016.

I organised for the hives to be inspected by an experienced beekeeper and member of the Manawatu Beekeepers Club. He diagnosed the purple hive as having a varroa infestation, and we applied a treatment. The treatment was in the form of a plastic strip coated with an anti-varroa chemical *(figures. 14 and 15)*. There are a few different types of treatment available, I didn't see which one this was. We left it for six weeks, and the mites were seemingly taken care of. Treatments are designed to be applied twice a year, once in spring and again at the end of the beekeeping season, which is around autumn.

Figure 14. Varroa strips applied in the hive -visible are the 'c' shaped light yellow strip tops. Authors own.

Figure 15. Another view of the varroa treatment strips. Authors own.

6.2 Summer

It was a mild summer this year, more sun than rain, but always the wind of the Pohangina Valley. Summer is the main period of flowering; the time when nectar 'flows' (see appendix 1: glossary). The honey bees build up to this, growing the colony in spring and readying the cells for the nectar, pollen, honey and water that will be brought back and stored with the wax. The honey bee is visiting and collecting from the flowers in the apiary. In this time of abundance, the honey bees in the apiary are foraging from numerous sources, creating honey to grow the hive and to begin the process of storing food for later. In our beekeeping, we made decisions about feeding the bees[3] **[9]**, altering the hive ware, and tried honey from the hives for the first time.

[3] Feeding the bees with sugar syrup see Appendix 2: Langstroth Hive, for the apparatus designed for this.

6.2.1 Experiencing honey

Collecting honey from the beehives was not the purpose of our beekeeping, but when we saw cells of it in the hive, recognisable by the texture and colour of the cell contents and capping, I was very excited by it. The taste of the honey was a part of my experience of honey bees in the apiary:

> *We opened the purple hive and found more bees and a lot more burr comb sticking the top of the frames to the bottom of the syrup feeder. There were more frames filled, almost all of them. A lot of good honey stores. In fact, as we manoeuvred the frames and scraped away burr comb the honey coated our gloves and the hive tool. Bees were sticking to us. Some became so coated in honey that they couldn't move. This was 'real' honey. Not just me sticking a finger into comb. We scraped enough honey filled comb away to make half a cup of honey. (I later had it on toast and it was amazing! Runny and floral. Sweet in a way that kind of dissolved away. It definitely tasted like sugar syrup, but it was musky and earthy)*
> *Fieldnotes, 14 January, 2017.*

We took this honey back to the house and everyone tried it. Mum is not a fan of our honey. She said she prefers other native honeys, like rata. The small cup of honey we took from the hive after cleaning up some surplus comb (we say surplus, the bees would not call it that) was clear, pale yellow and runny. I had tried honey straight from the comb, which turned out to be nectar, and the difference is discernible. Nectar is thin, and tastes like sugar. Honey is thicker, even the runnier honey, and smells floral. The honey was subtle, and a bit like the sugar syrup we were feeding the hives at the time.

I have learned a little about types of honey, for example, one participant said that thistle honey is runnier than other types, and at the MBC demonstration of honey extraction I learned that mānuka honey is so thick that to extract it from comb it needs to be agitated. So, from this, as well as knowing that our pasture is made of thistle, buttercups and clover, we have called our honey 'failed farmer honey'. A mix of all the pest species found on our land. No doubt there is also gorse in the honey. Our failure to keep our pasture grassy and weed free is a boon for the bees. So maybe we should call our honey after that. Maybe we should call our honey 'bees first choice'.

6.2.2 The time to be conscious of potential swarming

Summer is a time of increased honey bee population as well as hive activity, and as such, it is the time when the colony is most likely to swarm. A swarm occurs when a nest is overcrowded, and a group of honey bees leaves the hive (Matheson & Reid, 2011). If a colony swarms, the beekeeper must capture the group of bees in order to keep them: and this is not always possible, particularly if the bees move to settle on a very tall tree or if the swarm goes unnoticed. To mitigate the risk of swarming, beekeepers will make sure that a colony has ample hive space to match its growth, or it will perform what is called a 'split', which is the act of dividing a colony into two (Matheson & Reid, 2011). We added more hive units to accommodate for bee growth in summer:

> *So we decided that the purple hive was almost ready for the next boxes to be placed on top. The yellow needed longer, perhaps feeding more often. But the overall sense we got from the hives was that they were growing stronger. Making honey! We didn't need to take any actions in remedy of any problems. 14 January, 2017*

The number of bees in the hives, especially the purple, were increasing. We made ready for adding some space in the form of another box. The second purchase of equipment happened, painted the boxes, and added them to the stacks. We were aware of the bees outgrowing their space and warming from the hives. Late-spring

through to mid-summer is a time of growth, and thus a time to be weary of the swarm. Managing hives for swarms in summer is an example of the way that a beekeeper learns from the honey bee, understanding its behaviour to achieve the goals of keeping a colony fixed in a hive, or encouraging bee population growth by adding hive space.

6.2.3 Coming to know drone bees

It was during this season that we started to see drone brood. All brood cells are capped in beeswax, but the capped larvae of worker bees are slightly curved over the cell, whereas drone brood is larger, protruding from the cell to accommodate the larger body of the drone.

Figure 16. Honey bee brood, with drone brood at the lower right hand side. Authors own.

This is illustrated in the image above *(figure 16. above)* which shows bee larvae and capped brood. The upper third of these cells are worker bee brood and the lower two thirds shows capped drone brood and uncapped drone larvae. The drone is the male of the honey bee species. At first I found it hard to discern between the bee sexes, but began to identify the drones larger body, particularly its eyes, which are much larger than the worker bees. The drone also behaves differently: while the worker bees and queen are always moving about throughout the hive, the drones move slowly, feeding

from cells within the hive or occasionally leaving the hive entrance. The drones of a colony emerge in Summer for the purpose of contributing genetic material to the virgin queens of other colonies through mating. The sole purpose of the drone is to contribute genetic material, which is useful for the reproduction of the colony, but does not contribute to the production of hive products like honey and beeswax. Thus, from the perspective of the honey bee colony, the drone is a key actor, whereas to the beekeeper it is potentially less important.

6.3 Autumn

Summer winds down into Autumn. The temperature drops, there is more rain, and, in May we have the first frost. At the apiary the trees are starting to lose their leaves and the dam is filling up again with the rainfall. I see less bees at the hive entrance, but I begin to notice the noise bees produce within the hive:

> *I could hear the bees within it. I couldn't tell which hive was making the noise. The hives have grown so much in the six months they've been there. (There are two ¾ boxes on the yellow, and two ¾ and one full depth box on the purple. That's twenty, and thirty frames respectively, compared to their initial five.) The noise was a hum or buzz, in bee sensory language. It's similar to electrical current or static. I felt each hive, to see if the noise would produce vibration, but it didn't come through the wooden boxes. It was amazing. The volume they produced. I think they were likely regulating the temperature because it was a cold morning. Fieldnotes, 10 March, 2017.*

We began this season confident with the state of the bees. Each hive had a full three-quarter box of honey. This amount would sustain them when they couldn't forage. We even thought we might be able to take some away for ourselves. In contrast to this, I heard that the honey season was considered poor. MBC members reported that they weren't taking any honey from the hives, and commercial beekeepers were moving their hives from mānuka sites and trying to find places with better floral resources. We went to collect the honey one day, and found that both the purple and yellow hives had either consumed their stores or they had been robbed. The apiary in Autumn is a space of competition. The honey bees guard the hive from intruders which desire the food stored within or a warm space to spend the winter. Autumn is a time when the bees are most aggressive in their defensive efforts, but also in their last-ditch effort to bring nectar and pollen to store in the hive before the dearth of winter. It is a transition into winter for the bee, storing resources to keep the colony alive when there is nothing to forage, and for the beekeeper, assessing and manipulating the hives to aid the colony in its wintering.

6.3.1 Encounters with intruder bees

It is during Autumn that the colony is most exposed to competitors, such as the bumblebee, wasp and mouse. The stores of food and brood from the spring and summer are at risk of robbing, and the approaching winter makes the loss of stores difficult to compensate for. Additionally, honey bees will seek food where they can, robbing from other colonies, and risking the transmission of pest and disease, particularly varroa and AFB. To mitigate this risk, we applied another miticide treatment and filed a disease return to report any issues or changes in the apiary: a requirement of being a beekeeper in New Zealand. I had not seen robbing, but one participant, Nigel, described his experience of it:

> Nigel: Well it looked like there were quite a few bees swarming around, because there had been no bees, they'd all died, there'd been no activity on the outside – coming or going – so that's why I thought a swarm had moved in. 'cause that's when my hive was getting full, so I thought, 'I hope that's not my queen' (laughs) but it wasn't. He said, 'na, na, they're just robbing'.

Jordan: So they take it all? [wax as well as honey]

Nigel: Yeah they use it for their own. That's why you've got to be careful with AFB. They'll take the stuff from that one back to your good one. So, that was interesting. I've seen robbing.

Jordan: That's something that I didn't think I'd be able to recognise. But it sounds like you'd notice. That it's abnormal.

Nigel: Yeah, it is abnormal. It looks like swarming, if you think of bees on here, and there. Unusually. Normally they just go backwards and forwards; in and out the door. Just their normal behaviour. But yeah, they were around the box, trying to get in at different points 'cause they didn't know where the entrance was.

This conversation is another example of beekeepers noticing the honey bee as a part of the beekeeping practice. Nigel knows what robbing bees look like, comparing it to what swarming bees look like. He also notes the potential spread of disease, which is a concern for beekeepers. The bees that are robbing are perhaps not considering this, seeing the empty hive as another source of important resources. The beekeeper sees the mixing of different bees and hives as a kind of contamination which carries risk.

6.3.2 Encounters with wasps

We took notice of the signs of disease and pest, and the most antagonistic being in the apiary during this season was the wasp. There are four introduced species of wasp in New Zealand, two of which are destructive in beekeeping. Both species have bright yellow bodies with black stripes on their abdomens (Matheson & Reid, 2011, p. 182). In late March, Dad and I noticed a lot of these wasps around the house. We killed as many of them as we could, squashing with any implement at hand: wooden spoon or brick *(figures 17 and 18 below)*. Our lack of empathy for wasps is shared by many beekeepers and bee enthusiasts, as David recalled:

"Wasps can be very destructive. When I was working with [a local commercial honey business] we had wasps that destroyed a whole yard of bees. They had

chipped away at the honey stores and they'd gotten to the brood as well. 'Cause they go for both the honey for carbohydrates and protein from very new brood"

Figure 17. Wasp squashed on brick. Authors own.

In the apiary, we noticed that wasps were hanging about the hives, sometimes entering them. The honey bees were guarding the hives, but were dying in their efforts *(figure 18.)* For every dead wasp at the hive entrance there was a dead bee:

> *The wasps have an advantage in that their stinger doesn't have barbs that catch and pull out their intestines, like the bee. The wasp can deploy its stinger multiple times without dying. I've been watching the bees at the apiary for 'guarding behaviours', and so far have*

seen some patrolling, where bees hang out around the entrance. A wasp flying around the hive entrance gets set upon by one or two bees. If the wasp is grounded, the bee will grab it with its two foremost legs, and wrestle to manoeuvre its stinger to sting the wasp. Fieldnotes: 10 April, 2017

Figure 18. Dead wasp and bee at hive entrance. Authors own.

During an inspection in April we inadvertently exposed the bees to wasps, who targeted the frames we had taken from the hive and set to one side. Watching the wasp invasion was upsetting and triggered a wasp-eradicating mission for Dad. The initial step taken was to reduce the entrances on the hive, giving the bees a smaller space to guard. We kept an eye on the hives, keeping a count of wasps around and watching the behaviour of the bees. We bought a trap, a skep-hive (picture of this)

shaped plastic container which was filled with a liquid attractant and shaped so that once the wasp had made it to the liquid it was trapped within and drowned. The problem with this was that it didn't distinguish between winged insects. It attracted a number of non-bee-threatening insects, and no wasps. We then tried to locate and poison nests, but this was unsuccessful and time consuming. A beekeeper had mentioned a bait administered by the Department of Conservation (link to this) which targets wasps. This wasp killing solution, a bait called VESPEX, was bought and laid in the apiary *(figures 19 and 20)*. The wasps will carry the poison back to their nests and die.

Figure 19. VESPEX bait station at the apiary. Authors own.

Figure 20. VESPEX bait station near the beehives. Authors own.

6.3.3 When bees may swarm [11]

One day in March we found some bees in the garage that had found some surplus beekeeping gear. They particularly liked an old frame of honey that we had taken away when changing from full depth hive boxes to three-quarters *(figures 21 and 22, below)*. I placed the frame outside to let them take what they wanted, and found that the few bees we had noticed earlier had returned to recruit others.

> *An hour or so later Mum said that I needed to come and take care of the bees because from her bedroom window she could see many more bees mobbing the frame. They'd also gotten into the garage and any other bee-smelling equipment I'd been silly enough to leave some access open to. There were so many bees! They were airborne outside and flying around the beekeeping gear in the garage. It was swarm-like in that there were a lot of bees, although it wasn't swarm behaviour. They didn't*

seem angry at this point, but when I had to go into the garage to retrieve the suits (so we might deal with the situation) it was hard to avoid the bees. Fieldnotes, 16 March, 2017

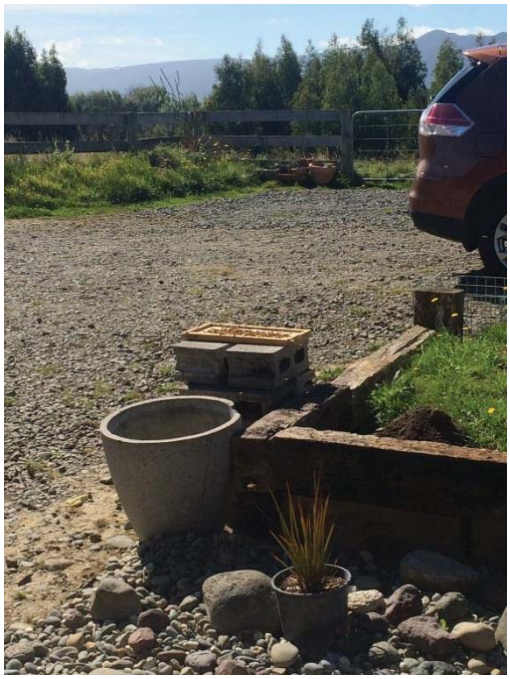

Figure 21. View of the swarming bees from a bedroom window. Authors own.

Figure 22. The frame and attracted bees. Authors own.

Dad and I put on our suits and moved the frame down to the apiary. I hope that they were all our own bees so that we weren't displacing them too much. I was also anxious that outsider bees would rob our hives. Then I came back to the house and applied some smoke. The only thing we could do was wait until they'd figured out that there wasn't a good food source in the garage or around the house (aside from the flowering plants.)

It was an exciting bee event, and I got a lot of photos. But it was stupid beekeeping. We should have known better than to leave bee products like wax and frames with uncapped nectar out for the bees. They find it! It shows my lazy understanding of the honey bee in that I assume that what I decide is gear or stored bee product is kept separate from the bee. For all I know about bee senses and trying to capture the bee in sensory information, I underestimated their ability to find wax and nectar. It also shows how the honey bee sees these boundaries we humans make. In other words, they don't care about them!

After a few hours, the bees went their way mostly. We had to move a few of the bees to windows or outside because they had become sleepy from too much smoke (another beekeeping error I made in panic and impatience). We are all keeping an eye out for bees inside the garage when we're in there. Fieldnotes: 19 March, 2017

This swarming event is an example of our beekeeping going awry. My mistake created an encounter which was unpleasant for all involved. There were bees all over the front of the house and inside the garage. It is clear in my mind as an example of arrogance and the falsity of containing or controlling bees. It also illustrates a tension of research with honey bees: bees are not contained to hives, they are mobile agents. In a similar vein, during an MBC demonstration of honey extraction, the audience was warned to be careful when processing honey: The bee will smell the honey, and try to steal it back.

6.4 Winter

Unlike the other seasonal transitions, where one seemed to blend into the next, winter seemed to start one day at the end of May. As one participant noted, the winter season doesn't start on the first of June. May was the first frost and 5pm sun sets. Winter is the season which the colony and the beekeeper have been building towards. The winter preparations have been completed for bee and beekeeper. In the apiary, we completed our last full check, feeding and made our best attempt at insulating the hive for the colder weather to come. What seems to be a quiet time for the beekeeper is busy for the honey bee colony. I describe what the beekeeper looks for throughout the season. This is mostly contained to the outside of the hive, whereas the bee inside the hive is completing very different tasks. The honey bees begin to sustain the remaining colony, feeding from stores and regulating the temperature of the hive.

6.4.1 Final inspection of the beekeeping year

During May, we noticed that the bees were less active. The colder temperatures and wet weather had prevented the bees from leaving the hives. We opened them for a final inspection in May to remove the last varroa mite treatment strips, check on the honey stores, and add some insulation to the hive. Because of the lack of activity at the hive entrances we had expected docile bees, and so we proceeded without a smoker. Opening the hives was managed without the smoke, but I mishandled a frame, and we

saw that the cold temperature and lack of smoke meant that the bees were less resilient:

> *As I was handling a frame I lost my grip and dropped it. It hit the pallet and the bees fell off of the frame. I picked the frame up again and put it in the hive but there were no bees left on it. I tried to scoop the thrown bees from the pallet, but I couldn't do it gently enough. Normally the bees would have found their way back to the hive entrance, but I think it was too cold. They clustered on the pallet and many of them died. Fieldnotes: 12 May, 2017.*

The smoke would normally have distracted the bees and kept them away from us. The queen of the purple hive, who we have been unable to locate on several occasions, came to the top of the frames twice during this inspection. I assume that this was because there was no smoke. So while the benefit of having no smoker with us was that the queen might have presented herself more readily, we were wrong in our assumption that the conditions of winter made the bees more placid. It is a false assumption: the honey bees are not quieter during this time.

6.4.2 Wintering bees

During the winter, the bees cluster within the hives. The cells that held brood and food are now spaces for bees to occupy and keep warm. The stores which made comb and fed larvae are now used to feed the bees in the cluster, which fuels the bee bodies and their work to keep warm. Leading up to the coldest days of winter when we won't open the hive, we are learning to observe from outside the hives. Storch (1985) remarks on the beekeeper who interprets the signals of the hive from outside: "Most people will not hear anything at all; but a well-trained ear will distinguish a soft buzz, similar to a lightly uttered "sh"" (1985, p. 7). I am still learning to interpret these

signals, listening at the hive entrance at different times of the day, in different conditions:

> *I crouch down in front of the hives, it's about 5 in the evening and the sun is going down. I haven't seen bees coming and going at the entrances. Maybe the odd be every now and then that comes to check me out. But now, while I can't see the bees, I listen for them. I remember earlier in the year, maybe at the end of summer, listening and hearing a buzzing within the hive that I called 'electric', like a current. This time I hear a subtle and almost monotone hum. Fieldnotes, 25 May, 2017.*

Other external signs of the colony are the weight of the boxes. We should be able to discern how much honey is left on the frames through this, and supplement with other feeding solutions. The entrance will still be busy at times, as bees will still forage on warm, sunny winter days. It is a place for interactions of other kinds too:

> *Our cat, Dude, was smooching the yellow hive. He rubbed his feline cheeks into the bubble wrapped corners of the bottom box. There were a few bees about as it was a sunny, warm morning without much wind. Some of the bees were hanging about the top entrance of the feeding tray, and others were at the entrance, guarding and assessing. Little Dude walked around the hive, smooching the other corners, the pallet base, and a brick that was nearby. Occasionally a bee would buzz, and the cat would notice, but not stop what he was doing. He moved to sit right in front of the one open hive entrance.*

He was closer than I would ever get, even with a suit. I thought he might be angling to swat bees coming and going, but neither the cat nor the bee cared about each other. The bees continued to fly about, and the cat continued to smooch. Fieldnotes, 2 June, 2017

Going forward we will be listening at the hive entrances, hoping that the temperatures aren't too low for the honey bees to manage, and that there is enough stored honey for their consumption. Honey bees are resilient beings and work over this season to survive. This is my first winter with bees, and I do not know what to expect. What will emerge from the hive in the spring time?

6.5 Conclusion

This chapter is a drawing together of encounters within the apiary between honey bees and humans, including my own experiences over the course of my beekeeping. Seasonal weather is an actor in the honey bee colony network, and tracing its role as such shows points of tension between actors, enabled and thwarted desires, and the overall fragility of the apiary. The survival of the honey bee colony is contingent on many actors, not all of which come together to the benefit of the bee. This chapter shows that entanglements are situated in a particular space, time and perspective; in other words, the apiary is not one space, experienced in one way by all beings who exist there. Encounters with honey bees in the course of my fieldwork included meetings where I was unnoticed, a nuisance, or where I killed bees. My coming to know honey bees involved learning to interpret different modes of communication, the intimidating mass buzz which signalled that I move away from bees, and the particular movements of a queen bee laying eggs in the hive. The encounters presented here illustrate that the honey bee is shaped by multiple, fragile actors and networks, which do not conform to a single representation.

The seasons structured my coming to know the honey bee as a beekeeper. As a beginner, I was learning what to expect to see within the hive as well as what tasks to perform. I based my decision to represent the colony and the practice of beekeeping in this structure on this. These presentations of seasonality are only potential iterations. For some these seasonal narratives were positive, or successful in relation to their aims, and the opposite is true for other beings. Sometimes a 'good' season for one, is 'good' for another, for example, a summer with abundant nectar is good for the production of honey for bee and beekeeper. Alternatively, the conditions of one summer might be 'bad' for mānuka nectar, which is negative for the commercial beekeeper who desires the high value honey, but affects the honey bee less. For all the effort given to creating mānuka honey, seasonal conditions cannot be predicted or controlled. And this only matters to the beekeeper, because the bee has many floral options.

Multispecies encounters are messy and asymmetrical. Therefore, writing about how beings relate necessitates a different kind of narrative: one that is open-ended, messy, abrupt and is always in a state of flux; becoming something more in relation to what the narrative captures. For example, 'Winter' captures a time of uncertainty for me, the end of my time as a honey bee ethnographer and the first season of beekeeping, so the narrative was shorter, more abrupt, and less about my meeting with honey bees. The narrative also needed to express the honey bee winter: the networks the honey bee worked within became smaller, contained to the hive.

7. Swarm

7.1 Introduction [12]

‘Swarm’ describes both a body of bees and an event in the life of the colony. A swarm commonly occurs in late spring through summer, when a colony has grown too large for its nest. The queen leaves the nest with a group of bees to find a new nesting site, leaving behind bees who will raise a new queen. There are recognisable segments to a swarm event, specifically, the initiation of the swarm, flight, clustering, and the settlement of a new nest. Similarly, the moving body of a swarm is the organisation of many bees relative to one another. It is an example of the colony as a superorganism (Seeley, 1989), where individual bees cooperate as a unit (p. 548). Individual bees perform specified tasks in the swarm. The swarm is a network of bees, which may or may not include the beekeeper, preventing the event or recapturing the bees. The swarm network may also involve other humans who encounter a cluster of bees on, around, or in a space such as a wall, car or tree. The aim of this section is to experiment with bee writing to create a swarm narrative that privileges the honey bee. I will use my understanding of biological and behavioural characteristics of the honey bee in a swarm in the presentation of a swarm of bees. The first section describes the initiation of a swarm event, where a group of bees departs from the original hive. The second section follows this group as it clusters on a tree while deciding where their new nest will be located. For the third component of this story, I use poetic narrative to illustrate the dance communication, the dance and its interpretation, which informs the swarms decision. Finally, the swarm is in a cluster once again, and it encounters a human. Writing about (and with) a swarm of bees illustrates that different kinds of writing can reveal more about the honey bee, enabling more to be known about bee worlds and multispecies agency.

7.2 Becoming a swarm

The nest had grown over the season...So full that queen cells had been created...There would soon be a new queen...A challenge...The current queen was still thriving...The heat had been rising...Many bee bodies all working to find and store and feed...Soon some of us would break away...following our seasoned queen in search of a new hive...Some had gone forth to see where we might go...

The time of departure was nearing...We generated heat as we moved around in preparation...Buzzing excitedly....We gorged ourselves on nectar foraged and honey stored...When we were full we waited...And the call went out across the hive...depart... the sound we make is all that can be heard...a stirring and almost abrasive vibrating buzz...the tempo and volume increasing as departure nears...

One by one…we move to the entrance…warm bodies…wings ready…and we go.

We hover…collect together…around the queen…wait for stragglers…and then the leaders begin…sweep around…pulling us higher up…towards the bright warm… keeping the cloud of us together…'this way'…they say…we follow…their signals…buzz and scent…along…steered towards a large green thing…a tree…'this spot'…a new base…as one we group around the trunk…settling…for now

7.3 Clustering

Scouts returned with information...Space...Food...The dance was repeated by bee after bee...an ensemble performance all around the cluster...soon the mass seemed to vibrate along with the wagglers...Individuals pull away from the cluster...flying around the swarm, hectic, dancing around each other in a manic fashion, they move from the tree...

Many of us fill the air...there are still many within the swarm cluster, but many more are moving...manoevvring around the cluster...hovering in wait....ready to join...it is a liquid form...sometimes holding together and seeming solid...a bee may tear away and another re-join the group...again and again...move off and join...the mass sometimes seems less solid, the individuals more noticeable...

Drones come to the surface of the cluster still attached to the tree...the queen is about to make her appearance ...all the while bees hover near...signalling... "this way" the scouts say... "time to move" the queens attendants tell her...she tells us to move with her scent and her movement...the air fills with bees...less and less remain clinging to the pine...soon the space all around is flecked with rapidly moving bees...we begin to move away from our temporary lodgings...

7.4 Interpreting dance

I weave

Over

Under

the others.

Awaiting the return of the dancer.

There,

Returning. Landing.

Attention! She vibrates. Attention!

To and fro on top of us.

She seeks an audience.

Shimmy,

waggle

vibrate.

Here it is,

this far,

this way.

Another joins her,

another and another.

Until we have all learned the way.

One by one

into the light.

Into the air.

Lining the space between.

We know the way.

Moving wings pull up,

and up.

Weaving over, under the others.

Awaiting the return of the dancer.

There, she returns.

Merges with our cluster.

Attention! She vibrates.

Attention! She demands

To and fro on top of us.

She seeks an audience.

Shimmy,

waggle

vibrate.

Here it is,

this far,

this way.

Another joins her.

another and another.

Until we all know.

One by one

into the light.

Into the air.

Lining the space between.

We know the way.

Moving wings pull up,

and up.

7.5 Swarm collection: enter beekeeper

The beekeeper: Nigel collected a swarm from a tree growing on a berm in suburban Palmerston North. A friend called and told him about the location of this swarm, and he collected it from the tree, into a bucket, and then transferred the swarm to a nuc. This is the interaction of swarm and beekeeper.

We are in the branches of a tall, skinny tree...Moving with the wind...The bright-warm has circled around our cluster once...Now it is high up...Scouts are away...one or two return every so often...'here?' they suggest...they dance, moving from spot to spot...recruiting others to dance with them...I join the dance...we reach agreement

The tree moves...not like when the wind pushes it...but a lurch from the trunk...Something is leaning against it...I leave the cluster...take up my wings...move towards it...It is a tree leg...smells like old dead tree...A tall beast approaches the tree leg...climbs on it...and moves closer to the cluster...smells like the white beast...the one that comes with smoke...but it is not

Others break off the cluster...coming to investigate the beast...it moves closer to the group...It's coming for us...we fly about it...moving around a reaching arm...singing a loud waring...it pulls back...moves down the leg...away from us...safe again...we re-join the others

I climbed the tree, it was only four metres high, but my ladder didn't quite reach

I didn't have a suit, I just moved away when they seemed agitated, and then came back when they had settled down again

I got a few stings

I couldn't quite reach the cluster, so I had to cut the branch they were on

It fell to the ground, which they didn't like very much

The beast cut...

We all fell from the branch...

NO...we yell at the beast...STAY AWAY...

We yell to one another ATTACK IT...and PROTECT HER...

We are loud...angry...

A group fell...spread on the green...

some in the branches...others managed to fly...and wait...mid-air...

Some attack...they spend their venom...

And fall back...ripped apart

But the queen had fallen with the cluster...

I needed to stay with her...most of us did...on the green

And are picked up by the beast

I collect the bees into a plastic bucket, pulling some netting over the top

Then I put them in my car and drive them home

A beekeeper friend has brought a nuc box

That's where I put them.

I got the queen, so the rest of the bees would have come with her.

I'll return to collect any stragglers.

We are in another box...contained again...

We cluster around the queen...staying with her...protecting her...

I cannot see out of the new box...apart from the top...where I can see the sun...

But the bright warm is not moving...the box is...

When we stop moving...we are lifted...

and tilted...

and we fall again...into a new box

7.6 Anthropologist interpretation

These presentations of four segments of a swarm event are experimental bee writing. To centre the honey bee in the writing I created a bee narrator. In this I chose the worker bee, who would remain with the main body of the swarm, the central body of the swarm. Other worker bees perform tasks and leave the swarm or cluster, but the worker bee remains within the swarm for the cycle of the swarm event. This is an event and behaviour which does not necessarily involve any human, and I would argue that the human is enrolled into the swarm network to ensure its success. However, swarming has been viewed by humans, and so the behaviour has been interpreted to me via participants, other beekeepers, and bee behavioural scientists. It was an ideal example of the culmination of the various sources of bee knowledge that are available.

Creating a bee narrator for this writing involved considering how the honey bee views and interprets the world, and translating this into writing. I had difficulties with this, especially with regard to word choice. That the honey bee has colour vision meant that I could describe the tree which the swarm settled on as green, but what else the bee interprets about a tree is unknown (Matheson & Reid, 2011). The tree is enrolled in the swarm network as a stable place for a cluster of bees to settle temporarily and bees might not care what colour it is or what it smells like. To overcome the shortcomings of language in capturing the swarm, more emphasis is placed on the shape of the words, which are deliberately arranged to portray the feeling of the swarm event. Additionally, companion audio and visual recordings will illustrate the event.

Through beekeeping participants, video shared online **[13]**, articles and simulations in entomological studies, I have constructed a swarm story. The first section of the swarm story represents the initiation of a swarm event. The current nest site is unsuitable, in this case because the colony is too large for it after a successful season, and the original queen leaves with a group of worker bees. The swarm is a

reproductive event, splitting the colony in two. The second segment of the narrative is the formation of a cluster of bees. This is a grouping of bees which have settled temporarily on a structure, such as a tree branch or in some cases this is the surface of a car or within a roof. I tried to capture the feeling of the cluster, which is at once a unit where bees organise themselves around the queen, and also a base for scouts to enter and exit, finding new sites, communicating findings and the interpretation of scout information by waiting bees. It is the site of decision making. The cluster is static and yet full of energy.

The swarm is a body of bees, and simultaneously an event which orders individual bees in a particular way. The swarm as a body of bees makes coordinated movements to leave the original nesting place and to travel in flight towards a new nesting site, forming a cluster at intervals between the origin and destination. In its cluster form, the swarm is a fluid collection of bees, which has a skin-like surface. This swarm-skin allows bees to leave and re-join in the process of scouting for information which will lead to a decision about where the new nest will be made. As in the hive/nest, the queen is at the centre of the swarm body. As the source of future bees, her survival is paramount to the bees. The swarm clusters around the queen at all times for her protection.

The swarm is a network, assembling bees within a colony to perform acts for bee survival. The desire of the swarm is to find a suitable space for the colony to nest in. The problem of finding such a space enrols worker bee scouts into the swarm network. The scouting of nest information is performed by individual bees. Multiple scouts will leave and re-enter the surface of the swarm, communicating the location of a potential site. These bees return to communicate, through dance or scent, and other bees interpret the information. The scout will make return journeys between the swarm and site, reassessing its suitability, until consensus is reached (Seeley & Visscher, 2003; Seeley, Visscher, & Passino, 2006). Potential nest sites enter the network, and exit the

network if they are deemed unsuitable. The chosen future nest site then becomes the fixed destination of the swarm.

The bees can enrol the beekeeper to perform the selection of future nest and transport to this destination. Perhaps presenting itself by clustering in a human-settled or easy-human-access site, such as within a small roadside tree in a populated suburb, is the swarms way of attracting humans. The human beekeeper can insert itself in the swarm network, with the desire to obtain the bees. The beekeeper might also enter the network to contain the 'problem' of a swarm when the bees have clustered or settled in a space which alarms humans, such as within the wall of a house (link to blog) or on a car (link to blog). The beekeeper enrols tools, such as a ladder or bucket, to reach and obtain a swarm. As with the participant who shared his swarm collection with me, this could be the event which transforms the human bee enthusiast to beekeeper. However, the collection of a swarm of bees by a human beekeeper is not a given: the bees can settle and survive without human intervention.

Once the swarm event has begun, the original colony has broken, and the relationship between the swarming bees and beekeeper is uncertain. The swarm event is a disruption of the beekeepers' efforts to fix a colony of bees within a hive, and as such, the human beekeeper can thwart the swarm. Authors of the guide *Practical Beekeeping in New Zealand,* Matheson and Reid (2011) describe swarming as "extremely undesirable", and describe techniques used to prevent swarming (2011, pp. 110-114). The human beekeeper learns to interpret the signs of a hive which may swarm, and intervenes in the event. One method of prevention is for the beekeeper to perform a 'split'. Using the moveable parts of the hive to this purpose, the beekeeper can take frames from the original hive and transplant them in a new hive. The queen is among the bees transplanted, which causes the bees remaining in the original hive to raise a new queen. The beekeeper simulates a swarm event by splitting the hive this way.

7.7 Conclusion

The swarm event is a demonstration of the agency of the honey bee. It is an act of reproduction, necessary for ensuring the survival of the colony, and it is an act of breaking or un-becoming, as the bees leave their original nest. The swarm is also a behaviour which shapes the honey bees involved in particular ways: the bees coordinate in flight to scout a new nest site, make group decisions, and take on individual tasks that are unique to a swarm. The swarm illustrates two distinct ways of knowing the honey bee, as an individual and as a mass. It is also an event and network which may, or may not, involve the human. It may be the disruption of the human-bee relationship in beekeeping, or, as with one participant, the opportunity to begin one. Representing the swarm in writing requires attending to the messy, unpredictable aspects of honey bee worlds, including times when seemingly stable connections, such as that between bee and hive, break. This chapter is an experiment in writing with the honey bee in order to privilege it. To centre the honey bee in this writing I have drawn from knowledge of how honey bees experience the world and imagined the swarm from the perspective of a worker bee. Engaging with honey bees requires becoming sensitive to the ways that they know, experience and communicate about the world.

8. Conclusion

This thesis had two aims, the first of which was to explore the world of the Manawatu honey bee. I approached this question with principles of multispecies theory, locating the honey bee within the New Zealand honey industry, the practice of beekeeping, and in the encounters of beings in the apiary. I went about doing this by tracing honey bee networks, understanding which beings and materials the honey bee colony enrolled in its goal of survival. This approach levelled the agency of beings in the apiary, which challenged the human-centric beekeeping-oriented representations which I laid out in the first chapter, 'Coming to know the Honey bee through Apiculture in New Zealand'. The aim to describe the world of the Manawatu honey bee was to show that 'the productive honey bee' is one possible representation of many. The honey bee is an unpredictable, unruly being which acts in the interest of the colony it is part of.

The second aim revolves around how to privilege the honey bee in ethnography. Given that the honey bee has been confined to being represented in the context of beekeeping and productivity, how can I investigate the Manawatu honey bee? The first part of this methodological question is how to apply a multispecies approach, informed by principles of actor-network theory. I undertook interviews with beekeepers, hobbyist and commercial, to learn about the honey bee. I also purchased two parcels of bees which were installed in hives on my parents' small farm in Feilding. I enrolled myself as a participant in an auto-ethnographic approach, documenting my process of becoming a beekeeper and observing bees. This was important to my research as it was the only methodology which was not based on written or oral language. The signals honey bees use in direct and indirect communication are not symbolic. The sounds, scents, sights and points of physical contact at the hive or the flower are not best expressed by language: when I read or talked about the buzz of an angry hive, it was lacking compared to when I had experienced or been the recipient of it.

My approach was based around encounters in the apiary between the honey bee and the actants enrolled in networks. I attended to the negative or thwarting connections made also, to contrast further with the accounts of a passive, obedient bee. Encounters with pest and disease, death, and violence are part of the honey bee world. In the apiary, I acknowledged times when I was forcing a meeting with the bee when I opened the hive, times when the bee paid me no attention, or when the honey bee was threatened by my presence and issued her sting and venom to me. Following honey bees in encounters provides a means of studying the honey bee, investigating the multiple, changeable, and co-produced representations of the insect

The representation of the honey bee in ethnographic text was the next consideration of my approach. I learned about the biological and behavioural characteristics of the honey bee as an individual and within a colony, and observed some of these at the apiary. A facet of representing the honey bee is experimenting with different narrative forms, including creating hybrid bee-human narrators, poetic narrative, and presenting sensory details of honey bee life, such as images, video and audio. The result of this was an experimental representation of honey bees. The first example of this is 'Honey', where I traced the honey network from the perspective of the bee and the human beekeeper for contrast. The second account I presented was a collection of honey bee narratives, mostly originating from my beekeeping experiences, which are organised by the season. The intent of this was to follow the life of the honey bee within a colony, which is dictated by the conditions of each season. Finally, the most experimental piece of writing, 'Swarm'. The swarm is an event in the life of a colony and also descriptive of a body of bees during the event. This event and behaviour stood out to me as one of the most contested for meaning: it is a means of reproduction for the bee, but absconding bees means that a beekeeper loses their colony. It is also an intimidating event to witness, particularly when the swarm settles temporarily in a space like the wall of a house or boot of a car. These representations provide alternatives to the account detailed in the opening chapter of this thesis, 'Coming to know the Honey bee through Apiculture in New Zealand'.

The empirical chapters of this thesis present four distinct accounts of honey bees. The first, presented in Chapter Two: "Coming to know the Honey bee through Apiculture in New Zealand", presents the standard industry perspective, which describes the product of honey bee hives and the practices, enacted by human beekeepers with tools, who harness the potential of honey bees as producers of honey, beeswax, propolis, as well as pollinators which sustain horticulture and agriculture. This representation does not pay enough attention to the agency of the honey bee, and when it does, it is recognised only for the work it does to produce honey, and how its potential may be harnessed by human beekeepers. Approaches which aim to accentuate the agency of the honey bee, such as the work of Tsing (1995), Moore and Kosut (2013, 2014) and Spiers (2014), practice research methodology which views the honey bee as a source of information and collaborative being. However, the written presentation of honey bees is not taken seriously as a way to centre the honey bee in accounts of bee worlds. This thesis addresses the challenge of representation in three key ways: first, the use of multispecies thinking, which makes the honey bee the focus of ethnography; second, an ethnographic methodology which examines multiple bee networks, some of which do not involve humans; and third, a considered representation of honey bees in writing, as well as through visual and audio materials. This ethnography accepts that there are times when I am not present in encounters with the honey bee. In response to this, my writing changes: it becomes more creative, drawing on the sensory capabilities and behaviours of bees to create ethnographically-informed imaginative bee narratives.

I presented a standard, industry focused, account of bees at the beginning of this thesis deliberately, to give context to the state of honey bee affairs in New Zealand when I began this research. I argue that this is the most common kind of account of honey bee worlds. To contrast with this standard narrative, I presented three alternative accounts of honey bees, which are discrete pieces of writing where different networks come into view; and the different networks required different modes of writing. These chapters do not fit easily together: the descriptions of honey bee anatomy in Chapter Five jar with the poetic writing of a waggle dance presented in

Chapter Seven. As the thesis progresses, the empirical chapters take on different shapes, such as the seasonal shaping of Chapter Six, and the use of sensory language that shapes Chapter Seven into poetic narrative. Importantly, the disjunctures between these chapters cannot be smoothed out. Their difference represents the complex, unruly, wildness of honey bees, and the multiple, varied networks which compose honey bee worlds. They are parts of a whole in that they are individual iterations of honey bee worlds, which contrast with human worlds.

The final chapter, "Swarm" is an example of what can be said about these things when accounts are presented in alternative forms. This chapter represents an event or bee behaviour which is an un-becoming. The swarm of bees leaving the origin hive for a better nest is an act of breaking, or severing a connection between the hive which mediates the human beekeeping practice and the bee. It is disruptive to human ways of knowing the honey bee, illustrating that connections are partial and co-constructed. The idea of 'keeping' or 'taming' nature – through the example of apiculture – is a fantasy of control, and it is a hopeful thought. Bees can be cajoled or manipulated into remaining in the beekeeper's network, but they can, and do, rebel. The bee is unruly. So, I suggest that the term 'beekeeping' does not adequately capture the relationship between human and bee. There is no human mastery over the honey bee: the bee can break the connection in a number of ways, including swarming. The desires of the beekeeper are often compatible with those of the honey bee, and various practices can strengthen the connection, but it remains tenuous and contingent. Human and non-human relationships are messy, unpredictable entanglements that are formed for the needs and desires of the beings and matter involved.

Footnotes

1. Honey bees groom by licking and using their legs to scrape their bodies (Matheson & Reid, 2011).

2. Charles Peirce's theory of signs, specifically a typology which defines three categories of sign (icon, index and symbol) (Deledalle, 2001; Kohn, 2013)

3. Feeding the bees with sugar syrup see Appendix 2: Langstroth Hive, for the apparatus designed for this

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Appendices

Appendix 1: Glossary: Components of bee worlds and beekeeping

This is a description of terminology used in this thesis to describe honey bee worlds. The terms used in reference to the honey bee, honey bee groupings and bee behaviour are presented in the first segment. Secondly, I describe the terminology of beekeeping, including the terms used to describe spaces of bees and where the practices of beekeeping take place. Most of these terms are described in text, and more will emerge in specific contexts, where the terms will make more sense.

Honey bee

The **European honey bee**, scientifically named *Apis mellifera*, is the species of bees which have been domesticated for the practice of beekeeping because of their production of surplus honey. I will also refer to this insect as a 'bee' or 'bees'. The honey bee begins life as an egg, laid within a hexagonal cell in comb, and grows in this space, fed and cleaned by other bees, until it is sealed in and undergoes its transformation from larvae to bee. The grown bee will chew its way through the wax capping that sealed it in and join in with the activities of the hive.

The term **colony** refers to a collective of bees. When I use this term, I refer to a group of bees, such as the group which resides within a hive.

Nest is a term used to describe the residence of honey bees 'in nature'. Honey bees are not dependent on humans for a place to call home; They can create their own nest, although there are pests and diseases that make this endeavour risky for the bee. Sometimes the colony might create a nest in a fence or roof, which seems great for the bees, but less comfortable for the humans living in close proximity.

There are three types of honey bee within the colony:

The hierarchy of the colony is headed by the **queen bee (QB)**, the genetic storehouse of the hive which ensures its growth and survival. The queen emerges from her cell a virgin. In order to lay eggs to populate the hive the queen ventures out of the hive and

mates with **drones** (male bees). She does so in the first few weeks of life and thereafter leaves the hive rarely, if at all. (Matheson & Reid, 2011, p. 48)

The male **drone bees** don't perform tasks in the colony aside from providing male genetic material to other queens. (When are drones created and why?? Matheson and Reid)

There is a single QB in the colony, and many thousands of **worker bees**. The worker bees are female but have no ovaries, so they cannot create offspring. The worker bees perform the non-reproductive work within the colony - each role defined by the age of the bee. The youngest, for example, are tasked with cleaning the hive, and the eldest are the bees we see foraging outside.

Beekeeping

An **Apiary** is a space where beehives are placed, and beekeeping takes place. I will also refer to this as a 'bee yard' although for me this has stronger meaning as a human space where honey bees are placed. In NZ, the definition of apiary – how many hives are situated in one space for example – has an impact on the regulation of beekeeping. There are fees relative to the number of hives a person has, and how many apiary sites they are placed upon.

Apiculture refers to the practices of beekeeping. The keeping of bees within hives, and all actions taken to manipulate the bees within hives to the aims of the beekeeper

The **hive** is the man-made structure which bees reside in when kept by beekeepers. I use this specifically when speaking about the physical components of the hive, as well as a group of bees which reside within a hive. There is an appendix which details the components of the langstroth style hive, which is the most commonly used style of hive in New Zealand (Matheson & Reid, 2011).

Nuc: A 'nuc' is a nucleus colony, which is comprised of a queen and approximately 12,000 bees. They are used to strengthen a hive by adding a queen bee, or to start a hive off. 'Nuc box' refers to the small box the nuc comes in (Matheson & Reid, 2011)

Treatments

Season:

Season link: Refers to working with an understanding of the seasons and planning management accordingly. Beekeeping is very season-dependent.

Flow, flowering: A term which describes the time of flowering of a specific plant, as well as the main seasonal flow of nectar which occurs in late spring through to late summer.

Appendix 2: The Langstroth Hive

The 'hive' is the man-made structure which bees reside in when kept by beekeepers. The most commonly used hive in New Zealand is called the 'Langstroth Hive'. As I mentioned earlier in chapter 2., 'Beekeeping in New Zealand', this hive was created by Reverend Langstroth in 1851 and was introduced to New Zealand in 1876. It is preferred because it has moveable parts that enable beekeepers to manipulate the hive to various ends, such as for the inspection of pest and disease within the hive, which is a requirement of all beekeeping practices in New Zealand. In this appendix I will explain the key components of the langstroth.

> *This is the hive which we chose for our beekeeping because it is a standard, and thus easy to reference when speaking with other beekeepers. There is a lot of information available. Fieldnotes, September, 2016*

Figure 23. Our langstroth hives. Authors own.

Figure 24. Internal components of a langstroth hive box. Authors own.

The images above show our langstroth hives. *(Figures 23 and 24.)*. The frames of the langstroth are rectangular, designed to fill the space of the box while leaving space for the bee to move, called 'bee space'. It is designed based on the bees' tendency to fill unnecessary space within the hive with propolis or comb. The honey bee builds comb on frames. The comb is made from beeswax and comprised of hexagonal cells which hold the gathered materials, stored food, and the bee brood. (Brood is the first stage of bee reproduction, from egg to larvae.) Cells sit at a slight angle, oriented upwards, to keep their contents secure.

Figure 25. An apiary of langstroth hives. Authors own.

Figure 25. shows a grouping of langstroth hives in an apiary, or bee yard, which is a space for beehives and beekeeping. As you can see from the images of the langstroth, it is a system of hive components stacked together. The components are made from varying materials, but tend to be made of wood or plastic. I will briefly explain the purpose of each component of the langstroth hive from top to bottom:

The **lid** or **roof** of the hive is the top-most piece, and protects the hive from weather. Some are ventilated to counteract condensation

The **inner cover** of the hive sits beneath the lid, and seals the bees into the boxes beneath it. It also helps to maintain the temperature.

The next component is the **honey super,** a hive box dedicated to managing honey stores. The bees store honey in cells on many frames, but the surplus store will be in this box.

A **queen excluder** is sometimes used to keep the queen from entering the honey super. The excluder is usually a sheet of mesh with holes which are too small for the queen to fit through, while allowing worker bees to pass and work on the honey.

Beneath the honey super or queen excluder sits the **brood chamber**, which describes a hive box dedicated to the reproduction of the hive. The frames within these boxes are used by the queen for laying in. There are also stores of honey, nectar, pollen and water here. The

Frames fill the boxes, whether they are honey supers or brood chambers.

Finally there is the **base** or **floorboard** of the hive, which keeps the hive elevated and sealed. This is usually where the **entrance** of the hive is found. There are a variety of base board types, such as the ventilated plastic one we used, as well as entrances.

There are many other additions to this, because beekeepers often create solutions to specific issues in the hive. One addition to mention is the **feeding tray or frame**, which holds supplementary food for the colony. We have a feeding tray, which sits between the top box and roof of the hive in place of the top mat. Other feeding solutions include frames which sit in the boxes of a hive. Whichever method used, the bees will have access to the food, sugar syrup or pollen cake, without drowning in the syrup or being trapped in the feeder.

Another aspect of hive ware to note is the sizing. The langstroth hive has three main variants in the size of boxes. There is the full depth (FD), which is (measurements), the three-quarter depth (3/4) and the half-depth size. Beekeepers may choose any size or combination of box sizes, depending on considerations such as their strength or beekeeping goals. We purchased both full depth and ¾ depth boxes, intending to use the former for brood, so that the colony had more space here, and the latter for honey so it was easier to lift. There are many alternative components and combinations to this within the langstroth hive style, but these are the ones which I have become familiar with, use in beekeeping, and write about during this thesis.

Appendix 3. Information sheet

Information sheet

Beekeeping in the Manawatu: Following the bee

Hello, my name is Jordan Luttrell and I am a student of Massey University undertaking a Master of Arts in Social Anthropology. As part of my degree I am conducting research on beekeeping in the Manawatu. I would like to invite you to participate in this research by sharing your knowledge and experiences of beekeeping. The aim of my research is to explore honey bees in the region and the kind of beekeeping that takes place here.

If you agree to participate in this research, I would conduct one or two interviews with you about your experiences of beekeeping. These interviews would take around 30minutes to an hour, and would be recorded. I may also ask if I can see your beehive, or to view another aspect of your work with bees.

If you decide to participate, you have the right to:

- Decline to answer any particular question;
- Withdraw from the study (up until one month after the final interview);
- Ask any questions about the study at any time during participation;
- Provide information on the understanding that your name will not be used unless you give permission to the researcher;
- Be given access to a summary of the project findings when it is concluded (June 2017);
- Ask for the recorder to be turned off at any time during the interview.

Anonymity throughout this research is assured and pseudonyms will be used in the final reporting. You may choose a name to call yourself if you wish.

Data from the interviews, including any pictures taken, may be used in the final research report. Interview recordings will be deleted following the completion of the report. Participants are welcome to access a summary of the project findings and you will be contacted when this is finalised and available. All information will be stored on a laptop with a password and therefore will only be accessible by the researcher as well as the supervisor named at the end of this letter. Recordings will be kept on a secure device.

Should you wish to register your interest in participating in this study or have any further questions please contact myself or either of my supervisors, Dr. Carolyn Morris and Mr. Stephen FitzHerbert.

Thank you for your consideration.

Jordan Luttrell

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This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research.
If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director (Research Ethics), email humanethics@massey.ac.nz

Appendix 4. Consent form

Consent Form

Beekeeping in the Manawatu: Following the bee

I have read the Participant Information Sheet made available to me, and I understand the nature of the research and why I have been asked to participate. I have had the opportunity to ask questions and have them answered to my satisfaction.

I agree to take part in this research.

I understand that I am free to withdraw participation at any time, and to withdraw any data traceable to me up to one month after the interview.

I agree to be audio taped.

I understand that data and information from the interview and the Consent Form will be kept for six years, after which they will be destroyed.

(Please circle the appropriate statement)

I wish/do not wish to have a copy of any tape recording relating to my interview.

I wish/do not wish to receive the summary of findings.

Name_____

Signature_____ Date _____