SUNSHINE YATES
CONSULTING

New Zealand Food Waste Audits

Prepared for
WasteMINZ

October 2018

DOCUMENT QUALITY CONTROL

Version	Date	Written by	Distributed to
Draft 0.1	25/09/2018	Sunshine Yates	Jenny Marshall
Draft 0.2	15/10/2018	Sunshine Yates	Jenny Marshall
Draft 0.3	24/10/2018	Sunshine Yates	Jenny Marshall
Draft 0.4	29/10/2018	Sunshine Yates	Jenny Marshall
Final 1.0	4/12/2018	Sunshine Yates	Jenny Marshall

CONTACT DETAILS

WasteMINZ
Jenny Marshall
Sector Group Co-ordinator

Phone 09 476 7162

Sunshine Yates Consulting Limited
Sunshine Yates
22 Notley Street
Westmere
Auckland

sunshine@sunshineyatesconsulting.co.nz

TABLE OF CONTENTS

EXECUTIVE SUMMARY

How much food waste does the average New Zealand household throw away each year? And could that food waste be avoided? Those are the questions this 2018 study seeks to answer as a follow-up to a similar study in 2014-2015. Which, of course, leads to the question: are New Zealanders wasting less food than they did three years ago?

In 2013, WasteMINZ launched a national project to measure how much food was being sent to landfill each year by New Zealand households. In 2014-2015, this project included food waste audits to collect and measure food waste generated by households and set out for kerbside collection and landfill disposal. In addition to the audits, residents were surveyed to gain accurate data on household food waste disposal behaviours.

These findings were used to drive a three-year national communications campaign called Love Food Hate Waste, which aimed to influence household food waste behaviours.

Love Food Hate Waste is jointly funded by Central Government, through the Waste Minimisation Fund administered by the Ministry for the Environment, and 61 city, district and regional councils. The campaign is funded for three years – it began on 1 February 2016 and will end on 31 January 2019.

Over the three-year campaign Love Food Hate Waste has focused on raising awareness of the issue of food waste through a range of different mediums (e.g. infographic, videos, blog content, media stories).

In addition to awareness-raising, Love Food Hate Waste has used a solutions-based approach to give people the knowledge and tools they need to reduce the amount of food they waste.

Each year of the three-year campaign targeted a specific theme. Year 1 focused on leftovers, year 2 tackled storage, while year 3 was about strategies for families, such as meal planning and what to do with non-avoidable food waste.

Activities included collaborating with New Zealand chefs to develop a suite of recipes to use leftovers and commonly wasted foods, conducting research with the University of Otago to determine the best way to store vegetables in order to extend their shelf life, and creating four seasonal Easy Choice – Family Kai meal planners to help feed low-income families on a budget whilst teaching them to reduce their food waste.

In 2018, the Ministry for the Environment funded a follow-up food waste audit and household survey to measure the impact of the Love Food Hate Waste campaign and determine whether food-wasting behaviour had changed at the household level.

The 2014-2015 audits found that food waste comprised, on average, 30.0% of kerbside refuse collected from household across the 12 local authorities included in the project. Two of the local authorities included in the project, Timaru and Selwyn, also had a separate food waste collection that collected household food waste for composting. When the households from Timaru and Selwyn were removed from the overall sample, the average proportion of food waste in household kerbside refuse collections was 33.5%. This equates to 3.17 kg of food waste per household per week.

In the 2018 follow-up audit, food waste comprised on average 34.1% of household kerbside refuse collections across the six local authorities included in the follow-up project, which excluded Timaru and Selwyn. This equates to 3.15 kg food waste per household per week.

The difference in the proportion of refuse that was food, disposed by households in 2018 and in 2014-2015, is not statistically significant.

In 2014-2015, 49.7% of the average household's food waste was comprised of 'avoidable' food (i.e. food that could have been eaten). In 2018, 'avoidable' food made up 48.8% of the average household's food waste. The difference is not statistically significant.

In 2018, the average household threw away 164 kg of food per annum of which 86 kg was 'avoidable'. Per person this equates to 61 kg of food waste and 32 kg of 'avoidable' food waste.

On a national basis this equates to 157,398 tonnes of avoidable food disposed of to landfill through domestic kerbside collections per annum.

The average cost per household of discarded 'avoidable' food was calculated. In 2018, the average household in New Zealand spent $12.38 on food each week that was wasted unnecessarily, which equated to $644 per household per annum. In 2014-15, excluding Timaru and Selwyn data, the average household in New Zealand was spending $647 on food that was wasted.

The total cost of 'avoidable' food waste being landfilled in New Zealand in 2018 is $1.17 billion dollars.

Food waste was classified into 16 different food groups. The food groups were further categorised into food types. Seventeen of the Top 20 most common 'avoidable' food types were the same in 2014-2015 and 2018. Bread was still the most common 'avoidable' food type in both audits, followed by leftovers.

A survey was distributed to all households that participated in the audit and was returned by 29% of households.

Just over half of the households (54%) that completed the survey stated that they had done something to reduce food waste in the past three years. The most common new behaviour was buying less food (23%), followed by composting (or using a worm farm or Bokashi) (17%), and eating more leftovers (15%).

Twenty-two per cent of the surveyed households stated that they had heard of the 'Love Food Hate Waste' campaign, and 65% of these households had done something to reduce food waste in the past three years. Overall, there was 27.1% less food waste disposed of per household that was aware of the Love Food Hate Waste campaign than per household that was not. This is a statistically significant difference.

Of the 175 households that were audited and returned surveys in 2018, only 67 were households that had also been audited and returned surveys in 2014-2015 and were still inhabited by the same occupants. There was a 5% increase in the quantity of food waste disposed of by these households in 2018, despite 22% (15 households) of these 67 households being aware of the Love Food Hate Waste campaign.

In conclusion, the research found that there had been no discernible change in overall food waste disposal to kerbside collections by households in the past three years. However, households that were aware of the Love Food Hate Waste campaign, disposed of a statistically significant lesser quantity of food waste (27.1% less) than households that had not heard of the campaign.

1 INTRODUCTION

In 2013, WasteMINZ, the representative body of New Zealand's waste and resource recovery sector, launched a national food waste project to research and influence food waste disposal in New Zealand. The project was overseen by WasteMINZ's Behaviour Change Sector Group, and the project was undertaken in close consultation with local authorities across the country.

The initial aim of the project was to gather data on the quantity and composition of food waste disposed of by households in New Zealand. WasteMINZ designed a National Food Waste Prevention Project that enabled councils across New Zealand to capture food waste data that was both region-specific and could be amalgamated into a national database.

WasteMINZ contracted Waste Not Consulting to adapt a methodology for measuring food waste in domestic kerbside refuse. The methodology had been initially developed by WRAP (Waste and Resources Action Programme) in the UK in 2007 and updated in 2013.

In 2014 and 2015, WasteMINZ and 12 local authorities contracted Waste Not Consulting to undertake audits of food waste in domestic kerbside refuse at locations around the country. The project also involved surveys of households to determine specific waste disposal behaviours and certain household characteristics.

The results of that project were presented in a report entitled *New Zealand Food Waste Audits 2015*.

Nationwide, in 2014-2015, food waste from 1,402 households was separated and weighed. Surveys were completed by 701 (50%) of those households.

In 2018, WasteMINZ secured funding from the Ministry for the Environment to undertake a smaller set of food waste audits to evaluate the effectiveness of the Love Food Hate Waste campaign.

WasteMINZ approached Sunshine Yates, of Sunshine Yates Consulting Limited (SYCL), to undertake the new project. Sunshine Yates was previously a Director of Waste Not Consulting and managed the food waste audit project in 2014/2015.

The 2018 food waste audits had two objectives. The first was to re-examine the quantity and composition of food waste disposed of by households in New Zealand to kerbside refuse collection, and the portion of this food waste that was 'avoidable', 'potentially avoidable', or 'non-avoidable'.

The second objective was to compare the quantity of food waste disposed of from households that were included in both the 2014-2015 audits and the 2018 audits, and to see whether food waste disposal by those households that were aware of the Love Food Hate Waste campaign had changed relative to those households that were not aware of the campaign.

The methodology used in 2014-2015 was replicated in 2018, but on a smaller scale. In 2018, food waste was audited from 597 households in six territorial authorities. The proportion of households from each territorial authority is provided in Table 1.1.

Table 1.1 – Distribution of food waste audits 2018

Local authority	% of audited households sampled from each area	Timing of audit
Auckland Council	34%	July
Hutt City Council	9%	May
Porirua District Council	10%	May
Waimakariri District Council	18%	March
Waipa District Council	10%	July
Wellington City Council	20%	May

The audits were undertaken between January 2018 and July 2018. Each area was audited at the same time of year as it had been in 2014-2015, with the exception of a small sample of households in Auckland (in Takapuna), that were audited in March in 2014, and in July in 2018.

This report outlines the combined results of all the food waste audits from 2018, and includes the following elements:

1. Analysis and reporting on food waste data from audits of domestic kerbside refuse from 597 households
2. Analysis and reporting on survey data from 205 households, 175 of which were included in the audit and 30 from households that were not included in the audit.
3. Costing of 'avoidable' food waste based on the average costs of foods in New Zealand.

2 METHODOLOGY

The aim of the food waste audits was to gather data on the quantity of food waste disposed of through domestic kerbside refuse collections in New Zealand, determine the proportion of that food waste that was 'avoidable', 'potentially avoidable', or 'non-avoidable', and calculate the cost of the 'avoidable' food waste.

The methodology used for this project was based on a methodology first devised in the UK by WRAP and then adapted by Waste Not Consulting in 2014 to suit the project requirements in New Zealand. The same adapted methodology has been used in 2018.

A major difference between the WRAP study and the New Zealand research is that the WRAP study included an analysis of food waste disposed of through domestic kerbside refuse collections, via the sewer, and to home composting and feeding to animals. This study only analysed food waste disposed of through domestic kerbside refuse collections.

There were several separate elements to the methodology used for this project. These include the following, which are described in further detail in the following sections:

1. Selection of sample areas
2. Survey of households in sample areas
3. Collection of sample of domestic kerbside refuse from sample areas
4. Separating and analysing the food waste in the sample of domestic kerbside refuse
5. Costing the 'avoidable' portion of the food waste
6. Analysing the waste audit data
7. Analysing the survey data.

2.1 Sample area selection

The 2018 audits were undertaken in the same local authority areas as in 2014-2015, but, due to funding restrictions, only half of the areas that were included in 2014-2015 were included in 2018. As far as possible, SYCL attempted to sample the same households as in the first project. Unfortunately, the households surveyed in 2014-2015 did not always have refuse set out at kerbside at the time of the 2018 collection.

Not all households set out refuse every week, and in some instances, the timing of the waste collection had changed since 2014-2015, and refuse had not been set out by the householder at the time of the sample collection. In these cases, the sample collection vehicle could not wait for residents to set out refuse and had to continue its route in order to collect from other streets before the Council or private collection contractors collected the refuse. When this occurred, refuse from other households in the same area was collected instead. Altogether, 48% of the households from which waste was collected in 2018 had also been sampled in 2014-2015.

Prior to the 2014-2015 audits, council staff selected the streets to sample in each local authority area. The streets were selected to ensure a spread of household types that was representative of the district or city. This included areas that represented the area's:

- urban and rural mix
- range of affluence levels

- types of refuse collection systems (bags or wheelie bins)

The streets were also selected based on their weekly collection day, and the time of day that their refuse was collected by the council or private refuse contractor. This was necessary to allow the audit team to collect from all streets in a particular area on the same day before their official refuse collection took place.

It was recognised that the project would be unlikely to be able to represent all of the above factors adequately, when the number of factors and the size of the sample were taken into consideration. However, the sample selection was undertaken with these factors in mind.

In 2018, the same streets and households, were targeted, as far as possible. However, due to the smaller sample size in 2018 (597 households in 2018 versus 1,402 households in 2014-2015), it was recognised that the sample would be less representative.

2.2 Opt-out opportunity

Wellington region councils included in the audit (Wellington, Porirua, and Hutt City) chose to provide householders with the opportunity to opt out of participating in the project. To do this, a letter was distributed, prior to the audit, to all households on the streets selected for the audit, introducing the householders to the project and informing them that their household was located on one of the sample streets. The letter provided householders with the opportunity to opt out of participating by calling or emailing the council.

Households that chose to opt out of the project were placed on an opt-out register, and their refuse was not collected as part of this project. Altogether, 31 households across the collection areas in Wellington City, Porirua City, and Hutt City requested to be omitted from the project.

The other councils included in the project chose not to send out an opt-out letter.

2.3 Survey methodology

Basic information about the households included in the food waste audits was valuable to the data analysis. This information was gathered through a short-written survey that was hand delivered to all households from which a refuse sample was collected. The survey was placed into their letterbox at the time of the refuse collection, along with a pre-paid, addressed envelope for the survey to be returned to council. A prize draw was set up for survey respondents, with grocery vouchers to be won.

In Takapuna, Auckland, due to a request from Auckland Council, the survey was hand-delivered before the sample collection.

The same survey was used throughout the project, with the exception of a slight change in Auckland, where Auckland Council requested that the words ‘food waste’ in the survey be substituted with ‘food scraps’ to match their marketing materials.

A sample of the survey is included in Appendix 1.

2.4 Sample collection

The sampling of refuse for the food waste audits in each council area was undertaken by SYCL. Each sample was collected from the area from which the previous sample had been collected in 2014-2015, including as many of the same households as possible.

The number of household samples collected in each area is outlined in Table 2.1.

Table 2.1 – Number of household samples collected

Local authority	Number of households
Auckland Council	201
Waipa District Council	59
Waimakariri District Council	109
Hutt City Council	52
Porirua District Council	60
Wellington City Council	116
Total	**597**

The sample collection was undertaken in the morning of the day of the households' usual waste collection.

Councils contacted the private waste collection contractors in their council area prior to the food waste audit and requested permission to collect refuse from their clients in the selected streets. Permission was provided by all private contractors.

Only households to which refuse could be clearly attributed were included. Refuse was not collected from beside shared driveways, where it could not be determined which house the refuse had been set out by. Refuse was also not collected from areas where rubbish bags were amalgamated into piles. This was done to ensure the audit results for a particular household could be matched to the survey results from that household.

Waste disposed of in wheelie bins was bagged into large plastic bags, and the empty wheelie bin left at the kerbside. All of the collected refuse was tagged with a unique ID to identify the address from which it was collected, and the tag number and address of the property was recorded.

In the Wellington region only, refuse was not collected from households that had contacted their local council to opt out of participating in the project.

In each audit area, the refuse was transported to a local transfer station or landfill for auditing on the same day as the collection.

2.5 Audit methodology

The audit locations and dates of the food waste audits are provided in Table 2.2.

Table 2.2 – Food waste collection dates and audit sites, 2018

Local authority	Collection period	Audit site
Auckland Council	23, 24, 25, 26 July 2018	Waitakere Refuse and Recycling Centre
Waipa District Council	30 July 2018	
Waimakariri District Council	29, 31 January 2018	Southbrook Resource Recovery Park
Hutt City Council	28, 29, 31 May, 1 June 2018	Southern Landfill
Porirua District Council		
Wellington City Council		

SYCL supervised and recorded the data (along with a second recorder) at each of the locations, and three teams of two auditors sorted the food waste.

Sorting was undertaken at the individual household level. The sample of waste from each household was weighed, the refuse was placed onto a sorting table, and the contents were sorted by a team of two auditors. The auditors started by removing all non-food waste from the sample. The food waste was then separated into its different components, placing each of these components into a separate container. All packaged food waste was removed from its packaging.

Sorted food samples

Once all food waste from a household had been sorted, the sample's unique ID was attached to one of the containers and all containers from the household sample were provided to the data recorders. The data recorders entered the sample number's unique ID into a spreadsheet before weighing each individual container and entering a description of each container's contents.

Data on the food waste was based on a list of 16 food groups (bakery, fresh vegetables, dairy, processed fruit etc.), and specific food types (white bread, carrots, cheese etc.) within each food group. The data recorder then assessed the contents of each container according to whether it was 'Avoidable', 'Potentially avoidable' or 'Non-avoidable'. The definitions used for these categories were:

- **'Avoidable'** food waste was food that could have been eaten at some point in time. It did not take into account the current state of the item (which could be mouldy, or past its 'best before' date), but considered, instead, its past potential. The whole item was included, even if part of it was unavoidable (i.e. the skin on a whole banana).
- **'Potentially avoidable'** food waste was food that some people eat, and others don't (e.g. apple and potato peels). This category also ignored the current state of the item (which could be mouldy, or past its 'best before' date).
- **'Non-avoidable'** food waste was food that was unlikely to be eaten by the majority of the population, such as banana skins, tea bags, and egg shells.

For items that were still in their original, unopened packaging, the 'best before' or 'use by' date was also recorded.

After each container had been weighed and recorded, the contents were disposed of.

Altogether, across all council audits, a total of 11,450 food samples were weighed, categorised, and recorded.

The 16 food groups used to categorise the food waste are listed below in Table 2.3. Definitions for these food groups are provided in Appendix 2. These food groups are based on WRAP's 2013 *Household Food and Drink Waste in the UK* report, though some minor changes have been made. The WRAP category 'Meals (homemade and pre-prepared)' has been divided into 'Homemade food' and 'Pre-prepared food' and some of the food group names have been shortened or adjusted e.g. 'Fresh vegetables and salads' has been shortened to 'Fresh vegetables' and 'Confectionery and snacks' has been changed to 'Snack foods'.

Table 2.3 – Food groups

Food groups
Bakery
Condiments
Dairy
Desserts
Drinks
Fats
Fresh fruits
Fresh vegetables
Homemade foods
Meat and fish
Other foods
Pre-prepared foods
Processed fruits
Processed vegetables
Snack foods
Staple foods

Within each of these food groups is a subset of food types. These are more specific descriptions of actual types of food. For example, under the food group 'Fresh vegetables' are the food types 'Lettuce', 'Potatoes', and 'Carrots'. The list of food types was created as the audits progressed, with new food types being added as they were sorted.

2.6 Cost of food waste

After completion of the 2014-2015 food waste audit, the cost, per unit quantity (either kilogram or litre), of every 'avoidable' food item listed in the audit was determined.

As there is no known source of national food prices for all food items sold in New Zealand, prices had to be determined through a number of sources.

1. Statistics New Zealand (Stats NZ) provided weighted average retail prices per kg for 135 of the most common foods, from their Consumer Price Index (CPI) basket. These were annualised for the period July 2013 to June 2014.

2. Food items not on the Stats NZ list were priced using the Countdown Online shopping website. This was the only online grocery shopping website in New Zealand, at the time, associated with one of the main supermarkets. The average of the two lowest prices for each item was used as the average price for that item. While these prices cannot be deemed to be truly representative of the average retail price across NZ, and are not annualised, they provide a reasonably-reliable cost.

3. Homemade meals were priced from two cookbooks – *The Healthy Food Guide* July 2014 (published by Healthy Life Media Limited) and *Live Below the Line* (published by Tear Fund).

Notes provided by Stats NZ in its Food Price Index indicate that, for fresh produce, "prices are based on the cheapest available produce of good quality in each retail outlet at the time of price collection", and that other items are based on "the cheapest available brand or variety in each retail outlet at the time of price collection."

The costs per kilogram or litre gathered from Stats NZ and supermarket shopping websites were then applied to all of the 'avoidable' food waste found in the audit, to determine the cost, per household, of this waste.

Cooked rice and cooked pasta were priced differently to raw rice and raw pasta to account for the weight of the water in the cooked food.

To calculate the cost of 'avoidable' food in the 2018 audit, it was decided to use the costings that were applied in 2014-2015, adjusted by the Consumer Price Index for Food. Between the first quarter of 2015, and the second quarter of 2018, there was a 2.7% increase in food prices overall[1]. While it is recognised that there are large variations in price changes from product to product, this has not been factored into this analysis. Overall, there were 306 different products priced and it is expected that price change variations will be evened out across those products.

[1] https://www.rbnz.govt.nz/monetary-policy/inflation-calculator

3 DATA ANALYSIS

There were two objectives to the 2018 food waste audits. Firstly, to re-examine the quantity and composition of food waste disposed of by households in New Zealand, and the portion of this food waste that was 'avoidable', 'potentially avoidable', or 'non-avoidable'.

Secondly to compare the quantity of food waste disposed of from households that were included in both the 2014-2015 audits and the 2018 audits, and to see whether there was any change in the quantity of food waste disposed of by households that were aware of the Love Food Hate Waste campaign compared to those households that had not.

3.1 Calculation of national household refuse tonnages

In 2014-2015, the food waste audits included data from 1,401 households from 12 territorial authorities. In 2018, the audits have included data from 597 households, from six territorial authorities.

The data gathered in these food waste audits cannot be considered representative of domestic waste across New Zealand, as there are a variety of factors that influence the tonnage and composition of refuse.

Firstly, the proportion of households that use wheelie bins (and the size of wheelie bins used) versus refuse bags is unknown. There is no national data on the proportion of households using wheelie bins versus bags, and not all local authorities have this information for their districts or cities. Therefore, it has not been possible to ascertain whether the sample collected as part of this project was representative of all households in New Zealand.

Secondly, the proportion of households that set out refuse in any given week is not known. All of the samples included in the food waste audits were taken from households that had set out refuse (i.e. a 100% set out rate). Data on the overall set out rate (the proportion of households in any given week that set out refuse) is not known for all territorial areas.

Thirdly, the effect of demographic factors on waste generation has not been accounted for. Collection areas were selected by each local authority in 2014-2015 to represent a mixture of socio-economic factors, and as far as possible the sample was collected from these same areas in 2018. A survey soliciting some demographic data (household size and age of inhabitants) was provided to all households in the project, however, there were too few responses (29%) to ascertain whether the sample was representative of these factors.

Since the data on the quantity of waste collected weekly per household from these audits cannot be considered representative of domestic waste across New Zealand, it has been necessary to extrapolate household refuse to a national average.

This was the same method used by WRAP in the UK, as described in Section 3.1 of *Methods used for Household Food and Drink Waste in the UK 2012.*

Given there is no national waste data reporting in New Zealand that would enable the accurate calculation of kerbside refuse per capita per annum, it has been necessary to estimate the quantity of kerbside refuse generated per person.

In 2014-2015, Waste Not Consulting used data from research undertaken throughout New Zealand, and expert judgement, to calculate that an average of 180 kg per capita per annum of kerbside refuse from residential properties was disposed of to landfills. This figure was based on data from a large number of solid waste audits and took into account the varying usages of different services, particularly refuse bags and 240-litre wheelie bins.

It was decided, for the sake of being able to provide a meaningful comparison between the audits in 2014-2015 and 2018, that the average of 180 kg per capita per annum of kerbside refuse from residential properties disposed of to landfills would also be used to extrapolate the 2018 results.

Using the base figure for the quantity of kerbside refuse (180 kg per capita per annum), the results of the food waste audit have been scaled to match the overall estimates of the annual tonnage of waste disposed of through kerbside refuse. Using national population and household number projections for 2018, based on the 2013 census, a scaling factor was applied to the audit results.

This scaling factor was derived from:

- the results of the 2018 food waste audits, which indicated that the average household set out was 10.09 kg of domestic kerbside refuse
- data on population[2] and household numbers[3], and the assumed average of 180 kg per capita per annum of kerbside refuse from residential properties. These figures were used to calculate an average of 9.24 kg of domestic kerbside refuse per household, per week.

Accordingly, the results of the 2018 food waste audits have been multiplied by 0.92 to scale the results downwards to match the national figure.

During the analysis of the 2014-2015 data, the population and household numbers from the 2013 census were used for extrapolation purposes[4].

3.2 Sample differences 2018 and 2014-2015

The food waste audits undertaken in 2014-2015 included more than twice as many households as in 2018, from twice as many territorial authorities.

There were several changes between the samples that were collected for each project that would have influenced the results.

In 2014-2015, the proportion of household refuse that was food waste was 30.0%. In 2018, the proportion of food waste was 34.1%. This difference was due to a large extent to the inclusion of two councils with food waste collections in the 2014-2015 audit, Selwyn and Timaru. Residents in

[2] National ethnic population projections, by age and sex, 2013(base)-2038 update
[3] National household projections, by household type, 2013(base)-2038 update
[4] The 2013 census figures used in the 2014-2015 analysis were 4,242,048 population and 1,549,890 households

these areas have the option of disposing of food waste to an organics bin (collected for composting) rather than to the kerbside refuse collection. Only food in the refuse collections was included in the calculation of the proportion of refuse to landfill that is food. Selwyn and Timaru had 18.3% and 14.8%, respectively, food waste in their household refuse collections. When Selwyn and Timaru are excluded from the analysis, then the proportion of food waste across all of the other areas was 33.5% in 2014-2015.

These two councils were not included in 2018. Selwyn District Council chose not to be involved due to work being undertaken on their transfer station, which meant there was nowhere to conduct the food waste audits. Timaru was not included due to project budget restrictions.

Auckland Council implemented several changes to waste collection services between 2015 and 2018. In 2015, kerbside refuse collections in south Auckland were rates-funded and households could place any number of bags of refuse at kerbside for collection. In Waitakere in 2015, council provided a user-pays bag collection. In 2017 services in Manukau and Waitakere were changed to a weekly wheelie bin collection. In Manukau this collection is rates funded, and each household is provided with a 120-litre wheelie bin. In Waitakere, households use 140- or 240-litre wheelie bins, on which they place a pre-paid tag for each collection.

These changes in waste collection services are likely to have affected waste disposal.

Households in Takapuna included in the 2018 audit had access to a weekly food waste collection, as part of an Auckland Council food waste collection pilot. This pilot had not been implemented at the time of the 2014-2015 audits. In 2018, as well as the kerbside refuse the contents of the food caddies were collected and included in the food waste audit.

4 AUDIT RESULTS

4.1 Quantity of food waste generated

Quantities of food waste disposed of as household refuse in New Zealand were calculated based on the assumption that each person disposes of an average of 180 kg per annum of kerbside refuse from residential properties, multiplied by the population of New Zealand, and divided by the number of households. This provides the annual household set out weight of kerbside refuse. This was then multiplied by the proportion of refuse that was food waste, as determined by the food waste audit, to calculate the annual set out of food waste per household.

Based on this calculation, in 2018, the average household set out 9.24 kg of domestic kerbside refuse per week, of which 3.15 kg (34.1%) was food waste. This equates to 480 kg of refuse per household per annum, of which 164 kg was food waste, and 86 kg was 'avoidable' food waste. Per person this equates to 61 kg of food waste and 32 kg of 'avoidable' food waste. On a national basis this equates to 298,246 tonnes of total food waste disposed of to landfill through domestic kerbside collections per annum of which 157,398 tonnes is avoidable food waste.

These figures have been used as the basis for all further analysis.

In 2014-2015, the average household set out 9.47 kg of domestic kerbside refuse per week, of which 2.84 kg (30.0%) was food waste. However, the 2014-2015 sample included households in Timaru and Selwyn districts, both of which had a kerbside organics collection. As a result, the proportion of food waste in their refuse was lower than in other areas and affected the overall proportion of food waste. If data from Selwyn and Timaru is removed from the 2014-2015 analysis, then the proportion of kerbside refuse that was food waste in 2014-2015 was 33.5%, which equates to 3.17 kg of food waste in weekly domestic kerbside refuse.

Based on a Student T-test, the difference between 34.1% food waste in 2018 and 33.5% food waste in 2014-2015 was not statistically significant. A Student T-test assists in determining whether two sets of data are significantly different from each other, in statistical terms. A two-sample unequal variance test assuming two-tailed distribution has been used. Evaluation of the P value for the T-test results was made using the definitions in the following table.

Table 4.1 – Student T-test – P values

P values	Significance
>0.05	Not significant
0.01 to 0.05	Significant
0.001 to 0.01	Very significant
< 0.001	Extremely significant

The results of the Student T-test are shown in Table 4.2, on the following page.

Table 4.2 – Significance of change in proportion of food waste

Samples	P value	Significance
Proportion of food waste in refuse in 2018 and 2014-2015	0.3157	Not significant

4.2 Avoidability of food waste

Based on the results of the 2018 food waste audits, of the 3.15 kg of food waste set out per household per week, 52.8% was 'avoidable', 13.5% was 'potentially avoidable', and 33.7% was 'non-avoidable' food waste. These categories are described in Section 2.5.

These proportions are based on the weight of the food waste sorted in the audits.

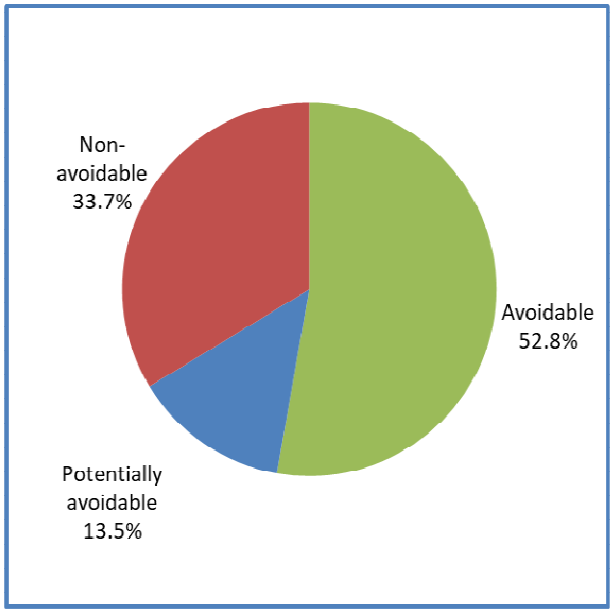


Figure 4.1 – Avoidability of food waste in kerbside refuse, 2018

Table 4.3 provides a comparison of the proportion of the food waste that was 'avoidable', 'potentially avoidable' and 'non-avoidable' in 2018 and 2014-2015, based on the weight of all food waste sorted being considered as one sample. The data from Selwyn and Timaru is omitted from this analysis, as their food waste disposal habits are likely to differ due to their use of a kerbside organics collection.

Table 4.3 – Avoidability of food waste – weight of all samples combined

Avoidability of food – all samples combined	2018	2014-2015
Avoidable	52.8%	50.9%
Potentially avoidable	13.5%	12.3%
Non-avoidable	33.7%	36.8%

In 2018, 52.8% of the food waste that was sorted was 'avoidable'. In 2014-2015, 50.9% of the food waste was 'avoidable'.

When analysed by household, rather than as an overall sample, the average proportion of 'avoidable' food was 48.8% in 2018 and 47.5% in 2014-2015, as shown in Table 4.4. This analysis was the average of the proportions for each household (rather than the weights contained in the overall sample), and therefore avoids anomalous samples unduly affecting the results.

Table 4.4 – Avoidability of food waste – average of percentages, per household

Avoidability of food – average per household	2018	2014-2015
Avoidable	48.8%	47.5%
Potentially avoidable	11.9%	9.9%
Non-avoidable	39.2%	42.5%

To determine if changes in the proportion of 'avoidable' food waste from 2014-2015 to 2018 were statistically significant or associated with variations between samples (random sampling errors), the data on the percentage of 'avoidable' food waste per household sample in the 2014-2015 audits and in the 2018 audits have been compared and analysed, using a Student T-test. The results of the Student T-test are shown in Table 4.5.

Table 4.5 – Significance of change in 'avoidable' food waste

Samples	P value	Significance
2014-2015 compared to 2018	0.33781	Not significant

Differences in the proportion of 'avoidable' food waste in the refuse, on a household basis, were not statistically significant between 2014-2015 and 2018.

Data on the quantity of 'avoidable' food waste generated per household was used to calculate the average quantity of 'avoidable' food waste disposed of by a low-, medium-, and high-wasting household. This data has not been weighted – it is the data from the audits.

Based on the 597 households in the audit, the third of households that disposed of the lowest quantity of 'avoidable' food disposed of between 0.00 kg and 0.67 kg per week, with an average of 0.27 kg per household. Another third of households were medium-wasters, disposing of between 0.68 kg and 1.87 kg per week of 'avoidable' food waste, with an average of 1.19 kg. The third of households that generated the most 'avoidable' food waste disposed of between 1.89 kg and 21.88 kg, with an average of 4.01 kg.

Eighty-two per cent of households disposed of less than 3 kg of 'avoidable' food, and 99% disposed of less than 8 kg of 'avoidable' food waste. Five per cent of households disposed of no 'avoidable' food. The average household had 1.82 kg of 'avoidable' food waste (these are unweighted and are therefore the weights found in the audit, not scaled to represent the average New Zealand household).

Table 4.5 – Low, medium, high wasting households, 'avoidable' food per household set out

Household	Range	Average
Low-wasters	0.00 kg to 0.67 kg	0.27 kg
Medium-wasters	0.68 kg to 1.87 kg	1.19 kg
High-wasters	1.89 kg to 21.88 kg	4.01 kg
Total all households	**0.00 kg to 21.88 kg**	**1.82 kg**

The quantity of 'avoidable' food disposed of by the 99% of households that disposed of less than 8 kg per set out, is presented in Figure 4.2 and shows the distribution of the quantity of 'avoidable' food waste samples.

The effect of household size (number of people living in a house) and refuse set out rates (how often a household sets out its refuse for collection) are not factored into this analysis.

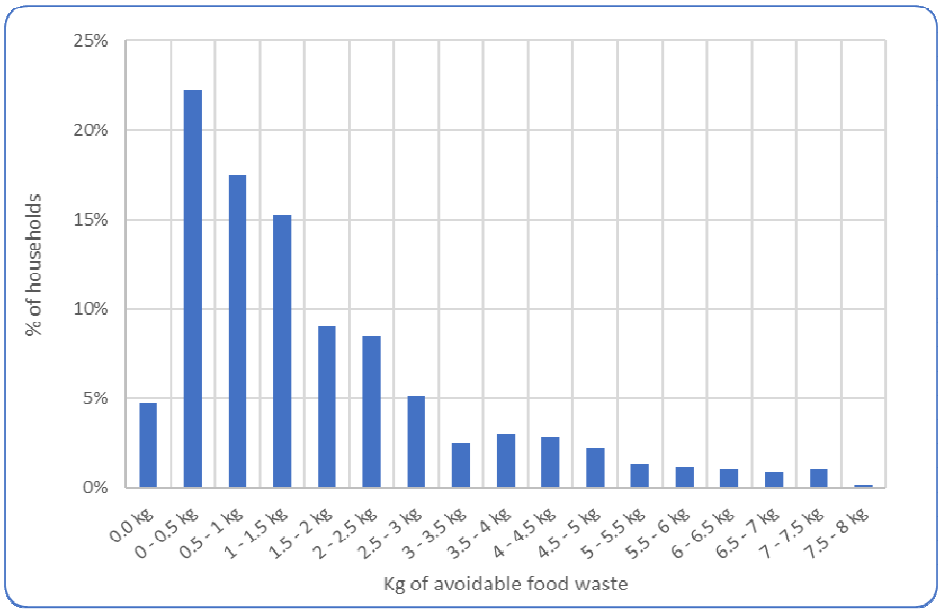


Figure 4.2 – Distribution of 'avoidable' food waste samples per household set out, 2018

4.3 Food groups

Based on the results of this study, approximately 298,246 tonnes of food waste are disposed of through domestic kerbside refuse collections in New Zealand annually. In 2014-2015 the figure was 260,377 tonnes (calculated excluding Selwyn and Timaru data). The increase in 2018 is due in large to New Zealand's population increase over this period.

The audit categorised all food waste into 16 food groups. These food groups are described in Appendix 2. Figure 4.3, 4.4 and 4.5 shows the composition of food waste by food group. Each food group is split into 'avoidable', 'potentially avoidable', and 'non-avoidable' food waste. The results for 2018 and 2014-2015 are compared in each figure. The 2014-2015 results exclude food waste from Selwyn and Timaru.

In 2018, the largest group of food waste, by weight, was fresh fruit, at 26% of all food waste, and 10% of all food waste was 'avoidable' fresh fruit. Fresh vegetables was the next largest category, at 25%, with 11% of all food waste being 'avoidable' fresh vegetables. Meat and fish comprised 13% of the food waste, over half of which was 'non-avoidable' (mostly bones and shellfish shells).

Nine per cent of all food waste was bakery items, and 5% was 'avoidable' homemade food (leftovers).

Dairy includes eggs, and the 'non-avoidable' portion was egg shells. The 'non-avoidable' portion of the drinks food group was tea bags and coffee grinds (3% of all food waste). The 'other foods' food group includes pet food, baby food, medicinal supplements, and 'gunge', a food type used to categorise non-identifiable food waste. Gunge was categorised as 'potentially avoidable'.

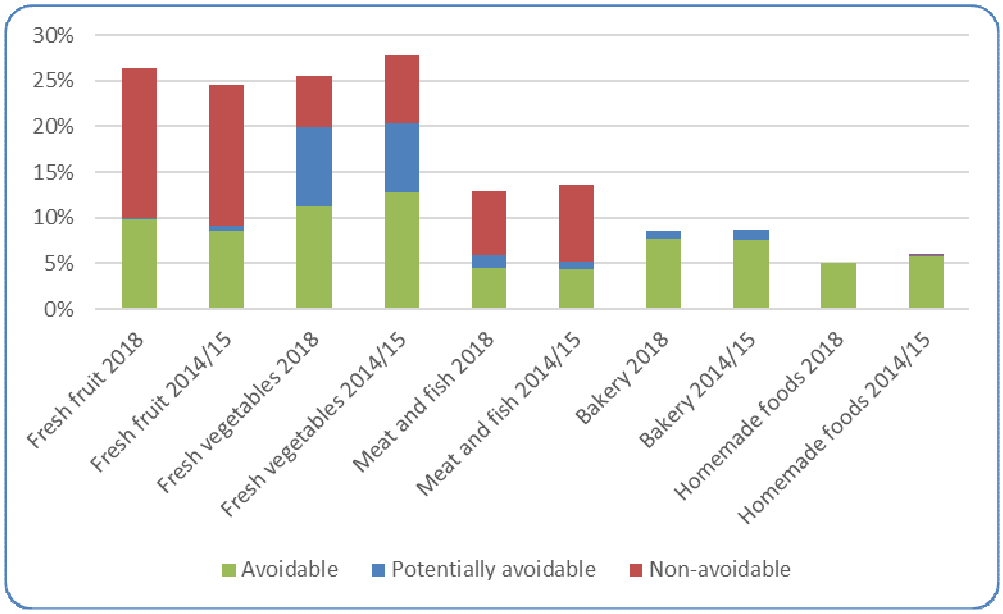


Figure 4.3 – Composition of food waste by food group, by avoidability, 2018 and 2014-2015

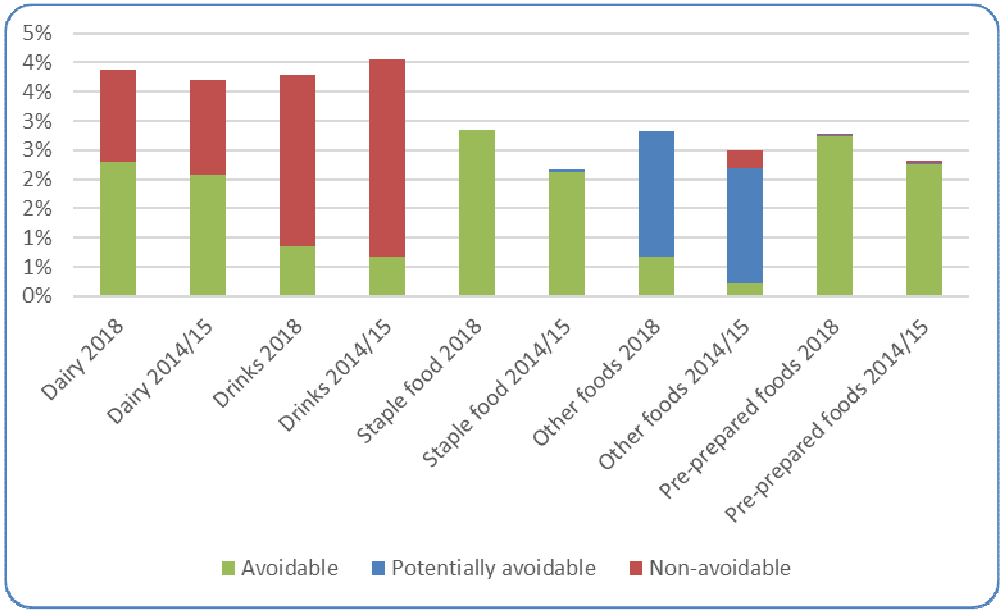


Figure 4.4 – Composition of food waste by food group, by avoidability, 2018 and 2014-2015

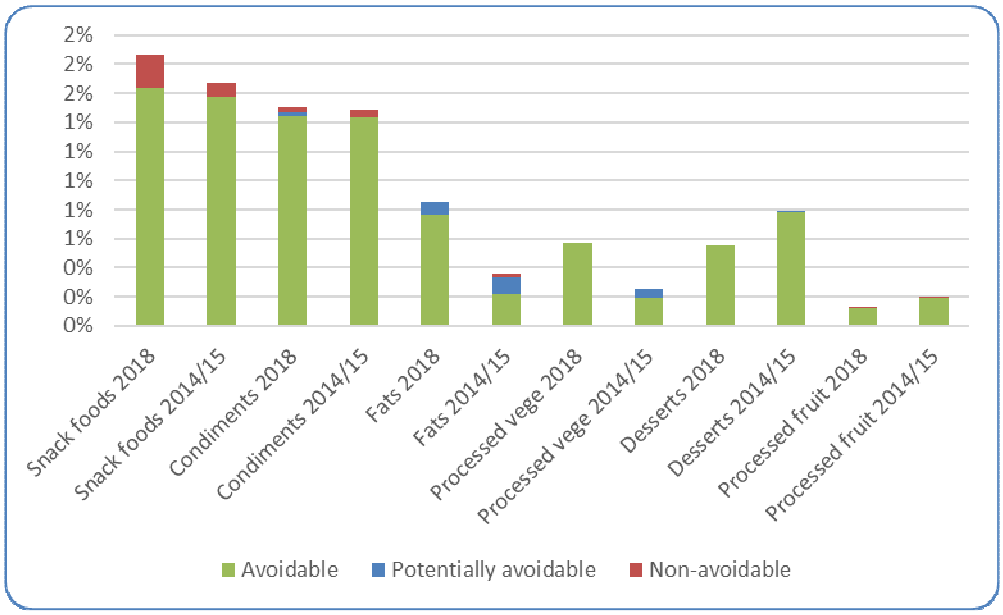


Figure 4.5 – Composition of food waste by food group, by avoidability, 2018 and 2014-2015

4.4 Cost of avoidable food waste – by food group

The cost of all 'avoidable' food waste was calculated using food costs determined as described in Section 2.6. This provides an indication of the amount of money households waste on a weekly and annual basis by buying food that they could have, but did not, consume.

Based on the composition of the food waste from the results of the 2018 audit, and the average quantity of waste generated per household as based on the calculations described in Section 3.1, the average household in New Zealand spends $12.38 on food each week that is wasted unnecessarily, which equates to $644 per household per annum.

On a national basis, according to this research, New Zealanders were spending almost $16.8 million per week, or $1.17 billion per annum in 2018, on 'avoidable' food that they were wasting.

In 2014-2015, based on the results of the audit, the average household in New Zealand spent $10.83 on 'avoidable' food each week, which equated to $563 per annum. However, when data from Selwyn and Timaru are excluded, then the average household spend on 'avoidable' food in 2014-2015 was $12.44, which equates to $647 per household per annum.

In 2014-2015, it was calculated that New Zealanders were wasting $16.8 million per week, or $872 million per annum. When this figure is recalculated without Timaru and Selwyn data, then in 2014-2015 New Zealanders were wasting $1 billion in 2014-2015. The increase from $1 billion to 1.17 billion in 2018 is due to a 15% population increase from 2013 to 2018 and a 2.7% rate of inflation for food.

Table 4.6 shows the cost of 'avoidable' food waste per annum by food group. The food groups are ordered according to the cost of 'avoidable' food waste, from largest to smallest. Individual food groups are discussed in further detail in the next section.

Table 4.6 – Cost of 'avoidable' food waste in New Zealand, per annum, by food group, 2018

Food group category	Cost of 'avoidable' food waste in New Zealand per annum
Meat and fish	$191,500,778
Fresh vegetables	$164,250,624
Homemade foods	$148,516,706
Bakery	$147,994,825
Fresh fruit	$126,168,975
Pre-prepared foods	$104,326,798
Condiments	$71,352,149
Dairy	$67,015,955
Snack foods	$66,925,139
Desserts	$21,893,053
Staple foods	$16,704,981
Processed vegetables	$16,230,305
Other foods	$11,908,750
Fats	$10,342,049
Drinks	$5,886,779
Processed fruits	$2,616,092
Total	**$1,173,633,957**

Based on the results of these food waste audits, almost $200 million of meat and fish will be disposed of through domestic kerbside refuse collections in 2018. A further $164 million of fresh vegetables, and almost $150 million each in homemade foods (leftovers) and bakery items will be disposed of through domestic kerbside refuse collections this year.

4.5 Top 20 food types

Within each of the food groups there are numerous food types. Table 4.7, on the following page, provides the Top 20 food types, when all 'avoidable', 'potentially avoidable' and 'non-avoidable' food wastes are combined.

Table 4.7 – Top 20 food types – all food waste combined, 2018

Top 20 food types – all food waste combined	Proportion of food waste	Tonnes of food waste per annum
Bananas	7.37%	21,990 T
Oranges, mandarins etc	5.99%	17,871 T
Bread	5.94%	17,706 T
Poultry	5.61%	16,717 T
Leftovers	4.33%	12,901 T
Potatoes	4.03%	12,005 T
Lemons	2.75%	8,187 T
Apples	2.56%	7,637 T
Tea/teabags	2.42%	7,232 T
Mixed vegetables	2.34%	6,971 T
Beef	2.23%	6,655 T
Gunge	2.14%	6,375 T
Broccoli	1.85%	5,531 T
Pumpkin	1.80%	5,378 T
Eggs	1.79%	5,349 T
Carrots	1.78%	5,317 T
Lettuces	1.66%	4,961 T
Onions	1.50%	4,480 T
Rice	1.37%	4,076 T
Sweetcorn	1.32%	3,945 T

Table 4.8, on the following page, lists the Top 20 'avoidable' food waste types, ordered by weight, as well as the estimated tonnes of each 'avoidable' food waste disposed of to domestic kerbside refuse collections in New Zealand per annum, based on the sample of 597 households in the audit. The cost of each 'avoidable' food type disposed of to landfill each year has also been calculated.

Bread was the largest 'avoidable' food type, by weight, at 9.6% of all 'avoidable' food waste. Approximately $62.5 million worth of bread is disposed of to domestic kerbside refuse collections annually. The next most common 'avoidable' food waste was leftovers, at 8.2% (at an annual cost of $140.3 million), followed by oranges and mandarins, at 4.0% of all 'avoidable' food waste (and an annual cost of $20.5 million). It is worth noting that an unknown proportion of the oranges and mandarins disposed of to kerbside refuse were windfall from residential gardens. These would not have been purchased.

The Top 20 'avoidable' food types comprise 55% of all 'avoidable' food waste.

Table 4.8 - Top 20 food types – 'avoidable' food waste, 2018

Top 20 'avoidable' food types	Proportion of 'avoidable' food waste	Tonnes of 'avoidable' food waste per annum	National cost of 'avoidable' food waste per annum
Bread	9.6%	15,174 T	$62,589,440
Leftovers	8.2%	12,901 T	$140,374,320
Oranges, mandarins etc	4.0%	6,302 T	$20,516,361
Apples	3.3%	5,117 T	$14,818,152
Bananas	3.1%	4,844 T	$12,933,883
Potatoes	3.0%	4,767 T	$8,323,120
Poultry	2.6%	4,083 T	$50,279,800
Rice	2.6%	4,076 T	$2,675,883
Lettuces	2.4%	3,754 T	$13,225,023
Beef	2.0%	3,208 T	$45,825,926
Yoghurt/yoghurt drinks	1.8%	2,755 T	$23,608,375
Pumpkin	1.7%	2,660 T	$5,545,415
Takeaway - chips	1.6%	2,572 T	$18,162,066
Carrots	1.5%	2,297 T	$4,952,898
Cheese	1.4%	2,194 T	$27,034,234
Grapefruits	1.4%	2,141 T	$8,639,315
Tomatoes	1.3%	2,020 T	$10,665,459
Lemons	1.3%	1,998 T	$9,132,618
Kiwifruit	1.3%	1,973 T	$5,735,182
Cabbages	1.2%	1,967 T	$3,455,205

Table 4.9, on the following page, provides a comparison of the Top 20 'avoidable' food types in 2018 and 2014-2015, by proportion of all 'avoidable' food.

Table 4.9 – Comparison of Top 20 'avoidable' food types – 2018 and 2014-2015

Top 20 'avoidable' food types - 2018	Proportion of 'avoidable' food waste	Top 20 'avoidable' food types – 2014-2015	Proportion of 'avoidable' food waste
Bread	9.6%	Bread	10.5%
Leftovers	8.2%	Leftovers	7.8%
Oranges, mandarins etc	4.0%	Potatoes	5.2%
Apples	3.3%	Apples	3.3%
Bananas	3.1%	Poultry	2.8%
Potatoes	3.0%	Bananas	2.6%
Poultry	2.6%	Lettuces	2.6%
Rice	2.6%	Oranges, mandarins etc	2.3%
Lettuces	2.4%	Pumpkins	2.2%
Beef	2.0%	Carrots	1.9%
Yoghurt/yoghurt drinks	1.8%	Cabbages	1.8%
Pumpkin	1.7%	Onions	1.7%
Takeaway - chips	1.6%	Takeaway - chips	1.7%
Carrots	1.5%	Tomatoes	1.5%
Cheese	1.4%	Rice	1.4%
Grapefruit	1.4%	Cake	1.3%
Tomatoes	1.3%	Sandwiches - homemade	1.3%
Lemons	1.3%	Yoghurt/yoghurt drinks	1.3%
Kiwifruit	1.3%	Beef	1.2%
Cabbages	1.2%	Cheese	1.1%

Seventeen of the Top 20 'avoidable' food types from 2014-2015 were still in the Top 20 in 2018. Onions, cake and sandwiches – homemade were not in the 2018 Top 20. These were replaced in 2018 by grapefruit, kiwifruit, and lemons.

The Top 20 was based on the overall quantity of a particular 'avoidable' food type across all samples. In some cases, a large sample of a particular food type in one or two households can affect the ranking of that food type overall. For example, oranges and mandarins made up 4.0% of all 'avoidable' food in 2018, and only 2.3% in 2014-2015. In 2018, there were 'avoidable' oranges and mandarins in 122 samples. The majority (86%) of these samples contained 0.4 kg or less of 'avoidable' oranges and mandarins. Two households had significantly larger quantities of 'avoidable' oranges and mandarins, with one Auckland household disposing of 10.0 kg and one Waipa household disposing of 4.6 kg. If these two samples were to be omitted, then the proportion of 'avoidable' oranges and mandarins in the food waste in 2018 would be 2.7%.

Figure 4.5 shows the distribution of the sample sizes of 'avoidable' oranges and mandarins in 2018.

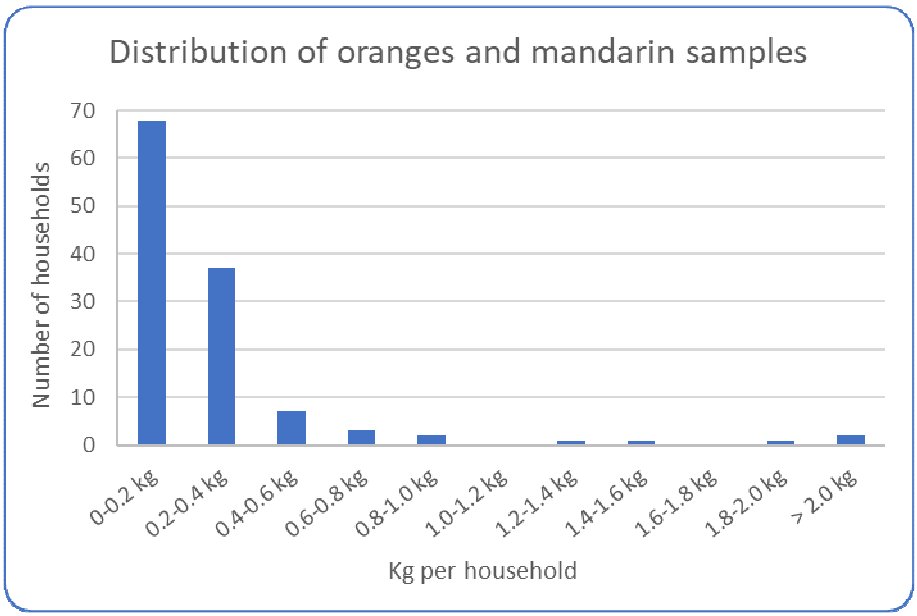


Figure 4.5 – Distribution of 'avoidable' oranges and mandarin samples in 2018

Beef increased from 1.2% in 2014-2015 to 2.0% of 'avoidable' food in 2018. In 2018, 'avoidable' beef was present in 74 samples. The majority (86%) of these samples contained 0.4 kg or less of 'avoidable' beef. However, one household disposed of 5.8 kg of beef.

Figure 4.6 shows the distribution of beef samples in 2018.

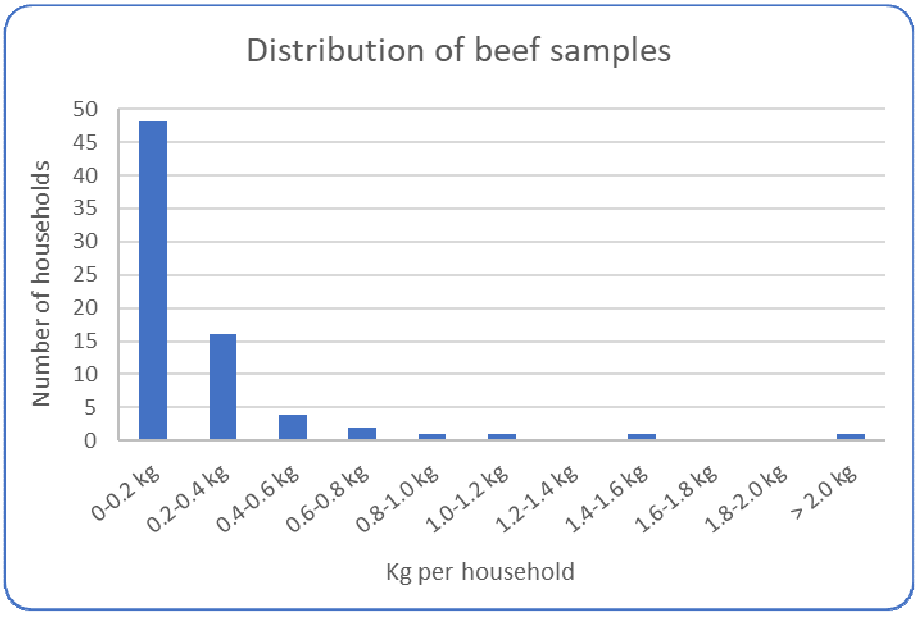


Figure 4.6 – Distribution of 'avoidable' beef samples in 2018

On the other hand, some items, such as 'avoidable' grapefruit, were only present in 9 samples, as shown in Figure 4.7, but the weight of those nine samples was enough to place grapefruit in the Top 20.

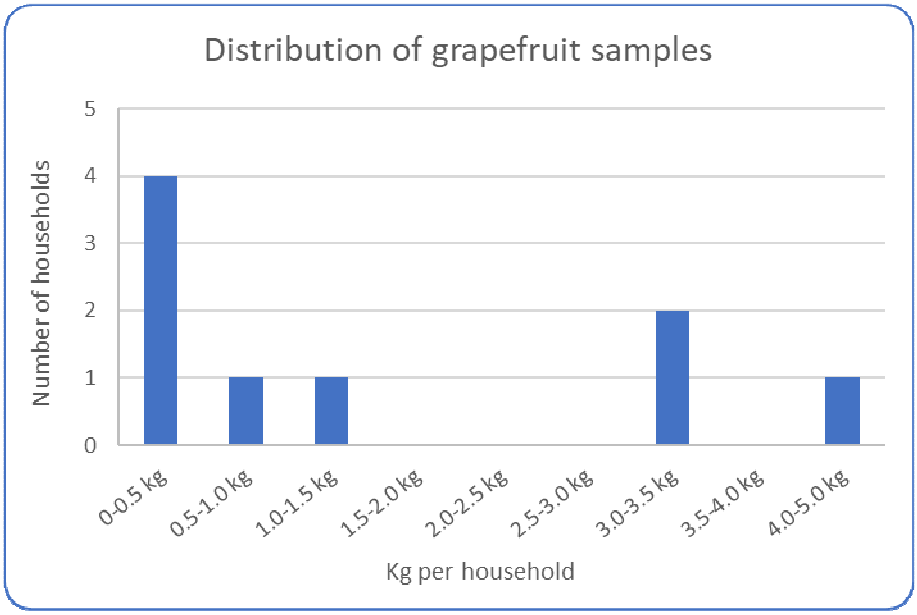


Figure 4.7 - Distribution of 'avoidable' grapefruit samples in 2018

The distribution of the other eight Top 10 'avoidable' food types are provided in Appendix 4.

4.6 Best before and Use by dates

During the audit, all food waste that was packaged in its original, unopened packaging had the 'Best before' or 'Use by' date recorded by the auditor before the packaging was removed. This information was documented by the data recorder.

Of the 11,450 food items recorded during the audits, 123 items, or 1.2%, were in their original unopened packaging.

For each of these items the dates of the refuse disposal period that the collection for the audit covered were determined, and the Best before and Use by dates were sorted according to whether they fell before the start of the food waste audit refuse collection period, during that period, or after that period.

Table 4.10 – Best before and Use by dates

Best before and Use by dates	Best before # and %		Use by # and %		Combined # and %	
Before disposal period covered by audit collection	71	68%	11	58%	82	67%
During disposal period covered by audit collection	17	16%	3	16%	20	16%
After disposal period covered by audit collection	16	15%	5	26%	21	17%
Total	**104**	**100%**	**19**	**100%**	**123**	**100%**

Of the 123 packaged food items in the food waste audits, 67% were past their Best before or Use by date before the period covered by the refuse collection. A further (16%) reached their Best

before or Use by date during the collection period for the audits. It was not possible to tell exactly when these items were placed in the bin, and therefore whether it was before or after the Best before or Use by dates.

Seventeen per cent of all unopened, packaged items were disposed of before their Best before or Use by date.

5 SURVEY RESULTS

A survey was placed in the letterbox of each household from which a refuse sample was collected. In Takapuna, at the request of Auckland Council, the surveys were delivered to all households in the sample area before the collection took place. Altogether 205 surveys were returned from all audit areas. However, only 175 of these surveys could be linked to a household from which refuse was collected. This equates to a response rate of 29% from audited households, which was lower than in 2014-2015, when 50% of households returned a survey.

A sample of the survey is provided in Appendix 1.

Of the 175 surveys from households included in the 2018 audit, 89 were from households that were also audited in 2014-2015, but only 67 were from households that were audited both years, and still had the same occupants living in the house.

The results presented in this section have not been scaled to represent the national average as described in Section 3.1. The food waste audit results presented alongside the survey questions are as found in the audits, thus enabling a more reliable comparison with audit results for these same survey questions in 2014-2015.

5.1 Food waste disposal options

Of all 175 surveys received from households in the 2018 audit, 39% responded that they compost or worm farm food waste, 28% responded that they feed food waste to animals, and 32% responded that they use an in-sink disposal system to dispose of food waste. Twenty-one per cent of these households claim to be disposing of food waste in more than one of these manners (e.g. disposing of food waste to compost and feeding it to animals).

In 2014-2015, 42% of households claimed to compost or worm farm food scraps, 29% responded that they feed food scraps to animals, and 28% responded that they use an in-sink disposal system to dispose of food scraps. Twenty-three per cent of these households claim to be disposing of food waste in more than one of these manners (e.g. disposing of food waste to compost and feeding it to animals).

It is evident from the results of the audit that while households may use these methods to dispose of a proportion of their food waste, they were still disposing of food waste to their rubbish bins.

5.2 Perceptions of quantities of food disposed of

Householders were asked to rate how much food they believe they throw away. The results of this question are shown in Figure 5.1, for all surveys in 2018 and 2014-2015. In 2018, almost two-thirds of respondents (65%) state that they dispose of 'hardly any' to 'a small amount' of food waste. In 2014-2015, 66% of respondents stated that they dispose of 'hardly any' to 'a small amount' of food waste.

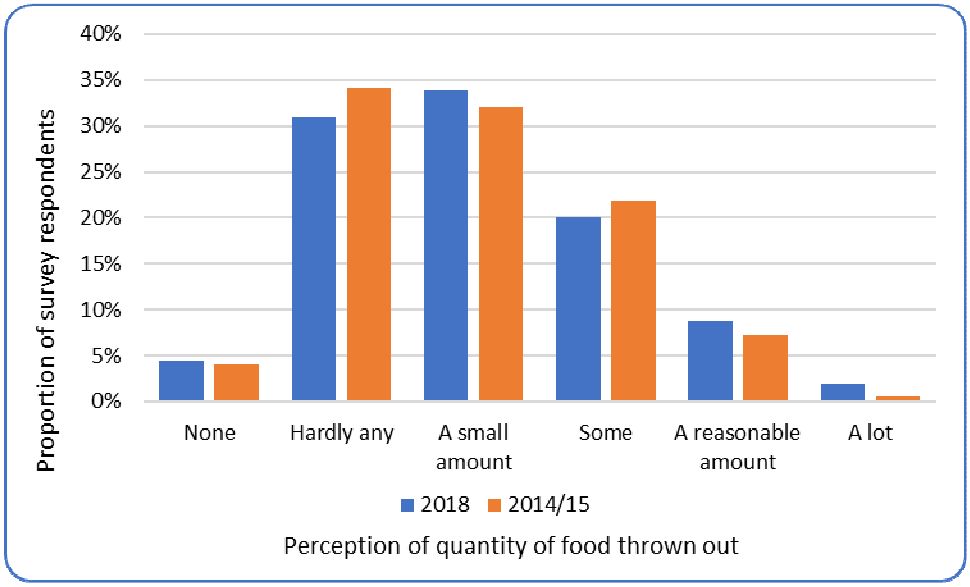


Figure 5.1 – Quantity of food waste households perceive they throw away

Figure 5.2 shows the difference between the householders' estimate of the scale of their food waste disposal, and their actual, average, food waste disposal. This is based on all types of food waste combined ('avoidable', 'potentially avoidable' and 'non-avoidable').

In the surveys in both years, householders appear to have an appreciation of the scale of their food waste disposal, though in 2018, households that stated that they disposed of a 'reasonable amount' of food waste disposed of less food waste than those who stated that they disposed of 'some' food waste. In 2018, the spike in the quantity of food waste disposed of by households that state that they dispose of a lot of food waste was caused by one household that disposed of almost 15 kg of food.

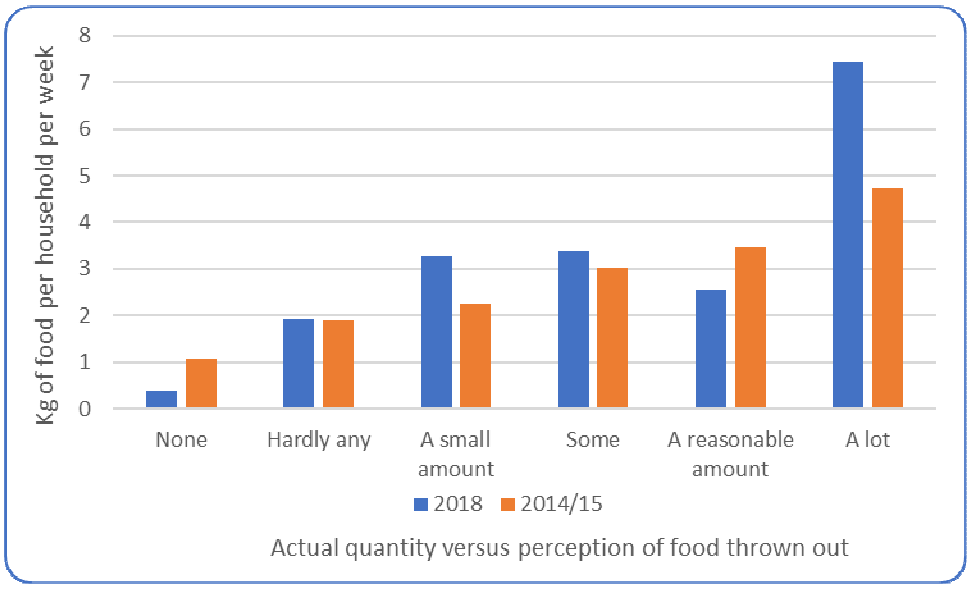


Figure 5.2 – Actual quantity versus perception of food waste disposal

5.3 Food waste disposal by household type and size

Households that responded to the survey were asked to specify how many people lived in the house and to which age group the households' inhabitants belonged. Using these age groupings, the average weight of 'avoidable' food waste, and of all food waste combined, per set out, was calculated for households that have children under the age of 15, households that do not have children under the age of 15, and households that only have occupants over the age of 65.

Table 5.1 provides the average weight of 'avoidable' food, and of all food waste by household type, per person and per household, per week.

Table 5.1 – Average set out rates for food per household type

Type of household	Average # occupants	Avoidable food waste		All food waste	
		Kg per household per week	Kg per occupant per week	Kg per household per week	Kg per occupant per week
Households with children under 15 yrs	4.3	1.74 kg	0.40 kg	3.04 kg	0.70 kg
Households without children under 15 yrs	2.5	1.25 kg	0.50 kg	2.39 kg	0.95 kg
Households with only inhabitants 65 yrs and over	1.7	0.61 kg	0.36 kg	1.67 kg	0.98 kg

Households with children under 15 generate more 'avoidable' food waste and more overall food waste per household, than households without children. Households with only occupants over 65 generate lower quantities of both waste streams, per household, than younger households.

However, when calculating food waste generation per person, people in households with children under 15 generate a similar quantity of 'avoidable' food waste, per person, per week, as the other types of households, and less overall food waste.

Figure 5.3 shows the quantity of overall food waste and 'avoidable' food waste disposed of per person, in households of different sizes.

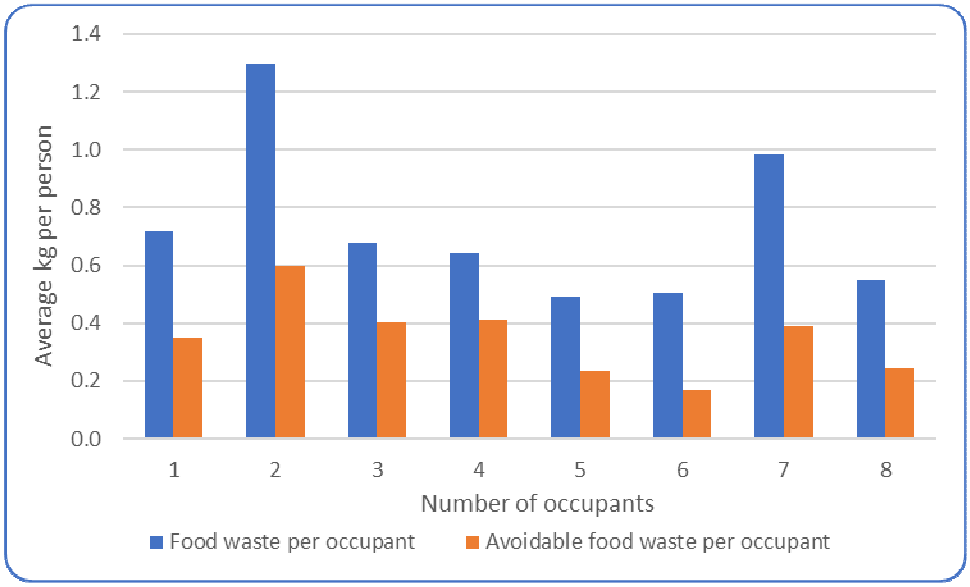


Figure 5.3 – Average set out rates for food per household size

Households with two occupants dispose of more 'avoidable' and overall food waste per person than any other household size. The spike in food waste in households with seven occupants was due to one household that disposed of almost 15 kg of food waste.

Figure 5.3 suggests that the number of occupants in a household has more effect on food waste generation than the age of the inhabitants.

5.4 Food waste reduction behaviours

When asked "Have you done anything to reduce food waste over the past three years", over half of respondents (54%) stated that they had. Households that indicated that they had tried to reduce food waste were asked what they had done. There were 119 answers to this question, listing a range of different food waste reducing behaviours. Many answers listed several behaviours. These behaviours were divided into initiatives that reduce food waste at source and behaviours that reduce food waste to the waste bin by diverting it.

Of the 119 answers, 79 (66%) related to food waste reduction behaviours (buying less, cooking less per meal, eating left overs etc.), and 43 (36%) related to new diversion behaviours (compost, food waste collection, feeding food to animals etc). Some households have undertaken both food waste reduction and diversion behaviours.

Table 5.2, on the following page, lists the various reduction and diversion behaviours undertaken. The most common behaviours were buying less food (23%), followed by using a compost bin (or worm farm or Bokashi bucket) (17%), or ensuring that leftovers are eaten (15%).

Table 5.2 – Food reduction and diversion behaviours undertaken by respondents

Food reduction and diversion initiatives	# of responses	% of responses
Buy less	33	23%
Compost (or worm farm/Bokashi)	24	17%
Eat leftovers	21	15%
Cook less	12	8%
Use food waste collection	10	7%
Use freezer	10	7%
Feed animals	7	5%
Plan meals	6	4%
Shop more often	4	3%
Grow veges	4	3%
Use more of the fruit and vege	3	1%
Use in-sink waste disposal	2	1%
Buy 'Food in a bag' type meals	2	1%
Give surplus food away	2	1%
Eat less meat	1	1%
Become vegan	1	1%
Make jams, relishes, preserves	1	1%
Using beyond use by/best by	1	1%

5.5 Love Food Hate Waste campaign

The survey asked householders "Have you heard of the Love Food Hate Waste campaign". Forty-six, or 22%, of households of the 205 households that returned surveys stated that they had heard of the campaign. Twenty-two per cent of survey respondents from Auckland and Wellington, 29% of survey respondents from Waimakariri, and 9% of respondents from Waipa had heard of the 'Love Food Hate Waste' campaign.

Of the 46 households that were aware of the Love Food Hate Waste campaign, 65% stated that they had done something to reduce food waste in the past three years. Fifty-two per cent of respondents that had not heard of Love Food Hate Waste campaign stated that they had done something to reduce food waste in the past three years.

On average, households that had heard of the Love Food Hate Waste campaign, and were audited (40 households), disposed of 27.1% less food waste per household, or 31.8% less food waste per occupant, than those that had not heard of the campaign. The quantity of food waste disposed of per household that had heard of the Love Food Hate Waste campaign versus those that had not, is a statistically significant difference, using a Student T-test analysis, as shown in Table 5.3.

Table 5.3 – Significance of difference in food waste quantities between households that have and have not heard of LFHW campaign

Samples	P value	Significance
Difference in quantity of food waste from households that have and have not heard of LFHW campaign	0.0470	Significant

The differences in food waste disposal between households that have heard of the Love Food Hate Waste campaign and those that have not, are shown in Figure 5.4.

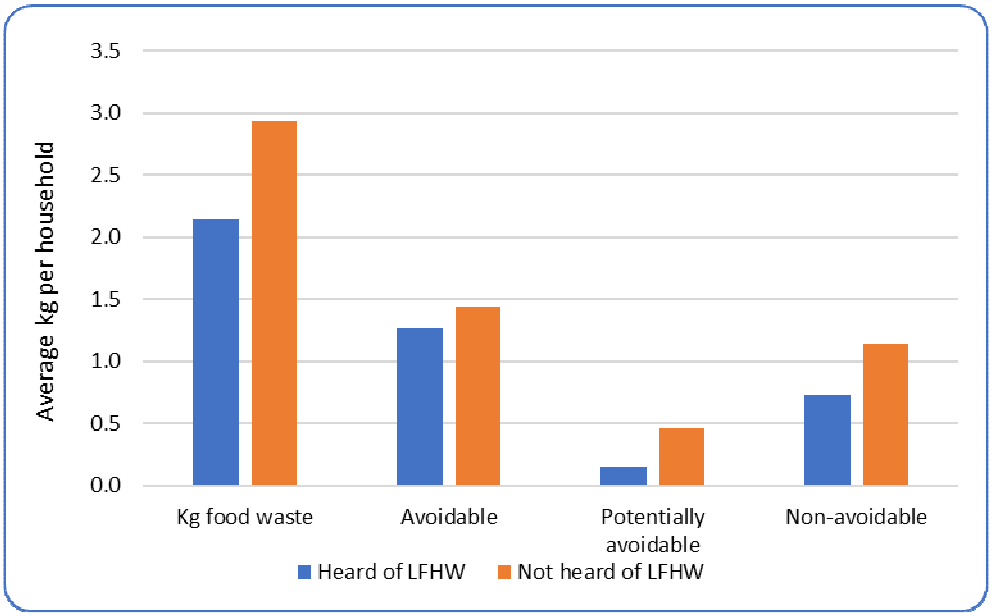


Figure 5.4 – Food waste disposal by households that have and have not heard of Love Food Hate Waste campaign

There is not sufficient data to determine whether this significant difference in the quantity of food waste between houses that have and have not heard of the Love Food Hate Waste campaign is due to the campaign, or because households with an interest in food waste reduction are more likely to know of the campaign or were more likely to respond to the survey.

6 COMPARISON OF SAME HOUSEHOLDS 2018 AND 2014-2015

Of the 175 households that were audited and returned surveys in 2018, 67 were also audited and returned surveys in 2014-2015 and were still occupied by the same people.

There was a slight increase in food waste overall and in 'avoidable' food waste across these 67 households since 2014-2015. Figure 6.1 compares the quantity of food waste in those 67 households in both audits. In this comparison the food waste weights have not been scaled to represent the national average. These are the weights as found in both audits.

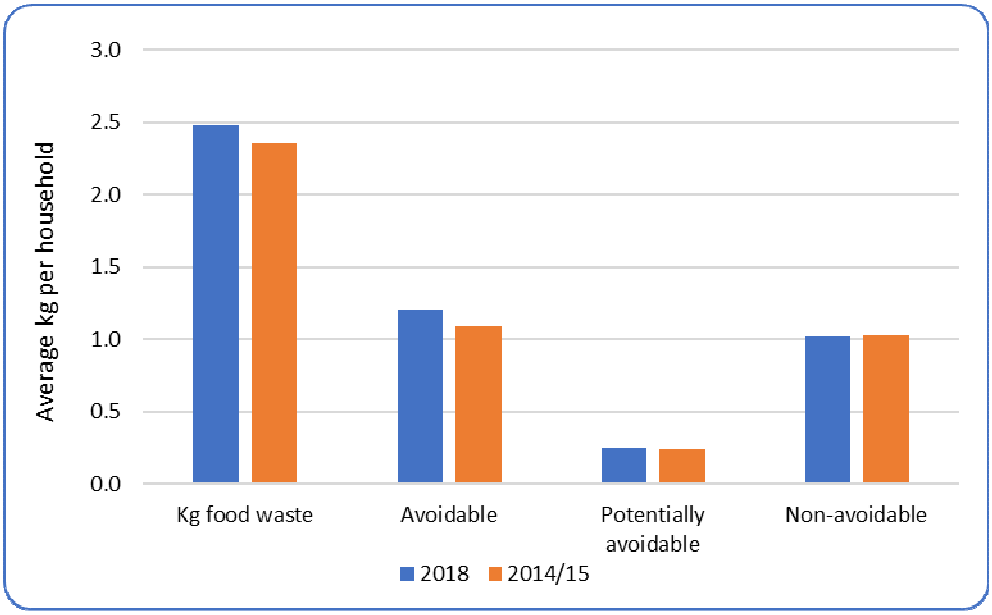


Figure 6.1 – Food waste disposal by households included in both audits

Overall, there was a 5% increase in food waste and an 11% increase in 'avoidable' food waste in this sample of households between 2014-2015 and 2018. However, 57% of these households had less food waste in 2018 than in 2014-2015, and 42% had more food waste. One household had no food waste either year.

Just over half (52%) of these households had an increased quantity of 'avoidable' food waste in their refuse in 2018. The average quantity of the increase was 1.08 kg and the median increase was 0.69 kg. Twenty-eight households had decreased 'avoidable' food waste in 2018, with an average decrease of 1.07 kg and a median decrease of 0.70 kg. Four households set out no 'avoidable' food waste in either audit.

Of the 67 households that were audited and surveyed in 2014-2015 and 2018, 15 (22%) had heard of the 'Love Food Hate Waste' campaign. Of those households, eight had a decrease in 'avoidable' food waste in 2018 and six had an increase. One had no 'avoidable' food waste either year.

Figure 6.2, on the following page, shows the quantity of 'avoidable' food waste disposed of in both audits by households that had heard of the Love Food Hate Waste campaign.

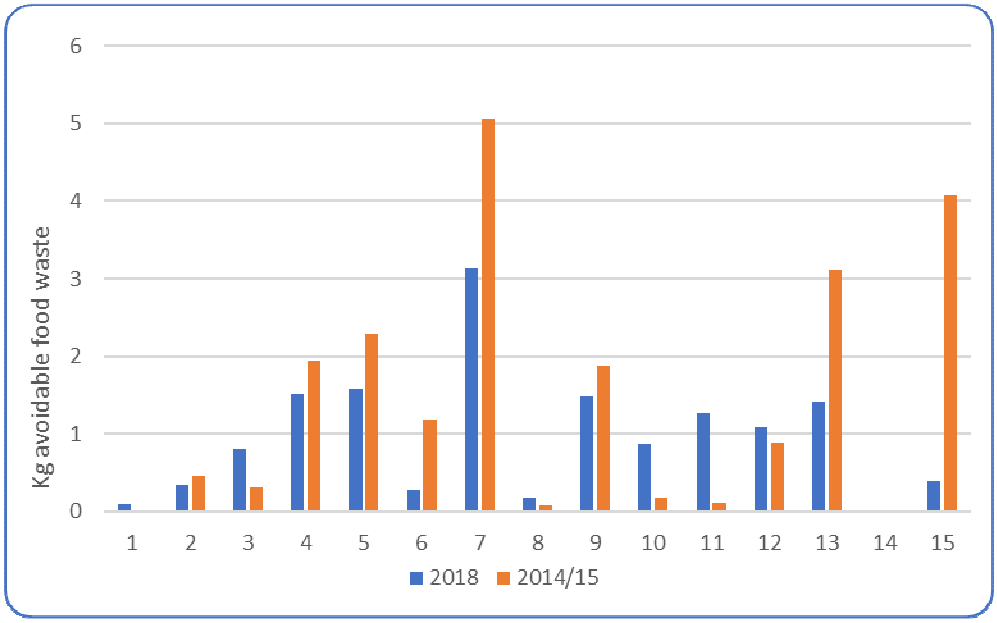


Figure 6.2 – 'Avoidable' food waste disposed of by 15 households that have heard of Love Food Hate Waste, 2018 and 2014-2015

The survey asked whether they had done anything to reduce food waste since 2015. Eight of the households that had heard of Love Food Hate Waste had, five hadn't, and two did not answer the question. The sample size is too small to provide statistically significant results.

7 RESULTS PER HOUSEHOLD 2018 AND 2014-2015

This section provides a comparison of the food waste audit results for the average New Zealand household. In reality, there is no such thing as an 'average' New Zealand household – few, if any, households in New Zealand conform exactly to the 'average'.

These figures are provided as a snapshot of food waste generation in New Zealand in 2014-2015 and in 2018, at a level that readers can more easily relate to. All of these results are based on one week's worth of kerbside refuse disposal for the average household.

Based on the results of the 2014-2015 audit, 30.0% of the average household's weekly refuse set out for a kerbside collection was food waste. In 2018, 34.1% of kerbside refuse was food waste. If the 2014-2015 samples from Timaru and Selwyn are removed from the analysis as they have food waste collections, then in 2014-2015 the average household's weekly refuse contained 33.5% food waste.

In 2018, this food waste was 52.8% 'avoidable', 13.5% 'potentially avoidable' and 33.7% 'non-avoidable'. In 2014-2015 this food waste was comprised of 53.5% 'avoidable', 11.7% 'potentially avoidable' and 34.8% 'non-avoidable' food waste.

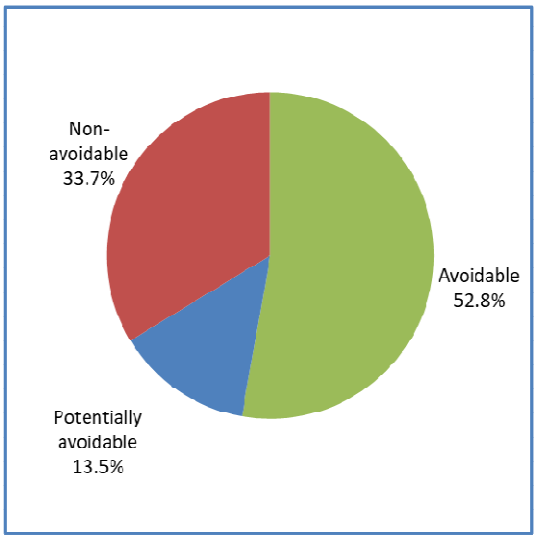


Figure 6.1 – Avoidability of food waste in 2018

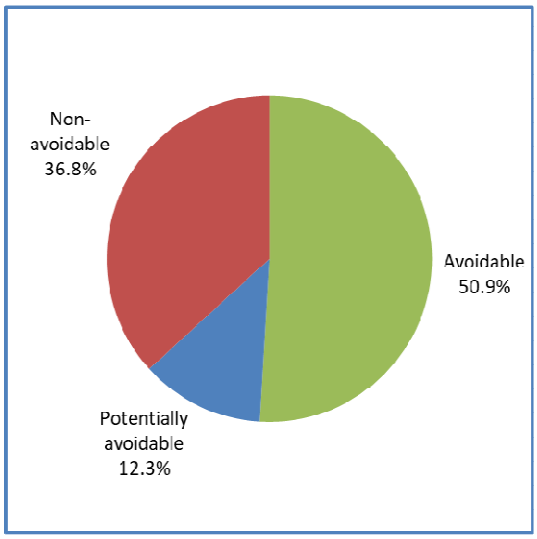


Figure 6.2 – Avoidability of food waste in 2014-2015 (excl. Timaru & Selwyn)

The average composition of this 'avoidable' food waste, by weight, by food group, in both audits, is shown in Figures 6.3 and 6.4.

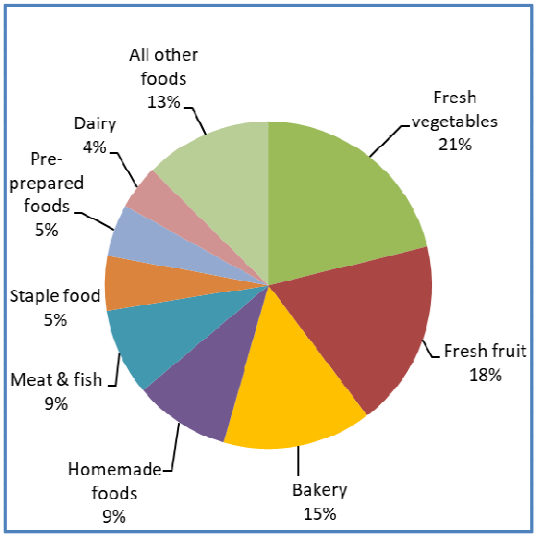


Figure 6.3 – 'Avoidable' food waste by food group in 2018

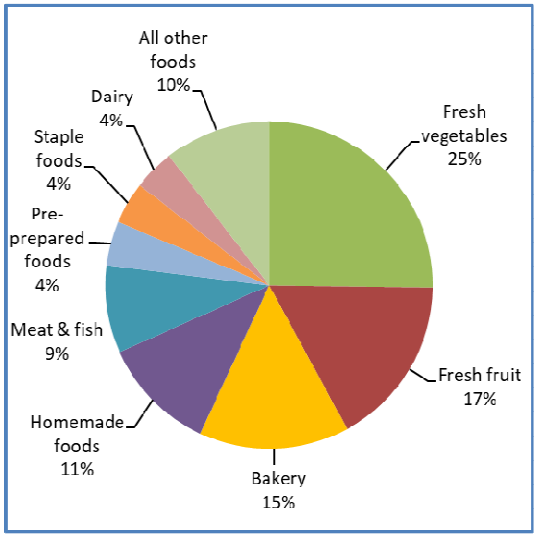


Figure 6.4 – 'Avoidable' food waste by food group in 2014-2015 (excl. Timaru & Selwyn)

In 2014-2015, excluding waste from Selwyn and Timaru, the average household spend on 'avoidable' food was $12.44, which equates to $647 per household per annum.

The average cost of 'avoidable' food waste per household, per week, in 2018 was $12.38, which equated to $644 per household per annum.

The cost of the 'avoidable' food waste in the top food groups is shown in Figures 6.5 and 6.6. The proportions are different to Figures 6.3 and 6.4, as the average cost of food varies between food groups.

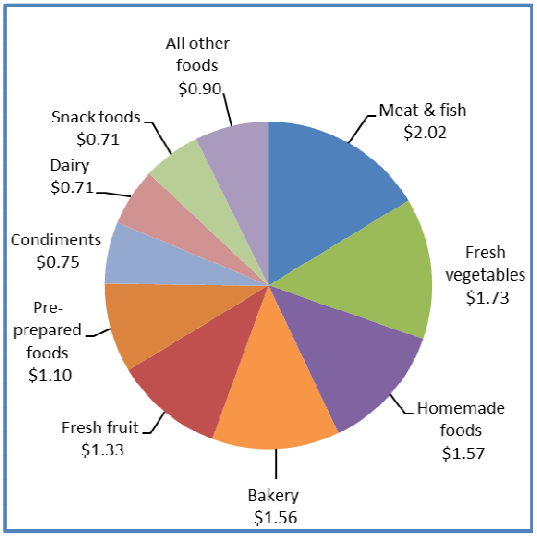


Figure 6.5 – Cost of 'Avoidable' food waste by food type, per household, per week, in 2018

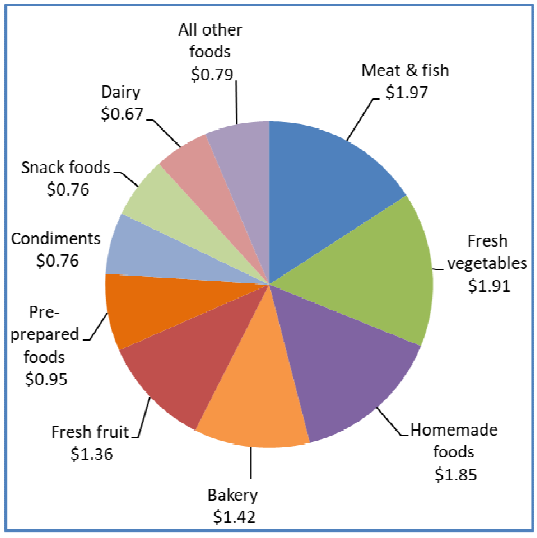


Figure 6.6 – Cost of 'Avoidable' food waste by food type, per household, per week, in 2014-2015 (excl. Timaru & Selwyn)

8 CONCLUSIONS

One of the two key objectives of the research was to determine whether the composition and quantity of food waste disposed of by households in New Zealand, and the portion of this food waste that was 'avoidable', 'potentially avoidable', or 'non-avoidable', had changed since 2014-2015.

The other objective was to compare the quantity of food waste disposed of from households that were included in both the 2014-2015 audits and the 2018 audits, and to see whether food waste disposal by those households that were aware of the Love Food Hate Waste campaign had changed relative to those households that were not aware of the campaign.

Comparing the results of the audits in 2018 and 2014-2015 has shown that there was very little change in the composition and quantity of food waste disposed of by households to kerbside collections. In 2018, the proportion of the overall kerbside refuse that was food waste was 34.1%, and in 2014-2015, once Timaru and Selwyn samples are removed, it was 33.5%. This difference is not statistically significant.

The portion of food waste that was 'avoidable' in 2018, as an average of household samples, was 48.8%. In 2014-2015 it was 47.5%. Again, this difference is not statistically significant.

The results of the two audits appear to indicate that there has been no measurable change in food waste disposal from households to kerbside collections over the three-year period.

There were slight differences in the composition of food waste between the two audits. However, 17 of the Top 20 'avoidable' food types in 2014-2015 were still in the Top 20 in 2018, and bread and leftovers were still the top two 'avoidable' food types.

Overall, 22% of the households that were audited and returned a survey had heard of the Love Food Hate Waste campaign. The effect of this campaign was measured by comparing the quantity of food waste disposed of by households that had heard of the campaign to those that had not. Overall, there was 27.1% less food waste disposed of per household that had heard of Love Food Hate Waste than from households that had not. This difference is statistically significant.

Whether this difference is due to the campaign having an effect on household behaviour, or whether this is due to a greater awareness of the campaign by households that are interested in food waste reduction is not known, but the amount of food waste disposed of by these 40 households was significantly lower than for the 135 households that had not heard of the campaign.

APPENDIX 1 – EXAMPLE OF NATIONAL SURVEY

WAIMAKARIRI DISTRICT COUNCIL

215 High Street
Private Bag 1005
RANGIORA 7440
New Zealand

Phone: (03) 311 8900
or: (03) 327 6834
Fax: (03) 313 4432
www.waimakariri.govt.nz

Our Reference: EXT-26-02 / 180118003774

20 January 2018

THE WAIMAKARIRI DISTRICT FOOD WASTE SURVEY

Complete and return this survey by Friday 9 February 2018 and go in to win one of three (3) $100 Grocery Vouchers.

Dear resident

In 2015, Waimakariri District Council took part in a national research campaign to better understand the issue of household food waste. Since then we have been working with other Councils to run a national campaign aimed at reducing food wastage in New Zealand.

Follow up research is now being carried out. This includes an audit of food waste from 120 households across the district, including your household and a few others in your street. This audit will help us estimate how much food waste is being generated across the district and tell us what it is composed of.

By answering a short (11 question) survey on the back of this letter you can help us to understand a little more about how your household deals with food waste. Once you fill out the survey, please post it back to us in the free post envelope provided, or send it to:

Waimakariri District Council food waste survey
Private Bag 1005
RANGIORA 7440

All completed surveys returned by Friday 9 February 2018 will go into the draw to win one of three $100 grocery vouchers. There are only 120 houses being surveyed so you have a good chance of winning.

Good luck and thank you for taking the time to complete and return the survey.

Regards,

Kitty Waghorn
Solid Waste Asset Manager

If you have any questions regarding this survey, please call the Waimakariri District Council ask to speak with one of the solid waste team

Accredited as an International 'Safe Community'
by the World Health Organisation Collaborating Centre on Community Safety.

WAIMAKARIRI DISTRICT COUNCIL

FOOD WASTE SURVEY

Please note: all of the information you provide in this survey will be kept confidential and no individual household information will be reported anywhere, at any time, ever.

1. **Does your household currently compost or worm farm any of your food waste at home?**
   Circle one: Yes / No

2. **Does your household currently feed any of your food waste to animals?** Circle one: Yes / No

3. **Does your household currently use an in-sink disposal system to dispose of any of your food waste?** Circle one: Yes / No

4. **Using a scale from 0 – 5, where 5 is 'a lot', and 0 is 'none at all', overall how much food would you say you throw away in general?** Circle one:

0	1	2	3	4	5
None	Hardly any	A small amount	Some	A reasonable amount	A lot

5. **Have you done anything to reduce food waste over the past three years?** Circle one: Yes / No

   If yes, what? _____

   _____

6. **Have you heard of the 'Love Food Hate Waste' campaign?** Circle one: Yes / No

7. **Were you living in this house in February 2015 (at the time of the last food waste research)?**
   Circle one: Yes / No

8. **How many occupants are there in total within your household?** _____

9. **Into which of the following age groups do the members of your household fall?** (write in number of occupants within each age band)

   0-4 years _____ 5-14 years _____ 15-24 years _____ 25-34 years _____

   35 – 44 years _____ 45-54 years _____ 55-64 years _____ 65 years & older _____

10. **Which ethnic/cultural groups does your household most identify with?** (please circle)

    European Māori Pacific Peoples Asian

    Middle Eastern/Latin American/African Other Ethnicity (please specify) _____

11. **What are your residential address and contact details?** *(this information is so that we can contact you if you win)*

    House number: _____ Street name: _____

    Telephone No: _____ E-mail: _____

APPENDIX 2 – FOOD GROUP DEFINITIONS

Food group	Description
Bakery	All bakery items, including bread, pastries, pies, scones etc.
Condiments	Includes condiments, sauces, herbs and spices, including garlic and ginger, dried and fresh herbs, seasoning sachets, jams, honey, salad dressing etc.
Dairy	All dairy products, including eggs. Includes cheeses, milk, yogurt etc.
Desserts	All cakes, puddings, ice cream etc. Does not include bakery type pastries.
Drinks	Tea bags, coffee grinds and granules, milkshakes, fruit juice, water, alcohol etc.
Fats	Oils, butter, margarine, lard.
Fresh fruits	All fresh fruit, including fresh fruit that has been cooked fruit, and excluding dried, canned or frozen fruit.
Fresh vegetables	All fresh vegetables, including fresh vegetables that have been cooked, and excluding canned or frozen vegetables,
Homemade food	All home prepared mixed foods, cooked or raw, including leftovers, homemade sandwiches, instant noodles, stews and soups.
Meat and fish	All meat and fish that are not included in a meal (which would then be categorised as homemade food). Includes shell fish, canned fish, bones etc.
Pre-prepared meals	All types of take away meals and snacks, including fish and chips, Indian and Chinese take away meals, coleslaw salads from take away restaurants, burgers, pizzas etc.
Processed fruit	Dried, canned or frozen fruits, when they can be identified as such, and is not included as an ingredient in another food.
Processed vegetables	Canned or frozen vegetables, when they can be identified as such, and is not included as an ingredient in another food.
Snack foods	Snack foods including sweets, biscuits, chocolate, nuts, crackers and chippies etc.
Staple foods	Rice and pasta, dry and cooked (but not included with other ingredients), cereals, flour etc.
Other	The other category includes unidentifiable food (categorised as Gunge), pet food, and baby food.

APPENDIX 3 – TOP 100 'AVOIDABLE' FOOD TYPES

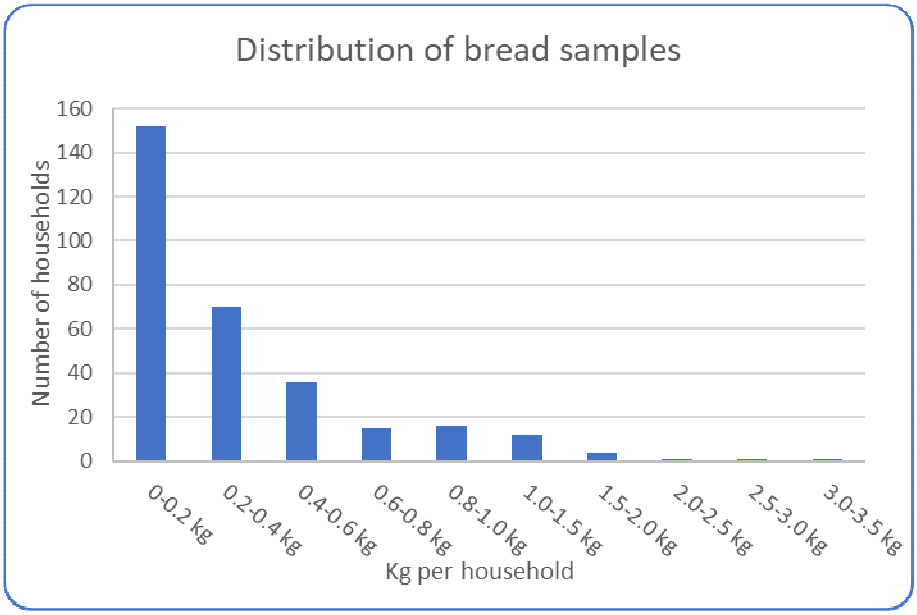
In previous section of this report different types of bread (white bread, mixed grain bread, wheatmeal bread and bread roll/baguette) have been combined into one overall bread category. In this table they are listed individually.

Top 100 food types – Avoidable food waste only	Proportion of all 'avoidable' food waste	Kg per household per annum	Tonnes in NZ per annum
Left overs	8.2%	7.07	12901
White bread	4.1%	3.54	6465
Oranges, mandarins etc	4.0%	3.45	6302
Apples	3.3%	2.80	5117
Bananas	3.1%	2.65	4844
Potatoes	3.0%	2.61	4767
Mixed grain bread	2.9%	2.52	4593
Poultry	2.6%	2.24	4083
Rice	2.8%	2.39	4364
Lettuces	2.4%	2.06	3754
Beef	2.0%	1.76	3208
Yoghurt/yoghurt drinks	1.8%	1.51	2755
Pumpkin	1.7%	1.46	2660
Fish and chips, takeaway - chips	1.6%	1.41	2572
Carrots	1.5%	1.26	2297
Cheese	1.4%	1.20	2194
Grapefruits	1.4%	1.17	2141
Bread roll/baguette	1.3%	1.13	2059
Wheatmeal bread	1.3%	1.13	2057
Tomatoes	1.3%	1.11	2020
Lemons	1.3%	1.09	1998
Kiwifruit	1.3%	1.08	1973
Cabbages	1.2%	1.08	1967
Oils	1.2%	1.07	1945
Sausages	1.2%	1.04	1897
Cake	1.1%	0.98	1787
Cauliflowers	1.1%	0.94	1710
World breads (naan, tortilla etc)	1.0%	0.88	1609
Pasta - cooked	1.0%	0.86	1578
Mixed vegetables	0.9%	0.81	1469
Sandwiches - homemade	0.9%	0.78	1430
Broccoli	0.9%	0.77	1405
Onions	0.9%	0.75	1375

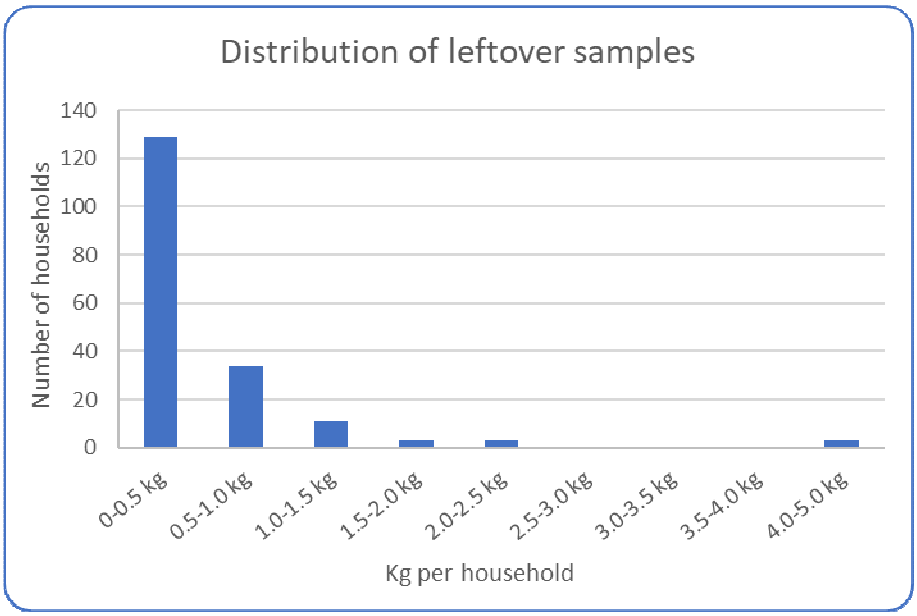
Top 100 food types – Avoidable food waste only	Proportion of all avoidable food waste	Kg per household per annum	Tonnes in NZ per annum
Pet food	0.9%	0.75	1360
Soups	0.9%	0.74	1356
Coleslaws	0.7%	0.59	1073
Pears	0.7%	0.58	1064
Cucumbers	0.7%	0.58	1051
Courgettes	0.7%	0.57	1033
Capsicum	0.6%	0.55	996
Ham	0.6%	0.54	994
Pizzas, takeaway	0.6%	0.54	979
Beans (all varieties)	0.6%	0.52	948
Biscuits, plain sweet	0.6%	0.50	911
Pastry	0.6%	0.49	892
Celery	0.5%	0.46	842
Flour	0.5%	0.45	830
Other dried foods	0.5%	0.45	826
Kumara	0.5%	0.45	821
Muffin	0.5%	0.44	809
Other bakery	0.5%	0.44	804
Crackers/crisp breads	0.5%	0.44	796
Other puddings	0.5%	0.42	758
Avocados	0.5%	0.41	745
Water	0.4%	0.39	705
Fresh fish	0.4%	0.38	696
Pineapples	0.4%	0.38	694
Eggs	0.4%	0.37	667
Fruit juice	0.4%	0.35	645
Indian meal, takeaways	0.4%	0.35	637
Sweetcorn/corn on the cob	0.4%	0.34	627
Feijoa	0.4%	0.33	603
Chocolate	0.4%	0.33	603
Pies	0.4%	0.33	601
Confectionery	0.4%	0.32	591
Chinese meal, takeaway	0.4%	0.31	569
Melons	0.4%	0.31	559
Mangos	0.3%	0.30	551
Bokchoy/chinese cabbage	0.3%	0.30	544
Lamb/mutton	0.3%	0.29	535
Other sauces	0.3%	0.29	531
Hamburgers, takeaway	0.3%	0.29	530
Nuts	0.3%	0.29	529
Baby food	0.3%	0.29	527

Top 100 food types – Avoidable food waste only	Proportion of all avoidable food waste	Kg per household per annum	Tonnes in NZ per annum
Mushrooms	0.3%	0.28	517
Plums	0.3%	0.28	514
Pork	0.3%	0.28	506
Other processed meats	0.3%	0.28	503
Grapes	0.3%	0.27	495
Beetroot	0.3%	0.27	487
Herbs/spices	0.3%	0.26	472
Cook-in sauces	0.3%	0.25	459
Silverbeet	0.3%	0.25	451
Mincemeat	0.3%	0.25	449
Spring onions	0.3%	0.25	448
Hummus	0.3%	0.24	446
Other raw vegetables	0.3%	0.22	408
Leeks	0.3%	0.22	407
Sour cream	0.3%	0.22	400
Dips	0.3%	0.22	398
Pasta - raw	0.2%	0.21	379
Potato crisps	0.2%	0.20	367
Bacon	0.2%	0.20	363
Sodas	0.2%	0.19	352
Other breakfast cereals	0.2%	0.19	339
Cream	0.2%	0.18	335
Milk	0.2%	0.18	328
Other crisps	0.2%	0.18	326
Other ethnic meal, takeaway	0.2%	0.18	323
Fruit pie/strudel/crumble	0.2%	0.18	323

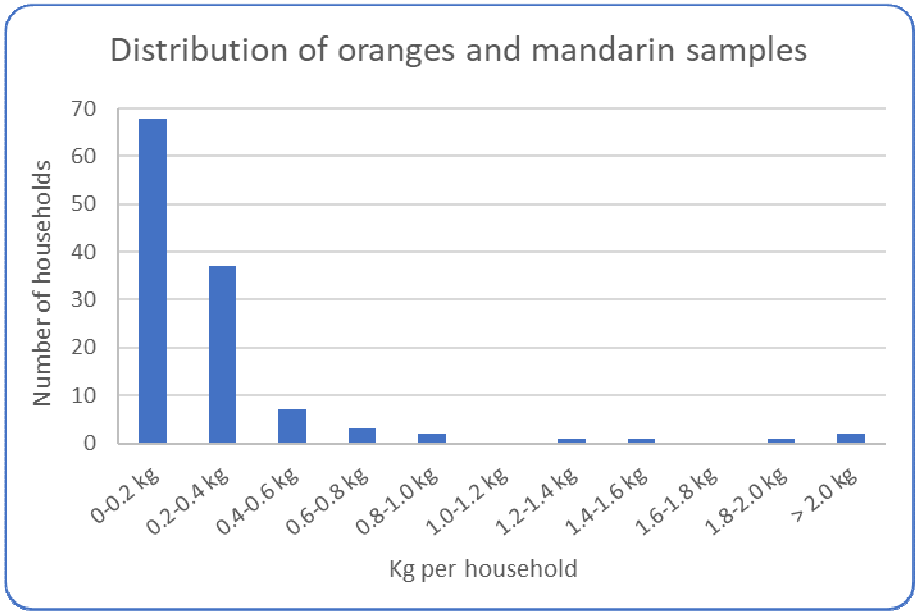
APPENDIX 4 – DISTRIBUTION OF TOP 10 'AVOIDABLE' FOOD TYPES



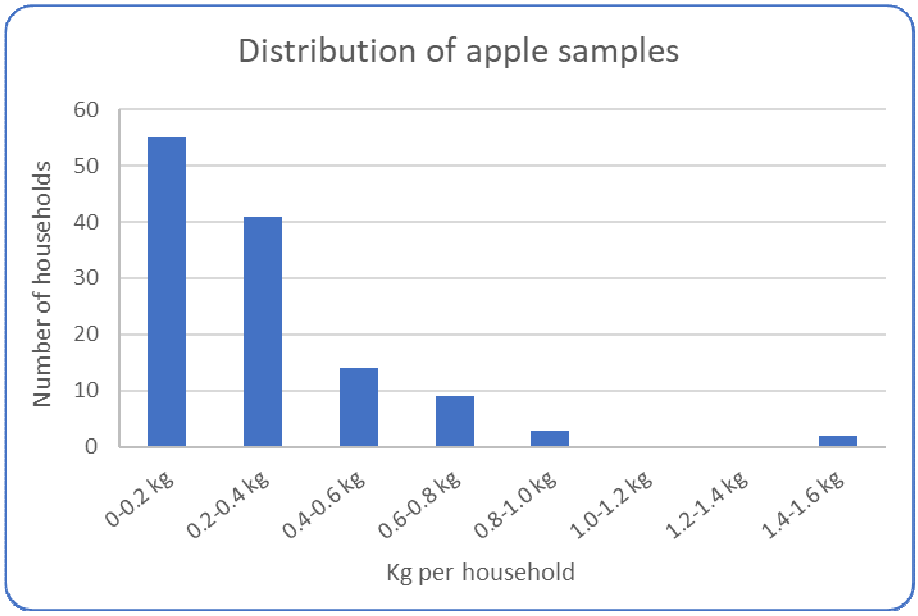
Distribution of 'avoidable' bread samples in 2018



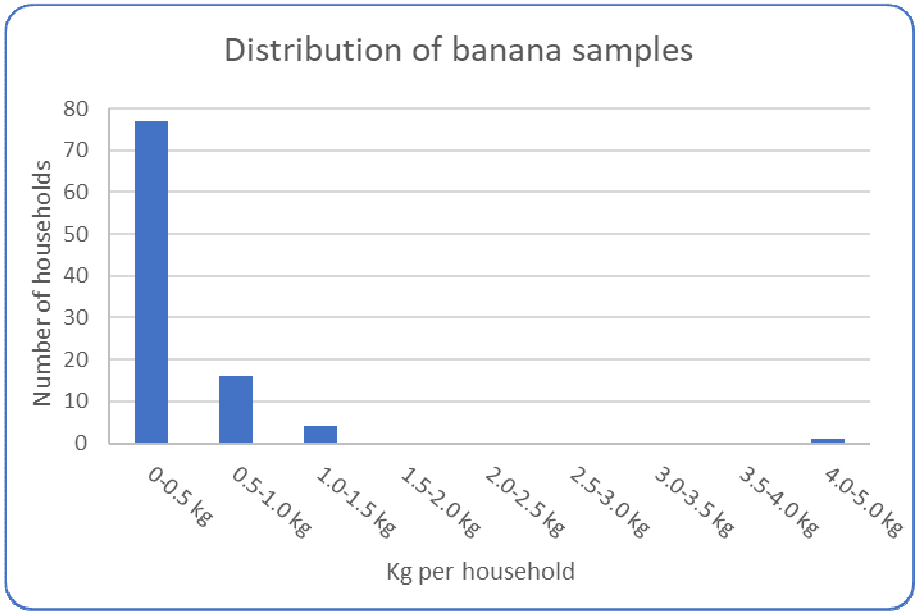
Distribution of 'avoidable' leftover samples in 2018



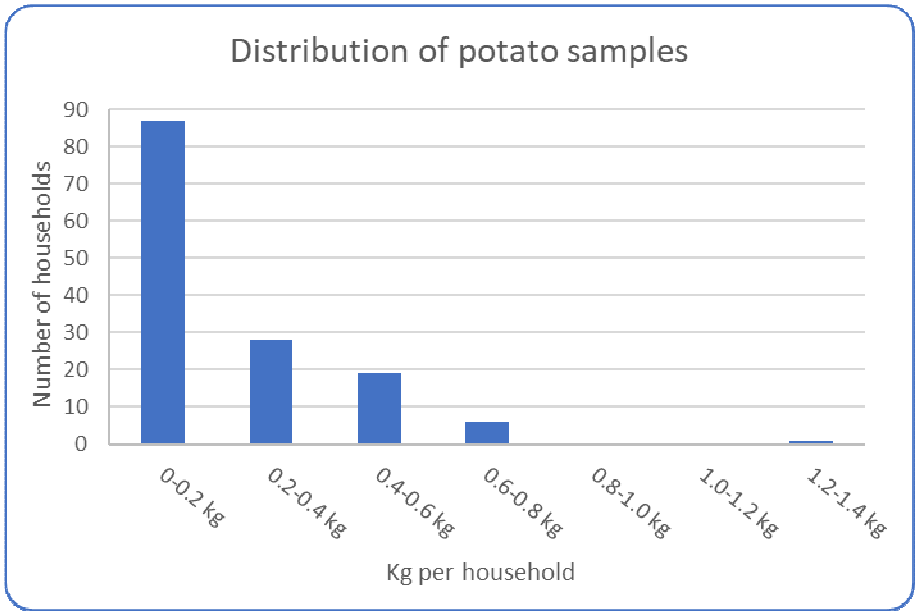
Distribution of 'avoidable' oranges and mandarin samples in 2018



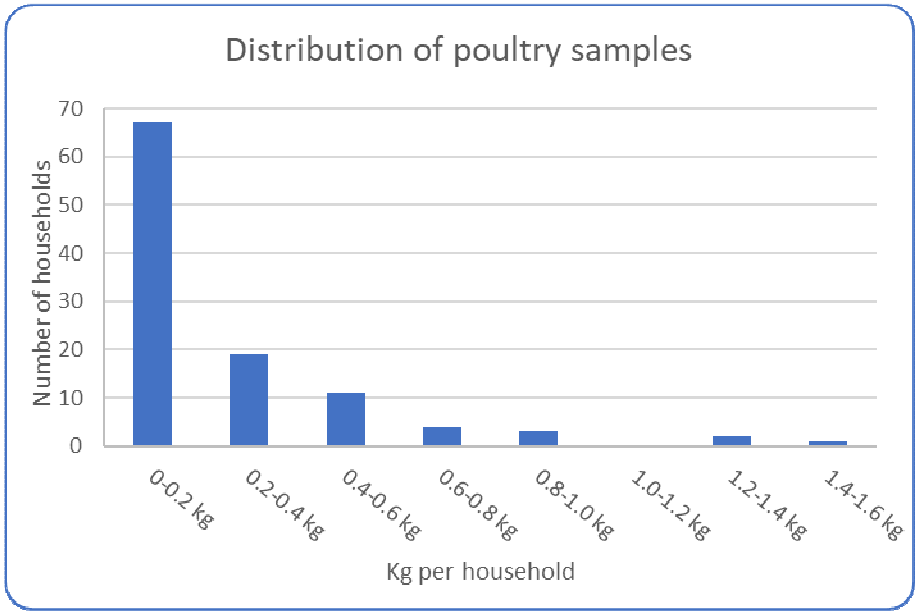
Distribution of 'avoidable' apple samples in 2018



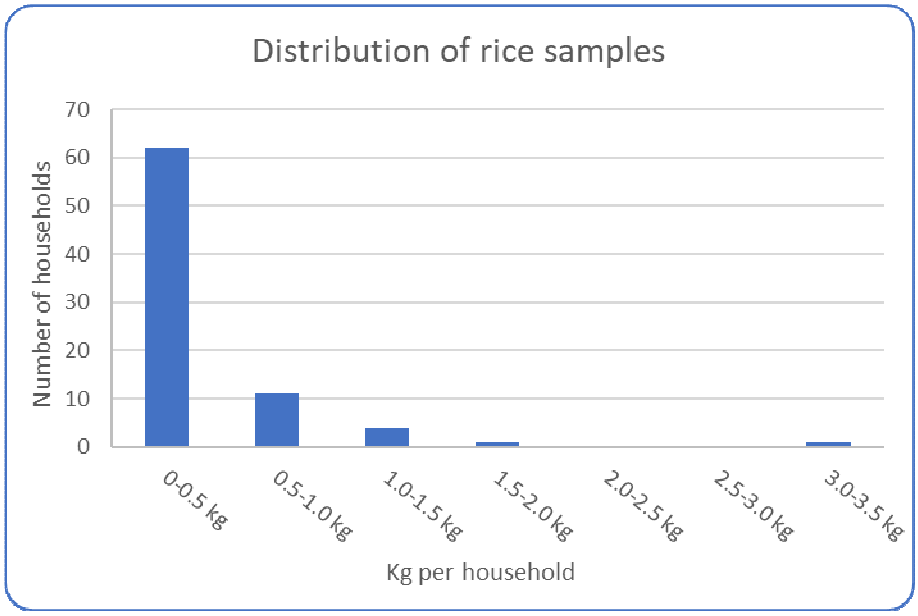
Distribution of 'avoidable' banana samples in 2018



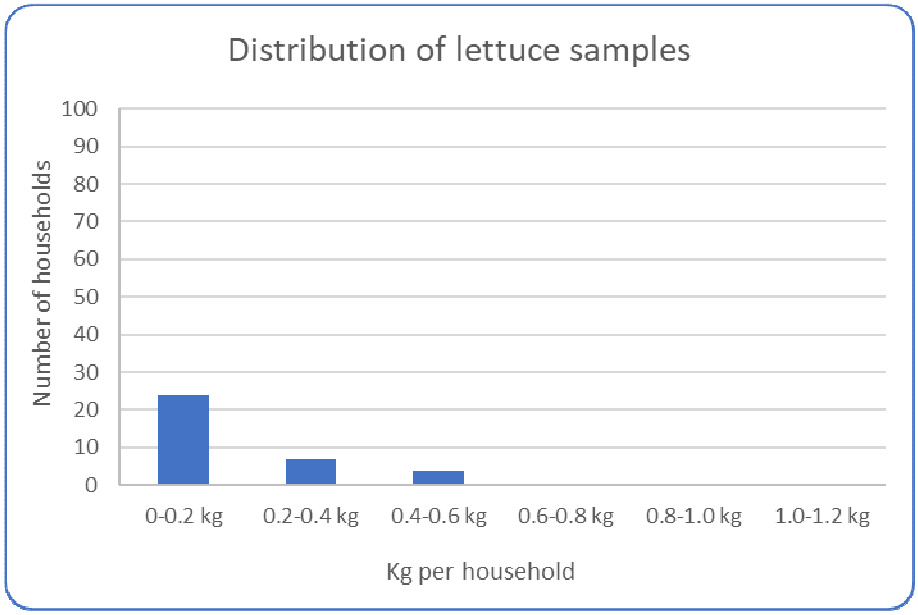
Distribution of 'avoidable' potato samples in 2018



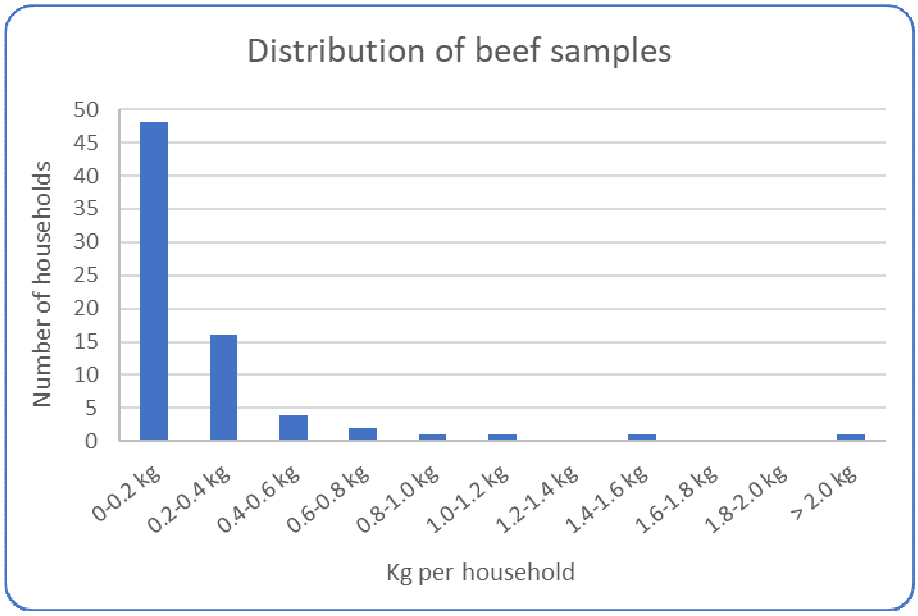
Distribution of 'avoidable' poultry samples in 2018



Distribution of 'avoidable' rice samples in 2018



Distribution of 'avoidable' lettuce samples in 2018



Distribution of 'avoidable' beef samples in 2018