An investigation into food waste produced in New Zealand restaurants and cafes

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Abstract

Background: The foodservice sector contributes to global food waste, and its downstream effects. However, few studies have attempted to quantify the food waste produced in this sector. Given the increasing trend of consuming food away from the household, food waste in restaurants and cafes is likely to be an emerging issue. The extent of this problem in New Zealand is unknown.

Objective: This research is set out to quantify food waste in New Zealand restaurants and cafes using self-reported and waste audit data. Food waste reduction attitudes, behaviours, and strategy ideas were also explored.

Design: Initially 250 restaurants and cafes in the North Island of New Zealand were randomly selected from Yellow Pages print directories and invited by telephone, email and/or face-to-face to complete a 30-item questionnaire. Due to low response, a convenience sample of 73 additional businesses were approached. Businesses were asked to quantify food waste and to describe waste reduction attitudes, behaviours, and strategy ideas. Questionnaire participants were invited to take part in a 24-hour food waste audit.

Results: In total, 13 restaurants and cafes returned the questionnaire (3.77% of the original sample and 5.48% of the convenience sample). A majority of businesses (N=10) reported avoidable food waste as less than 20% of the total food waste; however on-site waste audits of two businesses revealed this differed by 12% and 51%. Audited businesses reported less food preparation waste by 6% and 36% compared to quantified waste. Audited businesses also reported a greater amount of consumer plate waste by 11% and 16% compared to quantified waste. Preparation waste produced the most waste; this was either avoidable or potentially avoidable. Most businesses were satisfied with
their current food waste reduction behaviours, believing they were doing well. Economic gains were the main motivator for reducing food waste \((N=10)\). Three waste reduction strategies considered highly impactful and easy to implement were; to order products with a short shelf-life more frequently, to implement a first-in first-out system, and to allow customers to take home left-overs.

**Conclusion:** This research has begun to fill the gap in New Zealand literature quantifying food waste in restaurants and cafes. The low response rate indicates generating interest in this fast-paced foodservice sector to engage in research is challenging. Food waste should be quantified and classified using on-site waste audits, not self-reported measures, to obtain better estimates. Businesses appear to be unaware of their avoidable food waste, so current attitudes and behaviours do not support waste reduction activities. Policy makers, researchers and practitioners can use these findings to support more sustainable practices in this sector and contribute to the ultimate goal of reducing global food waste.
Preface

Dr. Miranda Mirosa, from the Department of Food Science, and Dr. Louise Mainvil, from the Department of Human Nutrition, kindly provided joint academic supervision for this thesis. Master of Dietetics student Sarah Chisnall worked alongside researcher whilst completing her own thesis. Methods for data collection were adapted from 2013 Waste and Resources Action Programme (WRAP) report, European Union (EU) Fusions food waste quantification manual, and food loss and waste accounting and reporting standard (1-3).

The candidate was jointly responsible, with Sarah Chisnall, for the following:

- Development of research protocol
- Submission of ethical approval
- Development of data collection tools

The candidate was responsible for the following:

- Recruitment for questionnaire and waste audit participants
  - 205 hours of phone calls to 250 businesses
  - 73 business visits for face to face recruitment
- Analysis of questionnaire data
- Conducting and analysing waste audits
- Thesis write up
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Thank you also to the participants of this research, especially those consenting to a waste audit. You were kind enough to make this process as easy as possible.

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<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>EU</td>
<td>European Union</td>
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<td>U.K</td>
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1. Introduction

The negative impacts of food waste are becoming a global concern as population levels, and rates of food insecurity continue to rise (4-8). Quantities of food waste differ throughout the world. In 2013, it was estimated that approximately one-third of all food produced is wasted at some point during the food supply chain (6, 9-13). This equated to approximately 1.3 billion tonnes of food waste, costing $940 billion (6, 9, 13, 14). Goal 12 of the 17 Sustainable Development Goals, agreed upon by the United Nations General Assembly, relates to sustainable consumption and production patterns (15). More specifically, target 12.3 aims to halve the global food waste at the retail and consumer levels per capita and reduce food losses along production and supply chains, including post-harvest losses by 2030 (15, 16).

The global food crisis relates not only to the amount of food waste produced but also the environmental, social and economic implications (5, 6, 17, 18). Food waste is the third largest contributor to greenhouse gases and carbon emissions (14, 18). With increasing rates of obesity and malnutrition, social integrity is being questioned (4, 7, 12, 19, 20). Finally, economically, food costs increase at each step of the food supply chain therefore, food wasted towards the end of the supply chain has significant costs (9, 14, 18, 21, 22).

The foodservice sector is one of great diversity, including restaurants, cafes, hospitals, and halls of residence. Restaurants and cafes are increasingly popular in developed
countries (17, 23). A sustainable living culture is emerging as consumers’ social conscience influences their choices (24, 25).

International researchers have debated methodologies for food waste assessments (1-3). Some studies gather quantitative data on waste produced, while others qualitatively assess food waste attitudes and behaviours (1, 10, 17, 26-31). The feasibility of food waste reduction strategies, specific to the industry, has also been investigated (11, 13, 21, 23, 28, 32, 33). In New Zealand, recent food waste studies have been undertaken at the household level and in large-scale food services (e.g. hospitals), but food waste produced in restaurants and cafes has not been explored (10, 34, 35).

Therefore, the aim of this research is to quantify food waste within restaurants and cafes in New Zealand.

The objectives of this research include:

1) To quantify food waste in New Zealand restaurants and cafes using self-report measures,

2) To quantify food waste in a sub-sample of New Zealand restaurants and cafes using observational (waste audit) methods,

3) To compare the self-report estimates of food waste to the reference method (waste audit), and

4) To explore New Zealand restaurant and cafe owners’ food waste reduction behaviours, attitudes and strategy ideas for this sector.
This research will be designed to use both quantitative and qualitative methods to generate baseline data, filling a current gap in the literature. This thesis will primarily investigate food waste in the North Island of New Zealand.
2. Literature Review

Internationally, more emphasis is being placed on the increasing levels of food waste from all areas of the food supply chain (24). The food supply chain is a multistep process including raw food material production, processing, distribution and consumption (2, 26). This begins when raw materials enter the supply chain and end when food is consumed. All food and food products not utilised or consumed throughout this process are considered waste. Food waste in developing countries tends to be at the end of the food supply chain (6, 13, 18). Whereas consumer plate waste is a problem in developed countries (5, 6, 12, 13). The definition of food waste is often debated in the literature and interchanged with food loss (5, 6, 12, 18, 26, 36). ‘Food loss’ is defined as food wasted at the beginning of the supply chain (36). Whereas ‘food waste’ is that wasted towards the end of the supply chain (36). For the purpose of this study, ‘food waste’ is defined as all edible and inedible food that is thrown out (such as fruit and vegetable scraps, meat bones), partially used foods, foods that have passed their use by or best before date, or food thrown away for other reasons (1, 2). European Union (EU) Fusions supports excluding packaging in the quantification of food waste (2). Food waste is further categorised as either ‘avoidable waste’ (food that was edible at some point, e.g. bread, vegetables), ‘potentially avoidable waste’ (food that some people eat and others do not, e.g. potato peels, broccoli stalks) or ‘unavoidable waste’ (inedible food, e.g. eggshells, meat bones) (1, 10, 23).
Topics discussed in this chapter include: the implications of food waste (2.1), food waste within food services (2.2), different methods of waste assessment (2.3), the current attitudes and behaviours towards food waste (2.4), food waste within restaurants and cafes (2.5), and finally strategies to reduce food waste (2.6).

2.1 Implications of Food Waste

The implications of food waste can be categorised as economic, environmental, or social (5, 6, 17, 18, 30). Each implication is not mutually exclusive, as one often affects the other. The following sub-sections will address these three implications.

2.1.1 Economic Implications

When food is wasted, it contributes to an economic loss. Such losses are incurred at each stage of the food supply chain. Food waste occurring at the consumer end has utilised more resources, leading to greater economic loss (1, 21, 28). Estimating the costs associated with food waste are challenging. Food production requires numerous inputs and multiple step processes before food reaches the plate for consumption (6, 14, 24). These costs also include transporting food waste to landfill and the costs involved with disposal (12, 17). Labour hours of chefs add an additional cost to the foodservice sector (23).

The total cost of food waste varies between countries and there has been limited research completed quantifying such costs in New Zealand. In 2011, the annual cost of food wasted in the U.K. was estimated as £2.5 billion ($4.8 billion NZD), with the expectation this would rise to £3 billion ($5.8 billion NZD) by 2016 (1). Food waste in the USA was estimated to be $130 billion ($190 billion NZD) in 2010 (12). And Finland, a country
with a population size closer to New Zealand, estimated their total food waste to cost €400-500 million ($690-860 million NZD) in 2013 (9, 37).

A recent report looked at a business case for reducing food waste (14). A range of food sectors was captured as they analysed 1,200 business sites including food manufacturers, food retail, hospitality sites, and food services. Champions concluded for every $1 invested in food waste reduction, the business received a $14 return (14). The companies with the highest return tended to be restaurants (14). This is the first time a monetary value has been placed on the profit of food waste reduction strategies. In conclusion, a reduction in food waste is ultimately of economic benefit to a business (14). The foodservice sector, specifically restaurants and cafes, is a for-profit, competitive market. The customer experience is often a key performance indicator. Balancing customer satisfaction with economic gain can be a challenge in itself, without the added pressure of reducing food waste.

2.1.2 Environmental Implications

To date, there has been a wide range of research carried out into the environmental implications of food waste. Throughout the food supply chain, every input is wasted when a food item is discarded. These inputs include a range of natural resources such as water and land, along with resources used to export food around the world (1, 5, 6, 11-13, 18). At each stage of the food supply chain, there are a number of environmental implications if that food is not consumed (5, 7, 12, 18, 32, 38).
On average, it is expected food production accounts for 20-30% of global greenhouse gas emissions (11, 39, 40). In 2007, this was equated as 3.3 G tonnes of CO₂ emissions (18). WRAP’s report calculates avoidable food waste from the U.K. alone, is contributing 2.7 million tonnes of carbon emissions (1). Agriculture is estimated to be accountable for 92% of the global water footprint (11, 18). The food supply chain is where the largest amount of greenhouse gases are produced (39). This indicates that by the time food is wasted in the foodservice sector, a majority of these greenhouse gas emissions are produced for no apparent reason.

With an increasing focus on sustainability and lowering carbon emissions, new ways to create energy from waste are being researched and implemented (29, 38, 41). Utilising food waste is more sustainable and beneficial than land fill disposal. However, decreasing the quantity of food waste produced is a first step resolution, proving to be more sustainable than waste disposal (42).

2.1.3 Social Implications

The social implications of food waste can be viewed as a motivating factor for reducing this waste. Food is a necessity for life, and is often taken for granted by those who have easy access. Food insecurity was previously viewed as an issue of developing countries (6, 7, 12). Increasing population levels are contributing to increased rates of food insecurity amongst developed countries, such as New Zealand (4, 6, 8, 20). Alongside increased food insecurity, current obesity rates are some of the highest seen throughout history (19, 43). Both issues related to food intake, these contrasting health outcomes question current social integrity.
Within the food supply chain, some of the highest rates of carbon emissions and food waste are occurring at the consumption end (18). This indicates targeting the general population to implement change (18). A desire to live sustainably seems to be increasing throughout the world, including New Zealand (21, 24, 25). Social image is important within the foodservice sector for attracting new, and return customers (23, 44). The foodservice sector has a social responsibility to local community. Adapting sustainable practices is a step in the right direction for reducing the social implications of food waste.

2.2 Food Waste in Food Services

The foodservice sector is large and diverse which makes it challenging to quantify food waste across this entire sector. The ‘foodservice sector’ comprises of people and businesses engaged in the process of preparing meals and drinks for consumption outside of the household (2, 45, 46). Food waste research in this sector is less comprehensive than production and household food waste, although researchers have estimated that the foodservice sector generates 12% of total food waste (2, 10, 30, 38, 47-50). This is quantified as 920 thousand tonnes from the United Kingdom (U.K.), 11 million tonnes within the EU, and 19.5 million tonnes from the United States of America (USA) (1, 2, 12). These results are staggering, and of this food waste, an estimated 75% is avoidable (1).

Food waste within the foodservice sector is often categorised into three main waste flows: ‘food spoilage’ (any food that has been discarded due to spillage or spoilage, e.g. mould, loss of quality, past product 'best before' or 'use by' date), ‘preparation waste’ (any food item discarded during meal preparation, e.g. vegetable peelings, bread crusts, bones,
or incorrect cooking times and techniques), and ‘consumer plate waste’ (any food item that has been ordered by the customer but was left on the plate uneaten) (1).

Studies have used varying methodologies to estimate food waste in the foodservice sector, making comparisons between studies difficult. Studies to date have been conducted in large-scale foodservice organisations include hospital sites, hotels, university halls of residence, catering companies and schools (23, 26, 27, 29, 32, 35). Regardless of setting, results highlight a significant quantity of food waste is produced in the foodservice sector.

2.3 Waste Assessment

The recommended approach to reduce food waste is a three-step process; target, measure and act (14, 16). Ultimately, what gets measured gets managed, therefore quantifying food waste is an essential step (14, 16, 18). Differing methodologies were seen throughout the literature, limiting the comparisons between studies (1, 10, 17, 23, 26-31, 51). Recently, a number of expert organisations have come together to produce a food waste quantification manual and set of accounting and reporting standards (2, 3). The EU Fusions manual discusses the gold standard for collecting food waste data based on the current setting and any data already available (2). There is also the food loss and waste protocol (FLW) which provides internationally accepted standards on food waste accounting and reporting (3). Prior to this, there was no clear gold standard on waste assessment found. Many studies use either quantitative or qualitative analysis, however, few use combinations of both (1, 10, 17, 26-31). Methods such as waste audits (random sample of waste collected and weighed over a period of time), material flow analysis
(systematic assessment of the flows and stocks of materials within a system), and participant observation are often used in isolation (1, 10, 17, 23, 26-31, 46, 52).

Discussed in the EU Fusions manual are some commonly used and agreed upon data collection and waste assessment methods (2). Utilising existing records can be one method if such data is already available, although data validity is questionable. If such records are not readily available, measurement and calculation techniques can be used (2). These often require a waste audit to have been undertaken. Direct weighing of food waste using scales generates accurate, stand-alone data (2). This is a simple assessment method, involving low researcher training and is deemed consistent with limited room for researcher error. Counting and volumetric assessment involve assessing the number of food items or the space the food waste takes up, respectively (2). Waste compositional analysis generates detailed information which can be linked to attitudes and behaviours around why food waste has occurred (2). This method involves organising and separating food waste into set categories which can then be weighed to generate raw data (2).

If completing a food waste audit is not possible, other qualitative methods such as collecting questionnaires or diaries can be used. Questionnaires are an efficient means to gather widespread data (2). They can be used to gain insight into attitudes and behaviours of food waste, along with providing an estimate of the perceived food waste generated. Self-reported data may be inaccurate as participants tend to over- or under-report dependent on what they perceive as the ‘desired’ answer (48, 51). Diaries provide an
information log of the business’s documented food waste and related behaviours (2).

Diary use has similar advantages and disadvantages to questionnaires.

Combining the above quantitative and qualitative assessment methods can provide valuable insight into the amount of food waste produced and the attitudes and behaviours of food waste. The U.K. WRAP report used survey questionnaires and waste audits to combine both quantitative and qualitative data collection. Similar study designs have been used to assess food waste within New Zealand households by Waste Management Institute New Zealand Inc. (WasteMINZ) (10, 34).

To date, there is no waste assessment data on restaurants and cafes in New Zealand, so this research aims to fill this gap in the literature by applying methodologies and ideas from international studies to the New Zealand setting (1-3, 10, 34). Food waste in this sector needs to be quantified to determine the extent of the problem, and if it’s significant, then baseline data is needed to assess the impact of waste reduction strategies.

2.4 Food Waste in Restaurants and Cafes

Few studies have quantified food waste produced in the restaurant and cafe foodservice sector. The definition of a restaurant and cafe is often open to interpretation. WRAP’s definition of “outlets that have table service” is most commonly used and recommended by EU Fusions (1, 2). For the purpose of this study, the New Zealand Yellow Pages business self-classifications are used, ‘cafe and coffee bar, BYO restaurant, licensed restaurant, and unlicensed restaurant’ (53).
Food waste in restaurants and cafes has been acknowledged for many years. In 1983, researchers concluded 20-38% of food was wasted through a hotel dining service (27). This study also noted more food was wasted when eaten away from the home compared to a domestic setting (27). It is increasingly common to consume food away from the home in other countries (17, 23), so it can be assumed New Zealand residents are following a similar trend. The U.K. restaurant foodservice sector has quantified food waste at 199,000 tonnes per year (1). A Finnish study collected diaries from 51 outlets that weighed edible and inedible food waste. Of all handled food, 17-25% was wasted with the highest proportion coming from consumer plate waste (31). Katajajuuri et al and Heikkila et al findings support these conclusions (9, 22).

Limited research is available assessing food waste produced in restaurants and cafes on a global scale. Dining outside of the household is increasing in popularity, leading to an increased number of restaurant and cafe outlets. It can be hypothesised that food waste in this sector is increasing.

2.5 Food Waste Attitudes and Behaviours

Awareness of food waste is increasing and more efforts are being made to reduce waste (5). In order for change to occur, it is necessary to consider the current attitudes and behaviours of food waste. Consumer practices and demands drive the foodservice sectors behaviours (5, 22, 25). Altering customer attitudes towards food waste proves challenging for any restaurant or cafe. One study found employees felt apprehensive about educating customers on food waste (23). The foodservice sector is there to provide a service and experience for its customers.
Several studies have found people often feel guilty when wasting food, however, do not see it as a serious issue (28, 34, 42). In the past, food waste indicated a person’s wealth as they could afford to waste food and it was seen as a ‘luxury’ (5, 25). It is possible that this attitude is present today, especially if the negative implications of food waste are unknown. Bernstad’s study assessed household recycling attitudes and behaviours (49). The key elements influencing a person’s recycling rates are thought to be; education on the importance, convenience/accessibility, economic factors, environmental awareness, social norms and demographic factors (49). This study demonstrates that educational status and knowledge on environmental implications are not the determining factors in order to change behaviours, rather convenience is a key factor in changing food waste attitudes and behaviours (49). Heikkila et al concluded the eight main elements impacting on food waste are; society, business concept, product development, management, professional skills, diners, competitors, and communication (22). Neff et al concluded that the strongest motivator for reducing food waste was to save money, and environmental outcomes were ranked as the least important (48). Quested et al supports these findings, concluding people are disengaged with the environmental consequences of food waste (42).

Many factors are considered highly impactful for food waste reduction. However, cooperation between the consumer and business is necessary to generate change, as consumer practices impact on business behaviours (22). A multifaceted approach targeting consumer, industry and government policy is required to change attitudes and behaviours. This research seeks to assess what motivates businesses to reduce their food
waste by combining the above elements into four key motivating factors; environmental, economic, social, or personal factors.

2.6 Strategies to Reduce Food Waste

Waste reduction strategies and methods can be implemented and utilised to reduce the amount of food waste. There are many international organisations raising awareness and promoting a reduction of food waste alongside sustainable practices. The key aims are to educate, share experiences and provide tools in order to reduce food waste. Organisations include, but are not limited to EU Fusions, WRAP U.K, The Sustainable Restaurant Association (U.K), Love Food Hate Waste (New Zealand), The Green Seal, United Against Waste (Switzerland), and the Green Restaurant Association (USA and Canada) (1, 2, 54-58). Several have created criteria for defining a sustainable restaurant, resources with strategies to be implemented, and some provide training programs and complete audits. However, membership costs range from approximately $1000-$3000 NZD annually, limiting the number of businesses who can afford this expense. Several organisations criteria are not specially designed with food waste in mind, focusing more on organic and locally sourced food. The international organisations are large and the content is not always applicable to New Zealand businesses. Organisations such as EU Fusions and WRAP U.K. support creating a network platform to share experiences and a community committed to reducing food waste (1, 2).

Many strategies have been researched to reduce food waste and assess the hierarchy of waste disposal. A reduction in plate size has been shown to reduce the amount of food wasted due to less being served, although the customers perception remains unchanged as
the plate still appears full (12, 33). Kallbekkens’ study supports this strategy with results showing food waste was reduced by 19.5% when plate size was reduced (11). Reducing portion size has a similar effect to reducing plate size (11, 33, 48, 50). Allowing customers to help themselves to seconds or to have unlimited sides, can remove the desire to serve larger portions as they are aware they can go back for more (11). Providing customers with the option to take their left-overs home in a doggy bag also reduces consumer plate waste (25, 50). In order to reduce preparation waste, strategies such menu planning, and a fruit-to-root approach can be utilised (50). Fruit-to-root is when the business aims to use all aspects of the food item, including the potentially avoidable and unavoidable waste. It is expected that there will still be waste from this strategy, although finding innovative uses for food waste will reduce the quantity of waste being disposed. Donating food was previously considered unsafe as the business was liable for any food safety repercussions. This meant donating food was uncommon. With the introduction of the Food Act 2014, businesses are now protected and able to donate food (59). Although this act was passed several years ago, knowledge of the food donors clause is limited in restaurants and cafes (48).

Existing research shows many of the above strategies are beneficial in reducing food waste (1, 11, 12, 25, 33, 48, 50). This research aims to assess which strategies local business owners consider impactful and their perceptions on ease of implementation.

2.7 Conclusion

Studies use varied waste assessment methodologies which has led to inconsistencies when comparing results. However, individual results highlight a significant quantity of
food waste is produced in the foodservice sector. It can be concluded that a reduction in food waste is ultimately of economic benefit to a business (14). Decreasing the quantity of food waste produced is a first step resolution, proving to be more sustainable than waste disposal methods (42). Adapting sustainable practices is beneficial reducing the environmental and social implications of food waste.

Dining outside of the household is increasing in popularity. Foodservice providers should be concerned of the quantities of food waste produced in their business. There is no quantified food waste data available for New Zealand restaurants and cafes. Before waste reduction strategies are implemented, baseline data needs to be collected. Individual attitudes and behaviours towards food waste are also necessary for creating change. This research is set out to quantify food waste in New Zealand restaurants and cafes using self-reported and waste audit data. Food waste reduction attitudes, behaviours, and strategy ideas were also explored. This research design incorporates methodologies and ideas of international studies, and applies these to the New Zealand setting (1-3, 10, 34).
3. **Objective Statement**

To date, no existing literature has been found which quantifies food wastage, or analyses current attitudes and behaviours in New Zealand restaurants and cafes. Therefore, the aim of this research is to quantify food waste in New Zealand restaurants and cafes.

The objectives of this research include:

1) To quantify food waste in New Zealand restaurants and cafes using self-report measures,

2) To quantify food waste in a sub-sample of New Zealand restaurants and cafes using observational (waste audit) methods,

3) To compare the self-report estimates of food waste to the reference method (waste audit), and

4) To explore New Zealand restaurant and cafe owners’ food waste reduction behaviours, attitudes and strategy ideas for this sector.

Part of a larger national study, this thesis will primarily investigate food waste in upper regions of the North Island of New Zealand. These regions account for approximately half the cafes and restaurants throughout New Zealand. This research will be designed to use both quantitative and qualitative methods to generate the necessary baseline data, filling a current gap in the literature. Research methodology and protocol will be further discussed in chapter 4.
4. Subjects and Methods

The following chapter will discuss the research design and rationale (4.1), selection of restaurants and cafes (4.2), development process of data collection tools (4.3), data collection (4.4) and data analysis (4.5).

4.1 Research Design and Rationale

Data collection was carried out between 31st July and 9th October 2017. The research was ethically approved by the University of Otago (Appendix A). Throughout this research, two data collection techniques were used; self-reported questionnaires and waste audits. Both of these techniques will be discussed later in this chapter.

This research utilised a mixed method approach. R. Burke Johnson et al defined mixed methods research as one where the “researcher combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration” (60). A mixed method approach is often seen to improve analytical power and expand the scope of the research (61).

Quantitative data was collected to assess food waste volume, food waste flows and demographics specific to each business. Quantitative research is defined as a formal, objective and systematic process in which numerical data is used to obtain information (62). This research used waste composition analysis (physically separating, weighing and categorising food waste) (2).
Qualitative data was collected to assess current attitudes and behaviours of food waste, reduction strategies and motivators to reduce food waste. Qualitative research is an inquiry process where the researcher seeks to understand phenomena or to explore a social or human problem (63). This research style is usually performed in the field with the researcher gaining a holistic view and understanding of the situation as a whole (64). The use of a questionnaire (gathering information from a large number of businesses through a set of structured questions) and conversation during waste audits produced qualitative data (2). Based on the nature of food waste and sustainable practices, utilising a mixed methods approach is well suited for this research.

4.2 Selection of Restaurants and Cafes

Participants of this research were business owners of randomly selected restaurants and cafes throughout New Zealand. All businesses listed in local 2016/17 Yellow Pages print directories under ‘cafe and coffee bar, BYO restaurant, licensed restaurant, and unlicensed restaurant’ were selected, creating a nationally representative sample (53). All 5970 businesses were entered into Microsoft Office Excel 2016 based on region, business type, and business listing number in the regional Yellow Pages (53). Businesses were randomly assorted using a random number generator to generate 500 businesses across New Zealand. These businesses were separated into two sub-samples, each comprising of 250 restaurant and cafe businesses for two Masters of Dietetic students to complete individual theses. This thesis used 250 businesses from the Northland, Auckland, and Waikato/Kings Country/Thames Yellow Page regions. These regions account for approximately half the cafes and restaurants throughout New Zealand. Due to low response, a convenience sample of 73 businesses was also contacted via face to face
interviews leaving a paper copy of the self-reported questionnaire. A convenience sample group is defined as one where the most easily accessible subjects are selected (65). These businesses were chosen due to their location, and ease of access for the researcher to visit. Utilising a convenience sample was deemed valuable due to the low response rate during phase one of the self-reported questionnaire collection. The researcher was able to utilise personal connections in order to increase the sample size of this research.

Businesses were excluded if they were deemed a fast food or takeaway restaurant due to the nature of their business operation. Excluded businesses were nine McDonalds, one Subway, and one Wendy’s Hamburgers. These businesses are self-reported as an unlicensed restaurant in the New Zealand Yellow Pages (53).

Three additional businesses were audited in Taranaki and Manawatu regions by the researcher. Although not in the original selected data set, geographic, time and budgetary implications led to adding these businesses to this research data set.

4.3 Development of Data Collection Tools

Refer to Appendix B for the self-reported questionnaire which was adapted from the 2013 WRAP report (1). This was reviewed by the thesis supervisors and by Jenny Marshall from WasteMINZ. The questionnaire was designed to be administered orally, via a telephone call or online, sent via an email link using the computer software Qualtrics.
A pilot study of the self-reported questionnaire was undertaken between 26\textsuperscript{th} and 28\textsuperscript{th} of July 2017. This was piloted to a convenience sample of University of Otago Masters of Dietetic students. They were selected based on the researchers’ personal relationships and their previous knowledge of this research. Eleven responses were collected along with feedback. Further adaptations to the questionnaire were made.

Methodology for the on-site waste audit was designed using EU Fusions food waste quantification manual and the food loss and waste accounting and reporting standard (2, 3). These manuals are considered the most up-to-date gold standard frameworks for food waste assessment. Also taken into consideration was the methodology used by WRAP for analysis of restaurants and cafes (1). Methodology from recent research undertaken by WasteMINZ was also applied to maintain consistencies across New Zealand based research. An On-Site Food Waste Audit Data Collection Form was developed by Sarah Chisnall, Masters of Dietetic student working on this research topic (Appendix C).

4.4 Data Collection

4.4.1 Questionnaire Interviews

A collection of questionnaire data was undertaken by telephone calls and in person interviews. The use of questionnaires can be convenient for distribution to multiple businesses and generation of a large sample size, however a larger degree of error is seen with self-reported waste quantification (2, 48, 51, 66). The researcher contacted 250 businesses via telephone call to request participation in this research. All willing participants were asked for their preference in completing the questionnaire during the telephone call or an online version emailed to them. Participants who preferred to
complete the questionnaire online were emailed a Qualtrics online questionnaire. The participation information sheet and opt-in consent was imbedded in the online questionnaire. A reminder email was sent seven days after the initial email to all participants who had not completed the questionnaire. Questionnaires completed via email were given a cut-off date of 30th September 2017.

Participants who preferred to complete the questionnaire verbally were read the information sheet and verbal consent to participate in this research was recorded (Appendix D). All verbally completed questionnaires were audio recorded. The researcher transcribed answers and input to the online questionnaire for data analysis through Qualtrics.

The researcher visited an additional 73 local businesses to personally request participation. Paper copies of the questionnaire, participant information sheet and participant consent form were provided along with prepaid return envelopes (Appendices B, D, and E). All businesses whom completed the questionnaire went into a draw for one of four $50 prizes, kindly supplied by WasteMINZ.

4.4.2 On-Site Waste Audit

Businesses were asked for consent to participate in a 24-hour food waste audit at the end of the questionnaire. Five businesses consented and were contacted by the researcher to participate in the waste audit. Businesses were read the waste audit information sheet and consent confirmed (Appendix F). Where possible the researcher set up the waste audit. Three bins were set up at the beginning of the 24-hour period in a designated area of each
kitchen. The researcher took a selection of bin sizes; 4.5 litres, 9.6 litres, and 68 litres, for participants to select from. Participants selected the most appreciate sized bins based on their knowledge of current food waste produced in their business. All staff were briefed on separating waste into food spoilage, preparation waste, and consumer plate waste. Definitions and example foods for each category were laminated and taped to the associated bin as a reminder to staff (Figure 1). Where the researcher was unable to set up the waste audit, businesses were provided instructions on how to separate food waste and emailed labels to place on three bins of their choice. The head chef or business owner briefed the staff. The researcher returned at the end of the 24-hour period to collect the food waste.

Figure 1: Example of on-site waste audit bin set up
Food spoilage, preparation waste and consumer plate waste bins were weighed for the total waste produced in each category. Using waste compositional analysis, the researcher then separated each of the above into 13 food groups to the best of the researchers’ ability. Food groups were fruit, vegetables, potatoes, meat, fish, dairy, eggs, bakery, cereals and grains, legumes nuts and seeds, packaged liquids, miscellaneous, and unidentified food waste (1). Two litre containers were labelled and used to weigh the total food waste in each food group (Appendix G). Within the 13 food groups, waste was further sorted into avoidable, potentially avoidable and unavoidable food waste. Two litre containers were also used to record the weight of food waste using these three distinctions. All weights were recorded on the On-Site Food Waste Audit Data Collection Form (Appendix C). Additional notes were made of trends the researcher saw whilst separating the food waste.

No liquid waste was received during any on-site waste audit; it was therefore not part of the waste analysis.
4.5 Data Analysis

When all questionnaire interviews were complete, data was analysed using Qualtrics. Quantitative data was analysed through a Qualtrics produced report and Microsoft Office Excel 2016. Qualitative data was coded on the Qualtrics produced report. Data was highlighted based on food waste themes for each question (Figure 2).

| Portion control | reducing ordering when necessary | regularly rotating stock + checking stock for expiry | encouraging doggy bags |
| Doggy bags | staff feedback | wastage book |
| FIFO is followed | Staff are trained to label and date every product that goes into the kitchen |
| Proper use of measuring scales | Portion control | right method of cooking |
| Reviewing food purchasing/storage practices | Portion control | staff training |
| Staff meals | Storage items | Stock rotation | staff training | Recipe |
| Ordering food to demand |
| Portion sizes/servings | reducing items e.g. roast tomatoes used in a big breakfast and then reused in a quiche | offer different specials based on current foods |
| Order supplies each day | offer smaller sized meals through the menu options | use products which expire first | provide doggy bags if customer wants it |
| Portion control meals | purchase ingredients as needed and purchase everyday | offer doggy bags | alter menu each day based on supplies |

Key

| Staff training | portion control | flexibility with ordering food and forecasting | FIFO | offering a doggy bag | and altering the menu based on current stock |

Figure 2: Example of analysed qualitative data

When all waste audits were complete, data was entered into a Microsoft Office Excel 2016 spreadsheet. Descriptive statistics was calculated on the quantity of food waste produced on site.
5. Results

The following chapter summarises the results of the food waste questionnaire (5.1), the on-site waste audits (5.2), and comparisons between self-reported data and quantified food waste (5.3).

5.1 Questionnaire

In total 312 businesses were contacted to participate in the self-reported food waste questionnaire (Figure 3). Eleven businesses were excluded based on the nature of the business. Thirteen businesses completed the questionnaire producing a response rate of 4.17% (3.77% of the original sample and 5.48% of the convenience sample).

![Diagram of questionnaire recruitment process and respondent number]

Figure 3: Questionnaire recruitment process and respondent number
Data collected from the questionnaire was used to determine general business characteristics (Table 1).

Table 1: General Business Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Percentage (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-reported business classification</strong></td>
<td></td>
</tr>
<tr>
<td>Cafe</td>
<td>53.85 (7)</td>
</tr>
<tr>
<td>Restaurant</td>
<td>30.77 (4)</td>
</tr>
<tr>
<td>Cafe and Restaurant</td>
<td>15.38 (2)</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
</tr>
<tr>
<td><strong>Do most of your customers consume food on your premises or take their food away?</strong></td>
<td></td>
</tr>
<tr>
<td>Eat their food on the premises</td>
<td>69.23 (9)</td>
</tr>
<tr>
<td>Take their food away from the premises</td>
<td>0</td>
</tr>
<tr>
<td>About equal amounts take food away as eat on the premises</td>
<td>30.77 (4)</td>
</tr>
<tr>
<td><strong>Geographic location of business</strong></td>
<td></td>
</tr>
<tr>
<td>Northland</td>
<td>7.69 (1)</td>
</tr>
<tr>
<td>Auckland</td>
<td>61.54 (8)</td>
</tr>
<tr>
<td>Waikato/Kings Country/Thames</td>
<td>7.69 (1)</td>
</tr>
<tr>
<td>Taranaki</td>
<td>7.69 (1)</td>
</tr>
<tr>
<td>Manawatu</td>
<td>15.38 (2)</td>
</tr>
<tr>
<td><strong>Approximately how many covers does your business serve on a daily basis?</strong></td>
<td></td>
</tr>
<tr>
<td>0 - 25</td>
<td>0</td>
</tr>
<tr>
<td>26 - 50</td>
<td>30.77 (4)</td>
</tr>
<tr>
<td>51 - 100</td>
<td>46.15 (6)</td>
</tr>
<tr>
<td>101 - 200</td>
<td>7.69 (1)</td>
</tr>
<tr>
<td>201 - 300</td>
<td>15.38 (2)</td>
</tr>
<tr>
<td>More than 300</td>
<td>0</td>
</tr>
<tr>
<td><strong>How many days a week does your business trade?</strong></td>
<td></td>
</tr>
<tr>
<td>0 - 3</td>
<td>7.69 (1)</td>
</tr>
<tr>
<td>4 - 5</td>
<td>23.08 (3)</td>
</tr>
<tr>
<td>6</td>
<td>7.69 (1)</td>
</tr>
<tr>
<td>7</td>
<td>61.54 (8)</td>
</tr>
<tr>
<td><strong>How many weeks per year does your business trade?</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;40</td>
<td>7.69 (1)</td>
</tr>
<tr>
<td>41-42</td>
<td>0</td>
</tr>
<tr>
<td>43-44</td>
<td>0</td>
</tr>
</tbody>
</table>
Businesses reported that the largest contributor to food waste was from Consumer Plate Waste at 43% followed by Preparation Waste, 36% and Food Spoilage, 21% (Figure 4).

<table>
<thead>
<tr>
<th>Weight Range</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-46</td>
<td>0</td>
</tr>
<tr>
<td>47-48</td>
<td>15.38 (2)</td>
</tr>
<tr>
<td>49-50</td>
<td>23.08 (3)</td>
</tr>
<tr>
<td>51-52</td>
<td>53.85 (7)</td>
</tr>
</tbody>
</table>

**Does your business regularly sort out food waste for disposal separately from general waste?**

- **Yes**: 61.54 (8)
- **No**: 30.77 (4)
- **I'm not willing to answer**: 7.69 (1)

**Do you monitor the amount of food waste your business produces?**

- **Yes**: 69.23 (9)
- **No**: 30.77 (4)

Figure 4: Average self-reported proportions of total food waste by three waste flows
Figure 5 displays the most commonly wasted food items, as self-reported by businesses for each waste flow. Vegetables and dairy were cited as waste eight and seven times respectively, due to spoilage. Food most often wasted during preparation were vegetable peels (cited 10 times), and vegetables (cited nine times). Sauce/condiments were the most commonly wasted item from consumer plate waste, cited 12 times.

Figure 5: Most commonly wasted food items cited within each three waste flows from 13 businesses
When asked how the business felt about their current food waste, seven reported feeling satisfied with their current efforts and content their business produced low waste levels. One business quoted feeling, “proud of effects to reduce food waste, very limited amount” (*Auckland, restaurant, not monitoring waste, 26-50 covers/day*), and another thought that they, “are doing everything we can to minimize all food waste” (*Manawatu, restaurant, monitor waste, 26-50 covers/day*). Five businesses held moderate views that their food waste levels were neither low or high. One business believed, “the amount of food waste produced in my cafe is in reasonable range” (*Auckland, cafe and restaurant, not monitoring waste, 51-100 covers/day*), and another commented, “we don't have a huge amount of avoidable food waste but there are areas we could improve on” (*Auckland, cafe and restaurant, monitor waste, 51-100 covers/day*). There was only one business who openly believed they “could do better” (*Auckland, cafe, not monitoring waste, 201-300 covers/day*).

Businesses were asked how important four different motivating factors were to them (Figure 6). Ten businesses reported financial/economic outcomes as ‘extremely important’, ranking this as the most important motivator for reducing food waste. Environmental outcomes were the second most important motivator with six businesses ranking this as ‘extremely important’ and five as ‘very important’.
Figure 6: Motivating factors to reduce food waste

Businesses were given a list of strategies and asked to decide if each strategy would be impactful in reducing food waste and the ease of implementing each strategy within their business (Figures 7 and 8). The two most impactful strategies were to order products with a short shelf-life more frequently and to implement a first-in first-out system with nine businesses reporting these to have a ‘high’ impact (Figure 7). The least impactful strategies as reported by business owners were; let customers order side meal items as separate side dishes, serve smaller portions of side dishes with one free top up and to donate food to food banks or the homeless. All three of the above strategies were ranked to have a ‘low’ impact on reducing food waste by five businesses (Figure 7).
Figure 7: Perceived impact of waste reduction strategies on reducing food waste
When asked to evaluate the ease of implementation, the first-in first-out system and allowing customers to take home left-overs where deemed the easiest to implement, each with 10 businesses ranking these strategies as ‘easy’ (Figure 8). This was followed by ordering products with a short shelf-life more frequently, ranked ‘easy’ by nine businesses. Donating food to food banks or homeless was considered to have the lowest impact (ranked by five businesses) on business food waste along with being the most difficult to implement (ranked by six businesses) (Figures 7 and 8).
Figure 8: Perceived ease of implementing waste reduction strategies
5.1.1 Monitoring vs not monitoring

Table 1 shows 69.23% of businesses reported they monitor their food waste. The most common way of monitoring food waste was by visual checks. One business reported they, “separate all food scraps and recycling. Look at what comes back on the plates” (*Auckland, cafe, monitor waste, 51-100 covers/day*). Whereas one business not monitoring their food waste mentioned, “low level of food waste so doesn't need to be monitored” (*Auckland, restaurant, not monitoring waste, 26-50 covers/day*), and another commented, “small cafe, it’s too hard” (*Northland, cafe, not monitoring food waste, 51-100 covers/day*). The most common policies and procedures businesses had in place to monitor and reduce food waste included; staff training, portion control, flexibility with ordering food and forecasting, first-in first-out stock rotation, offering customers a doggy bag and altering the menu based on current stock.
5.2 On-Site Waste Audit

Thirteen businesses were invited to participate in an on-site waste audit. Five businesses consented at the completion of the questionnaire. One business later declined during second contact. And another business incorrectly completed the waste audit, data from this business was discarded so as not to skew results. In total three on-site waste audits were successfully completed (Figure 9).

Figure 9: On-site waste audit recruitment process and number of completed audits
The total mean food waste generated was quantified as 3.22kg. This data is unable to be scaled to a national level. Three waste audits is a small and potentially bias sample on which to compare results to a national level.

Data analysis deemed preparation waste the highest contributor to total food waste (Figure 10). Preparation waste contributed an average of 68% to total food waste.

![Figure 10: Average quantified proportions of total food waste by three waste flow](image)
The break-down of total food waste into avoidable, potentially avoidable and unavoidable can be seen in Figure 11. Of the total waste analysed, 75% was avoidable or potentially avoidable.

Figure 11: Average quantified proportions of total food waste by three waste classifications

5.2.1 Food Spoilage

Food spoilage was received during one audit and was classified as 100% avoidable waste within the vegetables food group. This waste was cabbage leaves and was quantified as 0.421kg.
5.2.2 Preparation Waste

Analysis of total preparation waste found 46% was avoidable, 26% potentially avoidable and 28% unavoidable food waste. Figure 12 depicts the compositional analysis of preparation waste into the 13 food groups. Bakery (28%) and vegetables (23%) were the two largest waste groups. Within these food groups, 90% of all bakery food was considered avoidable and vegetables consisted of 70% avoidable food waste. The researcher noted bread, pastry off-cuts and potato peels as the most common avoidable food waste. Egg shells and coffee grinds were the most common unavoidable waste.

Figure 12: Compositional waste analysis into 13 food groups for preparation waste

*Packaged liquids excluded from graph as none gathered during on-site audit for all businesses.*
5.2.3 Consumer Plate Waste

Consumer plate waste consisted of 70% avoidable food waste, 7% potentially avoidable and 22% unavoidable. The highest contributing food group was vegetables (45% total waste) and of this 66% was considered avoidable waste (Figure 13). Side salad, rice and bread crusts were the most common avoidable foods found during analysis. A majority of the unavoidable waste analysed from consumer plate waste was edamame bean pods and tea leaves.

Figure 13: Compositional waste analysis into 13 food groups for consumer food waste

*Packaged liquids excluded from graph as none gathered during on-site audit for all businesses.
5.3 Self-Reported Food Waste vs. Quantified Food Waste

Questionnaire results from the three audited businesses will be compared to the on-site waste audit data analysed in this section.

All three audited businesses self-reported their avoidable food waste as less than 20% of their total food waste. From the on-site audit, business 1, 2 and 3 had avoidable food waste quantified as 71%, 32%, and 55%, respectively. Business 1 had the largest variance as they reported their avoidable food waste as 51% less than quantified. Whereas business 2 had the smallest, they reported their waste as 12% less than quantified.

Businesses were asked what proportion of their total food waste was derived from the three different waste flows. Self-reported classification and the quantified break down can be seen in Figure 14. Business 3 was excluded as this question was left unanswered within the questionnaire, leading to no self-reported data being gathered. Business 1 reported their food spoilage and preparation waste as less than quantified by 5% and 6% respectively, whilst reported consumer plate waste as greater than quantified by 11%. Business 2 reported their preparation waste as less than quantified by 36%, they also reported their food spoilage as great than quantified by 20% and consumer plate waste by 16%. 
Figure 14: Self-reported waste classification vs quantified waste classification
6. Discussion

This research attempted to quantify food waste in restaurants and cafes in the North Island of New Zealand. Chapter 5 describes the results of this research.

A majority of businesses self-reported their avoidable food waste as less than 20% of total food waste, which differs based on observations from three waste audits. On-site waste audits found food preparation produced the most waste and was either avoidable or potentially avoidable. Businesses also reported less food preparation waste, and reported a greater amount from consumer plate waste, raising questions about the validity of self-reported food waste estimates.

Most businesses were satisfied with their current waste reduction behaviours, displaying an attitude that their business is already doing well to reduce food waste. Businesses ranked economic factors as the most important motivator for reducing food waste. Three waste reduction strategies were ranked as highly impactful and easy to implement were; to order products with a short shelf-life more frequently, to implement a first-in first-out system, and to allow customers to take home left-overs.

6.1 Questionnaire

This research found most businesses ($N=10$) self-reported their avoidable food waste as less than 20% of the total food waste produced. This contrasts with literature which estimates 75% of total food waste is avoidable (1). However, this result is consistent with a WasteMINZ questionnaire undertaken in New Zealand households (34). Only 3% of participants self-reported wasting a high amount of food (34). New Zealand household
waste audits contradicted this, confirming 30% of food purchased by a household was wasted (10). It is common for self-reported data to differ from quantified data. It is often a subjective point of view and the participant may be influenced by the desired or most acceptable outcome (51, 66).

Interestingly, most businesses ($N=7$) did not see food waste as a problem for their business and were satisfied with current food waste quantities. Attitudes around food waste are often inconsistent in the literature (22, 42, 48, 49, 66). This result opposes other national studies where 82% of participants reported reducing food waste an important issue (34). It is possible that participants of this thesis research have previously implemented food waste reduction strategies, leading them to believe they have already made a substantial effort in reducing waste. This thesis did not directly investigate recent changes to food waste policies. Businesses viewing their current food waste as acceptable is alarming. This result suggests that simply implementing waste reduction interventions may not be impactful based on current attitudes. There is firstly a need to establish concern, demonstrate quantified food waste, and develop behavioural change interventions using known motivators.

The observation that economic factors are the most important motivator for reducing food waste is not new. The for-profit, foodservice sector is strongly driven by economic motivators (16). The latest Champions study supports this finding (14). A quantified economic gain for investment into waste reduction targets economic motivation and is beneficial for future interventions. Unexpectedly, ranked second most important were
environmental motivators. This contrasts with previous studies where environmental factors were the least important for reducing food waste (42, 48, 49). There are several explanations for this difference. The issue of food waste is growing in popularity, and there is an increased awareness of the environmental implications food waste causes (14, 16). A cultural shift to sustainability practices is emerging with more customers expecting a ‘green’ approach in restaurants and cafes (24). This result may highlight the cultural change or be a result of bias individuals participating. Future research could investigate this further so it may be considered when designing public health intervention strategies to reduce food waste in restaurants and cafes.

Based on available literature, the researcher hypothesised businesses who monitor their food waste would self-report lower levels of waste than businesses who do not monitor food waste. The act of simply monitoring can alter behaviours (2). However, this research determined that there are minimal differences between those who monitor their food waste and those who do not. This finding may be influenced by using self-reported data. Another possibility is those who do not actively monitor food waste were still more interested in sustainable practices due to their willingness to participate in this research.

6.2 Self-Reported Food Waste vs. Quantified Food Waste

All audited businesses self-reported their avoidable food waste as less than 20% of the total food waste produced in their business. However, the quantified avoidable food waste ranged from 32% - 71% of total food waste. Self-reported data bias may have influenced this finding. The range of inaccuracy between self-reported avoidable food waste and quantified avoidable food waste varies greatly between each business.
Interestingly, the business with the smallest variance between self-reported and quantified avoidable food waste, had the largest variance between self-reported classification into the three waste flows (food spoilage, preparation waste, and consumer plate waste). This finding is unexpected, as it was hypothesised businesses would either be more or less accurate with their self-reported food waste quantifications. Instead, there are inconsistencies with some measurements and not others. It is documented there are challenges to visually estimate food waste quantities accurately (51).

Both audited businesses reported less preparation waste and a greater amount of consumer plate waste when compared to quantified data. Preparation waste is directly produced from the business and is an area they have control over. However, consumer plate waste may be considered less within their control. Interestingly, the food waste blame has been shifted onto customers (50). However, more evidence is needed to support this claim. Future research could investigate the reasons behind businesses believing consumer plate waste is the largest waste generator.

### 6.3 Study Strengths

This research has many strengths which have led to the production of valuable results. Firstly, this research design utilised a mixed methods approach which allowed businesses to discuss attitudes and behaviours of food waste. Qualitative methodology allowed the researcher to probe further and participants to provide detailed explanations for their answers. Exact quotes provided by businesses on their thoughts surrounding food waste, what their business is currently doing to reduce food waste, and what motivates them to reduce food waste were reported. This data may be useful for future research into food
waste reduction interventions and strategies based on what motivates foodservice providers. Future research may consider using mixed methodologies in order to continue developing a deeper understanding of attitudes and behaviours.

Secondly, this research was designed utilising the latest literature on quantifying food waste (1-3). There are often large discrepancies between methodologies in the literature, leading to challenges when comparing results. These discrepancies range from basic definitions of food waste, through to the gold standard of performing waste audits (1, 10, 17, 23, 26-31, 51). This research separated food waste for audit into three categories; avoidable, potentially avoidable, and unavoidable waste. The latest gold standard recommends avoidable and unavoidable for simplicity (2, 3). There are advantages to the more detailed categorisation of food waste. Data is generated on items which are considered potentially avoidable and a more detailed waste compositional analysis is obtained. Other New Zealand based research also categorises food waste into these three categories (10). For the purpose of this research, the more detailed approach was selected which is also comparable to other New Zealand data. This research aimed to follow the guidelines set out by large, international organisations. By doing so, the data from this study can be used to begin understanding the current food waste situation in restaurants and cafes in the North Island of New Zealand.

6.4 Study Limitations

One limitation of this study is the characteristics of the participant group. The participants of questionnaires are usually those with an interest in the topic and therefore aren’t necessarily an average national representation (66). The restaurant and cafe industry is a
competitive, and often stressful environment. It can be suspected that participants of this research already had an invested interest in food waste due to the respondent burden of completing a questionnaire. It may be that results are slightly biased and a ‘best case’ scenario of the current food waste situation within New Zealand restaurants and cafes.

Another limitation of this research is the low response rate. Similar to a WRAP report, where 17 telephone surveys were completed by restaurants and the total number of outlets throughout the U.K. is estimated as 41,000 (1). The low response rate of this research may be due to initial contact not reaching the correct person and general staff declining to participate or pass a message on. Multiple calls were made to businesses at arranged times which suited the correct person to contact. However, many businesses decline participation and this placed a large time burden on the researcher. Restaurants and cafes are a fast paced environment and owners are extremely time poor. Completing the questionnaire may have been a time burden they simply couldn’t afford (51). This research attempted to overcome this limitation by contacting a large number of businesses (N=312). A future research opportunity could be adapting the questionnaire and distribution method. Adaptation of the questionnaire further to reduce the length, followed by a pilot test with a sub-sample of businesses to ensure it is suitable for the industry.

6.5 Conclusion

This research indicates food waste is an issue in restaurants and cafes in the North Island of New Zealand. The low response rate of this research indicates generating interest in this fast-paced foodservice sector is challenging. Current attitudes and behaviours do not
support the increased need for food waste reduction activities. Food waste should be quantified and classified using on-site audits, not self-reported measures, to obtain better estimates.

This research has begun to fill the gap in New Zealand literature quantifying food waste in restaurants and cafes. Policy makers, researchers and practitioners can use these findings to support more sustainable practices in this sector and contribute to the ultimate goal of reducing global food waste.
7. Application to Practice

These research findings can inform two areas of dietetic practice, foodservice management and public health.

Firstly, dietetic foodservice managers can embrace, and advocate for sustainable practices within their organisation and across the foodservice sector. Consumer purchasing trends and behaviours provide evidence dietitians need to be aware of emerging consumer interests in sustainability practices. Dietitians should also be aware of what other foodservice providers are doing to reduce food waste.

This research indicates foodservice providers may be unaware of their food waste. Food waste audits should be undertaken to estimate food waste across all areas of the foodservice sector. Visual estimations may be providing an inaccurate representation of food waste. Dietitians have historically completed plate waste audits however; they might now want to consider progressing into food waste audits across their service. The foodservice systems model may help identify areas where sustainable practices could be improved on (46, 67). Foodservice managers should keep in mind that reducing food waste may have economic gains. Nevertheless, dietitians will be required to balance financially viable decisions with environmentally sound outcomes.

Secondly, public health dietitians have a keen interest in sustainability due to its interconnections with food security and sustainable nutrition (68). Trends in food insecurity indicate inadequate nutritional intake for certain population groups. Dietitians
should be aware of the positive effects sustainability practices can have on food security. Dietitians should also be aware of the attitudes and behaviours local foodservice providers hold in order to tailor public health programmes.

This research found foodservice providers may not view food waste as a concerning issue. Applying public health theoretical models, such as the stages of change theory and organisational change theory, may lead to improved education on food waste implications across foodservice providers (69-71). Dietitians can use their training in community engagement and action planning to influence change at national and community levels. Dietitians advocating for government policy change may lead to increased sustainability practices across foodservice providers.

Dietitians may combine their knowledge of foodservice management and public health to educate on sustainable practices and effect change in the foodservice sector.
8. References

9. Appendices
Appendix A: Ethical Approval

UNIVERSITY OF OTAGO HUMAN ETHICS COMMITTEE APPLICATION FORM: CATEGORY B

(Departmental Approval)

1. University of Otago staff member responsible for project: Dr. Louise Mainvil

2. Department: Human Nutrition

3. Contact details of staff member responsible: louise.mainvil@otago.ac.nz

4. Title of project: Supporting the New Zealand Restaurant and Café Food Service Sector to Reduce Food Waste

5. Indicate type of project and names of other investigators and students:

- **Staff Research**
  - Names: Dr. Miranda Mirosa (Food Science)

- **Student Research**
  - Names: Sarah Chisnall (Human Nutrition), Emily Jones (Human Nutrition)

  Level of Study: Master of Dietetics

6. When will recruitment and data collection commence? 14th July 2017

   When will data collection be completed? 30th November 2017
7. **Brief description in lay terms of the aim of the project, and research questions:**

Food waste has been assessed in domestic and non-hospitality foodservice sectors within New Zealand. This study aims to quantify food waste in the hospitality foodservice sector. This investigation will assess the amount and types of food waste being produced in restaurants and cafés throughout New Zealand. Selected businesses will be asked to complete a questionnaire to quantify and describe their usual daily food waste, to explain current food waste policies and practices, and to comment on proposed food waste strategies and motives for change. Subsequently, a subset of 30 businesses will be randomly selected to participate in a food waste audit. Three bins will be provided to the business and collected after a 24-hour period in order to quantify food waste from spoilage, preparation, and consumer plates.

8. **Brief description of the method:**

**Part 1: Food Waste Questionnaire**

*Participant selection and consent*

A simple random sample of 500 New Zealand café/restaurants will be drawn from the sampling frame of all ‘Cafe’ and ‘Restaurant’ listings in New Zealand Yellow Pages directories. Each student researcher will be responsible for contacting 250 selected businesses, initially by telephone and then by phone and/or email, inviting them to complete a food waste questionnaire. A 30% response rate is expected (N=150 participants in total). To maximise response rates, participants will be offered the opportunity to be included in a prize draw for one of four Prezzie cards worth $50 each.

The initial phone call will aim to establish: whether the business is an operational café/restaurant, the appropriate person(s) to participate and their willingness to do so, and contact details (email, phone). Interested participants can choose to either: (i) undertake the survey verbally at that time, (ii) undertake the survey verbally at a nominated time convenient to them, or (iii) be emailed a link to the online questionnaire for completion within an agreed timeframe. Prior to data collection, informed consent will be obtained. Interested parties choosing options (i) and (ii) will be read the Information Sheet and Consent Form (Appendix A) and verbal consent will be sought (and recorded). Those choosing option (iii) will be emailed the Info Sheet and Consent Form and written consent will be requested. In all cases, questionnaire completion will indicate consent to participate.

*Questionnaire data collection*

Participants will be asked to spend approximately 30 minutes answering a series of questions either verbally or in self-administered online questionnaire format. During telephone surveys, the researcher will record verbal responses in written and audio formats (wherever possible) to ensure data accuracy and completeness. The researcher will prompt participants to elaborate on their responses where appropriate.

The 24-item questionnaire (Appendix B) is based on the WRAP Telephone Hospitality Survey\(^*\). Alterations were made for the New Zealand context and project scope. Selected businesses will be asked to quantify and describe their usual daily food waste, to explain current food waste policies and practices, and to comment on proposed food waste strategies and motives for change. Business characteristics will also be documented. Questionnaires will be labelled with a unique identifier, so researchers can contact non-respondents (send up to 3 reminders) and a sub-group of participants for Part 2 of the study, and link Part 1 and Part 2 data.

Part 2: Waste Audit

Participant selection and consent
Thirty businesses (selected from Part 1 participants willing to participate in a waste audit) will be invited via phone and/or email to have their waste audited over a 24-hour period. Purposeful sampling will be used to recruit a range of restaurants and cafés, based on quantity of self-reported food waste (high, medium, low) and location (limited to main centres: Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin). Financial, geographical and logistical constraints may impact on selection. Participants will give written informed consent prior to the audit (Appendix C).

Waste audit data collection
The researcher will provide each business with three bins and instructions for the 24-hour audit. During this 24-hour period, businesses will be asked to separate all food waste into three categories: kitchen spoilage, kitchen preparation, and consumer plate waste.

At the end of the 24-hour period, the researcher will collect the bins, check that waste was disposed in the correct bin, and weigh the total waste in each bin. Attempts will be made to categorise and weigh the contents of each bin (e.g. fruit, vegetables, meat, bakery, etc.). After the waste is processed, it will be disposed of at the restaurant/cafè site using their procedures. Waste audit data will be labelled with the participant’s unique identifier, so it can be linked to Part 1 data.

Data management (Parts 1 and 2)
All information collected will be securely stored in such a way that only the researchers named on this application will be able to gain access to it. At the end of the project, any personally identifying information will be destroyed immediately (i.e. contact lists with unique identifiers, audio-recordings, emails). Raw data on which the results of the project depend (i.e. signed consent forms, completed questionnaires and relevant comments, audit data) will be retained in secure storage (i.e. password-protected electronic files, or in a locked filing cabinet) in Dr. Marion’s University of Otago office until it is no longer needed, after which it will be securely destroyed. Dr. Mainvil will be responsible for the safe destruction of personal information and storage of raw data.

9. Disclose and discuss any potential problems and how they will be managed:

To manage health and safety risks when handling food waste, researchers will use protective equipment (e.g. tarps), clothing (including gloves) and eyewear at all times. Care will be taken to avoid spillage if transport is required.

Every attempt will be made to not disclose the names of participating businesses to anyone outside the research team. Names will not be published, unless this is specifically requested by businesses.

Applicant's Signature: [Signature]

Name (please print): Louise Mainvil

Date: 13/7/17
ACTION TAKEN

☑ Approved by HOD
☐ Approved by Departmental Ethics Committee
☐ Referred to U0 Human Ethics Committee

Signature of Head of Department: ..............................................................

Name of HOD (please print): .................................................................

Date: ........................................................

Departmental approval: I have read this application and believe it to be valid research and ethically sound. I approve the research design. The research proposed in this application is compatible with the University of Otago policies and I give my approval and consent for the application to be forwarded to the University of Otago Human Ethics Committee (to be reported to the next meeting).

IMPORTANT NOTE: As soon as this proposal has been considered and approved at departmental level, the completed form, together with copies of any Information Sheet, Consent Form, and survey or questionnaire should be forwarded to the Manager, Academic Committees or the Academic Committees Administrator, Academic Committees, Rooms G22, or G26, Ground Floor, Clocktower Building, or scanned and emailed to either gary.witte@otago.ac.nz or jane.hinkley@otago.ac.nz
Appendix B: Self-Reported Questionnaire

PART ONE:
The aim of this study is to assess the level and types of food waste generated by New Zealand restaurants and cafes, specifically looking at the areas of consumer plate waste, preparation waste, and spoilage waste.

Q1 Business Name _______________________________________________________

Q2 Business Address _____________________________________________________

Q3 Contact Name and Job Title _____________________________________________

Q4 Business Telephone ___________________________________________________

Q5 Self-reported classification of business
   ☐ Cafe
   ☐ Restaurant
   ☐ Cafe AND Restaurant
   ☐ Other ______________________

Q6 Do most of your customers consume food on your premises or take their food away?
   ☐ Eat their food on the premises
   ☐ Take their food away from the premises
   ☐ About equal amounts take food away as eat on the premises
   ☐ I’m not willing to answer

Q7 Which of the following types of food service does your business provide? (Select all that apply)
   ☐ Breakfast
   ☐ Morning break
   ☐ Lunch
   ☐ Afternoon break
   ☐ Dinner
   ☐ Snacks
   ☐ Take away
   ☐ No meals are provided
   ☐ I’m not willing to answer
Q8 Approximately how many covers does your business serve on a daily basis?
- 0-25
- 26-50
- 51-100
- 101-200
- 201-300
- More than 300
- I don't know
- I'm not willing to answer

Q9 What days of the week does your business trade? __________________________________________

Q10 How many weeks per year does your business trade? _________________________________

Q11 Approximately how much TOTAL waste (rubbish) does your business produce each day (e.g. bags or bins)? (Please specify amount e.g. 1.5 x 60L bin or 1 x 240L bin).

________________________________________________________________________________________

Q12 Approximately how much TOTAL recycling does your business produce each day (e.g. bags or bins)? (Please specify amount e.g. 1 x 240L bin).

________________________________________________________________________________________

Q13 Does your business regularly sort out food waste for disposal separately from general waste?
- Yes
- No
- I'm not willing to answer

Q14 Do you monitor the amount of food waste your business produces? (e.g. waste audits/reviews)
- Yes
- No
- I'm not willing to answer
Q15 If yes, how does your business do this? If no, are there any particular reasons why not?

_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

Q16 Approximately what percentage of your business' TOTAL waste would be food waste?
(By food waste we mean all edible and inedible food that is thrown out in your business, such as fruit and vegetable scraps, meat bones, partially used foods, foods that have passed their 'use by' date or 'best before' date, or food thrown away for other reasons).

☐ Less than 20% (less than one fifth or 1 of 5)
☐ 20 to 39% (one to two fifths or 1-2 of 5)
☐ 40 to 59% (two to three fifths or 2-3 of 5)
☐ 60-79% (three to four fifths or 3-4 of 5)
☐ 80% or more (more than four fifths or 4-5 of 5)
☐ I don't know
☐ I'm not willing to answer

Q17 Approximately what percentage of your business' total food waste would be considered avoidable food waste?
(By avoidable we mean any edible food that was intended for human consumption at some point before it was thrown away, even if it had become inedible at the time it was thrown away)

☐ Less than 20% (less than one fifth or 1 of 5)
☐ 20 to 39% (one to two fifths or 2 of 5)
☐ 40 to 59% (two to three fifths or 3 of 5)
☐ 60 to 79% (three to four fifths or 4 of 5)
☐ 80% or more (more than four fifths or 4-5 of 5)
☐ I don't know
☐ I'm not willing to answer
Q18 What proportion of your business' total FOOD waste is the result of:
(total must equal 100)

Food spoilage
(any food that has been discarded due to spillage, spoilage (e.g. mould), loss of quality, past product 'best before' or 'use by' date).

_____%

Food preparation
(any food item discarded during meal preparation (e.g. vegetable peelings, bread crusts, bones) or incorrect cooking times and techniques)

_____%

Consumer plate waste
(any food item that has been ordered by the customer but was left on the plate uneaten)

_____%

☐ I'm not willing to answer

Q19 What are the five most commonly wasted food items in your business for Food spoilage?

1st =
2nd =
3rd =
4th =
5th =

Q20 What are the five most commonly wasted food items in your business for Food preparation?

1st =
2nd =
3rd =
4th =
5th =
Q21 What are the five most commonly wasted food items in your business for Consumer plate waste?

1st =
2nd =
3rd =
4th =
5th =

Q22 How do you feel about the current amount of food waste produced by your business and why?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Q23 Do you have any policies and/or procedures in place to limit or reduce the food waste your business generates? (e.g. reviewing food purchasing/supply/storage practices, altering menu choice/ Portions, staff training, consumer education, provision of 'doggy bags', donating to food banks or the homeless)

☐ Yes
☐ No
☐ Don't know / not sure

Q24 If yes, please specify what type of policies and/or procedures your business currently follows

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

65
Q25 How would you rate the following strategies as a way for your business to reduce food waste?

<table>
<thead>
<tr>
<th>Order products with a short shelf-life more frequently in smaller amounts.</th>
<th>How much impact would this strategy have on reducing your business' food waste?</th>
<th>How difficult or easy would it be for your business to implement this strategy?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Implement a First-In, First-Out system to ensure oldest stock and partially opened/used stock is always used first.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offer a daily special based on what stock/product needs to be used quickly to prevent it from spoiling and being wasted.</td>
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</tr>
<tr>
<td>Use fresh fruit and vegetables without peeling or removing skins that are edible (e.g. carrot, apple, potato skins).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use bones and trimmings to make stocks, and fresh produce off-cuts such as cauliflower leaves and silver-beet stalks, to make sauces, pesto and salads.</td>
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<tr>
<td>Develop standardised recipes for menu items to ensure correct</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
cooking times and methods are followed to avoid over-or-under cooking products.

<table>
<thead>
<tr>
<th>Provide customers with a choice for smaller or larger portions of individual meal items on the menu and the associated price.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
</tr>
<tr>
<td>☐</td>
</tr>
<tr>
<td>Allow customers to swap meal items for an alternative they would prefer to eat.</td>
</tr>
<tr>
<td>Customers order meal items (that aren't the main feature of the meal) such as salad, rice and fries as a separate side dish.</td>
</tr>
<tr>
<td>Serve smaller portions of side dishes with one free top up available upon customer request.</td>
</tr>
<tr>
<td>Offer an option for customers to take home left-overs (provision of a 'doggy bag').</td>
</tr>
<tr>
<td>Donate food to food banks or the homeless.</td>
</tr>
</tbody>
</table>

Q26 Comments/other strategies which could impact your business' food waste

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Q27 Of the strategies listed above, which would be most effective in reducing your business' food waste and/or which would you be most willing to try?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Q28 What would motivate your business (you) to reduce food waste? How important are each of these outcomes to your business?

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Irrelevant</th>
<th>Not at all important</th>
<th>Somewhat important</th>
<th>Moderately important</th>
<th>Very important</th>
<th>Extremely important</th>
<th>I'm not willing to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is important that we save the planet</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<tr>
<td>(environmental outcomes)</td>
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<tr>
<td>It is important that we save money</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<tr>
<td>(financial/economic outcomes)</td>
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<tr>
<td>It is important that we save hungry people</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<tr>
<td>(social/humanitarian outcomes)</td>
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<tr>
<td>It is important we reduce guilt</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<td>□</td>
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<tr>
<td>(personal/internal outcomes)</td>
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</table>

Q29 Other outcomes that are 'very important' to me are:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

68
PART TWO:
In the second part of this project, we will be asking up to 30 cafes and restaurants to take part in an on-site food waste audit. This means staff would put food waste in one of three category bins over a 24-hour period and we would sort and measure it. In return, we would happily share our results with you. You're under no obligation to take up this offer.

Q30 Would your business be interested and willing to participate in a food waste audit?

☐ Yes - Great, thank you! We will contact you within a month if your business is selected for audit.
☐ No
## Appendix C: On-Site Food Waste Audit Data Collection Form

<table>
<thead>
<tr>
<th>Food Category</th>
<th>Total Weight</th>
<th>Avoidable Weight</th>
<th>Potentially Avoidable Weight</th>
<th>Unavoidable Weight</th>
<th>Additional Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPOILAGE FOOD WASTE</strong></td>
<td>TOTAL WEIGHT =</td>
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<tr>
<td>Fruit</td>
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<td>Vegetables</td>
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<tr>
<td>Potatoes</td>
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<tr>
<td>Meat</td>
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<td>Fish</td>
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<tr>
<td>Dairy</td>
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<tr>
<td>Eggs</td>
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<tr>
<td>Bakery</td>
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<tr>
<td>Cereals &amp; Grains</td>
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<tr>
<td>Legumes, Nuts &amp; Seeds</td>
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<tr>
<td>Packaged Liquids</td>
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<tr>
<td>Miscellaneous</td>
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<tr>
<td>Unidentified Food Waste</td>
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<td><strong>FOOD PREPARATION WASTE</strong></td>
<td>TOTAL WEIGHT =</td>
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<td>Fruit</td>
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<td>Vegetables</td>
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<td>Potatoes</td>
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<tr>
<td>Meat</td>
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<tr>
<td>CONSUMER PLATE WASTE</td>
<td>TOTAL WEIGHT =</td>
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<tr>
<td>Fruit</td>
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<td>Vegetables</td>
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<td>Bakery</td>
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<tr>
<td>Cereals &amp; Grains</td>
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<tr>
<td>Legumes, Nuts &amp; Seeds</td>
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<tr>
<td>Packaged Liquids</td>
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<td>Miscellaneous</td>
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<tr>
<td>Unidentified Food Waste</td>
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</table>
Appendix D: Questionnaire Participant Information Sheet

Supporting New Zealand Restaurants and Cafés to Reduce Food Waste

INFORMATION SHEET FOR PARTICIPANTS

Thank you for your interest in this project. Please read this information before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part, there will be no disadvantage to you and we thank you for considering our request.

Project Aim and Purpose

Reducing food waste can save businesses money and help the planet, so we want to find out:
- the level and types of food waste from ~200 restaurants and/or cafés throughout New Zealand, and
- learn what businesses are doing to limit food spoilage, preparation waste, and consumer plate waste.

This project will enable Sarah Chisnall and Emily Jones to complete their Master of Dietetics degree.

Participant expectations

We are asking New Zealand businesses, who are listed as a ‘Cafe’ or ‘Restaurant’ in the Yellow Pages, to answer ~20 questions over the phone, or via an online questionnaire, taking no more than 20-30 minutes.

The Dept. of Human Nutrition, who is funding this research, has approved the main questions (eg. estimate the amount and type of food waste in your café/restaurant, your thoughts about it, what your business is doing to reduce it), but some new questions may arise during a telephone call. You can choose to answer a question or not. Telephone interviews will be audio-recorded to save time; you can ask for the device to be turned off at any time. After the call, responses will be typed (excluding identifying information) and the audio-recording destroyed.

All information collected during this project will be treated confidentially. Only the people listed below will have access to your responses. After the project, identifying information will be destroyed. Dr Mainvil and Dr Mirosa will safely store your information at the University of Otago for at least 5 years. Project results will be published and made available from the University of Otago Library or us; every attempt will be made to preserve your anonymity (for you and your business) in any publications.

Can participants change their mind and withdraw from the project?

Taking part in this activity is voluntary. You may withdraw at any time with no disadvantage.

If you have any questions about our project, either now or in the future, please feel free to contact either:

- Sarah Chisnall* (Email: chisa097@student.otago.ac.nz)
- Emily Jones* (Email: jone185@student.otago.ac.nz)
- Dr. Miranda Mirosa^ (Email: miranda.mirosa@otago.ac.nz)
- Dr. Louise Mainvil* (Email: louise.mainvil@otago.ac.nz)

* Dept. of Human Nutrition
^ Dept. of Food Science

This study has been approved by the Department of Human Nutrition.

If you have any concerns about the ethical conduct of the research, you may contact the University of Otago Human Ethics Committee through the Human Ethics Committee Administrator (ph 03 479-8256). Any issues you raise will be treated in confidence and investigated, and you will be informed of the outcome.

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Appendix E: Questionnaire Consent Form

Supporting New Zealand Restaurants and Cafés to Reduce Food Waste

CONSENT FORM FOR PARTICIPANTS

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:

1. My participation in the project is entirely voluntary;

2. I am free to withdraw from the project at any time without any disadvantage;

3. Personal identifying information (my name, my business name, contact details, audio-recordings) will be destroyed at the conclusion of the project, but my questionnaire answers, on which the results of the project depend, will be retained in secure storage for at least five years;

4. I will be asked pre-approved questions about my café/restaurant’s food waste and what we’re doing about it. During a telephone call, the student researcher may ask some questions that have not been determined in advance. If I feel hesitant or uncomfortable, I may decline to answer any question and/or may withdraw from the project without any disadvantage of any kind.

5. This research is funded by the University of Otago’s Dept. of Human Nutrition.

6. The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand). Every attempt will be made to preserve my anonymity.

I agree to take part in this project.

Signature of participant

Date

Printed Name

Company Name
Supporting New Zealand Restaurants and Cafés to Reduce Food Waste
INFORMATION SHEET FOR PARTICIPANTS

Thank you for completing Part 1 (questionnaire) and showing interest in Part 2 (audit). Please read this information before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part, there will be no disadvantage to you and we thank you for considering our request.

Project Aim and Purpose
Reducing food waste can save businesses money and help the planet, so we want to work with ~30 New Zealand cafés and restaurants to observe, categorise and quantify their food waste over a 24-hour period. This audit will enable Sarah Chisnall and Emily Jones to complete their Master of Dietetics degree.

Participant expectations
Your café/restaurant has been selected for audit based on Part 1 results (location, type of business, high/medium/low food waste). If you choose to take part, staff will be instructed to separate all food waste produced over a 24-hour period into one of three category bins: consumer plate waste, preparation waste, or spoilage. Prior to the audit, a student researcher will visit to provide bins and instructions and answer questions (up to 1hr). At the end of the 24-hour period, the researcher will return to find out how the process went and conduct the waste audit (2-3hr). You can choose to answer researcher question(s) or not.

All information collected during this project will be treated confidentially. Only the people listed below will have access to your information. Please let us know if you want a copy of your results. After the project, identifying information will be destroyed. Dr Mainvi and Dr Miroa will safely store your information at the University of Otago for at least 5 years. Project results will be published and made available from the University of Otago Library; every attempt will be made to preserve your business’s anonymity.

Can participants change their mind and withdraw from the project?
Taking part in this activity is voluntary. You may withdraw at any time with no disadvantage.

If you have any questions about our project, either now or in the future, please feel free to contact either:

- Sarah Chisnall* (Email: chis097@student.otago.ac.nz)
- Emily Jones* (Email: jenem185@student.otago.ac.nz)
- Dr. Miranda Miroa (Email: miranda.miroa@otago.ac.nz)
- Dr. Louise Mainvi* (Email: louise.mainvi@otago.ac.nz) * Dept. of Human Nutrition
- Dr. Louise Mainvi* (Email: louise.mainvi@otago.ac.nz) ^ Dept. of Food Science

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Appendix G: Photos from On-Site Waste Audits

**Photo 1:** Example of total preparation waste

**Photo 2:** Example of total consumer plate waste

**Photo 3:** Example of food waste separated into food groups

**Photo 4:** Fruit preparation waste

**Photo 5:** Vegetable consumer plate waste

**Photo 6:** Potato preparation waste
Photo 7: Meat preparation waste

Photo 8: Fish preparation waste

Photo 9: Dairy consumer plate waste

Photo 10: Egg preparation waste

Photo 11: Bakery preparation waste

Photo 12: Bakery consumer plate waste
**Photo 13**: Cereals & grains consumer plate waste

**Photo 14**: Legumes, nuts & seeds preparation waste