

# Household Food and Drink Waste in the UK



A report containing quantification of the amount and types of household food and drink waste in the UK. Information is collated from recent studies covering all major disposal routes, and can assist WRAP, national and local governments and the food industry to develop policies, advice and tools to help us all reduce the amount of good food and drink that we purchase but don't eat.

WRAP helps individuals, businesses and local authorities to reduce waste and recycle more, making better use of resources and helping to tackle climate change.

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# Executive summary

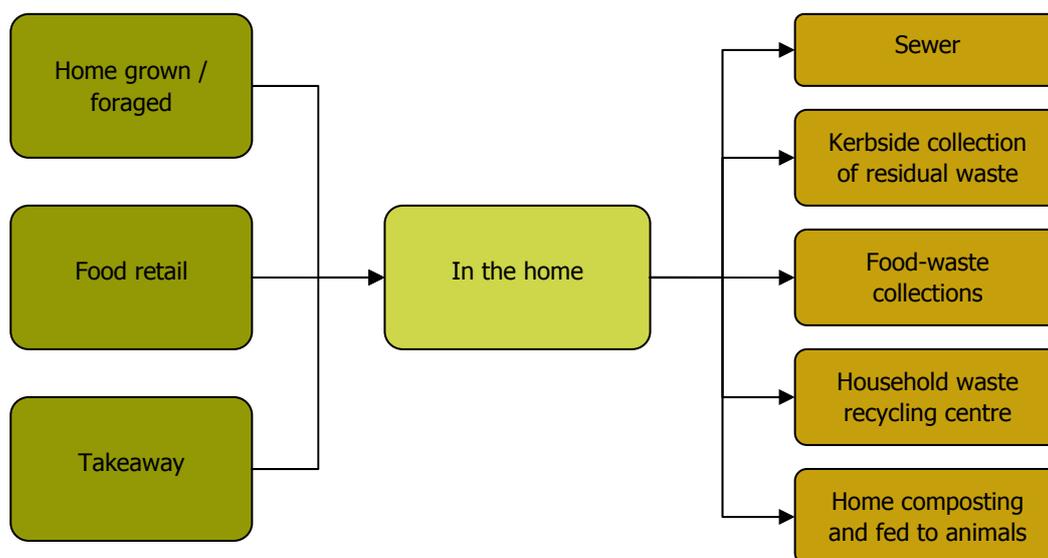
The issue of food and drink waste has moved up the social and political agenda in the UK in recent years, spurred in part by the publication of detailed information on the amount and types of waste produced (*The Food We Waste* report, WRAP, May 2008). Quantification of food and drink waste is of interest to a range of stakeholders including national and local governments, food retailers and manufacturers, waste management companies and concerned members of the public, with the information used to inform food-waste reduction activities, to plan waste collections and treatment, and for prioritisation by national governments.

Since publication of *The Food We Waste*, further research has been undertaken to quantify the amount of food and drink waste that is disposed of via the sewer (*Down the Drain* – published alongside the current report). Given this, it is timely for WRAP to update estimates of household food and drink waste in the UK. This opportunity allows the most recent estimates of household waste to be combined, using a methodology that builds on our learning from the past year.

The current report covers household food and drink waste disposed of via the routes illustrated in Figure A. It does not cover the following (non-household) sources:

- agricultural production
- food manufacture
- retail / wholesale
- hospitality / 'profit' catering (restaurants, pubs, hotels, etc.)
- 'cost' catering (schools, hospitals, services, etc.)
- other business waste streams, e.g. from offices
- street sweepings, litter bins

**Figure A:** Schematic of sources and disposal routes of household food and drink



The methodology used in this report takes information from a variety of sources (Table A). For waste collected by Local Authorities, the information comes from WasteDataFlow (total waste in household streams), the *Review of Municipal Waste Composition* (breakdown of this total which is food and drink waste) and *The Food We Waste* (breakdown of food and drink waste into food groups, food types and reasons for disposal); i.e. at each stage, the most relevant data source has been used. The estimates presented in the report most closely relate to 2007.

**Table A:** Summary of information used in current report

Disposal route via...	Information	Source of Information
Local Authority: <ul style="list-style-type: none"> <li>■ kerbside collections of residual waste;</li> <li>■ kerbside collections of food waste; and</li> <li>■ household waste recycling centres</li> </ul>	Total amount of waste in each stream	WasteDataFlow
	Fraction of total waste that is food and drink (kitchen) waste	<i>Review of Municipal Waste Composition</i> (Defra)
	Details of types of food and drink wasted, cost, reasons for disposal	<i>The Food We Waste</i> (WRAP)
Sewer	Total amount, type of waste, cost, reasons for disposal	<i>Down the Drain</i> (WRAP)
Home composting and feeding to animals	Total amount, type of waste, cost, reasons for disposal	<i>Kitchen Diary</i> (WRAP)

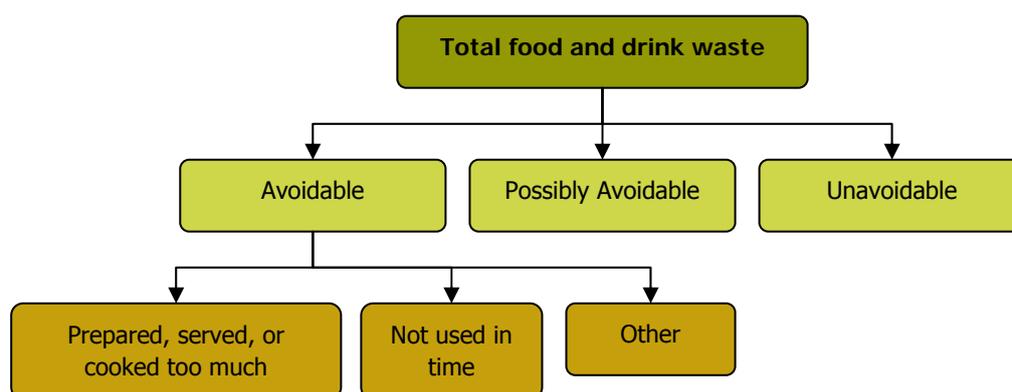
The research categorises food and drink waste by how avoidable the waste was:

- **Avoidable** – food and drink thrown away that was, at some point prior to disposal, edible (e.g. slice of bread, apples, meat).
- **Possibly avoidable** – food and drink that some people eat and others do not (e.g. bread crusts), or that can be eaten when a food is prepared in one way but not in another (e.g. potato skins).
- **Unavoidable** – waste arising from food or drink preparation that is not, and has not been, edible under normal circumstances (e.g. meat bones, egg shells, pineapple skin, tea bags).

Avoidable food and drink waste is further split by the reason for disposal:

- **Cooked, prepared or served too much** – food and drink that has been cooked, prepared or served in the home and subsequently disposed of; in the vast majority of cases, this is because too much food or drink was ‘processed’ in the home, but it would also cover cases where food or drink was damaged during this processing (e.g. burning).
- **Not used in time** – food and drink that has been disposed of because it has passed a date label (e.g. use by, or best before date), that has gone mouldy or rotten, looked, smelt or tasted bad.
- **Other** – any other reasons or waste for which it is not possible to discern the reason for disposal.

**Figure B:** Classification of food and drink waste in the report

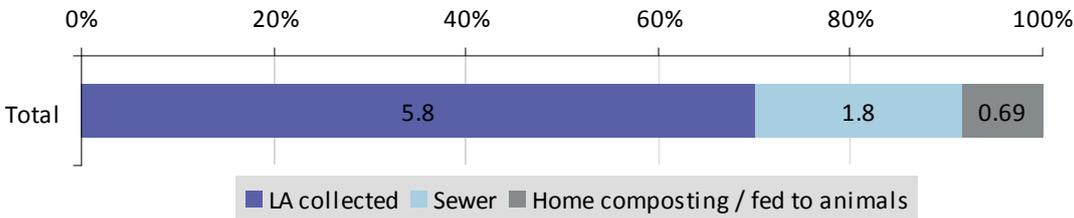


It is estimated that 8.3 ( $\pm 0.3^1$ ) million tonnes per year of food and drink waste is generated by households in the UK. This is the equivalent to 330 kg per year for each household in the UK, or just over 6 kg per household per week. This estimate is higher than *The Food We Waste* due to the updated estimate of food and drink waste disposed of via the sewer.

<sup>1</sup> 95% confidence interval encapsulating sampling errors

Of this, 5.8 million tonnes per year (70%) is collected by Local Authorities (Figure C) – mainly in the residual waste stream (general bin) and food-waste kerbside collections. A further 1.8 million tonnes per year is disposed of via the sewer<sup>2</sup>.

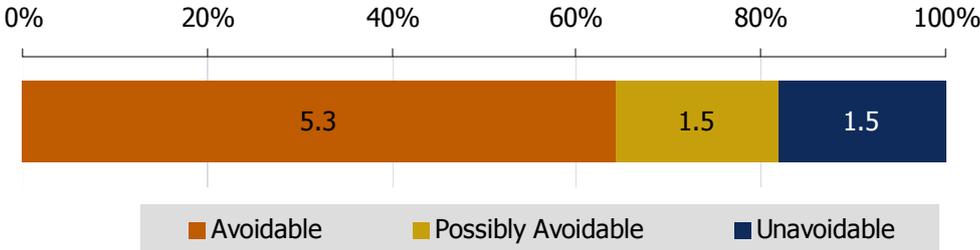
**Figure C:** Weight of food and drink waste generated in the UK, split by disposal route



*Figures within bar state waste in millions of tonnes per year*

5.3 million tonnes per year is avoidable – approximately two-thirds of the 8.3 million tonnes (Figure D). The remaining 3 million tonnes per year is split equally between unavoidable and possibly avoidable waste.

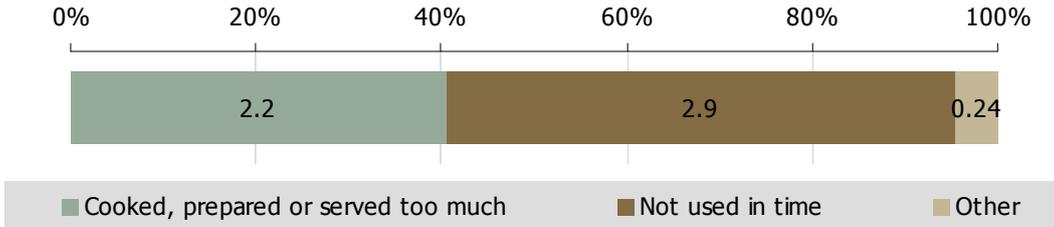
**Figure D:** Weight of food and drink waste generated in the UK, split by avoidability



*Figures within bar state waste in millions of tonnes per year*

Of the avoidable food and drink waste, 2.2 million tonnes is leftover after cooking, preparing or serving and 2.9 million tonnes is not used in time (Figure E).

**Figure E:** Weight of avoidable food and drink waste generated in the UK, split by reason for disposal



*Figures within bar state waste in millions of tonnes per year*

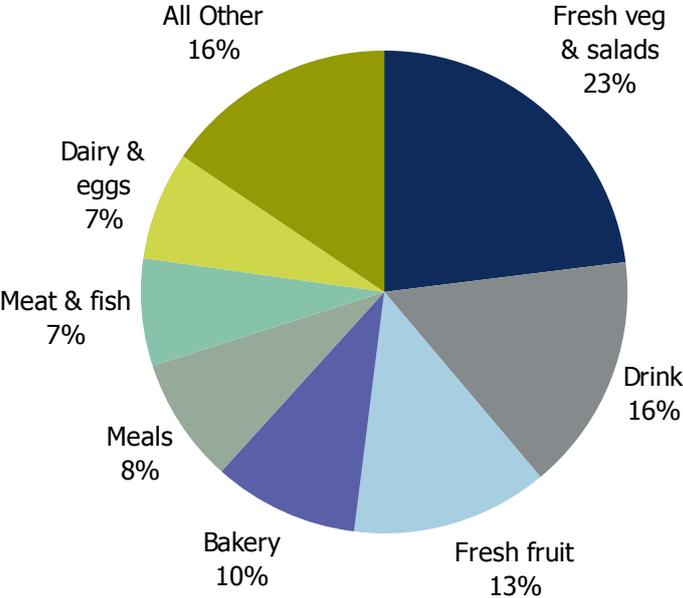
The food and drink waste generated comprises many different groups of food and drink (Figure F). The most prominent by weight are fresh vegetables and salad, which make up almost a quarter of arisings, drink (16%), fresh fruit (13%) and bakery (10%).

The updated figures relating to the sewer have an influence on the estimate of the proportion of purchases that are wasted. This is largely due to a lower proportion of liquid foods and drinks being wasted, compared to solid foods. There is also a large variation in the proportion of purchases that are wasted between different types of food and drink. For instance, 7% of milk purchases are wasted, 36% of bakery, and over 50% of lettuce and leafy salads (by weight).

<sup>2</sup> Excluding tap water added in the home to constitute foods such as tea, coffee and gravy

As an overview, the amount of food (including liquid and solid foods but excluding drink) wasted per year is 25% of that purchased (by weight). For food **and drink**, the 8.3 million tonnes per year of waste represents 22% of purchases (again, by weight).

**Figure F:** Proportion of weight of all food and drink waste, split by food group



To purchase the avoidable fraction of the food and drink waste would cost people in the UK a total of £12 billion per year<sup>3</sup>, an average of £480 per household per year. The greenhouse gas emissions associated with avoidable food and drink waste is the equivalent of approximately 20 million tonnes of carbon dioxide per year. This is roughly 2.4% of greenhouse gas emissions associated with all consumption in the UK.

In conclusion, reducing the considerable amount of household food and drink waste generated in the UK saves households money, whilst reducing our environmental impact.

<sup>3</sup> In prices current at the time of the original fieldwork.

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## Glossary and Abbreviations

- Avoidable waste – a classification used in the report relating to food and drink thrown away that was, at some point prior to disposal, edible, e.g. milk, lettuce, fruit juice, meat (excluding bones, skin, etc.); c.f. possibly avoidable and unavoidable waste
- Cooked, prepared or served too much – a classification used in the report relating to the reason for disposal; it includes food and drink that has been cooked, prepared or served in the home and subsequently disposed of; in the vast majority of cases, this is because too much food or drink was ‘processed’ in the home, but it would also cover cases where food or drink was damaged during this processing (e.g. burning)
- Defra – Department of Environment, Food and Rural Affairs
- Disposal route – the method by which household food and drink waste is collected or removed from the home; this term does not necessarily imply that the waste goes to landfill (see also Sewer, Local Authority collections, home composting and fed to animals)<sup>4</sup>.
- Food – includes milk
- Food group – broad classification of food and drink (e.g. bakery, drink, fresh fruit)
- Food type – detailed classification that subdivides ‘food group’ (e.g. fresh fruit is subdivided into types of fruit)
- Home composting and feeding to animals – a combined disposal routes considered in this report
- HWRC – Household waste recycling centre (also known as civic amenity sites)
- LA – Local Authority
- Local Authority collections – in this report, this refers to the household waste streams collected by, or on behalf of, the Local Authorities; these include kerbside collection of residual waste (the ‘general’ bin), food waste collections (including garden waste collections that accept food waste) and household waste recycling centres
- Not used in time – a classification used in the report relating to the reason for disposal; it includes food and drink that has been disposed of because it has passed a date label (e.g. use by, or best before date), that has gone mouldy or rotten, looked, smelt or tasted bad
- Possibly avoidable waste – a classification used in the report relating to food and drink that some people eat and others do not, e.g. bread crusts, or that can be eaten when a food is prepared in one way but not in another, e.g. potato skins; c.f. avoidable and unavoidable waste
- Unavoidable waste – a classification used in the report relating to waste arising from food and drink preparation that is not, and has not been, edible under normal circumstances, e.g. meat bones, egg shells, pineapple skin, tea bags; c.f. avoidable and possibly avoidable waste
- Sewer – one of the major household disposal routes of food and drink waste considered in the report, including material disposed of via the sink, toilet or other inlet to the sewer system
- WRAP – Waste & Resources Action Programme

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- Simon Budd and Peter Robinson for preliminary data analysis.

<sup>4</sup> The word ‘disposal’ is used here in its everyday sense. It is not used in the same sense as the legal definition of ‘disposal’ in Article 3 of the EU Waste Framework Directive (2008/98/EC), but is more akin to the Directive terms ‘treatment’ or ‘waste management’.

## 1 Introduction

The issue of food and drink waste has moved up the social and political agenda in the UK during 2008 and 2009. This was assisted by the publication of *The Food We Waste* report in May 2008, which quantified the types of household food and drink waste in the UK for the first time. This research has underpinned activities that raise awareness of this issue and help people to reduce the amount of waste generated. The environmental and financial benefits of cutting food and drink waste have since become more widely understood.

Since the publication of *The Food We Waste*, further research has been undertaken to understand the scale of food and drink waste being disposed of through channels other than the general bin and food-waste collections. The most significant contribution relates to disposal via the sewer and is disseminated in the report *Down the Drain* (§1.4.3).

Given these other research activities, it is timely for WRAP to update estimates of household food and drink waste in the UK. This opportunity allows the most recent and appropriate estimates of household waste to be combined using a methodology that builds on our learnings from the past year. This report contains these updated statistics, information to place them in context (e.g. purchase information) and a description of the methodology used in the calculations.

**Table 1:** Where different types of information are found in the report

Type of information	Suggested chapters
General understanding of food and drink waste in the UK	Chapters 2-4
Details relating to specific groups of food and drink	Chapters 2 & 5-12
Methodological information	Chapter 1 and Appendices
What this information means for an average household	Chapter 13

In the opening chapter, the background to this research is outlined beginning with a description of WRAP and its activities relating to the reduction of food and drink waste. The reasons for quantifying household food and drink waste are discussed in relation to the diverse range of stakeholders. The scope of the research is detailed in light of the various requirements of stakeholders, including definition of 'household', and the waste streams and types of material included in this research. Finally, the data sources and methodology used to obtain estimates in the report are described, alongside justification for their use.

Chapter 2 describes how information is reported in the Chapters 3-12 and its limitations. Chapter 2 should be read prior to those containing detailed quantification. Chapter 3 details the headline figures for household food and drink waste in the UK, broken down by disposal route, how avoidable the waste is, and the reason for disposal. Information is given by weight of the waste; quantification of the cost and environmental impact of the avoidable food and drink is also included.

The contribution to the total waste by each 'food group' (e.g. fresh fruit, drinks, bakery) is given in Chapter 4. As with Chapter 3, this is split by disposal route, avoidability and reason for disposal. Chapters 5-12 provide similar information at the most detailed level – by 'food type' (such as rice, apples, tea etc).

The final chapter of the main report (Chapter 13) draws together the preceding information and restates these quantities for an 'average' household over the period of a month. The appendices give details of the underpinning calculations.

### 1.1 WRAP and food-waste activities

WRAP helps individuals, businesses and local authorities to reduce waste and recycle more, making better use of resources and helping to tackle climate change. Established as a not-for-profit company in 2000, WRAP is backed by government funding from England, Scotland, Wales and Northern Ireland. More information on WRAP's work can be found on [www.wrap.org.uk](http://www.wrap.org.uk).

The reduction and recycling of food waste produced by people in their own homes is a major strategic priority for Governments and for WRAP, and involves several different approaches. When WRAP started working on food

waste in 2004 there was very limited information about the amounts and types of food waste produced. Good information on this, along with reasons why the waste is produced, is crucial in working with industry on reducing household food waste and for the development and targeting of the consumer-facing Love Food Hate Waste campaign, which was launched in November 2007 (<http://www.lovefoodhatewaste.com>). In order to address the knowledge gap, WRAP launched a major research programme in 2006, involving a range of qualitative and quantitative studies which can be found at: [www.wrap.org.uk/retail/case\\_studies\\_research/index.html](http://www.wrap.org.uk/retail/case_studies_research/index.html).

WRAP is also engaged with research quantifying elements of non-household food and drink waste: from both the hospitality sector and from food manufacturers, distributors and retailers.

In parallel, WRAP's Retail Programme has worked to develop the Courtauld Commitment, to which more than 40 retailers and brand owners have now signed up; this commits them to working in a range of ways to reduce both household packaging and food waste. Examples of industry initiatives can be found at: [http://www.wrap.org.uk/retail/courtauld\\_commitment/index.html](http://www.wrap.org.uk/retail/courtauld_commitment/index.html)

WRAP has a target to reduce UK consumer food waste by 250,000 tonnes by April 2011, saving households over £600 million and reducing carbon dioxide (CO<sub>2</sub>) equivalent emissions by over 1 million tonnes.

Since 2004, WRAP has also promoted home composting, whilst the organics programme has developed the commercial composting market, initially to enable more green waste to be processed but more recently to also encourage the centralised treatment of source-segregated food waste.

## 1.2 The need to quantify household food and drink waste in the UK

Information on food and drink waste generated in UK households is of interest to a diverse range of stakeholders – from Local Authorities to food manufacturers to concerned members of the public. The focus for the majority of stakeholders is the reduction of the amount of waste generated and / or extraction of the maximum benefit from the waste that is generated. The information required by these stakeholders is varied, including quantification of the total amount generated, the types of food and drink being wasted and the reasons for disposal. This section describes some of the uses of household food and drink waste data:

### Quantification of the impact of food and drink waste

The impacts of food and drink waste include the amount going to landfill and down the sewer, the cost to stakeholders – members of the public purchasing food and drink that is wasted and Local Authorities who pay for its collection and treatment – and the environmental and social impacts. To estimate these impacts, the amount and types of food and drink waste need to be known.

This information can be used by, e.g.:

- national governments – the information generated places the issue of food and drink waste in context, aiding planning and funding decisions. It can also help to determine the extent to which reducing this waste can contribute to the UK meeting obligations relating to landfill and green-house gas emissions;
- WRAP – to assess the benefits of interventions focused on food-waste reduction, allowing strategic and tactical decisions to be made in its delivery of the household food-waste reduction programme; and
- retailers and manufacturers of groceries and packaging – to determine which foods and drinks on which to focus waste-prevention activities.

This report includes the amounts of food and drink waste at a level of detail that allows cost and environmental impacts to be calculated. Estimates of cost to households are included (§3.2) alongside calculations of greenhouse gas emissions relating to food and drink waste (§3.3).

### Food-waste collection and treatment

In recent years, the number of Local Authorities collecting food waste separately from the residual (general) waste stream has increased; in 2008-09, household food-waste collections were operated by 31% of UK Local Authorities<sup>5</sup>. By collecting food waste separately, it is possible for a greater proportion to be diverted from landfill to treatment methods that reduce the environmental impact of this waste, such as anaerobic digestion or in-vessel composting.

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<sup>5</sup> Source: WRAP collation of information from LA websites and telephone survey. Information for Waste Collection Authorities and includes separate food waste collections and collections schemes accepting food waste with garden waste. It should be noted that schemes may not cover the whole of the Local Authorities involved, and, in the areas that do have collections, not all households necessarily participate.

For planning purposes, it is useful for Local Authorities, waste-management companies, and operators of anaerobic digestion and in-vessel composting facilities to have information on:

- the average quantity of food waste generated by a household;
- the variation in amount of food waste between types of households (e.g. by number of occupant); and
- the proportion of this total that is put out for collection.

This research estimates the total amount of food and drink waste generated by UK households, and thus helps understand the potential scope for collection and treatment of this waste. However, the research contains neither likely participation rates in collection schemes nor information on factors influencing the amount collected. This type of information can be found in WRAP's evaluation of food-waste collection trials<sup>6</sup>.

#### Behaviours associated with generation of food and drink waste

For public campaigns aimed at reducing household food and drink waste, it is useful to understand how the amount and types of food and drink waste relate to attitudes and behaviours (both actual behaviours and those claimed). Understanding these variations can help to plan campaigns: which groups of people to focus on; channels of engagement; and design of campaign material.

There are a large number of behaviours that influence the amount of food and drink waste generated by a household. These relate not only to shopping, food storage and preparation but also to types of food and drink consumed. The analysis required to disaggregate these factors is complicated, and not included in this report. However, consideration of the issues will continue to underpin WRAP's campaign and information relating to household size and the presence of children is included in §3.4.

### 1.3 Definition of household food and drink waste

This section defines what types of material are included in the report – i.e. a definition of food and drink waste. Furthermore, it details the flow of food and drink-related material in the UK – from purchase to disposal – which allows 'household' to be defined.

#### 1.3.1 Definition of material types

**Table 2:** Definitions relating to food and drink waste

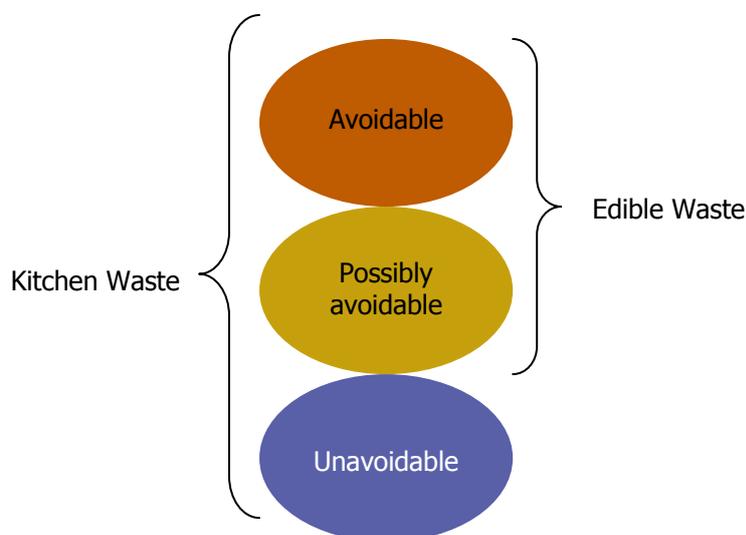
Waste Fraction	Description	Corresponding fractions in this report (§2.4)
Kitchen waste	Food or drink disposed of, including associated inedible material, such as bones from meat, egg shells, and inedible parts of fruit and vegetables, but excludes man-made packaging associated with food or drink, e.g. glass bottles, polymer film, aluminium cans.	All (avoidable, possibly avoidable and unavoidable)
Edible waste	Food and drink disposed of, excluding inedible material and packaging. It should be noted that this food and drink may not actually be edible at the point of disposal (e.g. it may have gone mouldy). However, it is composed of the fraction of food and drink that was, at some point, edible.	Avoidable and possibly avoidable
Avoidable waste	Food and drink, excluding inedible material and packaging. Further excluded are foods that some people eat and others do not (e.g. bread crusts), or that can be eaten when a food is prepared in one way but not in another (e.g. potato skins).	Avoidable

As discussed in §1.2, there are many people and organisations interested in food and drink waste. Their various requirements necessitate different definitions of food and drink waste. Table 2 describes three common definitions. 'Kitchen waste' is often used by Local Authorities and corresponds to what many food-waste collection schemes accept.

<sup>6</sup> [http://www.wrap.org.uk/downloads/Evaluation\\_of\\_the\\_WRAP\\_FW\\_Collection\\_Trials\\_Update\\_June\\_2009.bc3a65e8.7271.pdf](http://www.wrap.org.uk/downloads/Evaluation_of_the_WRAP_FW_Collection_Trials_Update_June_2009.bc3a65e8.7271.pdf)

The categories used in this report – avoidable, possibly avoidable and unavoidable – are listed in the third column of Table 2 (full descriptions of these fractions can be found in §2.4). The links between the classifications used in this report and those listed above are further illustrated in Figure 1. By including information on all three classifications in this report, it is possible to provide information useful to the majority of stakeholders.

**Figure 1:** Schematic illustrating the link between definitions associated with food and drink waste



In this report, food and drink are defined as waste if they are not consumed by a human. This definition is broadly in line with the definition of waste in European directive 2008/98/EC: ‘any substance or object which the holder discards or intends or is required to discard’. It could be argued that there is a slight discrepancy between these definitions when it comes to food and drink that has been either home composted or fed to animals. In such cases, this material has not been consumed by a human, but it has still been used to provide some value to the holder (e.g. by displacing purchases of compost or pet food). However, for the edible fraction of food at least, the value reduces greatly if not consumed; for instance, the value of the compost generated from food waste is generally a small fraction of the retail price of the food used to create it. Nevertheless, the amount of food and drink home composted and fed to animals is reported separately, allowing the reader to use the most appropriate estimate for their needs.

### 1.3.2 Definition of household

Given that this report focuses on household food and drink waste, it is important to define waste arising from households, as opposed to other sources. As illustrated in Figure 2, there are a number of sources of food and drinks that are consumed within the home. The largest of these sources is retail, but other contributions include home-grown food and takeaways.

For the purposes of this report, the following are classified as **household** waste streams:

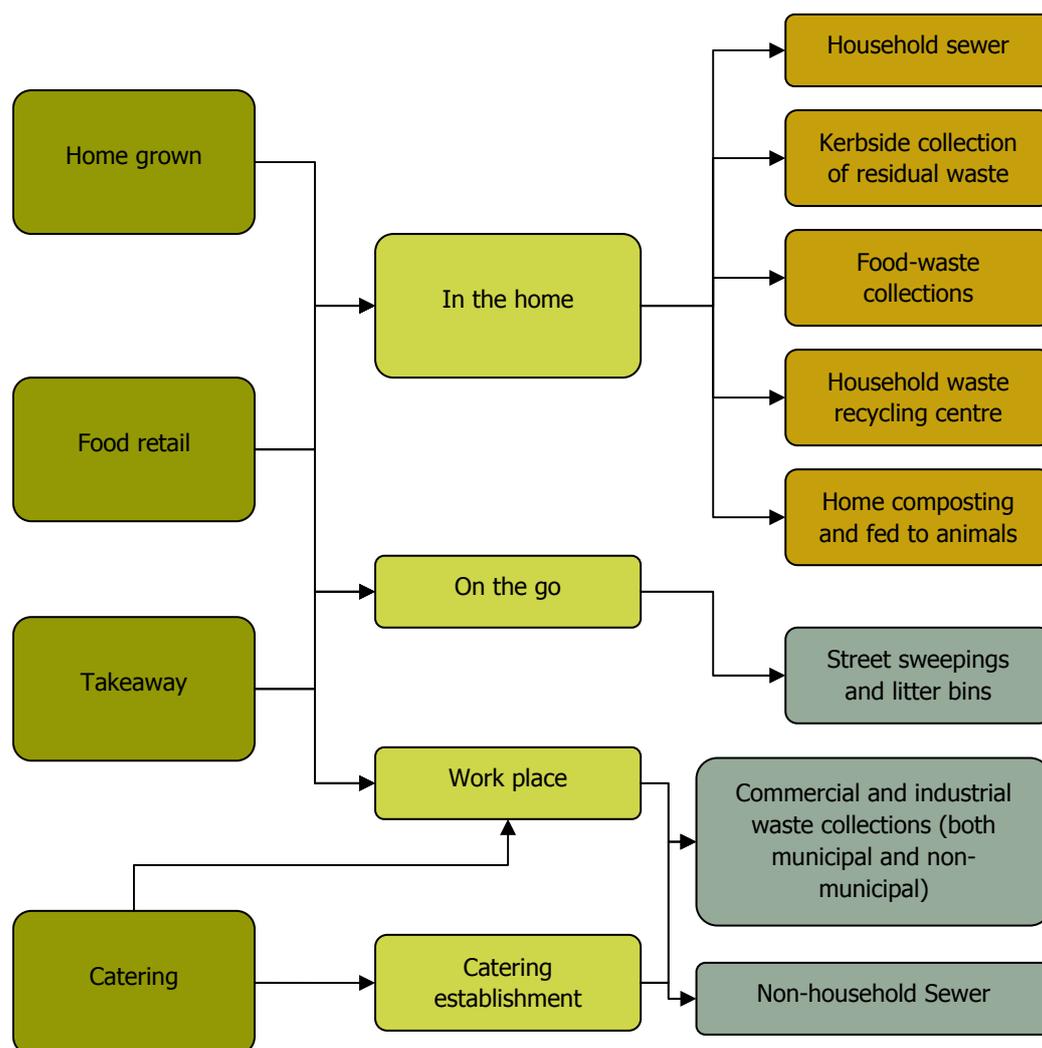
- residual waste stream (general bin);
- food-waste collections by Local Authority;
- household waste recycling centres (HWRCs, also known as civic amenity sites);
- the sewer (mostly down the sink);
- home composting; and
- fed to animals.

This means that food and drink waste disposed of outside the home – via street sweepings and litter bins, commercial waste streams and commercial sewers – is excluded from the definition of household waste. In effect, this excludes the vast majority of food and drink that is eaten outside of the home, i.e. foodstuffs eaten on the go, in the workplace, or in a catering establishment. There may be some waste that comes into the home associated with consumption outside of the home (and *vice versa*), e.g.:

- doggy bags – food sold by catering establishments such as restaurants that was not eaten on site and is subsequently taken home for consumption / disposal;
- fly tipping – food waste disposed of illegally; this could come from multiple sources including household.

However, it is likely that these latter flows are minor in comparison to those in Figure 2, and, for this reason, they have been assumed negligible in this report.

**Figure 2:** Schematic of major flows of food and drink and associated waste routes



### 1.3.3 Sources of food and drink waste

This report only describes food and drink waste arising from households. However, households are not the only source in the UK. Significant amounts of food and drink waste are also associated with:

- agricultural production;
- food manufacture;
- retail / wholesale – including distribution and from stores;
- hospitality / 'profit' catering – restaurants, pubs, hotels;
- 'cost' catering – schools, hospitals, services, etc.; and
- other business waste streams, e.g. from offices.

This current report does not detail the amount of food and drink waste associated with waste streams other than household. However, there are estimates that suggest that non-household waste sources contribute at least 9 million tonnes of food and drink waste per year in the UK<sup>7</sup>.

WRAP is also engaged in pieces of research to quantify the amount and types of food and drink waste in some of these elements of the food supply chain.

<sup>7</sup> [http://www.cabinetoffice.gov.uk/media/cabinetoffice/strategy/assets/food/food\\_matters1.pdf](http://www.cabinetoffice.gov.uk/media/cabinetoffice/strategy/assets/food/food_matters1.pdf) (p. 90) - this estimate excludes agricultural food waste, for which few accurate estimates exist. Household food waste is subtracted from the estimate presented in the reference.

- Hospitality – survey and compositional audit of food, drink and packaging waste generated from certain sectors within the hospitality industry including hotels, pubs, restaurants, quick service restaurants<sup>8</sup>. The work is being undertaken by Enviros Consulting Ltd and is due to report later in 2009.
- Retail supply chain research (joint delivery with Envirowise):
  - survey of product and packaging waste generated in food manufacturing, grocery distribution and in-store (any point from factory in-gate to point of sale); work being undertaken by DHL Environmental Compliance Solutions with the aim of publishing the final report in early 2010; and
  - resource maps – collation of detailed information on the flow of material through the supply chain of certain food categories; for instance, the first category to be investigated is fruit and vegetables and this is being undertaken by Cranfield University working with the IGD, the Fresh Produce Consortium and Ed Moorhouse Consulting with the aim of reporting later in 2009.

Although these pieces of research investigate discrete sources of food and drink waste, it should be noted that there are likely to be interactions between these sources. For example, where food and drink is pre-prepared prior to purchase, the associated waste is generated by the manufacturer or retailer, rather than in the home, e.g.:

- where ready meals are purchased in preference to home preparation of ingredients;
- where vegetables are sold trimmed (e.g. carrots already topped and peeled); and
- where fruit is sold pre-prepared (e.g. as fruit salad).

This interaction will also have some impact on the packaging associated with products, and in general there is an interaction between packaging and food and drink waste. For this reason, it will be important in the future to draw together relevant research to give a coherent picture of food and drink waste and packaging throughout the supply chain in the UK.

## 1.4 Measurement of food and drink waste

There are a number of possible methods for estimating the amount of household food and drink waste in the UK.

- **Compositional analysis** – recording food and drink waste through analysis of waste streams.
- **Diary keeping** – recording food and drink waste at the point of creation (usually the kitchen). One example of this would be a sample of the population keeping a food-waste diary.
- **'Subtraction method'** – measuring the difference between purchases and consumption of food and drink, and assuming that the difference is waste.

The latter method suffers from the fact that estimates of food and drink consumption have relatively large uncertainty associated with them, making this an unsuitable method for estimating waste.

The following section explores data available for quantifying food and drink waste in the UK. This includes compositional analysis and diary keeping, but also extends to other information sources.

### 1.4.1 WasteDataFlow

WasteDataFlow is a web based system that allows UK local authorities to report municipal waste data to Government. The waste collected by Local Authorities is weighed and reported to WasteDataFlow, split by waste streams, e.g. kerbside residual, street sweeping and litter bins. This system is the only data collection system for municipal waste arisings in the UK and has a 100% response rate.

There are other methods of obtaining an estimate of total household waste arisings within the UK. These would include sampling waste from collection rounds and extrapolating the information to the whole of the UK. However, the amount of waste generated and collected varies with many factors (e.g. time of year, housing type, waste and recycling collection system) and this presents issues in designing a sampling framework and obtaining a robust estimate.

For these reasons, WasteDataFlow is used in the current research as an estimate of total household waste arisings in the UK.

### 1.4.2 Compositional Analyses

Compositional analysis is a key method in determining the constituents of waste streams collected by Local Authorities. In its simplest form, compositional analysis involves households setting out their waste in the usual way (e.g. placing their bins on the edge of their property) and for this waste to be collected by those undertaking

<sup>8</sup> Quick service restaurants are popularly known as fast-food outlets

the analysis, rather than the usual waste collection operatives<sup>9</sup>. This waste is sorted into components and these are weighed and categorised. The number of categories into which the waste is sorted varies between studies, depending on the focus of the study and its budget. For example, the compositional analysis associated with *The Food We Waste* research categorised food waste into over 150 different types, a much higher level of detail than the vast majority of compositional analyses.

Two compositional-analysis studies are especially useful for the estimation of food and drink waste in the UK:

#### ***Review of Municipal Waste Composition***

This study<sup>10</sup> was commissioned by Department for Environment, Food and Rural Affairs (Defra) and undertaken by Resource Futures. The study collated the results from compositional analyses that had been performed on waste streams in a single area, mainly within one waste-collection authority or waste-disposal authority. Selection criteria were applied to compositional analyses, namely:

- a study carried out in 2005 or more recently;
- two or more phases – i.e. some attempt to account for seasonal variations; and
- some stratification to control for the area types when generalising results for an area.

Applying these selection criteria gave sufficient information to obtain estimates of the proportional split by material of the major waste stream in England. In contrast, for Scotland, Wales and Northern Ireland there were an insufficient number of compositional studies passing the criteria to make such estimates<sup>11</sup>. For England, this review provided quantitative information on the fraction of food and drink waste (including confidence intervals) for the relevant waste streams. In the case of kerbside residual waste, over 100 studies were used to obtain this estimate (see Appendix A.1 for further details).

The definition of food and drink waste used in the majority of these studies was consistent with 'kitchen waste' (§1.3.1), i.e. including avoidable, possibly avoidable and unavoidable waste. There is rarely any breakdown of the types of food and drink that the kitchen waste comprises. Thus, to meet the requirements of many stakeholders, further information relating to this breakdown is required, as detailed in the following section.

#### ***The Food We Waste Research***

*The Food We Waste* research was commissioned by WRAP and carried out by Exodus Research and WastesWork to obtain more detail about the types of food and drink collected by, or on behalf of, Local Authorities. The fieldwork for the research was carried out in multiple areas of 11 Local Authorities in England and Wales – comprising over 2000 households – in autumn 2007. It included two elements:

- a questionnaire relating to attitudes and claimed behaviours relating to the generation of food and drink waste; and
- compositional analysis of food and drink waste collected by Local Authorities.

The compositional analysis focused on the food and drink waste in collections of residual waste and, where applicable, food-waste collections (including schemes where food waste is accepted in the garden waste receptacle). Food waste was separated from other waste, categorised into food type, preparation state and weighed. Other information, include the presence of packaging was also recorded. Full details of the methodology can be found in the original report<sup>12</sup>.

An analogous study to *The Food We Waste* was performed in Scotland, again commissioned by WRAP and undertaken by Exodus and WastesWork. The fieldwork was conducted in autumn 2008 and the report was launched in September 2009. This piece of research has not been used to obtain estimates in the current research for reasons detailed in Appendix A.2. In the future, WRAP will explore methods to combine datasets from these similar pieces of research.

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<sup>9</sup> It should be noted that all WRAP-commissioned compositional analyses relating to food waste requires informed consent from households prior to the collection of their waste.

<sup>10</sup> *Municipal Waste Composition: A Review of Municipal Waste Component Analyses; Defra Project Number WR0119 (to be published soon)*

<sup>11</sup> In light of this finding, programmes of compositional analysis have been commissioned in Scotland and Wales via WRAP. The final reporting for these will occur in 2009 and 2010 respectively.

<sup>12</sup> [www.wrap.org.uk/thefoodwewaste](http://www.wrap.org.uk/thefoodwewaste)

### 1.4.3 Diary Research

Not all information relating to household food and drink waste can be obtained via compositional analysis. Some waste, for example, that which is home composted or fed to animals, is not collected by Local Authorities, or indeed any other party. For material disposed of via the sewer, it is often not possible to determine the type of waste once it has been poured down the sink.

Given these challenges, diary research is the only realistic methods of capturing quantitative information on waste disposed of via these routes. Diary research involves individuals in a household recording, in these cases, the food and drink waste that they generate, including the type, the amount (weight or volume), and reason for disposal.

Diary research does have limitations, relating to:

- participants forgetting to record items;
- participants choosing not to record items; and
- participants changing behaviour during the diary recording period, often in favour of behaviours that they perceive as more positive (e.g. generating less waste than usual).

The effect of these issues can be reduced via good briefing of participants, clear instructions and a well designed recording system. With regard to food and drink waste, it is likely that limitations will result in an underestimate of food waste generated, although it is not possible to determine the scale of any systematic error in the results. These limitations should be borne in mind when interpreting the results.

Two pieces of diary research have been used in the current report and these are discussed below.

#### ***Down the Drain***

The objective of this research was to quantify the food and drink waste being disposed of down the sewer – mainly via the sink. The work was commissioned by WRAP and carried out by Exodus Research, with the field work taking place in March 2008. Over 300 full participants took part in the research. The report for this work will be published alongside the current report<sup>13</sup>.

Together with a questionnaire relating to attitudes and claimed behaviours relating to food and drink waste, participants measured the volume or weight of food and drink waste that they were about to dispose of via the sewer. They were provided with weighing scales and measuring jugs for this purpose. The participants also provided a description of the waste and the reason for disposal, e.g. leftover at the end of a meal.

The items recorded were placed into categories consistent with *The Food We Waste* research by the researchers and approximate costs of the waste were determined. For food and drinks which are made by adding tap water in the home (e.g. tea, gravy made from granules), the quantity of this added tap water was estimated. Estimates of food and drink waste were reported that both included and excluded this added water.

In the current research, estimates **excluding** the tap water added in the home are used, i.e. the lower of the two estimates. This has the benefit of simplifying the comparison of food and drink waste with food purchases. This decision should be remembered when interpreting the results<sup>14</sup>.

This research informed the amount and composition of food and drink waste disposed of via the sewer.

#### ***Kitchen Diary Research***

The *Kitchen Diary* research predated *The Food We Waste* and sewer-based research. It was commissioned by WRAP and carried out by Exodus research, with the fieldwork in February 2007. Some results from this work are quoted in *The Food We Waste*; the original research is unpublished.

It comprised almost 300 participants, who were asked to record food and drink waste generated and the disposal route of each item. Although there is evidence to suggest significant under-reporting of some waste streams from diary research – especially those collected by Local Authorities – the estimate of food and drink waste that is

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<sup>13</sup> [www.wrap.org.uk/downthedrain](http://www.wrap.org.uk/downthedrain)

<sup>14</sup> *It should be noted that this estimate excluding tap water added in the home is not an estimate of the dried solids disposed of via the sewer – there is still a substantial amount of water within the waste that is included in this estimate. An estimate of dry solid content is found in Down the Drain.*

composted at home is consistent with other calculations performed by WRAP (unpublished). Given this consistency and in the absence of any other source of detailed information, it was decided to use the *Kitchen Diary* Research for estimates of food and drink waste that is home composted and fed to animals. It should be noted that the quantities associated with these two disposal routes are relatively small compared to Local-Authority collections.

### 1.5 Data sources used in this research

Table 3 summarises the sources of information used for obtaining estimates of household food waste in the UK in the current research. The *Review of Municipal Waste Composition* was used to estimate for the proportion of food and drink waste in Local Authorities collection in preference to *The Food We Waste* research, given that *Review of Municipal Waste Composition* contained information from a larger number of Local Authorities, and each was stratified and from two or more seasons. These proportions were applied to information from WasteDataFlow to obtain estimates of the total food waste in the UK. However, as the review contains negligible information on the make-up of this waste, *The Food We Waste* research was used to provide this detailed breakdown. For waste streams without compositional analyses – the sewer, home composting and feeding to animals – information was obtained from diary exercises. Details of the calculations can be found in Appendix A.

**Table 3:** Summary of information used to obtain estimates of food and drink waste in the current report

Disposal route via...	Information (Geographical Coverage)	Source of Information	Comments
Local Authority	Total amount of waste in each stream (UK)	WasteDataFlow	Includes kerbside residual, kerbside recycling, HWRC
	Fraction of total waste that is food and drink (kitchen) waste (England)	<i>Review of Municipal Waste Composition</i> (Defra)	Includes kerbside residual, kerbside recycling, HWRC
	Details of types of food and drink wasted, cost, reasons for disposal (England and Wales)	<i>The Food We Waste</i> (WRAP)	
Sewer	Total amount, type of waste, cost, reasons for disposal (Great Britain)	<i>Down the Drain</i> (WRAP)	Excludes tap water added in the home
Home composting and feeding to animals	Total amount, type of waste, cost, reasons for disposal (Great Britain)	<i>Kitchen Diary</i> (WRAP)	Home composting estimate of total amount are consistent with internal WRAP calculations

The results from these information sources are presented in Chapter 3. The 95% confidence intervals associated with these estimates are explored in Appendix A.6. It should be noted that the 95% confidence interval around the estimate for home composting and waste fed to animals is relatively broad (c.  $\pm 20\%$  of the estimate). Because these disposal routes contribute only a small fraction to the total household food and drink waste in the UK, the impact on the confidence interval around the total for all household waste streams is low. However, it does mean that the amount of food and drink waste disposed of via home composting and feeding to animals is a good indication, rather than a precise estimate.

As the fieldwork for *The Food We Waste* was conducted in the autumn months (September – November), there will be some impact on the results from the seasonality of food and drink purchases. This is likely to have the largest impact on certain types of fresh produce – e.g. soft fruit such as strawberries – that account for a small proportion of the total food and waste drink in the UK.

These estimates of the weight of waste are compared to the amount of food and drink brought into the home, obtained from the Family Food and Expenditure Survey. Details of the methodology are detailed in Appendix E and the results are given Chapter 3.

## 1.6 Calculations of Cost

In this report, the cost to individuals of food and drink waste is assumed equal to the retail price of the products wasted. A cost is only applied to the avoidable fraction of the waste. For products that are partially consumed (e.g. a half eaten sausage) the cost is assumed proportional to the percentage wasted. By using this method, the costs quoted are approximately equal to the savings that could be made if the food and drink waste were avoided.

The method of calculating these prices is that used in *The Food We Waste* and sewer-based research and full details can be found in the methodology sections of those reports<sup>15</sup>. In short, the process involves finding the closest match for an item from a range of on-line grocery websites. If a waste item or its packaging is branded – either by the retailer or manufacturer – that specific brand is sought. If no such branding is found, then an average price for that food type is applied. In all cases, the price per unit weight is calculated, and this is applied to the weight of each item.

These prices used were current at the time of each piece of research, i.e. autumn 2007 for LA-collected waste and spring 2008 for waste poured down the sewer. In effect, estimates of home composting and fed to animals use autumn 2007 prices, due to the method of extrapolation used.

## 1.7 Calculations of Environmental Impact

The methodology for calculating the greenhouse gas emissions associated with food and drink waste are presented in Appendix E. The emissions cover the relevant elements of the life-cycle of food and drink including: agriculture, manufacture, packaging, distribution, retail, transport to the home, storage and preparation in the home and waste treatment and disposal.

In addition to the greenhouse gas emissions, there are other environmental impacts and resource issues relating to food and drink waste including land and water use, eutrophication of water bodies, depletion of soils. Although important considerations, these have not been calculated as part of this report. However, the information on the different types of food and drink wasted in the UK could be used as the basis for such a calculation. In a similar manner, a calculation on the nutrients, including energy, within the food and drink waste could also be made.

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<sup>15</sup> [www.wrap.org.uk/downthedrain](http://www.wrap.org.uk/downthedrain), [www.wrap.org.uk/thefoodwewaste](http://www.wrap.org.uk/thefoodwewaste)

## 2 Quantitative reporting of food and drink waste

The following section describes the conventions adopted for the reporting of this research and it should be referred to when interpreting the data contained in the following chapters of this report.

### 2.1 Categorisation of food and drink waste

There is no perfect method for the classification of food and drink. Groupings can be made on the basis of how the food is eaten (e.g. cooked or raw), the source of the food (e.g. which part of the plant), or in what state the food is purchased (for example, pre-prepared). Given that the same food can be cooked, prepared and eaten in a variety of ways, this makes any food classification, to some degree, subjective. A classification system that works well for food and drink purchases may not be effective for waste, due to food-preparation changes, e.g. combining foods to make a meal.

The options for altering the classification from previous pieces of food-waste research commissioned by WRAP were limited, constrained by the information recorded at the time of the compositional analysis or diary keeping. However, some modifications were made, both to the groupings and the names. These changes made one or more of the following improvements:

- to correct a previous inconsistency, for example, margarine was listed as dairy;
- to group together small categories that otherwise could not be reported, for example plums, peaches, apricots, etc. were grouped as stone fruit; and / or
- to align some of the food-waste categories with categories in the Family Food and Expenditure Survey.

The food classifications used for the current report are listed in Appendix B. Waste was split into 15 groups, which were further sub-divided into 150 types. This classification attempts to accommodate the different perceptions of food and drink from the variety of stakeholders interested in food waste. It should be noted that milk is categorised under 'dairy and eggs', and as such a food, in line with the grocery supply chain.

An individual food (or drink) group is described in each of the Chapters 5-11. These chapters are ordered by the group's contribution to the total amount of food and drink waste, starting with the highest, namely vegetables and salad. Chapter 12 includes the food groups with minor contributions to the total (each accounting for less than 5% of the total). The chapters on vegetables & salad (Chapter 5), and fruit respectively (Chapter 7) contain a combined analysis of both fresh and 'processed' items.

### 2.2 Reporting of food and drink types

Not all food and drink types are reported separately. For each type, the 95% confidence interval was calculated for the total waste (see Appendix A.6 for further details). If the confidence interval was greater than  $\pm 30\%$  of the estimate, then the food type was not reported separately but combined into a category named, for example, 'all other bakery'. For instance, if the estimate for the total waste relating to a certain food type was 100,000 tonnes per year, then this would only be reported separately if the 95% confidence interval was less than  $\pm 30,000$  tonnes per year.

The food types that are not reported separately are highlighted in the first table of Chapters 5-11. As they are included in an 'all other ...' category, this process has no effect on the total food and drink waste reported for each food group, or the headline figure for the UK.

Using a relative confidence level of  $\pm 30\%$  as a cut off results in a fair degree of confidence for all food types reported in the following chapters. For the food types contributing a high proportion to the total food and drink waste in the UK (e.g. bread, potatoes, and meals), the relative confidence levels are around  $\pm 10\%$ , indicating a higher degree of certainty around the estimate. For those food types that just pass this cut off (i.e. the relative confidence level is just under  $\pm 30\%$ ), the estimate presented is a good indication of the level of waste, but not a precise estimate. In general, this lower level of certainty is associated with food types that contribute smaller amounts to the total, and the level of confidence for all food types included in the report can be found in Table 44 (Appendix A.7).

### 2.3 Rounding in tables

Given the relative uncertainty around estimates of the waste of individual food groups and food types, all information in the following chapters is reported to two significant figures. It should be noted that, for estimates where the relative error is close to  $\pm 30\%$ , these estimates are more uncertain than the two significant figures imply.

In tables and figures reporting food and drink waste, the sum of certain columns can be inconsistent with the total quoted in the final row; this is ascribable to the rounding convention adopted.

All amounts of less than 1,000 tonnes have been denoted as '< 1,000' in the tables. This includes categories for which no waste was found in the research; given that the surveys covered a sample of households – rather than all households in the UK – absence from the survey does not necessarily imply that the arisings in the UK are zero, only that they are likely to be low.

### 2.4 Avoidability and Reasons for Disposal

Two subdivisions of the total waste of a food group or food type are presented in subsequent chapters – the degree to which the food and drink waste is avoidable, and the reasons for disposal.

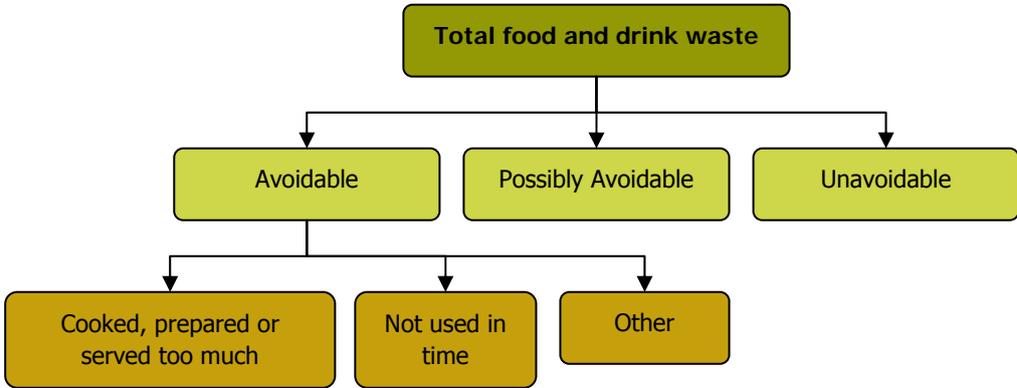
Food and drink waste is grouped into three groups according to its avoidability. These groups are the same as those used in previous WRAP-commissioned food waste research:

**Avoidable** – food and drink thrown away because it is no longer wanted or has been allowed to go past its best. The vast majority of avoidable food is composed of material that was, at some point prior to disposal, edible, even though a proportion is not edible at the time of disposal due to deterioration (e.g. gone mouldy)<sup>16</sup>. In contrast to 'possibly avoidable' (see below), the category of 'avoidable' includes foods or parts of food that are considered edible by the vast majority of people.

**Possibly avoidable** – food and drink that some people eat and others do not (e.g. bread crusts), or that can be eaten when prepared in one way but not in another (e.g. potato skins). As with 'avoidable' waste, 'possibly avoidable' waste is composed of material that was, at some point prior to disposal, edible.

**Unavoidable** – waste arising from food and drink preparation that is not, and has not been, edible under normal circumstances<sup>17</sup>. This includes pineapple skin, apple cores, meat bones, tea bags, and coffee grounds.

Figure 3: Classification of food waste by avoidability and reason for disposal



The avoidable food waste is further subdivided into the reason for its disposal (Figure 3). For both 'possibly avoidable' and 'unavoidable' food and drink waste, it is assumed that its avoidability classification adequately describes why it was wasted. There are a wide variety of reasons why avoidable food waste might occur, but for the purposes of this report they have been grouped into the following three categories:

**Cooked, prepared or served too much** – this includes food and drink that has been cooked, prepared or served in the home and subsequently disposed of. In the vast majority of cases, this is because too much food

<sup>16</sup> There are two exceptions to this rule: a) inedible items that are thrown away unused (e.g. unused tea bags), and b) the unavoidable fraction of whole items thrown away (e.g. the banana skin of a whole banana) - this material was all classified as avoidable, rather than split into the avoidable (banana flesh) and unavoidable fractions (banana peel). For future research, the methodology would be improved if the weight of each fraction were recorded in such cases.

<sup>17</sup> This definition takes a pragmatic view of this definition, as strictly speaking, most material classified as unavoidable could be ingested – drinks can be made from egg shells, stock from animal bones, marmalade from citrus peel, and pickle from melon rind. Therefore, inedible is defined as unpalatable to the vast majority of the population without substantial preparation.

was 'processed' in the home, but it would also cover cases where food was damaged during this processing (e.g. burning food). This category could also be referred to as 'leftovers'.

**Not used in time** – This covers food and drink that has been disposed of because it has passed a date label (e.g. use by, or best before date), has gone mouldy or looked, smelt or tasted bad.

**Other** – Includes any other reasons or items for which it was not possible to discern the reason for disposal.

For diary-based research, the diary respondent recorded the reasons for disposal, which were then grouped into the categories above. For compositional analysis, the reason for disposal was derived from the state of the item when disposed of (e.g. raw, purchased pre-prepared) and the presence (or otherwise) of packaging. Appendix C has full details of this derivation.

For compositional analysis, the classification into reasons for disposal works in the majority of cases; however, there will be exceptions where the reason for disposal cannot be obtained from the information present in the waste, or has been misclassified<sup>18</sup>. For this reason, some caution should be employed when interpreting the results relating to reason for disposal.

## 2.5 Reporting Cost

*The Food We Waste* reported estimates of the purchase value of the food and drink that was wasted in the UK. Estimates for both the total food and drink waste and the avoidable fraction were quoted. These values quoted were for the value of the food and drink at purchase; by the time of disposal, the food and drink may well have deteriorated in quality to the point of being valueless. The cost of avoidable food and drink waste broken down by reason for disposal was also included.

In the current report, the purchase values are again quoted, but only for avoidable food and drink waste, as this is the focus of the food-waste reduction activities. It is also problematic to split the value of foods comprising, for instance, avoidable and unavoidable fractions. Although the unavoidable fraction is not eaten, it can function as natural packaging (fruit peel), or containment (egg shell) that can also be turned into compost. The value of these functions is hard to access, and this is a second reason why unavoidable costs are not reported<sup>19</sup>.

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<sup>18</sup> As an example, some food or drink is disposed of prior to preparation because it is no longer wanted – i.e. the item is disposed of whilst still edible and in date. This might include instances of someone purchasing many items of one type of food, trying one and finding it is not to their taste and throwing away the rest. For the compositional analysis, this material this will be categorised as 'not used in time', as it has been thrown away in its raw (possibly packaged) state.

<sup>19</sup> All cost figures quoted by WRAP in advertising material and interviews relate to the cost of avoidable food, and this specific change in reporting does not have a bearing on these costs. However, other methodological changes (primarily inclusion of sewer-based research) do have an impact on costs.

### 3 Headline results: household food and drink waste in the UK

This chapter presents the headline results for the amount of household food and drink waste generated in the UK in a year. Information comes from a variety of sources that span a period 2005-2008 (§1.4); however, the estimates most closely corresponds to 2007.

To give further insight into these figures, the estimates of weight (§3.1) are sub-divided by:

- disposal route;
- food and drink;
- avoidable, possibly avoidable and unavoidable waste; and
- reason for disposal.

The estimates of cost of avoidable waste (§3.2) are sub-divided by:

- food and drink; and
- reason for disposal.

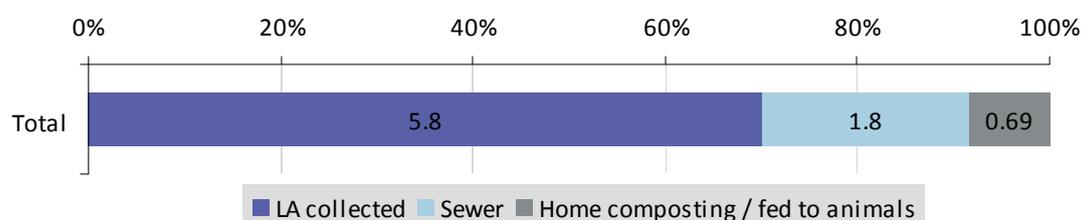
Estimates of the greenhouse gas emissions associated with the avoidable waste are given in §3.3. §3.4 provides information relating to the number of occupants of households and the presence (or otherwise) of children.

#### 3.1 Weight of food and drink waste in the UK

The total amount of food and drink waste generated by households in the UK is estimated as 8.3 million tonnes per year. The 95% confidence interval due to sampling is approximately  $\pm 4\%$  or  $\pm 0.3$  million tonnes per year<sup>20</sup>. This 8.3 million tonnes per year is equivalent to 330 kg per year for each household in the UK, or just over 6 kg per household per week. 8.3 million tonnes per year represents 22% of food and drink brought into the home (Appendix E).

The disposal routes for this 8.3 million tonnes per year of food and drink waste are given in Figure 4. The majority, 5.8 million tonnes per year or 70%, is collected by Local Authorities through kerbside collections<sup>21</sup> or household waste recycling centres (also known as civic amenity sites). 1.8 million tonnes per year of food and drink waste is disposed of via the sewer, and it should be remembered that this excludes water added to products in the home (§1.4.3)<sup>22</sup>. Food and drink waste composted at home or fed to animals constitutes a further 0.69 million tonnes per year.

**Figure 4:** Weight of household food and drink waste split by disposal route



*Figures within bars state waste in millions of tonnes per year*

In comparison to the figures in *The Food We Waste*, this new estimate for total food and drink waste in the UK is approximately 1.6 million tonnes per year higher (Table 4). This stems from increased estimates relating to disposal via the sewer, home composting, and feeding to animals. In contrast, the estimate for waste collected by Local Authority is almost unchanged.

<sup>20</sup> In addition to this uncertainty associated with sampling, there are non-sampling uncertainties, which are not possible to quantify. For this reason, the confidence interval quoted encapsulates only some of the total uncertainty, and is therefore a lower bound of the total uncertainty. See Appendix A for more details on the calculations and confidence intervals for each disposal route.

<sup>21</sup> Residual collections, food-waste collections, or garden-waste collections that accept food waste

<sup>22</sup> The water added to food and drink is estimated to total approximately a further 1.7 million tonnes per year.

**Table 4:** Comparison of estimates in current report and *The Food We Waste*

Disposal Route	Total household food and drink waste in UK (million tonnes per year)		Comment
	Current Report	<i>The Food We Waste</i>	
LA collections	5.8	5.9	Similar method used, but estimates updated
Sewer	1.8	0.6	New research has led to increased estimate – a large part of the increase is in drink
Home composting and fed to animals	0.7	0.2	New application of research has led to an increased estimate
<b>Total</b>	<b>8.3</b>	<b>6.7</b>	

Of the 8.3 million tonnes per year, 7.0 million tonnes per year (85%) is food with the remaining 1.3 million tonnes per year being drink (Figure 5). For waste collected by Local Authorities, over 90% (5.3 million tonnes per year) is food waste; the 0.48 million tonnes per year of drink waste includes a large fraction of ‘solid’ waste associated with drinks preparation – e.g. 0.3 million tonnes per year of tea bags, the vast majority of these used, and therefore classified as unavoidable waste.

In line with expectations, drink waste makes up a higher percentage (c. 45%) of the 1.8 million tonnes per year of food and drink waste disposed of via the sewer. Of the material classified as food disposed of via the sewer, a large proportion of this is liquid or semi-liquid, including milk, cooking sauces and oil.

The overwhelming majority of waste fed to animals or home composted is food; the small amount of material classified as drink is mainly tea bags and coffee grounds that are composted at home.

**Figure 5:** Weight of household waste by disposal route, split by food and drink

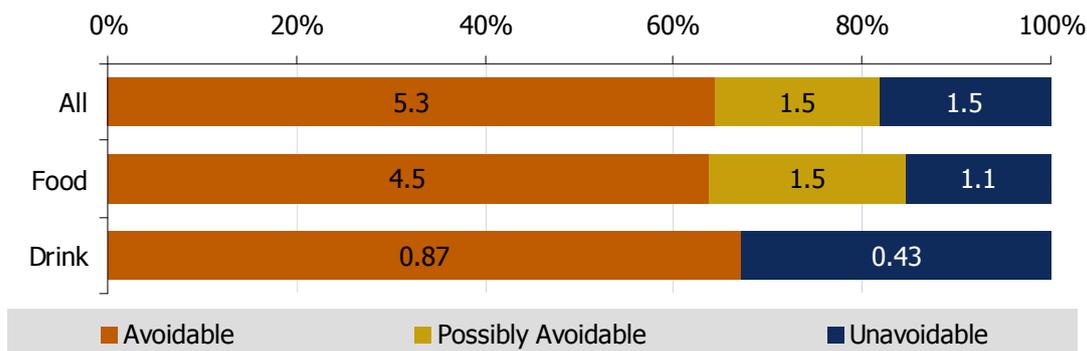


*Figures within bars state waste in millions of tonnes per year*

The majority of the total food and drink waste generated is avoidable – 5.3 million tonnes per year, or approximately 65% of the total (Figure 6). Although much of this food and drink may not have been edible at the point of disposal, the vast majority of this waste could have been avoided through better planning, purchasing, storage or preparation (see §2.4 for the full definition of avoidability). 5.3 million tonnes per year is the equivalent of 14% of the weight of food and drink brought into the home (Appendix E).

There is no significant difference between the fraction of food that is avoidable and the avoidable fraction of drink (both c. 65%). No drink waste is classified as ‘possibly avoidable’. Details of the food and drinks classified as possibly avoidable and unavoidable can be found in Chapters 5-12.

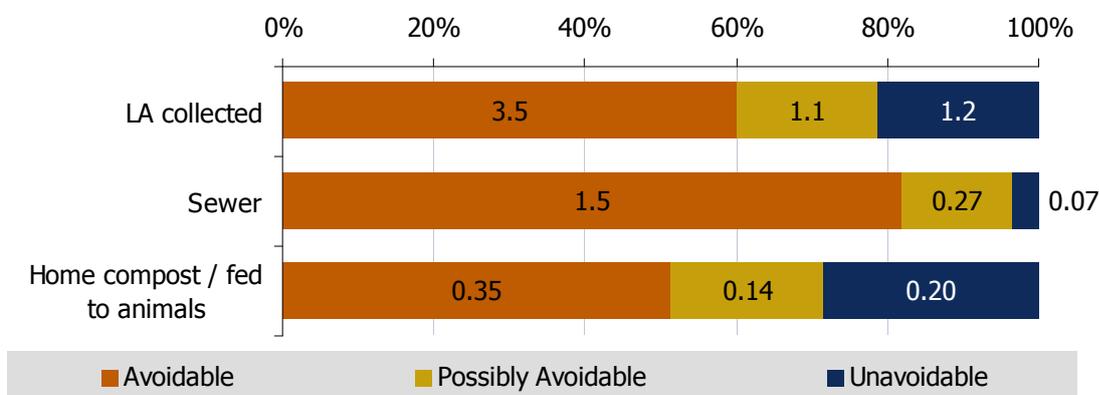
**Figure 6: Weight of household waste by food and drink, split by avoidability**



*Figures within bars state waste in millions of tonnes per year*

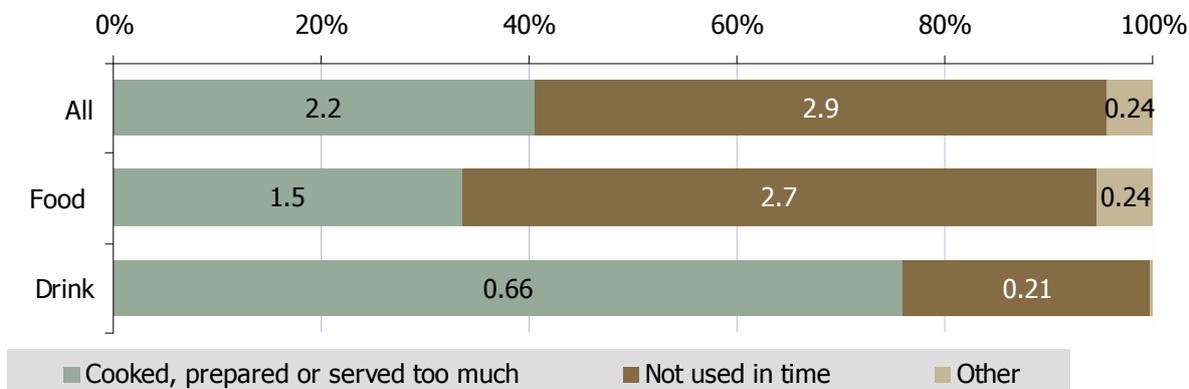
The avoidability of food and drink waste varies considerable with disposal route (Figure 7). Over 80% of food and drink waste disposed of via the sewer is avoidable, contrasting with 60% for Local Authorities and around 50% for home composting and fed to animals.

**Figure 7: Weight of household waste by disposal route, split by avoidability**



The classification of avoidable waste by the reason for disposal is also outlined in §2.4. Just over half of avoidable food and drink is classified as 'not used in time', with 40% classified as 'cooked, prepared or served too much'. This split is similar for food, although, as is seen in subsequent chapters, these fractions vary greatly between different types of food. However, for drink almost three-quarters of avoidable waste is classified as 'cooked prepared or served too much'. This may be a reflection of the longer shelf-life of most drinks reducing the proportion that is not used in time.

**Figure 7: Weight of avoidable household waste by food and drink, split by reason for disposal**

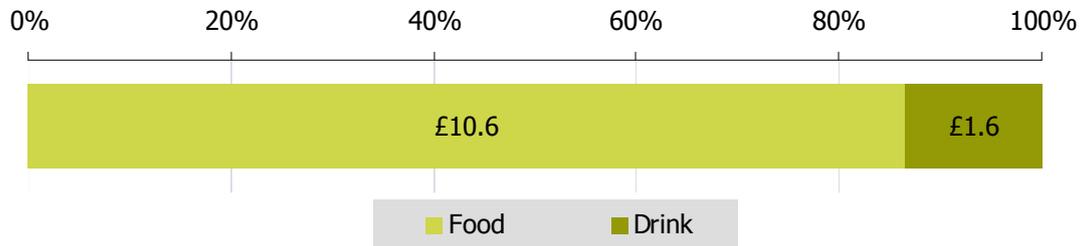


*Figures within bars state waste in millions of tonnes per year*

### 3.2 Cost of food and drink waste in the UK

As discussed in §1.6, the cost to individuals of avoidable waste is estimated from retail prices current at the time of the original research (autumn 2007 and spring 2008). The total cost is £12 billion per year (to two significant figures), or £480 per household per year. This avoidable waste represents 15% of expenditure on food and drink brought into the home.

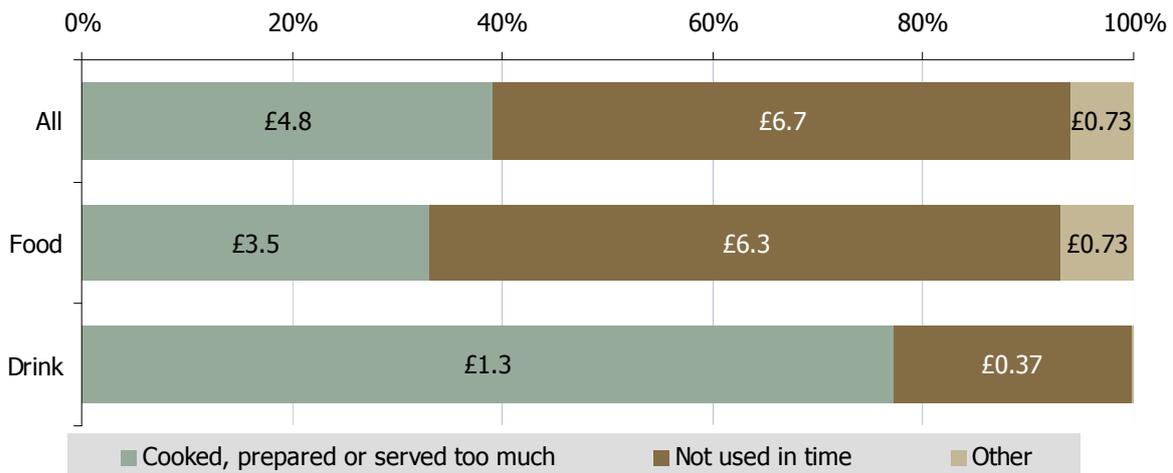
**Figure 8:** Cost of avoidable household waste split by food and drink



*Figures within bars state waste in £ billions per year*

The vast majority (c. 85%) of the cost of avoidable waste is contributed by food as opposed to drink (Figure 8). Of this food, the greater proportion (£6.3 billion per year) is disposed of because it wasn't used in time, compared to £3.5 billion for leftover food (cooked, prepared or served too much). In contrast, more drink is wasted because it is leftover, usually after serving (pouring). This costs £1.3 billion per year, as opposed to £370 million per year for drink 'not used in time'.

**Figure 9:** Cost of avoidable household waste by food and drink, split by reason for disposal



*Figures within bars state waste in £ billions per year*

### 3.3 Environmental impact of food and drink waste in the UK

The greenhouse gas emissions associated with avoidable food and drink waste in the UK account for approximately 20 million tonnes of CO<sub>2</sub> equivalent per year. This figure includes contributions from the relevant elements of the food and drink: agriculture, manufacture, packaging, distribution, retail, transport to the home, storage and preparation in the home and waste treatment and disposal.

To put this figure in context, the total greenhouse gas emissions relating to consumption in the UK (as opposed to emissions produced within the geographical bounds of the UK) amount to around 850 million tonnes per year<sup>23</sup>. Thus, avoidable food and drink waste accounts for approximately 2.4% of this total. This percentage may appear small; however, there is the potential to substantially reduce the amount of avoidable waste. If realised, these reductions would have an important contribution to reductions in the UK's greenhouse gas emissions.

<sup>23</sup> For example, Development of an embedded carbon emissions indicator (Defra, July 2008) quotes a value of 851.7 million tonnes for 2004, the most recent year reported.

### 3.4 Variation of waste with household characteristics

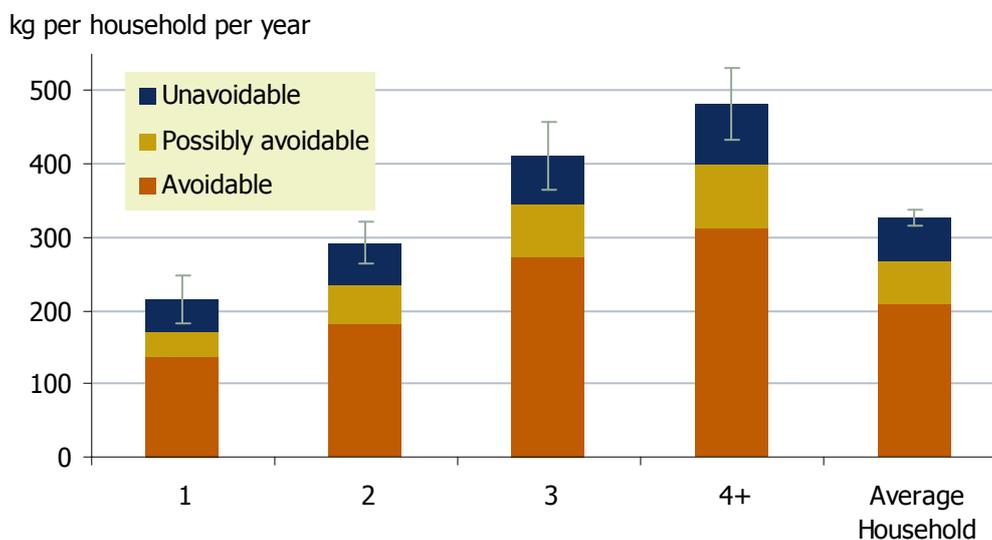
This section contains information on the amount of food and drink waste generated by different types of household. The weights and cost of this waste are given for households with different numbers of occupants ('household size'). For households containing more than one person, information is also given by whether a household contains children. Further information at a household level is contained in Chapter 13.

**Table 5:** Food and drink waste by household size, weight and avoidable cost

Household size	Weight generated (kg per household per year)				Cost of avoidable waste (£ per household per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
1	220	40	40	140	£310
2	290	60	50	180	£420
3	410	60	70	270	£630
4+	480	80	90	310	£720
<b>Average UK household (2.4 people)</b>	<b>330</b>	<b>60</b>	<b>60</b>	<b>210</b>	<b>£480</b>

For households with one occupant, the average amount of food and drink waste generated is 220 kg per year, with the avoidable fraction costing £310 per year. These figures increase with the size of the household; for households containing four or more people, 480 kg of food and drink waste is generated annually per household, with the avoidable waste costing £720. The higher the number of occupants in a household, the greater the amount of food waste generated, although it should be noted that the increase is not proportional, i.e. an average four-person household wastes less than four times the average single-occupancy household.

**Figure 10:** Weight of food and drink waste by household size, split by avoidability



*Intervals represent 95% confidence level around total food and drink waste estimate*

Table 6 present amounts of waste for all disposal routes for households of more than one person grouped into households containing children and those not containing children<sup>24</sup>. Households containing children generate on average 450 kg of food and drink waste annually, with the avoidable fraction costing £680. This is somewhat higher than households without children, which generated an average of 320 kg of food and drink waste per year at a cost of £470 for the avoidable part.

<sup>24</sup> In this research, children are defined as under 16.

**Table 6:** Food and drink waste by presence of children in household, weight and avoidable cost

Household type	Weight generated (kg per household per year)			Cost of avoidable waste (£ per household per year)	
	Total	Unavoidable	Possibly avoidable		Avoidable
Multiple occupancy <b>with</b> children	450	70	80	300	£680
Multiple occupancy <b>without</b> children	320	60	60	200	£470

It should be noted that the differences between households containing children and those without can be explained by the variation in the household size. On average, households with children contain 3.6 people, whereas multiple occupancy households without children contain 2.4 people. Table 8 illustrates the average amount of food and drink waste collected by Local Authorities for households containing three or four people. For both household sizes, there is no evidence to suggest a significant difference between these two groups in the amount of food and drink waste generated.

**Table 7:** Weight of food and drink waste **collected by Local Authorities** split by presence of children and number of occupants

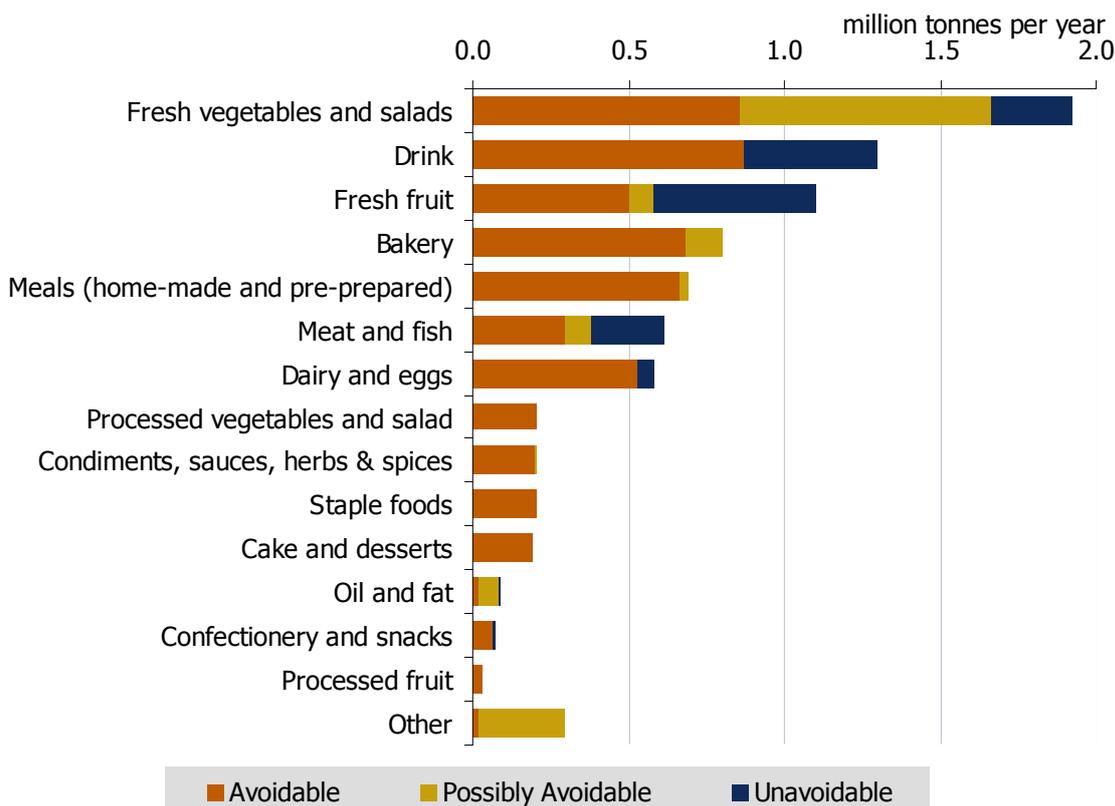
Household type	Weight generated (kg per household per year)	
	Three occupants	Four occupants
Multiple occupancy <b>with</b> children	290	340
Multiple occupancy <b>without</b> children	290	320

## 4 Results by food group

To gain further insight into food and drink waste, analysis is presented by food group. These food groups are the highest level of categorisation found in WRAP's food waste research; definitions for each category can be found in the following chapters, which also contain more detailed analysis and discussion of the waste within each group.

It is worth noting that drinks includes items used to make beverages that are not edible in themselves – tea bags and coffee grounds – that are nonetheless 'kitchen waste'. Also of note is that milk is grouped with other dairy products (i.e. as a food). Furthermore, water that has been added in the home to make products like tea and gravy has been removed from the analysis (§1.4.3).

**Figure 11:** Weight of food and drink waste by food group, split by avoidability



Fresh produce – fruit, vegetables and salad – contributes 3 million tonnes per year, over a third, of the food and drink waste generated annually. Although a relatively low proportion of fresh produce waste is avoidable (45%), it still constitutes over a quarter (1.4 million tonnes per year) of all avoidable food waste.

1.3 million tonnes per year of drink waste is generated annually (16% of the total). Around one-third of this (430,000 tonnes) is unavoidable, comprising tea bags and coffee grounds; the rest is avoidable.

Bakery waste accounts for 800,000 tonnes of waste. Of this, 680,000 tonnes is avoidable, with the remaining 120,000 tonnes largely composed of possibly avoidable bread crusts.

Homemade and pre-prepared meals (the latter including takeaways and those purchased in grocery stores) – including soups, sandwiches, and stews – comprise 690,000 tonnes of waste, of which the vast majority is avoidable. However, due to the relatively high cost of meals per unit weight, meals contribute the most to the cost of avoidable waste - £2,100 million per year or 18% of the total (Figure 12).

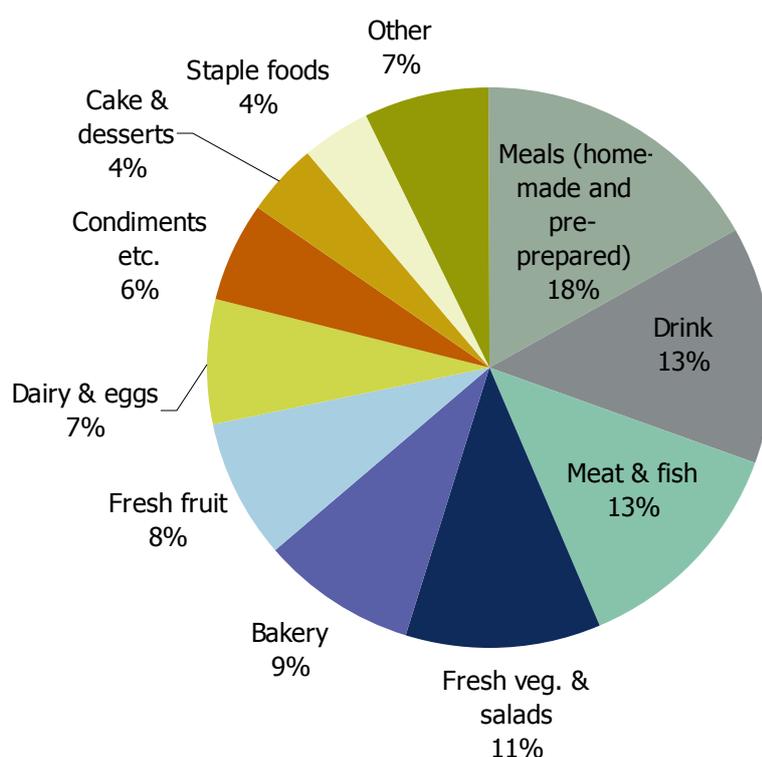
Meat and fish contribute a similar quantity of food waste (610,000 tonnes), but, in contrast to meals, approximately half of this is avoidable, with the remainder including inedible material such as bones.

Dairy and eggs is the final group to contribute more than 5% of the total food and drink waste. Of the 580,000 tonnes of waste, around 10% is unavoidable egg shells, with the remainder avoidable.

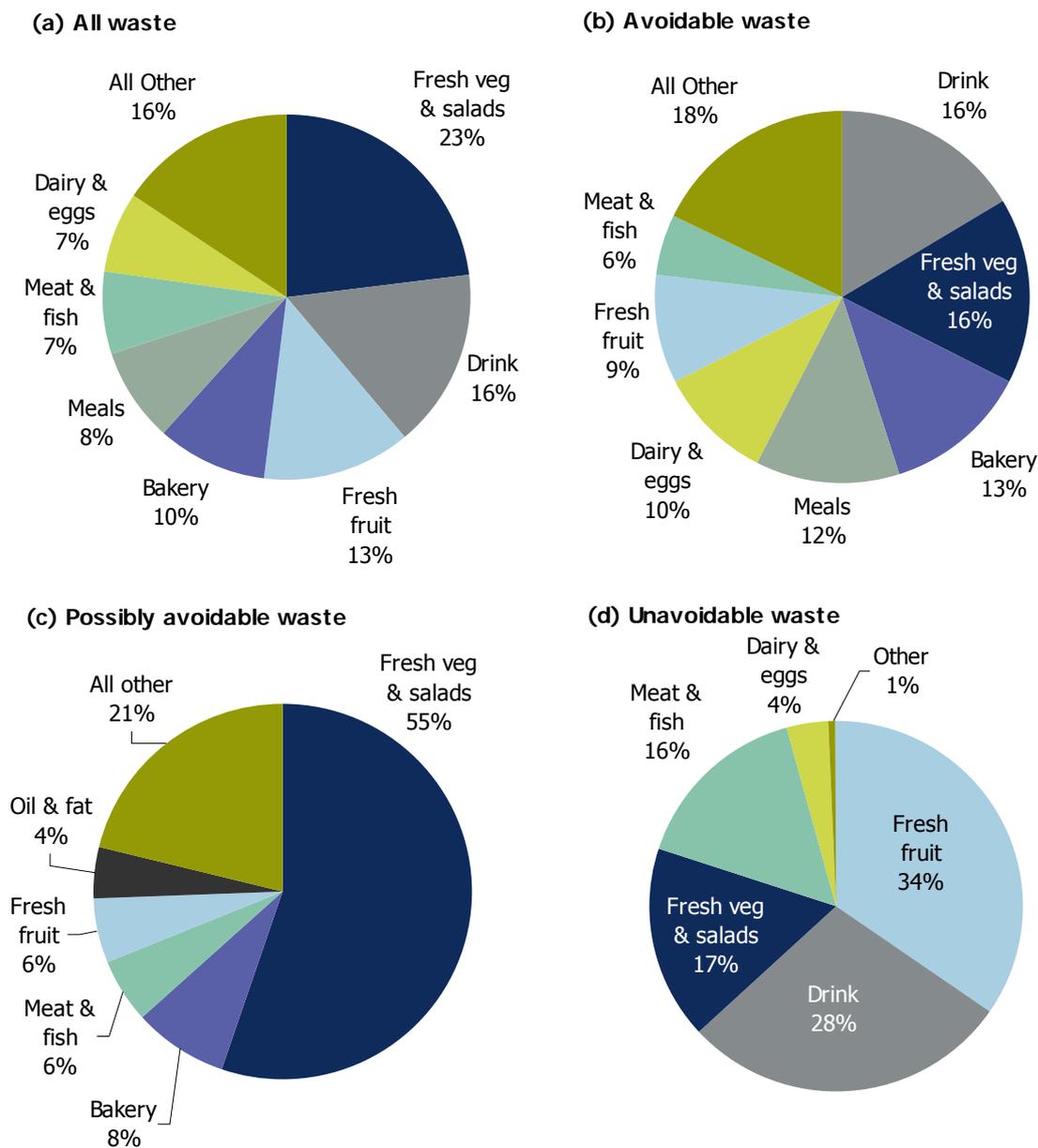
**Table 8:** The amount of food and drink waste by food group, split by avoidability

Food Group	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Fresh vegetables and salads	1,900,000	250,000	810,000	860,000	£1,400
Drink	1,300,000	430,000	<1,000	870,000	£1,600
Fresh fruit	1,100,000	520,000	81,000	500,000	£990
Bakery	800,000	<1,000	120,000	680,000	£1,100
Meals (homemade and pre-prepared)	690,000	<1,000	24,000	660,000	£2,100
Meat and fish	610,000	240,000	83,000	290,000	£1,600
Dairy and eggs	580,000	54,000	<1,000	530,000	£870
Processed vegetables and salad	210,000	<1,000	<1,000	210,000	£360
Condiments, sauces, herbs & spices	210,000	<1,000	6,000	200,000	£700
Staple foods	200,000	<1,000	<1,000	200,000	£470
Cake and desserts	190,000	<1,000	<1,000	190,000	£510
Oil and fat	90,000	5,000	64,000	20,000	£37
Confectionery and snacks	71,000	4,000	<1,000	67,000	£330
Processed fruit	30,000	<1,000	<1,000	30,000	£63
<i>Other</i>	<i>300,000</i>	<i>&lt;1,000</i>	<i>280,000</i>	<i>20,000</i>	<i>£110</i>
<b>Total</b>	<b>8,300,000</b>	<b>1,500,000</b>	<b>1,500,000</b>	<b>5,300,000</b>	<b>12,000</b>

**Figure 12:** Proportions of cost of avoidable food and drink waste, split by food group



**Figure 13:** Proportions of **weight** of food and drink waste, split by food group

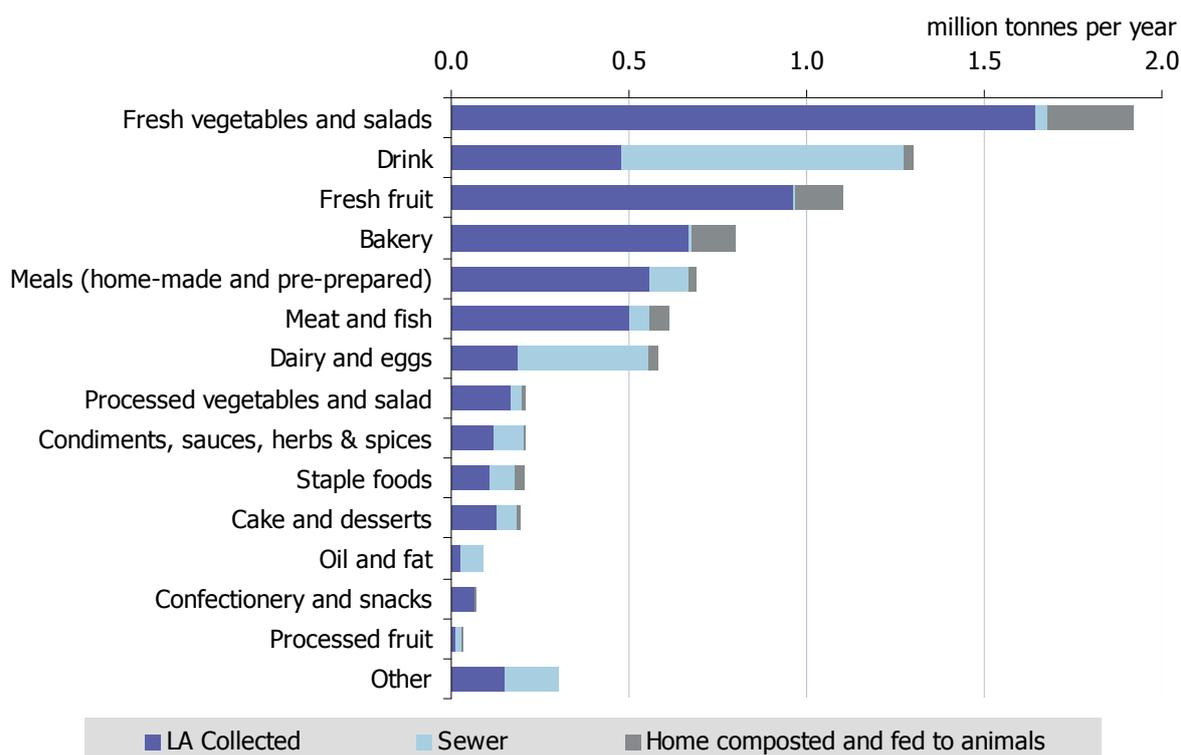


*The food group 'meals' includes pre-prepared (takeaway and ready meals) and homemade meals*

Figure 13(a) illustrates the split between the food groups of the total waste. The split for avoidable waste – in part (b) of the figure – is similar to that for all food and drink waste, due to a high proportion of each food group's waste being avoidable.

In contrast, the groups of food and drink that make up the possibly avoidable (c) and unavoidable (d) waste are very different from the total. Possibly avoidable food waste is dominated by fresh produce, in particular peelings of root vegetables. Other contributions are bakery (bread crusts), meat and fish (skin and fat), and fresh fruit (e.g. apple peelings). 95% of unavoidable food and drink waste comes from four food groups: fruit contributes a third (citrus peel, melon rind, apple cores and banana skins), with a further 28% from drink – mainly tea bags. Vegetables and salads make up 17%, and meat and fish – mainly bones – contribute a similar amount.

**Figure 14:** Weight of food and drink waste by food group, split by and disposal route



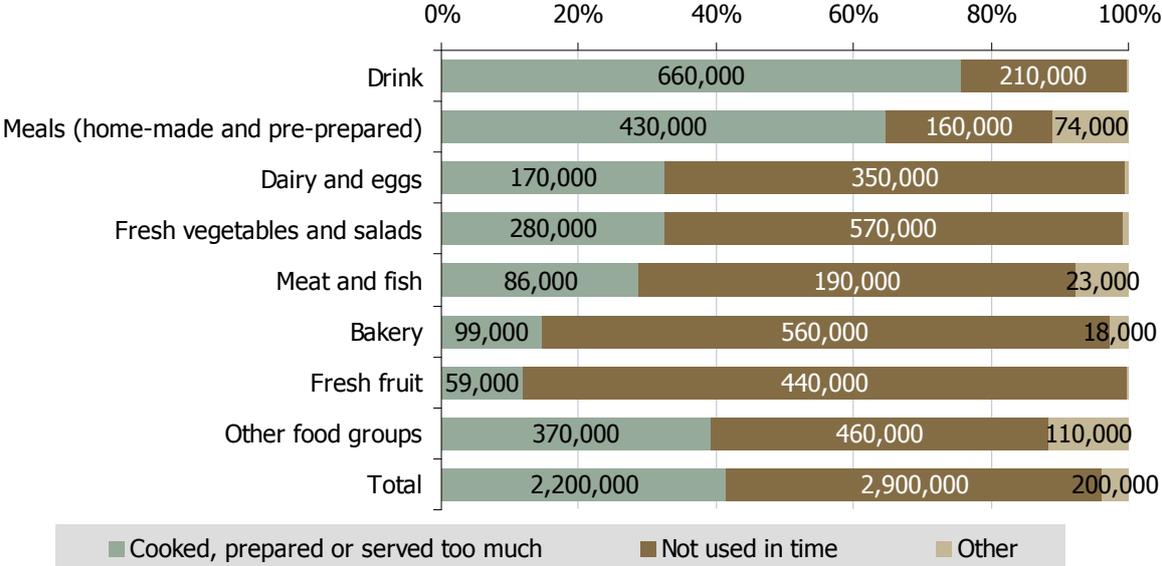
**Table 9:** The amount of food and drink waste by food group, split by disposal route

Food Group	Weight generated (tonnes per year)			
	Total	LA collected	Sewer	Home composting and fed to animals
Fresh vegetables and salads	1,900,000	1,600,000	31,000	250,000
Drink	1,300,000	480,000	730,000	23,000
Fresh fruit	1,100,000	960,000	6,000	130,000
Bakery	800,000	660,000	11,000	120,000
Meals (home-made and pre-prepared)	690,000	560,000	110,000	22,000
Meat and fish	610,000	500,000	60,000	53,000
Dairy and eggs	580,000	190,000	370,000	27,000
Processed vegetables and salad	210,000	160,000	33,000	11,000
Condiments, sauces, herbs & spices	210,000	120,000	85,000	4,000
Staple foods	200,000	110,000	70,000	24,000
Cake and desserts	190,000	130,000	53,000	12,000
Oil and fat	90,000	26,000	64,000	<1,000
Confectionery and snacks	71,000	64,000	<1,000	6,000
Processed fruit	30,000	13,000	13,000	4,000
Other	300,000	160,000	150,000	<1,000
<b>Total</b>	<b>8,300,000</b>	<b>5,800,000</b>	<b>1,800,000</b>	<b>690,000</b>

There is a strong variation in disposal route between the food groups, with a high proportion of groups containing liquids being disposed of via the sewer: drink, 'dairy and eggs', and 'oil and fat'. For 'dairy and eggs', this is strongly influenced by milk. Home composting is made up largely of fruit, vegetables and salads, although the vast majority of waste from these groups is collected by Local Authorities.

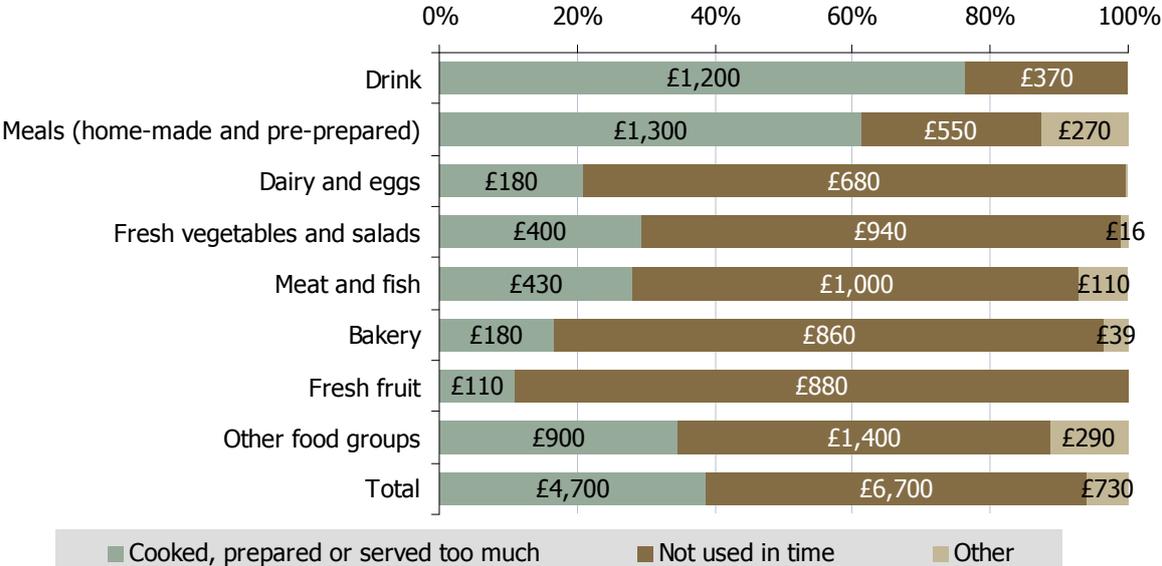
There is great variation between major food groups<sup>25</sup> relating to the reasons for disposal of avoidable food waste (as defined in §2.4). For food groups that have relatively short shelf lives (notably fruit, vegetables & salad, bakery and meat & fish), the majority of waste arises because the food was 'not used in time' (Figure 15 and Figure 16). At the other end of the scale are meals and drink, for which over 60% of the avoidable waste is classified as 'cooked, prepared or served too much'. Avoidable drink waste is made up largely of carbonated drinks and fruit juices; for the majority of these products, the shelf-life is very long prior to opening, and this may result in the relatively low levels of waste arising from 'not used in time'. For meals, 'not used in time' only applies to pre-prepared meals (e.g. ready meals and takeaway meals) that were thrown away intact.

**Figure 15:** Weight of avoidable food and drink waste by food group, split by reason for disposal



Figures within bars state waste in tonnes per year

**Figure 16:** Cost of avoidable food and drink waste by food group, split by reason for disposal



Figures within bars state waste in £ millions per year

<sup>25</sup> For food groups that have small contributions to the total avoidable food waste, significant results are presented in §12.

## 5 Results for vegetables and salad

### 5.1 Categorisation of vegetables and salad

Vegetables and salad have been split into 'fresh' and 'processed' to differentiate between those purchased in a fresh / uncut state, and those purchased preserved or pre-prepared. These foods will often be prepared in the home to form part of a meal (for instance as a vegetable portion in a typical 'meat-and-two-veg' meal, or a vegetable curry). When disposed of as a separate item – including the peelings and other discarded parts from the preparation of the meal – the waste is classified as vegetables and salad, whereas where it is combined with other ingredients, it is classified as a meal (Chapter 9).

**Table 10:** Types of vegetables and salads waste

Food Type	Fresh: what it includes	Processed: what it includes	What it doesn't include
Aubergine	Aubergine, peel, stem	Not found	
Baked beans	n/a	Baked beans	
Bean (all varieties)	Bean sprouts, French, green, runner	Black eye beans, chickpea, green, haricot, kidney beans, runner; canned, frozen	Drainings from the tin
Broccoli	Broccoli, stem	Frozen	
Cabbage	Cabbage, outer leaves, stem	Pickled	
Carrot	Carrot, peel, tops	frozen, pre-prepared, tinned	Drainings from the tin
Cauliflower	Cauliflower, outer leaves, stem,	Pickled	
Celery	Celery base, heart, leaves, stalks	Not found	
Coleslaw and hummus	n/a	Coleslaw, hummus	
Courgette	Courgette, ends, peel	Not found	
Cucumber	Cucumber, ends, peel	Not found	
Leafy salad	Chard, Chinese leaf, cress, mixed leafy salads, rocket, watercress	Not found	Lettuce as a single item
Leek	Leek, base, outer leaves, trimmings	Not found	
Lettuce	Lettuce, base, outer leaves	Not found	
Mixed vegetables	Mixed peelings, mixed vegetables	Frozen, mush, pre-prepared	
Mushroom	Mushrooms, skins, stalks	Breaded	
Non-leafy salad	n/a	Mixed salads, potato salad; takeaway, packaged	
Onion	Onions, shallots, ends, skins	Pickled, rings, dried	
Pea (all varieties)	Garden, mange tout, sugar snap	Frozen, tinned, mushy	
Pepper	Peppers, core, seeds, tops	In jar	
Potato	Potatoes, peel; baked, boiled, chips (if specified homemade), mashed, roast, uncooked	Chips, hash browns, potato waffles; packaged, pre-prepared	
Spinach	Spinach, stems	Frozen	
Vegetable based sandwich spread	n/a	Any vegetable based sandwich spread or pate	
Spring onion	Spring onion, outer leaves, stem	Not found	
Sprout	Sprout, outer leaves, stem	Frozen	
Sweetcorn / corn on the cob	Baby corn, corn on the cob, core, leaves,	Sweetcorn; canned, frozen	Drainings from the tin
Tomato	Tomatoes, skins, stalks	Passata, puree, sundried, tinned	Drainings from the tin
Other vegetables and salad	Greens, seeds, squash	Frozen greens, lentils, textured vegetable protein, soya, gherkins	
Other root vegetables	Beetroot, celeriac, parsnip, radish, swede, sweet potato, turnip	Not found	

*Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of either 'all other fresh vegetables and salad' or 'all other processed vegetables and salad'*

The vegetables and salads in the fresh group includes those which have been prepared at home, for example potatoes that have been baked, boiled, mashed or made into homemade chips, as we assume that the potatoes were purchased raw (or home grown). The exception to this is non-leafy salads (e.g. potato salad, bean salad), which are all categorised in the processed vegetables and salads group, as it was not always possible to make the distinction between those bought pre-prepared and those made in the home. All leafy salads can be found under the heading of fresh, and includes all mixed salads with a significant proportion of salad leaves.

Processed vegetables and salad includes items that were purchased tinned, frozen, pickled or otherwise processed. Notably, the group contains some food types not found in fresh form, which are baked beans, coleslaw and hummus, mixed non-leafy salad, vegetable-based sandwich spread, and meat substitute products such as soya mince. The group of processed vegetables and salad does not contain leafy salad, but could in theory contain any of the other vegetables listed in Table 10. In practice however, only those vegetables with examples given were found during the waste analysis. If chips could be positively identified as homemade, they were classified as 'fresh', otherwise they were assumed to be pre-prepared and therefore classified as 'processed'.

The vegetables and salad group does contain foods which are technically fruits, such as tomatoes and peppers. They are found in this section as they are most frequently eaten as, or alongside, savoury foods, and rarely eaten as fruit. If a food can be eaten both as a fruit and a vegetable, for example avocado, then it can be found in the chapter on fruit (Chapter 7). Although most fresh vegetables are available year-round from supermarkets, there is seasonal variation in the abundance and price of these foods, which influence the purchasing patterns. Cultural factors also affect eating patterns throughout the year, e.g. Brussels sprouts being consumed in greater amounts at Christmas.

## 5.2 Fresh vegetables and salad

### 5.2.1 Breakdown of fresh vegetables and salad by avoidability

**Table 11:** The amount of fresh vegetables and salad waste by type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Potato	770,000	<1,000	480,000	290,000	£230
Mixed vegetables	250,000	7,000	200,000	48,000	£58
Onion	130,000	93,000	<1,000	36,000	£29
Carrot	120,000	6,000	65,000	46,000	£36
Cabbage	85,000	18,000	14,000	53,000	£70
Lettuce	67,000	4,000	2,000	61,000	£64
Tomato	63,000	<1,000	2,000	61,000	£110
Other root vegetables	49,000	23,000	4,000	22,000	£38
Cucumber	44,000	10,000	3,000	31,000	£65
Sweetcorn / corn on the cob	43,000	18,000	1,000	24,000	£31
Broccoli	41,000	1,000	18,000	21,000	£44
Cauliflower	40,000	26,000	3,000	10,000	£16
Leafy salad	37,000	<1,000	<1,000	36,000	£170
Bean (all varieties)	29,000	6,000	2,000	22,000	£75
Pepper	24,000	8,000	<1,000	16,000	£55
Leek	20,000	11,000	<1,000	8,000	£38
Mushroom	16,000	<1,000	3,000	14,000	£38
Spring onion	8,000	2,000	<1,000	6,000	£29
All other fresh vegetables & salads	86,000	18,000	13,000	55,000	£150
<b>Total fresh vegetables &amp; salads</b>	<b>1,900,000</b>	<b>250,000</b>	<b>810,000</b>	<b>860,000</b>	<b>£1,400</b>

The amount of fresh vegetable and salad waste in the UK is in the region of 1.9 million tonnes per year. Of this, nearly half is avoidable waste (860,000 tonnes per year). The annual purchase cost of this avoidable fraction is approximately £1.4 billion.

A further 810,000 tonnes per year is possibly avoidable waste. This includes potato skins, which are normally used in some recipes but not in others, mushroom stalk, broccoli stem, spinach stalks, carrot peel, courgette peel, cucumber peel, which are eaten as normal by some people but are considered unpalatable by others.

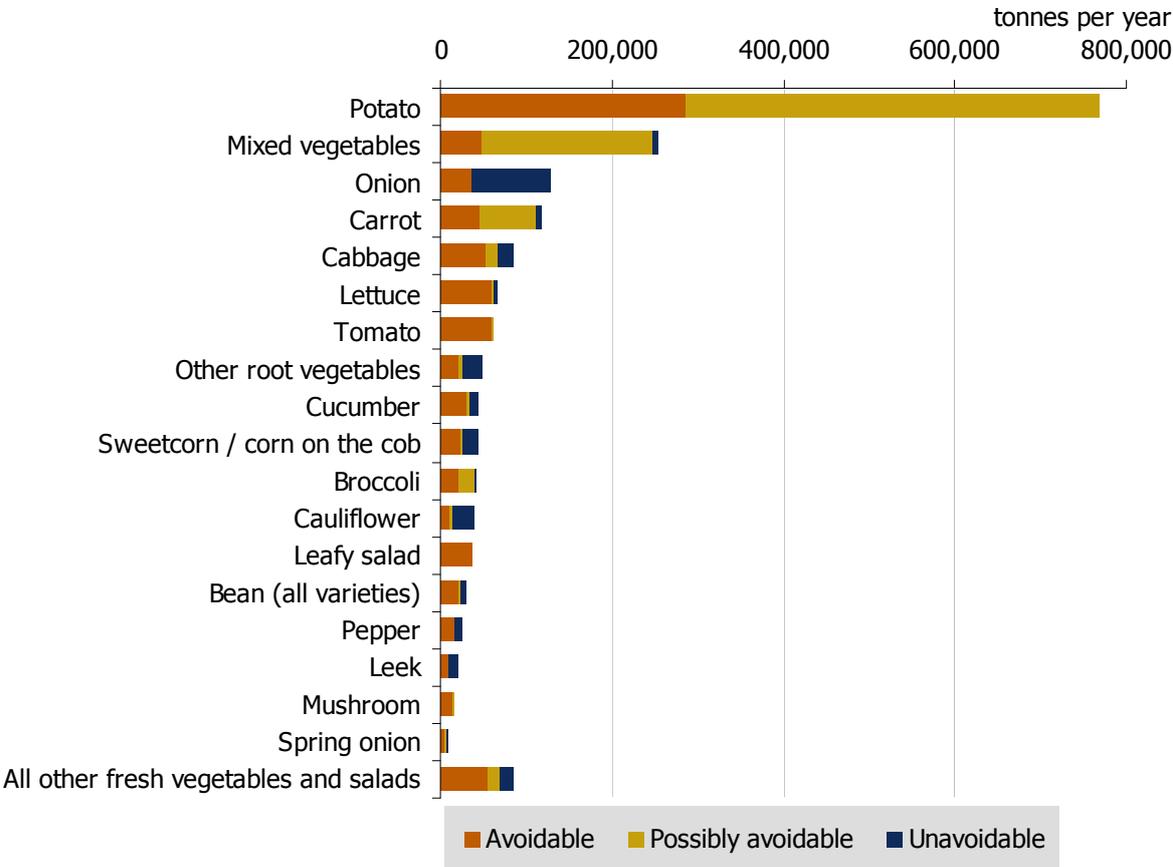
'Unavoidable' fresh vegetable waste includes onion skin, corn cobs, stalks of most varieties, swede and turnip peel, string from runner beans, carrot tops, cauliflower leaves, pea pods and pepper cores. There are 250,000 tonnes per year of unavoidable waste (the inedible fraction of the vegetables as they are purchased fresh).

By far the greatest proportion of fresh vegetable waste is potato (770,000 tonnes per year), which, in part, reflects the quantities purchased. The waste includes potato peel and jacket potato skin, which have been deemed to be 'possibly avoidable' for the purposes of this study. Potato peel / skin comprises 480,000 tonnes per year (three-fifths of fresh potato waste). This leaves 290,000 tonnes of avoidable potato waste, which costs £230 million per year.

Mixed vegetables refers to mixtures that were not easy to separate during the waste analysis, such as mixed peelings, mixed vegetables cooked together, or mixed vegetables referred to in the diary exercises. Mixed vegetables contribute a further 250,000 tonnes per year (more than a tenth of fresh vegetable waste). Most of this was designated 'possibly avoidable'. The avoidable mixed vegetable waste weighs approximately 48,000 tonnes and costs £58 million per year.

The next greatest amounts of waste are from onion and carrot (130,000 and 120,000 tonnes per year respectively). Onion skin is inedible, leaving only 36,000 tonnes per year of avoidable waste (costing £29 million); carrot skin can possibly be eaten, and avoidable carrot waste weighs approximately 46,000 tonnes per year (costing £36 million).

Figure 17: Weight of fresh vegetable and salad waste by type, split by avoidability



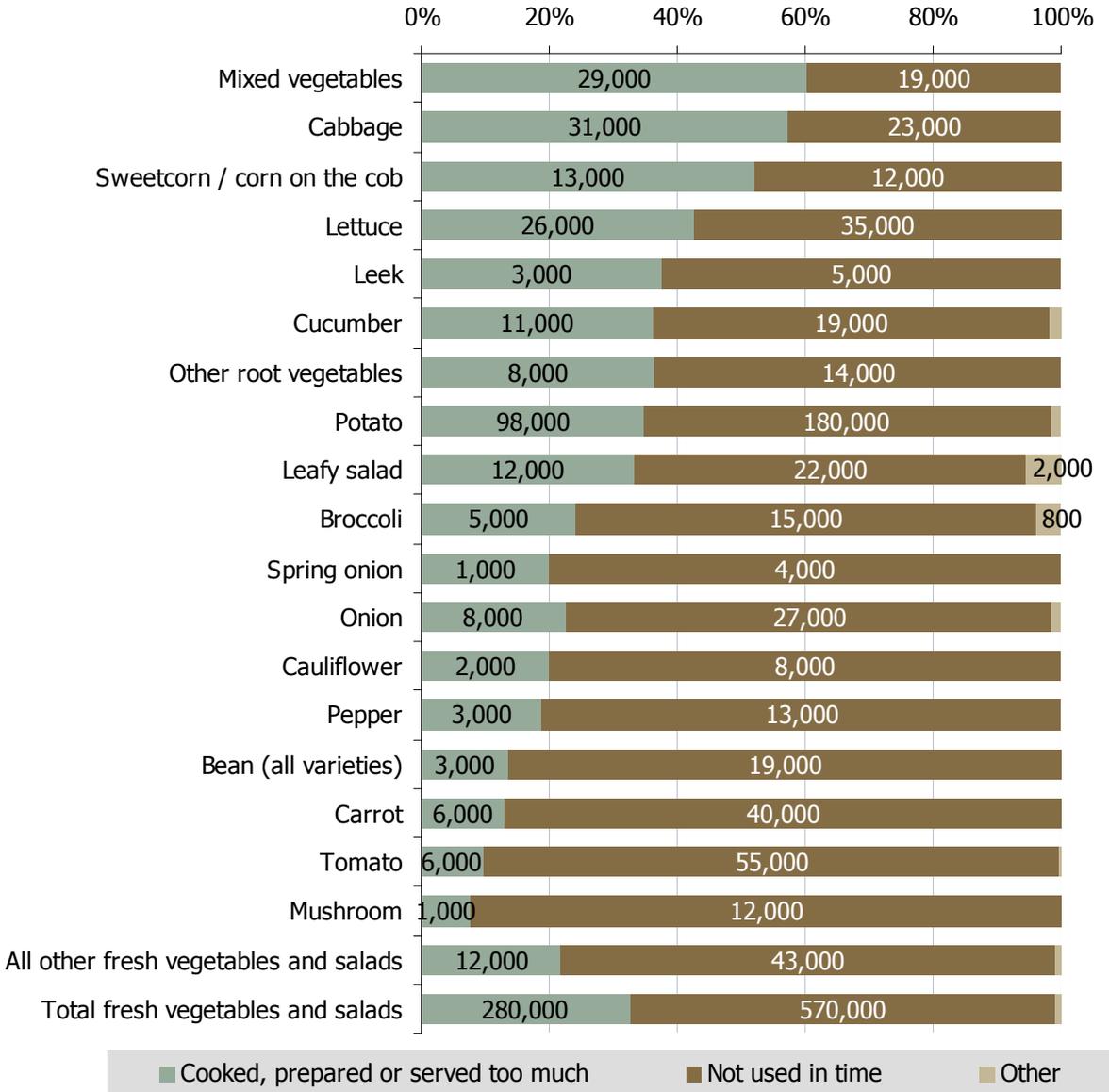
Lettuces and tomatoes are almost entirely edible, thereby making their waste largely avoidable. They each contribute 61,000 tonnes annually to UK food waste but their different relative costs means that the costs of the tomato waste is £110 million, as compared to £64 million of lettuce waste.

Although only contributing 37,000 tonnes of waste per year, the cost of leafy salads that are wasted £170 million tonnes annually. This reflects the relatively high cost per kilogram of e.g. bagged salads, relative to other salad ingredients.

**5.2.2 Breakdown of avoidable fresh vegetables and salad waste by reason for disposal**

Of the 860,000 tonnes of avoidable waste from fresh vegetables and salad generated annually, approximately two-thirds was disposed of because it was not used in time (Figure 18). This includes fresh produce that has gone rotten, mouldy or otherwise inedible, or has been discarded because it has passed a best-before date. Much of this waste is composed of vegetables that can deteriorate in quality in a relatively short space of time, for instance 35,000 tonnes per year of lettuce and 22,000 tonnes per year of other leafy salads. However, there are also substantial amounts of vegetables with longer shelf lives not being used in time, including 180,000 tonnes per year of potatoes and 27,000 tonnes per year of onions.

**Figure 18:** Weight of avoidable fresh vegetable and salad waste by type, split by reason for disposal

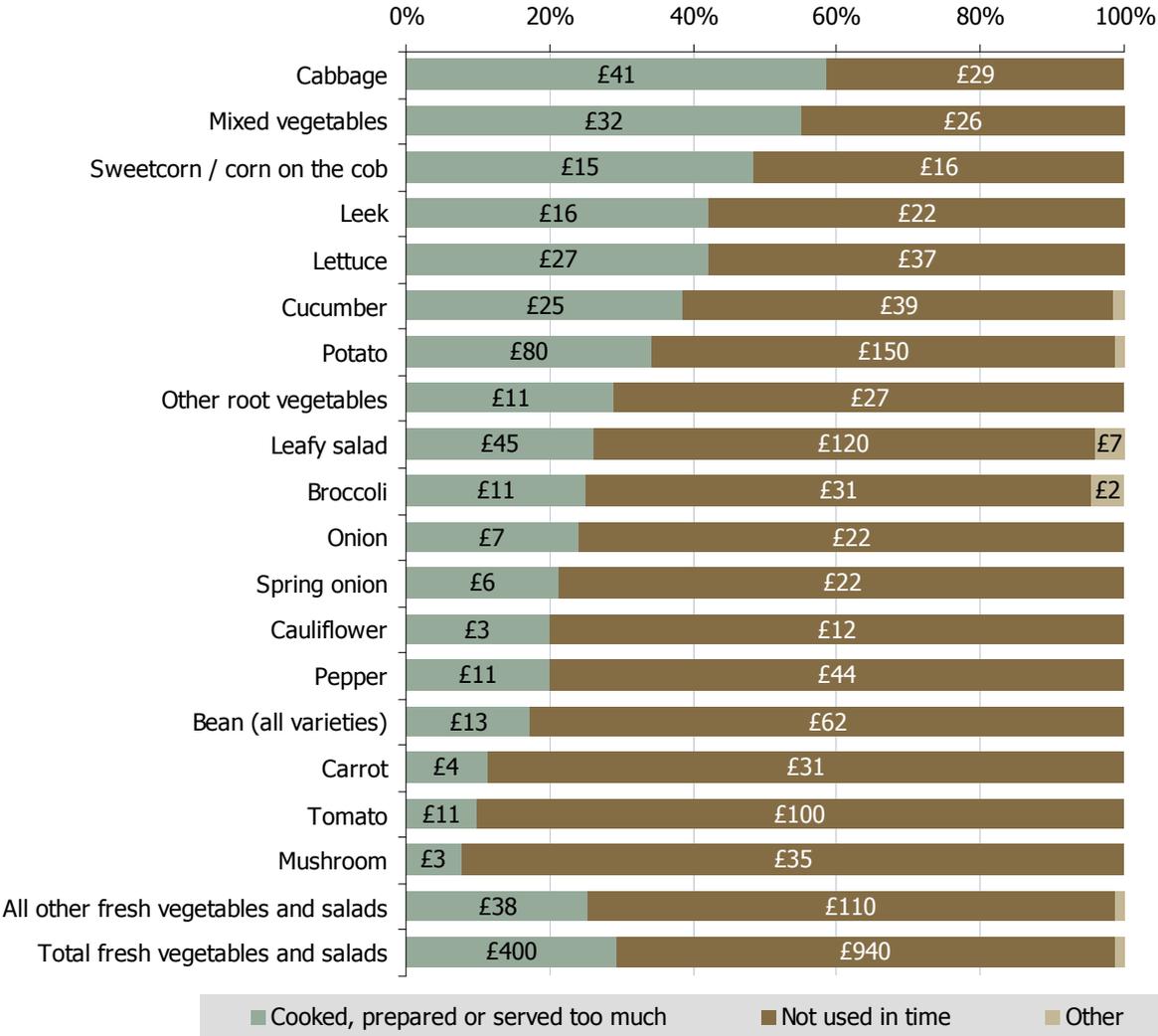


Figures within bars state waste in tonnes per year

The fact that two-thirds of potatoes are wasted because they are not used in time is in contrast to other staple foods that are commonly served as a part of a main meal, such as pasta and rice. For staples commonly purchased dried, less than a quarter of the waste is categorised as 'not used in time' (£12.2).

280,000 tonnes per year of all vegetables and salad is disposed of after preparation, serving or cooking. This includes approximately 100,000 tonnes per year of potato waste – divided between many different cooked forms (boiled, roasted, mashed, etc.).

**Figure 19:** Cost of avoidable fresh vegetable and salad waste by type, split by reason for disposal



Figures within bars state waste in £ million per year

### 5.3 Processed vegetables and salad

#### 5.3.1 Breakdown of processed vegetables and salad by avoidability

A total of 210,000 tonnes of processed vegetables and salad are disposed of annually in the UK, all of which is avoidable. The cost of the avoidable food waste is £360 million annually.

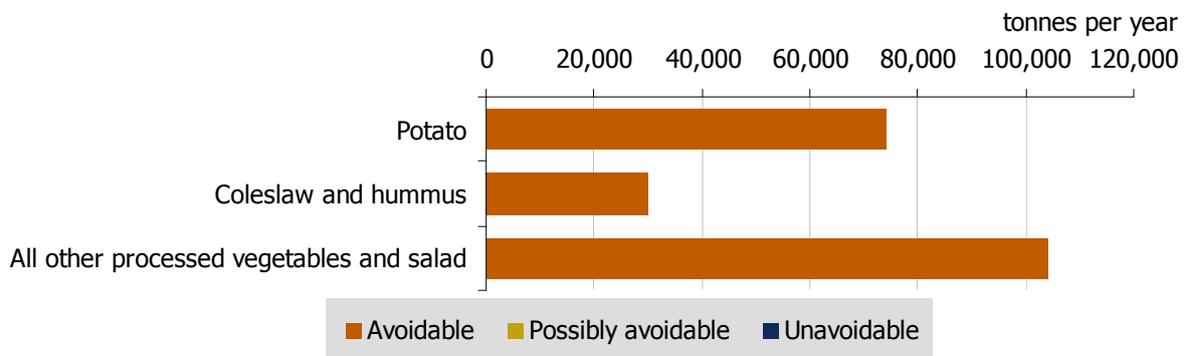
In contrast to fresh produce, the overwhelming majority of processed vegetable and salad waste is avoidable. In effect, purchasing pre-prepared food leads to the associated unavoidable or possibly avoidable waste being generated by food manufacturers rather than by the household. Taking the example of oven chips (made without potato skins), the possibly avoidable waste (potato skins) associated with these chips is generated by the food manufacturer, rather than the household consuming the product. Processed vegetables are generally in a state of preservation, such as dried, pickled or frozen and therefore less likely to perish. Consequently, for both these reasons, much less household waste is associated with 'processed' vegetables than fresh vegetables.

More than a third of the processed vegetables is potato (74,000 tonnes per year, cost of £74 million), and there are also 30,000 tonnes per year of coleslaw and hummus (cost of £75 million).

**Table 12:** The amount of processed vegetables and salad waste by type, split by avoidability

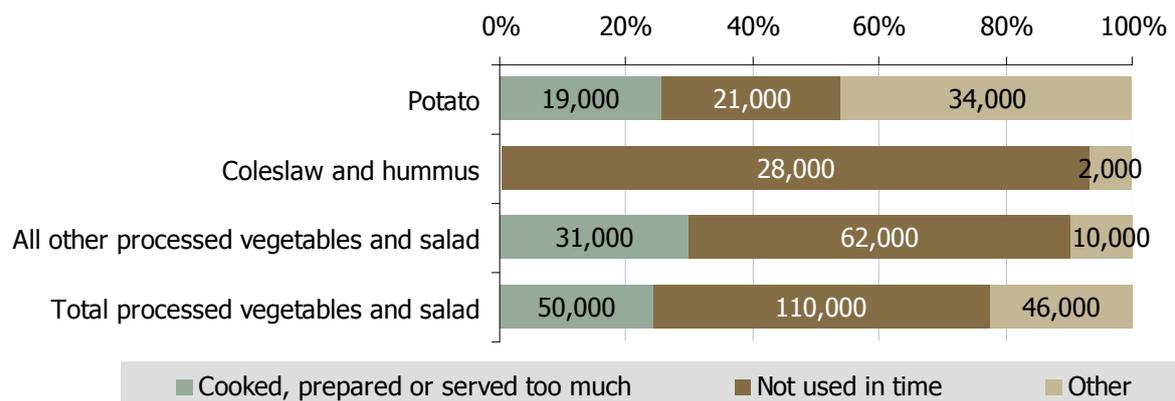
Food Type	Weight generated (tonnes per year)			Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	
Potato	74,000	<1,000	<1,000	£74
Coleslaw and hummus	30,000	<1,000	<1,000	£75
All other processed vegetables and salad	100,000	<1,000	<1,000	£210
<b>Total processed vegetables and salad</b>	<b>210,000</b>	<b>&lt;1,000</b>	<b>&lt;1,000</b>	<b>£360</b>

**Figure 20:** Weight of processed vegetable and salad waste by type, split by avoidability



### 5.3.2 Breakdown of avoidable processed vegetables and salad waste by reason for disposal

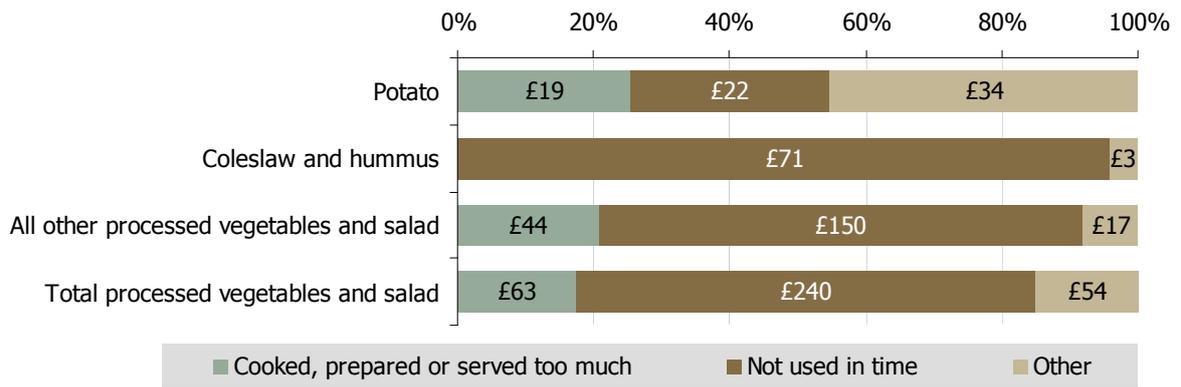
**Figure 21:** Weight of avoidable processed vegetable and salad waste by type, split by reason for disposal



Figures within bars state waste in tonnes per year

Processed vegetables and salads are less likely to be disposed of because they were not used in time (54%, c.f. 66% for fresh vegetables and salad). This is likely a reflection of their longer shelf-life. For the processed potatoes, the reason for disposal could not be confirmed in many cases, but where it could there is an equal split between the two reasons for disposal. The vast majority of coleslaw waste was disposed of packaged, and hence classified as 'not used in time'.

**Figure 22: Cost of avoidable processed vegetable and salad waste by type, split by reason for disposal**



*Figures within bars state waste in £ million per year*

## 6 Results for drink

### 6.1 Categorisation of drink

The drink group includes soft drinks, milkshakes, juices, hot beverages and alcoholic drinks. Bottled water is included, but tap water is not. The tap water used to make tea and coffee, or to dilute squash has been subtracted from the data, as discussed in §1.4.3. Soups and milk are not included here because they are generally considered to be foodstuffs rather than drink, and are classified under meals (Chapter 9) and dairy and eggs (Chapter 11) respectively. Table 13 shows the types into which drink has been categorised.

**Table 13:** Types of drink waste

Food Type	What it includes	What it doesn't include
Coffee	Coffee grounds, instant coffee granules	Water used to make coffee
Fruit juice and smoothies	Fruit juices, tomato juice, smoothies	Lemon juice
Hot chocolate	Both powder and liquid form	
Lager, beer and cider	Ale, cider, lager, stout	
Milkshake and milk drink	Flavoured milk, milkshake, milkshake powder (and milk if used to constitute), soya milk	Milk (except where used to constitute)
Carbonated soft drink	Cola, cream soda, dandelion and burdock, energy drinks, fruit-based soda, ginger beer, lemonade, limeade	Carbonated water
Squash	Squash	Water added to squash
Tea waste	Black, green, herbal teas; milk and sugar added to tea that is disposed of <sup>26</sup>	Water used to make tea
Bottled water	Bottled water, flavoured water; carbonated or still	Tap water
Wine	All wines	
Other alcohol	Alcopops, spirits, spirits with mixers,	

*Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of 'all other drinks'.*

### 6.2 Breakdown of drink by avoidability

Drinks account for 1.3 millions tonnes of waste in the UK annually. A third of this, 430,000 tonnes per year is unavoidable (tea bags and coffee grounds) and two thirds, 870,000 tonnes per year is avoidable. This avoidable waste costs £1.6 billion annually.

**Table 14:** The amount of drink waste by type, split by avoidability

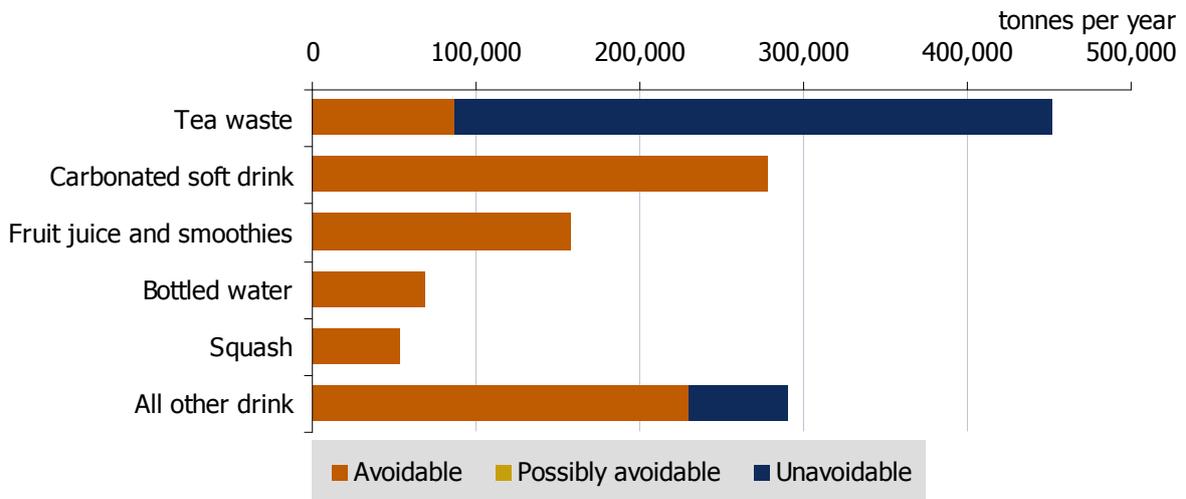
Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Tea waste	450,000	370,000	<1,000	86,000	£110
Carbonated soft drink	280,000	<1,000	<1,000	280,000	£250
Fruit juice and smoothies	160,000	<1,000	<1,000	160,000	£190
Bottled water	69,000	<1,000	<1,000	69,000	£48
Squash	53,000	<1,000	<1,000	53,000	£69
All other drink	290,000	60,000	<1,000	230,000	£980
<b>Total drink</b>	<b>1,300,000</b>	<b>430,000</b>	<b>&lt;1,000</b>	<b>870,000</b>	<b>£1,600</b>

The greatest proportion (one third) of the total drinks waste is tea, contributing 450,000 tonnes per year. Of this, only 86,000 tonnes per year is avoidable, made up of **unused** tea bags / leaves (c. 2,000 tonnes) and the waste associated with **undrunk** tea, namely milk, sugar and teabags (c. 84,000). This avoidable tea waste costs £110 million per year. Carbonated soft drinks account for 280,000 tonnes per year, all of which is avoidable, and costs

<sup>26</sup> See Appendix A.6 for full description of analysis relating to tea waste

£250 million. Fruit juices and smoothies costs £190 million for a further 160,000 tonnes per year. We throw away 69,000 tonnes per year (£48 million) of undrunk bottled water per year, and 53,000 tonnes of squash (worth £69 million). The unavoidable waste in 'all other drink' is associated with coffee.

**Figure 23:** Weight of drink waste by type, split by avoidability

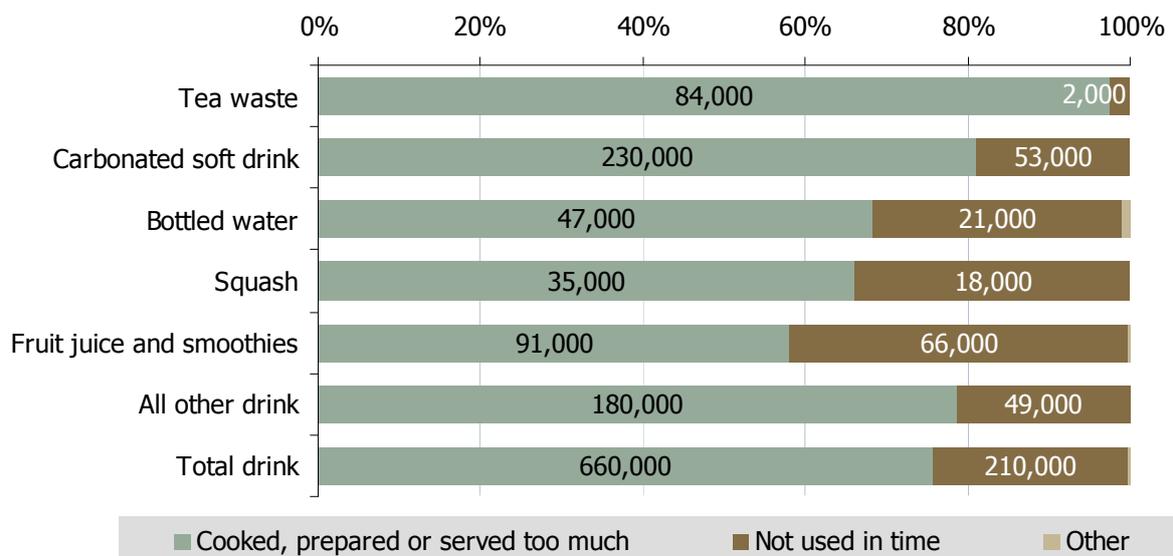


### 6.3 Breakdown of avoidable drink waste by reason for disposal

Of the avoidable drinks waste, over 85% was disposed of via the sewer. This means that the majority of the reasons for disposal come from diary entries, rather than being inferred from compositional analysis.

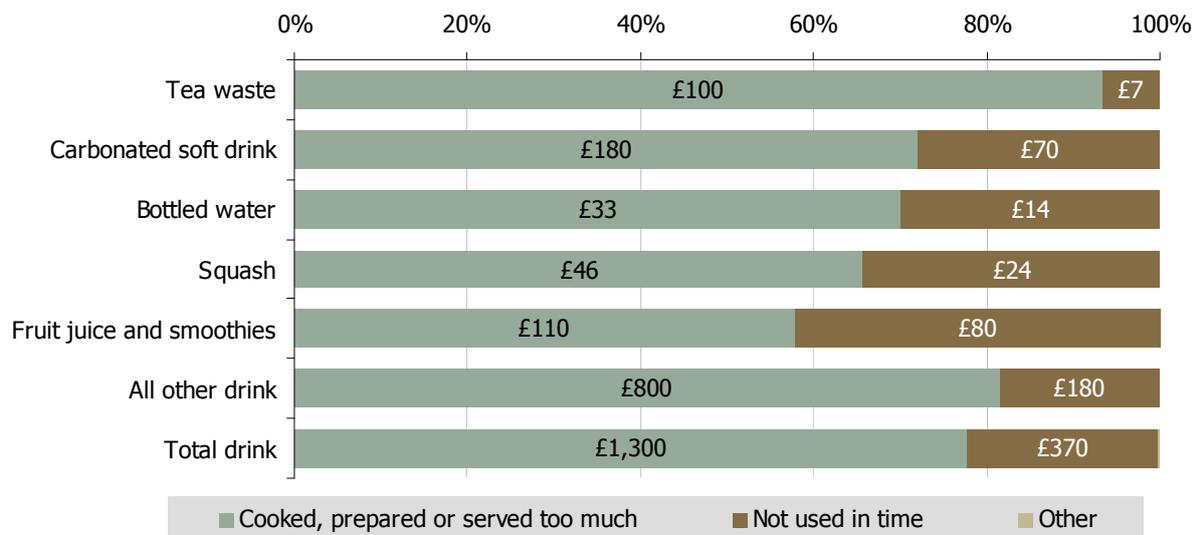
It was found that three-quarters of drink was disposed of as leftovers (e.g. after preparation or serving). Fruit juices and smoothies have relatively short shelf lives, and that is reflected in that they have the highest proportion (over 40%) disposed of because they were not used in time. Although not reported in this section, milk, with its shorter storage life, has an even higher proportion of disposal due to not being used in time (66%) - §11.3.

**Figure 24:** Weight of avoidable drink waste by type, split by reason for disposal



*Figures within bars state waste in tonnes per year*

**Figure 25: Cost of avoidable drink waste by type, split by reason for disposal**



*Figures within bars state waste in £ million per year*

## 7 Results for fruit

### 7.1 Categorisation of fruit

In this report, fruit is categorised according to the culinary definition, rather than the botanical definition. Hence, many food stuffs that are botanically fruit but are eaten as salad or vegetables – such as tomatoes or squash – are classified under vegetables and salad (Chapter 5). This categorisation is open to interpretation, as many fruits in this group are also eaten in savoury dishes, for example, papaya and avocado can be salad ingredients. The default is that if a food can be eaten as a fruit, then it is categorised as such. For this reason avocado and papaya are included in the current section.

In order to be considered 'fresh', the fruit had to be in its raw or minimally prepared state. Fruit salads were classified as fresh, unless known to be pre-prepared when purchased.

Processed fruit includes any items that are purchased dried, tinned, frozen and or otherwise processed. This group of foods could in theory contain any of fruit listed in Table 15. In practice however, only those fruit with examples given were found during the waste analysis. The lists are populated using real examples from the database and are not exhaustive.

**Table 15:** Types of fruit waste

Food Type	Fresh: what it includes	Processed: what it includes	What it doesn't include
Apple	Apple, core, peel	Cooked apple	Apple juice
Banana	Banana, banana skin	Banana chips	Plantain
Kiwi	Kiwi, kiwi skin	Not found	
Melon	Melon, rind, seeds, watermelon	Not found	
Mixed fruit	Fresh fruit salad, mixed peelings	Dried mixed peel, packaged fruit salads, pulp	
Orange	Clementines, mandarins, oranges, peel, satsumas	Not found	Orange juice
Pear	Pear, cores, peel	Tinned pears	
Pineapple	Pineapple, skin, top	Tinned pineapple	
Soft / berry fruit	Blackberries, blueberries, grapes, raspberries, redcurrants, stems, strawberries	Dried cranberries, frozen strawberries, raisins, sultanas	
Stone fruit	Apricot, avocado, cherry, damson, mango, nectarine, peach, peel, plum, stones	Dates, dried apricots, glace cherries, prunes, tinned peaches	
Other citrus	Grapefruit, lemon, lime, peel	Tinned grapefruit	Lemon juice
Other fruit	Coconut, fig, guava, lychee, papaya, passion fruit, pomegranate, rhubarb, unknown fruit	Coconut milk, desiccated coconut, dried figs	

*Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of either 'all other fresh fruit' or 'all other processed fruit'.*

Although most fruit is available year-round from supermarkets, some fruit, especially windfall, is subject to seasonal variation. Because the analysis of food waste in kerbside collection was conducted in the autumn, apples and stone fruit such as plums may be over-represented here. Many fruit are more widely available in the summer months, e.g. soft fruits such as strawberries and raspberries.

### 7.2 Breakdown of fruit by avoidability

Approximately 1.1 million tonnes of fresh fruit waste is produced by households in the UK annually. Nearly half of this, 500,000 tonnes per year, is avoidable, and costs £990 million annually.

A further 520,000 tonnes per year is unavoidable, being inedible parts such as banana skin, kiwi skin, apple core, melon seeds and rind, citrus peel, pomegranate skin, grape stems, and stones from plums etc. A much smaller amount, 81,000 tonnes per year, is possibly avoidable, which includes apple skin and pear skin, which are unpalatable to some but eaten by others; it also includes fruit mixed with peel, as a proportion of this would have been edible.

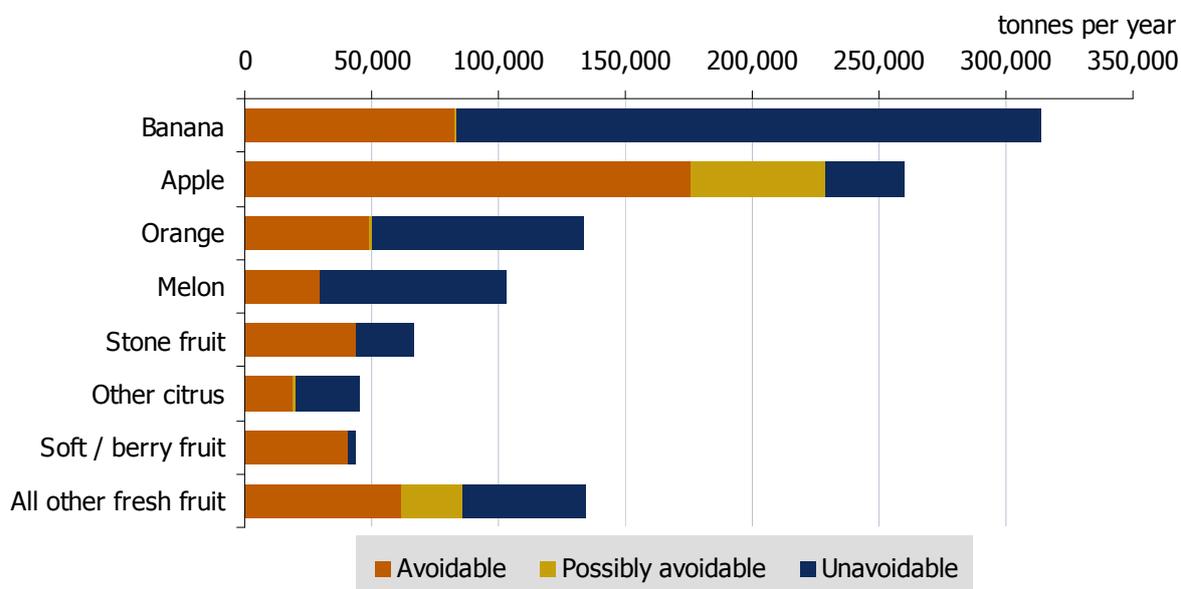
In addition to fresh fruit, there is also 30,000 tonnes per year of processed fruit waste produced by UK households. All of the processed fruit is avoidable – i.e. no ‘unavoidable’ or ‘possibly avoidable’ processed fruit waste was identified during the waste analysis. This is likely to be linked to all fruit in this category being pre-prepared or preserved.

In total there is 1.1 million tonnes of fruit waste produced in the UK annually<sup>27</sup>, 530,000 of which is avoidable at a cost of £1.1 billion.

**Table 16:** The amount of fruit waste by type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Banana	310,000	230,000	<1,000	83,000	£100
Apple	260,000	31,000	53,000	180,000	£300
Orange	130,000	84,000	<1,000	49,000	£73
Melon	100,000	74,000	<1,000	30,000	£62
Stone fruit	67,000	23,000	<1,000	43,000	£170
Other citrus	45,000	25,000	2,000	19,000	£26
Soft / berry fruit	44,000	3,000	<1,000	41,000	£150
All other fresh fruit	130,000	49,000	24,000	62,000	£110
<b>Total fresh fruit</b>	<b>1,100,000</b>	<b>520,000</b>	<b>81,000</b>	<b>500,000</b>	<b>£990</b>
<b>Total processed fruit</b>	<b>30,000</b>	<b>&lt;1,000</b>	<b>&lt;1,000</b>	<b>30,000</b>	<b>£63</b>
<b>Total fruit</b>	<b>1,100,000</b>	<b>520,000</b>	<b>81,000</b>	<b>530,000</b>	<b>£1,100</b>

**Figure 26:** Weight of fresh fruit waste by type, split by avoidability



Of the fresh fruit, more than a quarter (310,000 tonnes per year) is banana, most of which is inedible peel. The avoidable banana waste weigh 83,000 tonnes and costs £100 million per year.

<sup>27</sup> The addition of processed to fresh fruit waste does not alter the total weight of fruit waste when expressed to two significant figures.

Although the overall weight of discarded apple is less than banana (total 260,000 tonnes per year), much more avoidable waste is thrown away (180,000 tonnes per year, costing £300 million).

Citrus fruits and melons have a sizeable proportion which is inedible. However, there are still 49,000 tonnes of avoidable orange waste and 30,000 tonnes of avoidable melon waste discarded each year.

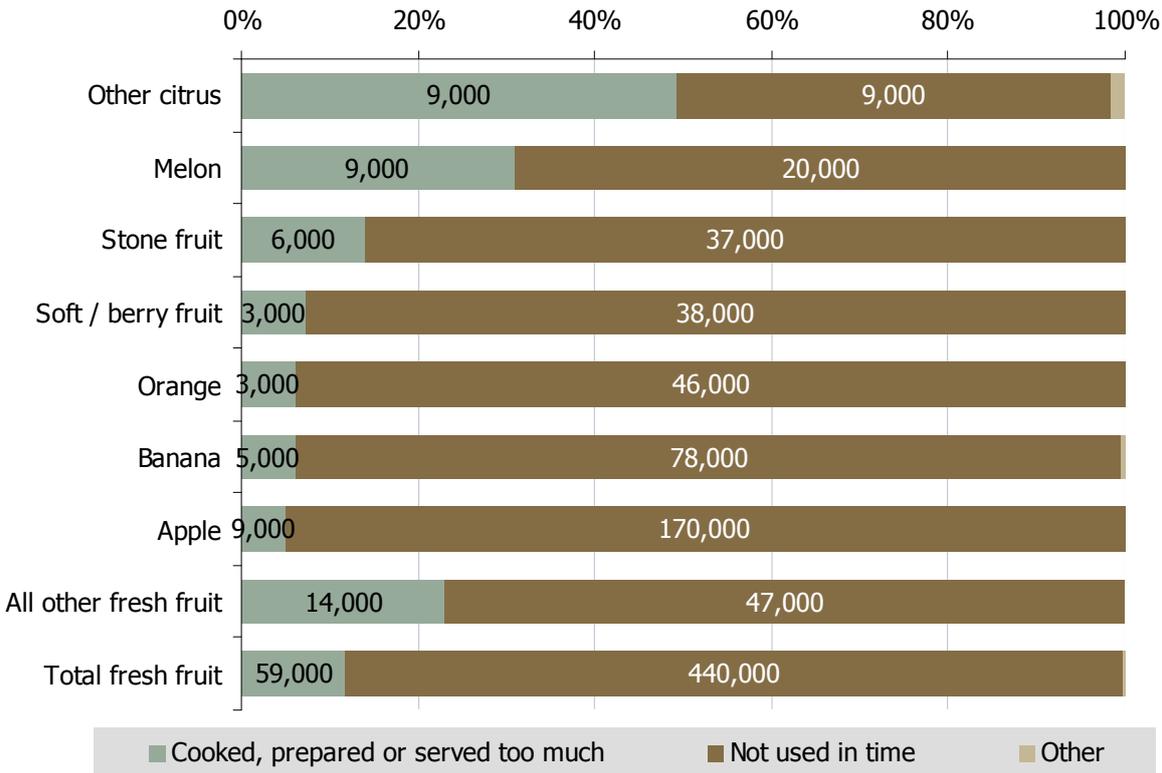
Soft and berry fruit is almost entirely edible, and the cost of the 41,000 tonnes of avoidable waste produced annually is £150 million.

### 7.3 Breakdown of avoidable fruit waste by reason for disposal

The vast majority of fresh fruit is disposed of because it was not being used in time (Figure 27). Previous diary research<sup>28</sup> indicates that this is mostly associated with fruit deteriorating in quality – going mouldy, looking or smelling bad. This relatively high proportion of food not being used in time is likely to be linked to the fact that fruit is perishable over a shorter time period than many other foods, and frequently purchased in large quantities. This could be further exacerbated by fruit being stored in sub-optimal conditions – in general fruit will store for longer in the fridge.

A fraction of the melon waste falls into a grey area between the two reasons for disposal. Frequently, melons are too large to consume during one meal and it is likely that they are cut up, with the uneaten portion stored (e.g. in the fridge). If this portion is subsequently thrown away, the methodology used here results in this waste being classified as 'cooked, prepared or served too much', although it could equally be argued that it was not used in time. This explains why melon has a higher proportion of waste classified as 'cooked, prepared or served too much'.

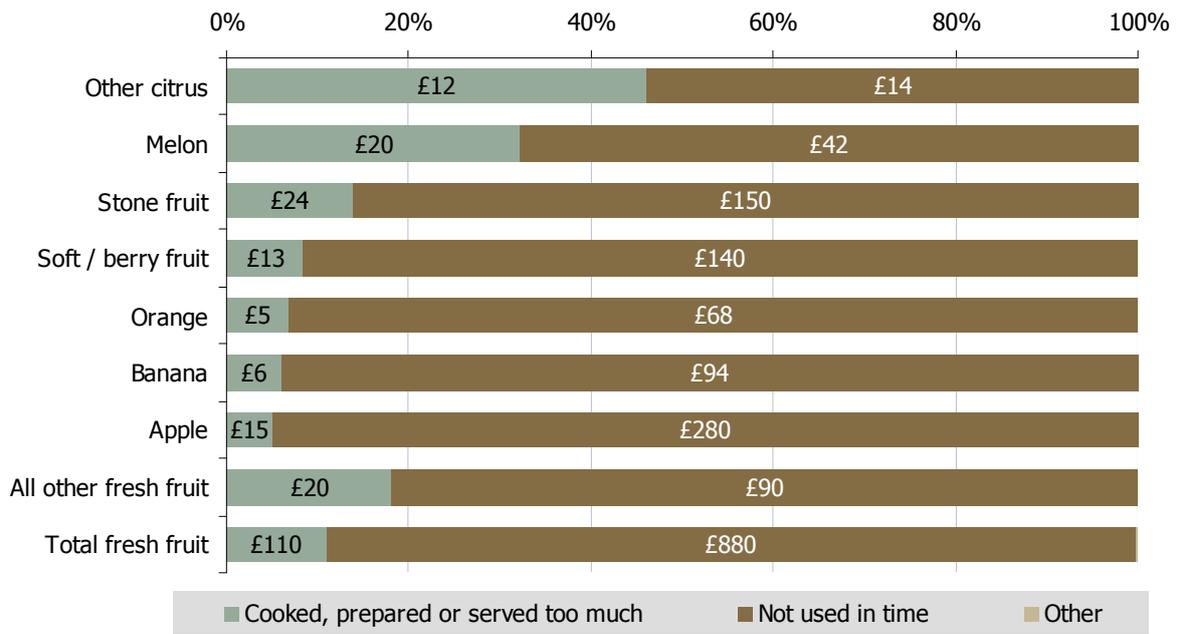
**Figure 27:** Weight of avoidable fresh fruit waste by type, split by reason for disposal



*Figures within bars state waste in tonnes per year*

<sup>28</sup> From Kitchen Diary research, reported in The Food We Waste, May 2008.

**Figure 28:** Cost of avoidable fresh fruit waste by type, split by reason for disposal



*Figures within bars state waste in £ million per year*

## 8 Results for bakery

### 8.1 Categorisation of bakery

Table 17 shows the foods included in the bakery group. Notably, sweet bakery items are not included here, but can be found in the cakes and desserts group (§12.3). Bread found in sandwiches is included under meals (Chapter 9).

**Table 17:** Types of bakery products waste

Food Type	What it includes	What it doesn't include
Cracker / crisp bread	Savoury biscuits, crackers, sesame toast, rye bread and crackers, rice cakes	Sweet biscuits
Breadsticks	Breadsticks	
Dough	Bread dough (cooked or uncooked), dough balls	Pizza crusts
Dumplings	Dumplings, dumpling mix	
Morning goods	Croissants, crumpets, oven bottom muffins, potato cakes, scotch pancakes, waffles	Danish pastries, hot cross buns, potato waffles, scones
Pastry	Filo, puff, shortcrust, vol-au-vents	Pies
Speciality bread	Bagels, brioche, chapatti, ciabatta, focaccia, garlic bread, naan, pitta, poppadom, stottie, tortilla	
Standard bread	Granary, white, wholemeal; baguettes, loaves, rolls; crumbs, crusts, whole slices and pieces; toasted or untoasted	
Yorkshire pudding and other batters	Batter mix, fish batter, pancakes, Yorkshire pudding	
Other bakery	Breadcrumbs (bought), bread mix, croutons, pizza base, taco shells.	

*Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of 'all other bakery'.*

### 8.2 Breakdown of bakery by avoidability

Nearly 800,000 tonnes of bakery waste is disposed of in the UK annually. Of this the majority is avoidable waste (680,000 tonnes per year) which costs £1.1 billion.

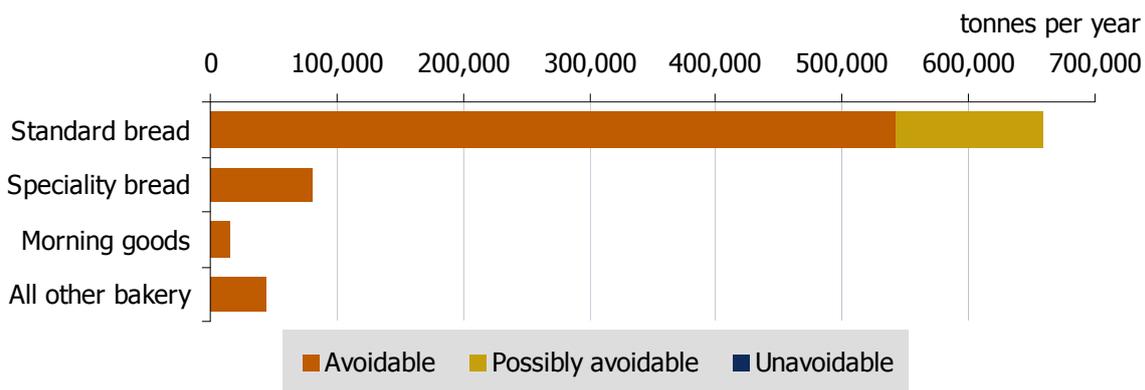
There is a further 120,000 tonnes per year of possibly avoidable food waste which includes items that some people choose not to eat or find unpalatable but which other people may eat, such as bread crusts. There is no 'unavoidable' bakery waste, as all these bakery products are supplied in a form either ready for consumption, or ready to be mixed (batter mixes etc).

**Table 18:** The amount of bakery waste by type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Standard bread	660,000	<1,000	120,000	540,000	£640
Speciality bread	81,000	<1,000	<1,000	80,000	£300
Morning goods	15,000	<1,000	<1,000	15,000	£39
All other bakery	44,000	<1,000	<1,000	44,000	£97
<b>Total bakery</b>	<b>800,000</b>	<b>&lt;1,000</b>	<b>120,000</b>	<b>680,000</b>	<b>£1,100</b>

Four-fifths of the bakery waste is standard bread: 660,000 tonnes per year, of which 540,000 tonnes is avoidable (costing £640 million annually). Additionally, around 81,000 tonnes of speciality bread is disposed of each year – the vast majority being avoidable – costing us £300 million, and 15,000 tonnes per year of morning goods, costing £39 million. All other bakery products (as listed in Table 17) account for 44,000 tonnes of waste per year.

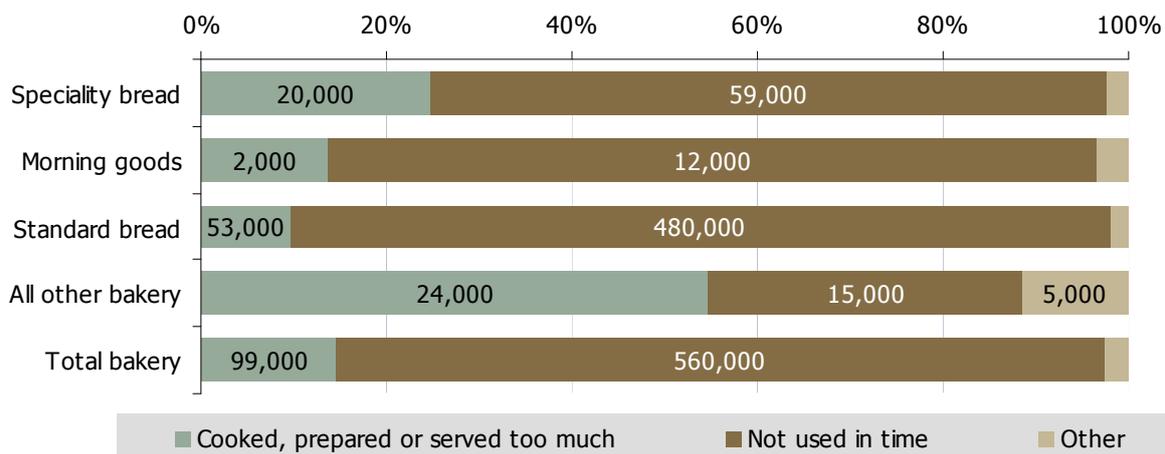
**Figure 29:** Weight of bakery waste by type, split by avoidability



### 8.3 Breakdown of avoidable bakery waste by reason for disposal

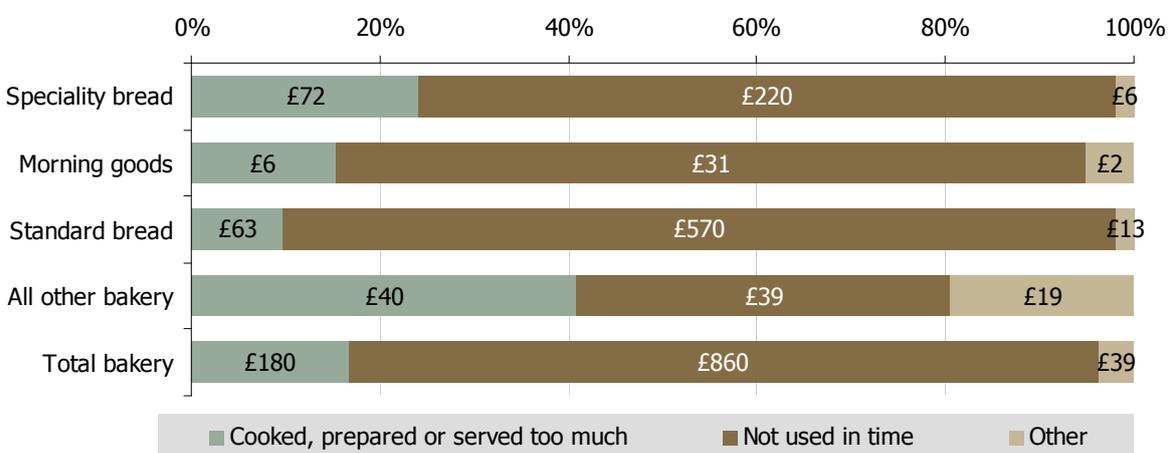
The high level of bakery-product disposal due to not being used in time reflects these products' relatively short shelf-life. What is particularly interesting, in light of it being a staple food, is that standard bread tends to go off rather than having too much served. This indicates that the majority of the bread waste is associated with behaviours relating to shopping and storage, rather than with the cooking, preparation and serving. This is similar to the situation with fresh potatoes, but contrasts with the dried staple foods (e.g. rice and pasta).

**Figure 30:** Weight of avoidable bakery waste by type, split by reason for disposal



*Figures within bars state waste in tonnes per year*

**Figure 31:** Cost of avoidable bakery waste by type, split by reason for disposal



*Figures within bars state waste in £ million per year*

## 9 Results for homemade and pre-prepared meals

### 9.1 Categorisation of homemade and pre-prepared meals

We eat a large proportion of our food in the form of meals, and the associated waste reported here only includes that which is disposed of in the household waste. For foods which are often consumed outside of the home such as sandwiches and takeaways, there is likely to be additional arisings in non-household waste streams, e.g. litter bins, office waste.

This food group includes soups, composite meals (spaghetti bolognese, curry and rice, fish and chips, etc), sandwiches, and composite savoury products, e.g. pasties, that can be eaten as a snack on their own or as part of a meal (Table 19). Each food type has been sub-divided into those purchased pre-prepared and homemade. The pre-prepared category includes ready meals and takeaways. It was not always possible to identify whether food was pre-prepared or homemade – in some instances, assumptions have been made and these are listed below.

**Table 19:** Types of meals waste

Food Type	What it includes		What it doesn't include
	Pre-prepared	Homemade	
Soup	Packet or tinned soup	Homemade soup (where specified)	Stock
Composite meal	Pease pudding, instant noodles, ravioli, ready meals, spaghetti hoops (not with other items), takeaway meals	Meals stated as homemade or not stated as purchased. Also includes pre-prepared savoury products and spaghetti hoops where combined with other ingredients	
Sandwich	Where known to be pre-prepared due to packaging type / brand name	All other sandwiches are assumed to be homemade	
Savoury products	Bhaji, pakora, pasty, pork pie, quiche, ravioli, samosa, sausage roll, Scotch egg, shami kebab, spring roll, unless stated homemade	Falafel, homemade veggie burgers, pie crusts, stuffing	

### 9.2 Breakdown of meals by avoidability

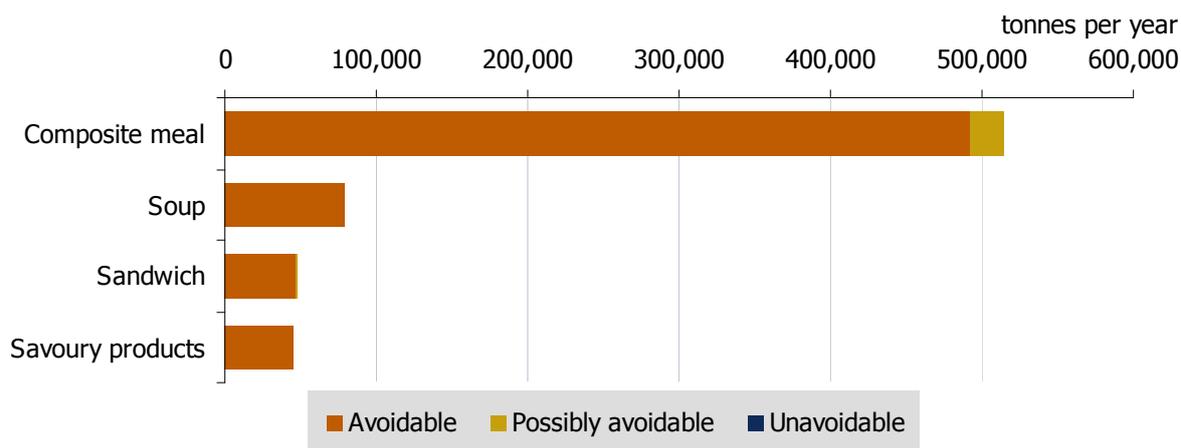
In the UK, we dispose of approximately 690,000 tonnes of mixed meal waste annually. Almost all of this is avoidable, and costs £2.1 billion. The rest is possibly avoidable (sandwich and pizza crusts, and plate scrapings that may include meat rinds etc). There was no unavoidable meal waste identified during the research.

**Table 20:** The amount of meal waste by type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Composite meal	510,000	<1,000	23,000	490,000	£1,700
Soup	80,000	<1,000	<1,000	80,000	£120
Sandwich	49,000	<1,000	1,000	47,000	£90
Savoury products	45,000	<1,000	<1,000	45,000	£180
<b>Total meals (homemade and pre-prepared)</b>	<b>690,000</b>	<b>&lt;1,000</b>	<b>24,000</b>	<b>660,000</b>	<b>£2,100</b>

Nearly three-quarters of the total meal waste is in the form of composite meals (510,000 tonnes per year), a further 80,000 tonnes per year is soup, 49,000 tonnes per year sandwiches and 45,000 tonnes per year savoury products.

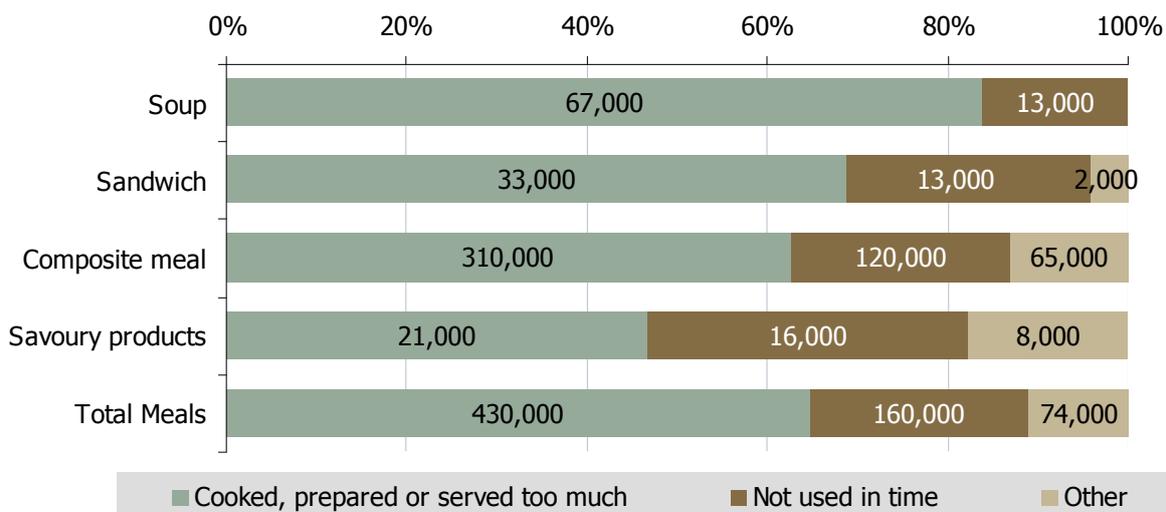
**Figure 32:** Weight of meal waste by type, split by avoidability



### 9.3 Breakdown of avoidable meal waste by reason for disposal

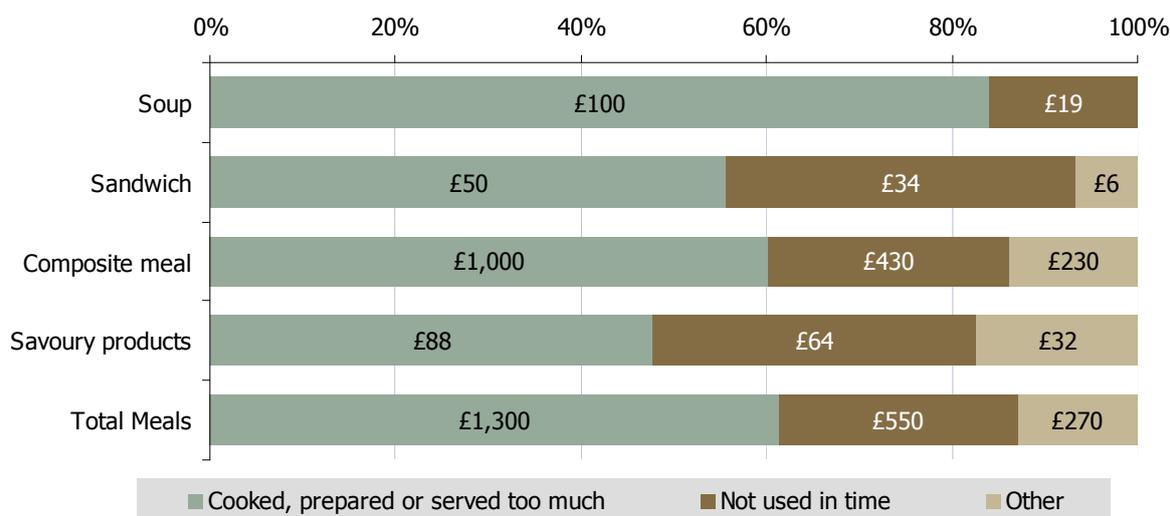
Avoidable waste makes up the vast proportion of meal waste. The majority of this arises from cooking, preparing or serving too much (430,000 tonnes). Soup has the highest proportion of 'prepared too much', and savoury products the lowest proportion. For savoury products, this will be influenced by the fact that, if the item was dished up as part of a meal – i.e. with other items – then the waste would have been categorised under 'composite meal' rather than savoury products.

**Figure 33:** Weight of avoidable meal waste by type, split by reason for disposal



*Figures within bars state waste in tonnes per year*

**Figure 34:** Cost of avoidable meal waste by type, split by reason for disposal



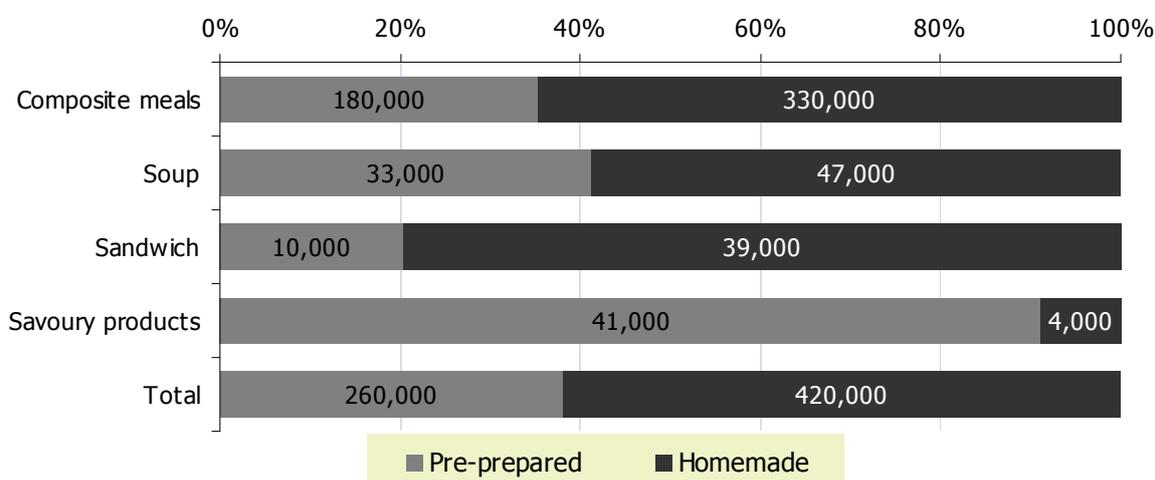
*Figures within bars state waste in £ million per year*

#### 9.4 Breakdown of avoidable meal waste by pre-prepared and home-made

The information shown in Figure 32 is further split by whether there was evidence that the food was pre-prepared (takeaway, ready meal, or purchased) in Figure 35. Where there is no evidence of being pre-prepared, it has been classified as homemade, with the exception of savoury products, which are classified as pre-prepared unless there is evidence they were homemade, as this seemed more likely. For this reason, the split is tentative.

The results indicate that the majority (>60%) of composite meal waste is homemade. The fraction for soup is similar to that for composite meals. A high proportion (80%) of sandwich waste arises from homemade items, whereas the vast majority of savoury products (>90%) are pre-prepared.

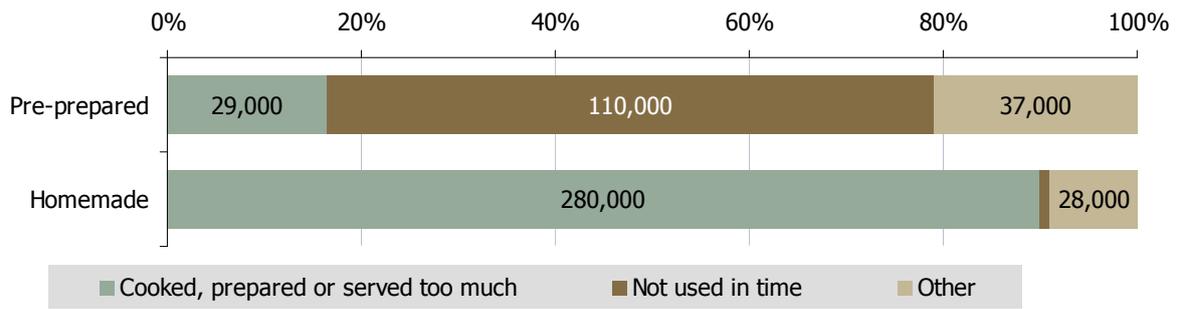
**Figure 35:** Weight of all meal waste by type, split by homemade / pre-prepared



*Figures within bars state waste in tonnes per year*

For composite meals, there are sufficient instances of meal waste occurring in the research to compare the reasons for disposal of pre-prepared and homemade. Approximately 60% of pre-prepared meals have been identified as 'not used in time'; this contrasts with homemade meals, for which over 90% of avoidable food waste is 'cooked, prepared or served too much' (Figure 36).

**Figure 36:** Weight of avoidable meal waste by homemade / pre-prepared, split by reason for disposal



*Figures within bars state waste in tonnes per year*

## 10 Results for meat and fish

### 10.1 Categorisation of meat and fish

This group includes carcass meats and processed meats, and all fish and shellfish, except those disposed of as part of a composite meal. Table 21 shows the types of foods included in the meat and fish group. Shellfish and fish have been grouped together because they are all animal products from the sea or fresh water.

**Table 21:** Types of meat and fish waste

Food Type	What it includes	What it doesn't include
Pork / ham / bacon	Bacon, bones, fat, gammon, ham, jelly, pork chops, rinds, sausages, spare ribs	Sausages identified as meat other than pork
Beef	Beef, bones, burgers, corned beef, fat, mince, roast beef, steak	Burgers or mince identified as meat other than beef, veggie burgers
Fish and shellfish	All fish, all shellfish (molluscs and crustaceans), bones, breaded or battered fish, caviar, crab paste, crab sticks, fish heads, guts, shellfish shells, fish skin	
Lamb	Bone, fat, lamb, lamb kebab	
Poultry (chicken / turkey / duck)	Bones, breaded chicken products, carcass, chicken, chicken wings, duck, fat, giblets, pheasant, skin, turkey	
Meat and fish based sandwich spread	Sandwich fillers containing meat or fish, pâté	
Bone (unidentifiable / mixed)	Mixed bones, unidentified bone	
Game	Pheasant, rabbit	
Other meat (unidentifiable / mixed meat / offal)	Black pudding, blood, unidentified fat, guts, haggis, hot dogs, jelly, kebab meat, kidney, liver, meatballs, mixed meat, tongue, unidentified meat	

*Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of 'all other meat and fish'.*

Meat foods which could be subject to seasonal fluctuation in particular are game (pheasants) having a shooting season of October to February, and poultry, especially turkey, which is consumed in greater amounts at Christmas.

### 10.2 Breakdown of meat and fish by avoidability

Meat and fish waste comprises 610,000 tonnes annually in the UK, of which nearly half (290,000 tonnes per year) is avoidable. This costs £1.6 billion annually.

The unavoidable fraction weighs nearly as much, 240,000 tonnes per year, and comprises bones and giblets, fish heads and shellfish shells.

Possibly avoidable waste makes up a small part of meat and fish waste (83,000 tonnes per year) and includes fish or chicken skin, or bacon rind, which is unpalatable to some but eaten by others; and fat from meat, which could be used as lard or dripping.

Half of the total meat and fish waste is poultry (300,000 tonnes per year). Almost two-thirds of poultry waste is inedible carcasses and bones (190,000 tonnes per year). The avoidable fraction weighs 81,000 tonnes, costs £350 million per year and comprises both carcass meat (e.g. chicken thighs and breasts) and processed poultry products, such as chicken nuggets.

Of the 120,000 tonnes per year of pork waste, three-quarters (93,000 tonnes per year) is avoidable, costing £440 million. Much of the pork is prepared pork products such as sausages, ham and bacon, rather than being carcass meat. A total of 43,000 tonnes of fish and shellfish waste is disposed of annually, of which three quarters (32,000

tonnes per year) is avoidable. Lamb makes up a small fraction of the total meat and fish waste (~5%), with avoidable lamb waste being 8,000 tonnes per year, costing £50 million annually.

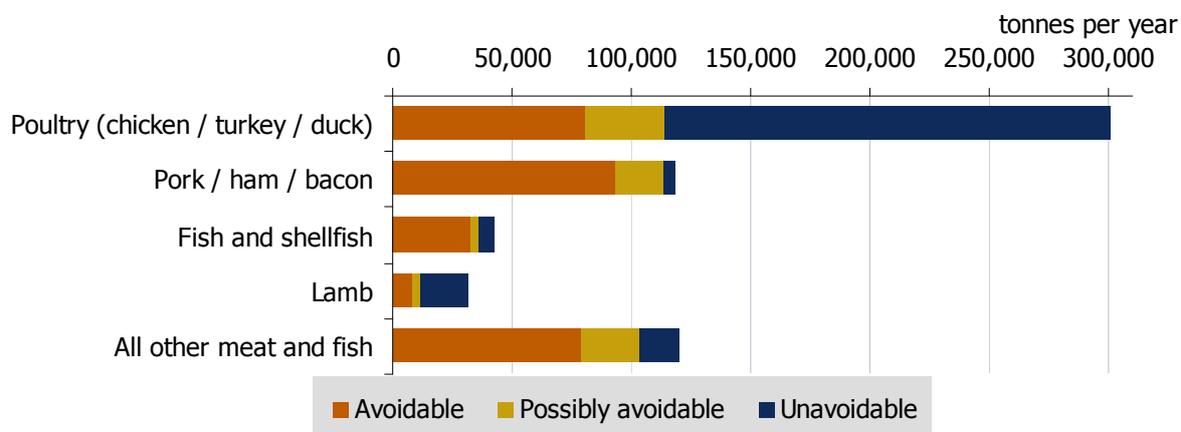
**Table 22:** The amount of meat and fish waste by type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Poultry	300,000	190,000	33,000	81,000	£350
Pork / ham / bacon	120,000	5,000	20,000	93,000	£440
Fish and shellfish	43,000	7,000	3,000	32,000	£250
Lamb	32,000	20,000	4,000	8,000	£51
All other meat and fish	120,000	17,000	24,000	79,000	£500
<b>Total meat and fish</b>	<b>610,000</b>	<b>240,000</b>	<b>83,000</b>	<b>290,000</b>	<b>£1,600</b>

A large proportion of the category 'all other meat and fish' is beef – both carcass meat and beef products. However, the confidence interval on the estimate is too broad for beef to be reported separately (see §2.2).

In general, the proportion of each type of meat that is unavoidable is a reflection of the amount of carcass meat sold. For poultry and lamb, a large fraction of the meat entering the home is carcass meat, which contains a substantial amount of inedible material. This accounts for the relatively high proportion of inedible waste for poultry and lamb – around two-thirds of the total waste. In contrast, much of the pork entering the home is in the form of non-carcass products – bacon, sausages, ham. The inedible material associated with these does not enter the household, and hence the proportion of pork waste that is unavoidable waste is much lower (<5%).

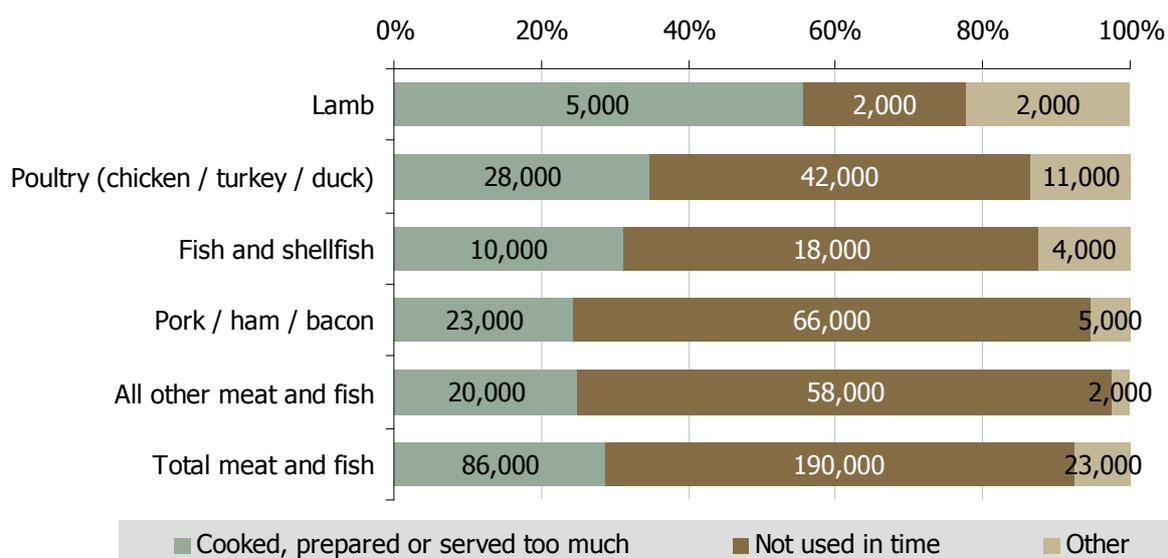
**Figure 37:** Weight of meat and fish waste by type, split by avoidability



### 10.3 Breakdown of avoidable meat and fish waste by reason for disposal

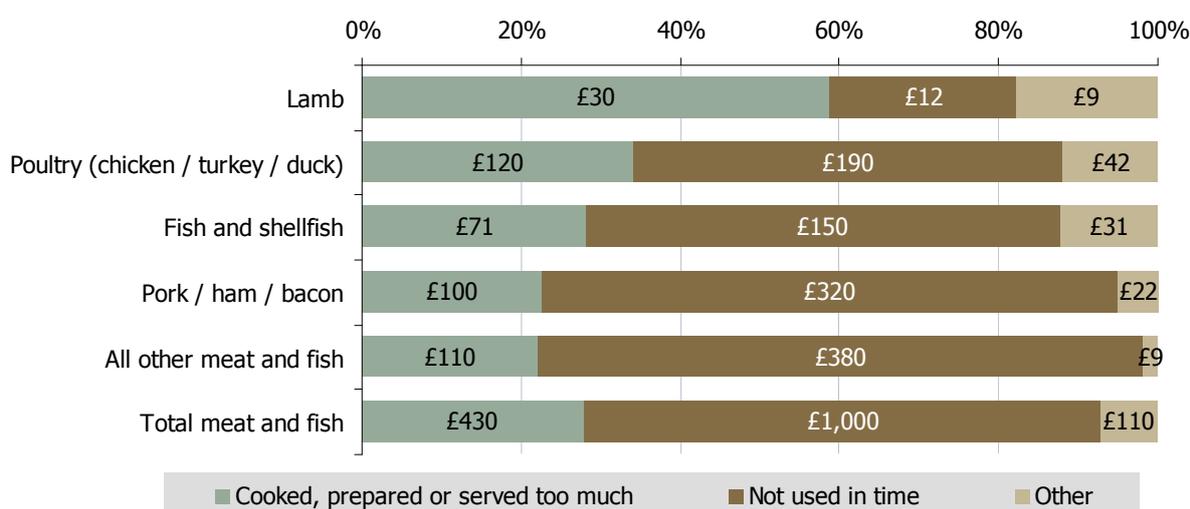
Of the 290,000 tonnes of avoidable meat and fish waste generated annually, the majority is disposed of because it was not used in time (Figure 38). Information from the *Kitchen Diary* research (reported in *The Food We Waste*) indicates that the vast majority of this waste is associated with adherence to date labelling, i.e. not using or freezing fresh meats and fish before the end of the use-by date. Only a very small amount of waste was associated with food that looked, smelt or tasted bad. The information for lamb should be treated as indicative only, due to the small number of instances of avoidable lamb waste in the research. For the other food types, there is little variation between the reasons for disposal.

**Figure 38:** Weight of avoidable meat and fish waste by type, split by reason for disposal



*Figures within bars state waste in tonnes per year*

**Figure 39:** Cost of avoidable meat and fish waste by type, split by reason for disposal



*Figures within bars state waste in £ million per year*

#### 10.4 Further breakdown of poultry and pork by food subtype

Due to the high number of instances of chicken and pork occurring in the research, it is possible to investigate these food types at a higher level of detail whilst still maintaining an acceptable degree of confidence around the estimates. Poultry and pork were divided into the subtypes shown in Table 23. There were more subtypes for pork, reflecting the wider diversity of pork products.

Of the total poultry waste, the greatest proportion by far is carcass meat and bones, and indeed most of this is bones, as shown by the high amount of unavoidable waste, 180,000 tonnes (Table 24). The avoidable portion of carcass meat is 61,000 tonnes, which costs £260 million per year. Processed poultry contains a lower proportion of unavoidable waste, as much of the bones etc. have been removed before retail, the exception being the leg and wing bones associated with fried chicken takeaways. There is 18,000 tonnes of avoidable waste of poultry products and 2,000 tonnes avoidable waste of sliced poultry at a cost of £77 million and £10 million per year respectively.

**Table 23:** Classification of poultry and pork into subtypes

Food Subtype	What it includes
<b>Poultry</b>	
Carcass meat / bones	Whole birds, portions (breast, thigh, drumsticks), bones and carcasses, fat. Includes marinated products where no evidence of any reforming process or breading.
Poultry product	Breaded products (nuggets, kiev), reformed drumsticks. Includes takeaway chicken as assumed to be breaded or coated in some way (and bones from takeaway chicken).
Sliced Poultry	Sliced sandwich meats e.g. turkey ham, honey roast chicken breast slices
<b>Pork</b>	
Bacon	Bacon (including rind and rashers)
Carcass meat / bones	Portions (chop, joint), bones, fat. Includes marinated products where no evidence of any reforming process. Includes smoked cuts such as gammon.
Sausages	Uncured sausages. All sausages were assumed to be pork unless packaging stated otherwise.
Sliced Ham	Sliced sandwich meats: ham, luncheon meat, polony.
Other pork product	Includes kebabs, cured sausages such as spicy sausage, salami, and chorizo.

**Table 24:** The amount of poultry waste by sub-type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Carcass meat / bones	270,000	180,000	32,000	61,000	£260
Poultry product	29,000	10,000	1,000	18,000	£77
Sliced Poultry	2,000	<1,000	<1,000	2,000	£10
<b>Total poultry</b>	<b>300,000</b>	<b>190,000</b>	<b>33,000</b>	<b>81,000</b>	<b>£350</b>

In comparison to poultry, there is a higher proportion of pork carcass meat that is avoidable (Table 25). This is likely to be linked to the proportion of bones and other inedible material being sold as part of pork carcass products. Consequently, 27,000 tonnes per year of avoidable pork waste associate with carcass meat and bones is generated, costing £140 million per year. The majority of the processed pork products are avoidable, the greatest waste being of sausages at 29,000 tonnes and a cost of £100 million per year. Sliced ham accounts for a further 21,000 tonnes or avoidable waste per year at a cost of £90 million. Avoidable waste of bacon is 14,000 tonnes and the cost is £96 million, reflecting its higher purchase price.

**Table 25:** The amount of pork waste by sub-type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Carcass meat / bones	39,000	5,000	7,000	27,000	£140
Sausages	31,000	<1,000	2,000	29,000	£100
Sliced Ham	28,000	<1,000	6,000	21,000	£90
Bacon	18,000	<1,000	5,000	14,000	£96
Other pork product	3,000	<1,000	<1,000	3,000	£15
<b>Total</b>	<b>120,000</b>	<b>5,000</b>	<b>20,000</b>	<b>93,000</b>	<b>£440</b>

## 11 Results for dairy and eggs

### 11.1 Categorisation of dairy and eggs

This food group includes milk, milk products and eggs. This category thus includes the majority of non-meat animal products. Milk substitutes such as soya and rice milk are not included here; they can be found in the drinks group. Foods in this group are frequently used in the construction of meals, and it is only when the foods themselves could be identified as separate items that they are reported here. Table 26 shows the 6 types of foods included in the dairy and eggs group.

**Table 26:** Types of dairy and eggs waste

Food Type	What it includes	What it doesn't include
Milk	Fresh, UHT and goats' milk	Soya milk, baby milk formula
Cheese	All cheese including goats' cheese	
Cream and crème fraîche	Clotted cream, cream, crème fraîche, sour cream	
Egg	Eggs (chicken, duck etc), egg shells	Fish eggs
Yoghurt / yoghurt drink	Fromage frais, yoghurt, yoghurt drinks	
Other dairy	Evaporated milk, milk powder, whey	

*Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of 'all other dairy and eggs'.*

### 11.2 Breakdown of dairy and eggs by avoidability

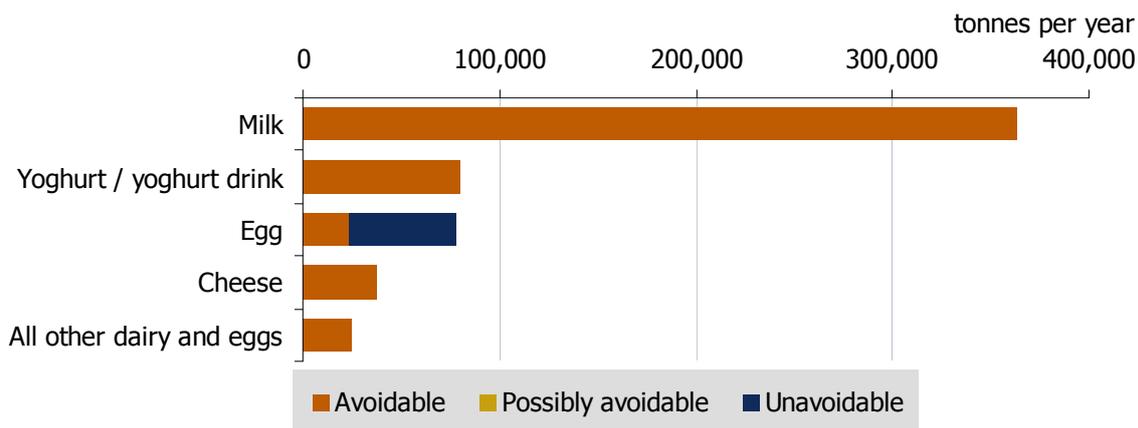
More than 580,000 tonnes of dairy and egg waste is disposed of in the UK annually, almost all of which is avoidable (530,000 tonnes per year), and costs £870 million.

The majority of the waste by weight is milk, 360,000 tonnes per year (c. 350 million litres), all of which is avoidable (there is no inedible fraction of milk). The avoidable fractions of yoghurt and cheese waste cost the UK £210 million and £240 million per year respectively. Egg shells, which are classified as unavoidable waste, account for around three quarters of the total egg waste of 77,000 tonnes per year. The avoidable egg waste (24,000 tonnes per year) costs £75 million.

**Table 27:** The amount of dairy and egg waste by type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Milk	360,000	<1,000	<1,000	360,000	£280
Yoghurt / yoghurt drink	80,000	<1,000	<1,000	80,000	£210
Egg	77,000	54,000	<1,000	24,000	£75
Cheese	38,000	<1,000	<1,000	38,000	£240
All other dairy and eggs	24,000	<1,000	<1,000	24,000	£69
<b>Total dairy and eggs</b>	<b>580,000</b>	<b>54,000</b>	<b>&lt;1,000</b>	<b>530,000</b>	<b>£870</b>

**Figure 40:** Weight of dairy and egg waste by type, split by avoidability



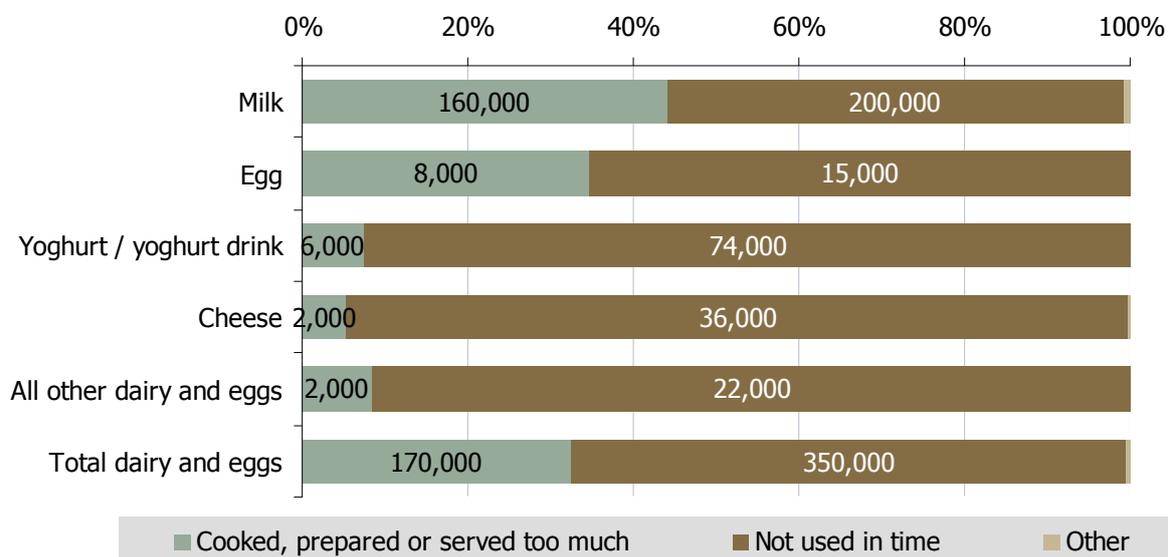
### 11.3 Breakdown of avoidable dairy and egg waste by reason for disposal

Figure 41 shows that the reasons for disposal of dairy products reflect the perishability of these foods, with a high proportion falling within 'not used in time'.

Milk has a different profile to yoghurt and cheese, with nearly half thrown away because too much is served. This difference may reflect differing behaviours associated with milk and drink, relative to food – it appears that we are more likely to pour a glass of milk that is subsequently not drunk, than to cut a cube of cheese and not eat it.

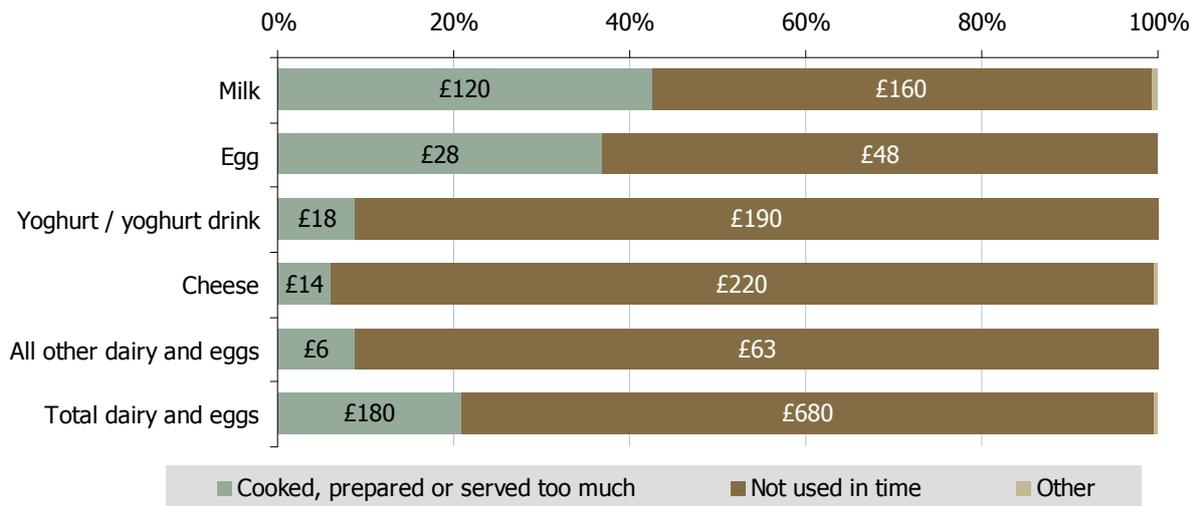
Information from the *Kitchen Diary* research indicates that the 'not used in time' waste relating to milk and cheese is split approximately equally between disposal triggered by date labelling and that prompted by the physical appearance (mouldy, tasting or smelling bad, etc.). For eggs, the vast majority of the 'not used in time' waste is related to date labelling.

**Figure 41:** Weight of avoidable dairy and egg waste by type, split by reason for disposal



*Figures within bars state waste in tonnes per year*

**Figure 42: Cost of avoidable dairy and eggs by type, split by reason for disposal**



*Figures within bars state waste in £ million per year*

## 12 Results for food groups with minor contributions

This chapter contains the food groups which each contribute less than 5% to the total amount of household food and drink waste. The inclusion of food types within these categories is based on the cut-off rule described in §2.2, and is the same as in other chapters. In light of this, and the fewer instances of food and drink waste recorded during research for these food groups, the breakdown of information to the level of food type is limited, and hence many of the potential tables in this chapter are omitted or, if included, contain less information than preceding chapters.

Although the food groups in this chapter form a smaller proportion of the total food and drink waste, there is still information useful to food-waste campaigns, not least relating to cook-in sauces (§12.1), staple foods (§12.2) and cakes (§12.3), all of which contribute more than 50,000 tonnes per year of waste per year in the UK.

### 12.1 Condiments, sauces, herbs & spices

#### 12.1.1 Categorisation of condiments, sauces, herbs and spices

Items in this group are usually added to other foods in small amounts in order to impart flavours. The table shows the 14 types of foods included in the condiments group.

**Table 28:** Types of condiments, sauces, herbs & spices waste

Food Type	What it includes	What it doesn't include
Cook in sauce	Sauces ready to make meals, either homemade or pre-prepared	Sauces as part of a meal
Dip	Dip, guacamole, salsa, taramasalata	Hummus
Gravy	Either as liquid or powder / granules	Tap water used to constitute gravy
Herb / Spice	Powdered spices, fresh and dried herbs, ginger, garlic, chillies,	
Honey	Honey	
Jam	Jam, marmalade	
Ketchup	Tomato ketchup	Brown sauce
Mayonnaise / salad cream	Mayonnaise, salad cream	
Olives	Olives	Olive oil
Pickle	Lime pickle, piccalilli, pickle	Pickled beetroot, pickled onions
Salt	Salt	
Sugar	Granulated, icing, caster	Syrup
Sweet spread	Chocolate spread, peanut butter	
Other condiments etc	All other sweet and savoury sauces, vinegar, stock, syrup.	

*Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of 'all other condiments, sauces, herbs & spices'.*

#### 12.1.2 Breakdown of condiments, sauces, herbs and spices by avoidability

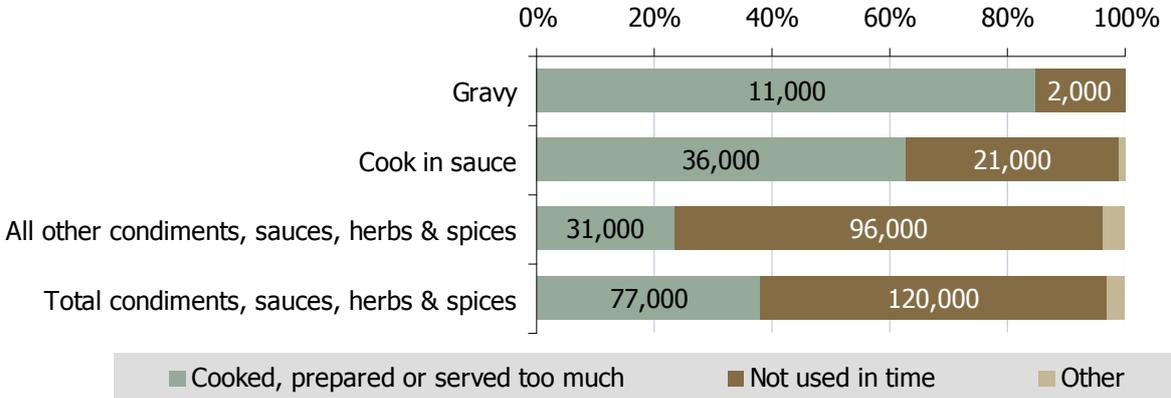
**Table 29:** The amount of condiments etc. waste by type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Cook in sauce	57,000	<1,000	<1,000	57,000	£160
Gravy	12,000	<1,000	<1,000	12,000	£63
All other condiments, sauces, herbs & spices	140,000	<1,000	6,000	130,000	£480
<b>Total condiments, sauces, herbs &amp; spices</b>	<b>210,000</b>	<b>&lt;1,000</b>	<b>6,000</b>	<b>200,000</b>	<b>£700</b>

Of the 210,000 tonnes of condiments etc. disposed of annually in the UK, nearly all (200,000 tonnes) is avoidable, costing £700 million. Most of the food types could not be reported individually due to the high level of uncertainty around the estimates; however, 57,000 tonnes per year of cook-in sauces and 12,000 tonnes per year of gravy is wasted, all of which is avoidable. A further 140,000 tonnes per year is made up of all the other food types listed in Table 28; the small amount of unavoidable waste and possibly avoidable is made up of garlic skin, ginger peel, and fresh herb stems.

12.1.3 Breakdown of avoidable waste of condiments etc. by reason for disposal

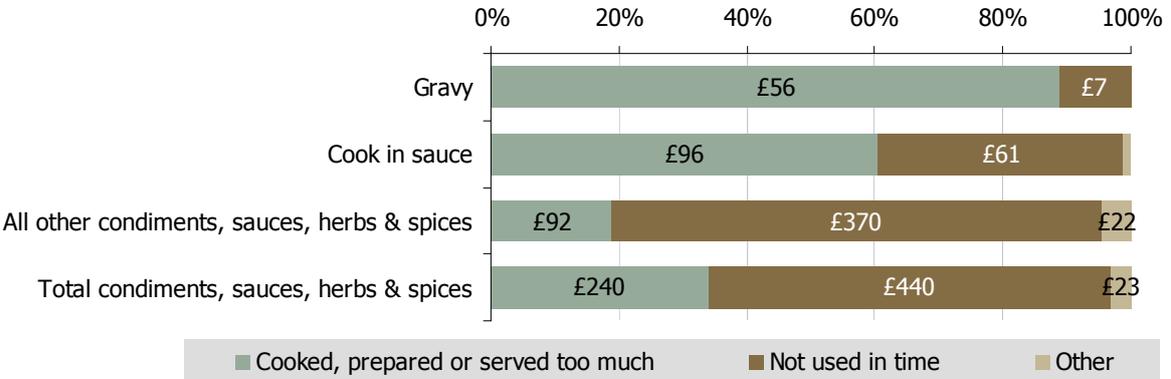
Figure 43: Weight of avoidable condiments etc. waste by type, split by reason for disposal



Figures within bars state waste in tonnes per year

The majority (60%) of avoidable waste relating to condiments, sauces, herbs and spices are disposed of because they are not used in time; however, the proportion is much lower for cook in sauces and gravy.

Figure 44: Cost of avoidable condiments etc. waste by type, split by reason for disposal



Figures within bars state waste in £ million per year

12.2 Staple foods

12.2.1 Categorisation of staple foods

Staple foods are starchy foods made from wheat, rice, other grains and vegetables that we eat as a source of carbohydrate. This food group contains neither bread, classified as bakery (Chapter 8), nor potato, which is included with vegetables (Chapter 5). Breakfast cereals have been included. Table 30 shows the five types of foods included in the staple foods group. The waste in this group includes a mixture of cooked and uncooked food and the waste may include a significant amount of absorbed water or milk.

**Table 30:** Types of staple foods waste

Food Type	What it includes	What it doesn't include
Breakfast cereal	Commercial cereals, porridge oats; dry or with absorbed milk	
Flour	Corn flour, flour	
Pasta	Noodles, pasta, takeaway noodles; cooked or dried	Pasta as part of a meal
Rice	Rice, takeaway rice; cooked or dried	Rice as part of a meal
Other staple foods	Couscous, polenta, semolina; cooked or dried	Other staples as part of a meal

*Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of 'all other staple foods'.*

### 12.2.2 Breakdown of staple foods by avoidability

In the UK we dispose of 200,000 tonnes of staple foods annually, all of which are avoidable and costs £470 million (Table 31). Approximately a third of this is breakfast cereals (75,000 tonnes per year, £210 million), a further third is rice (64,000 tonnes per year, £150 million), and a fifth is pasta is (42,000 tonnes per year, £85 million).

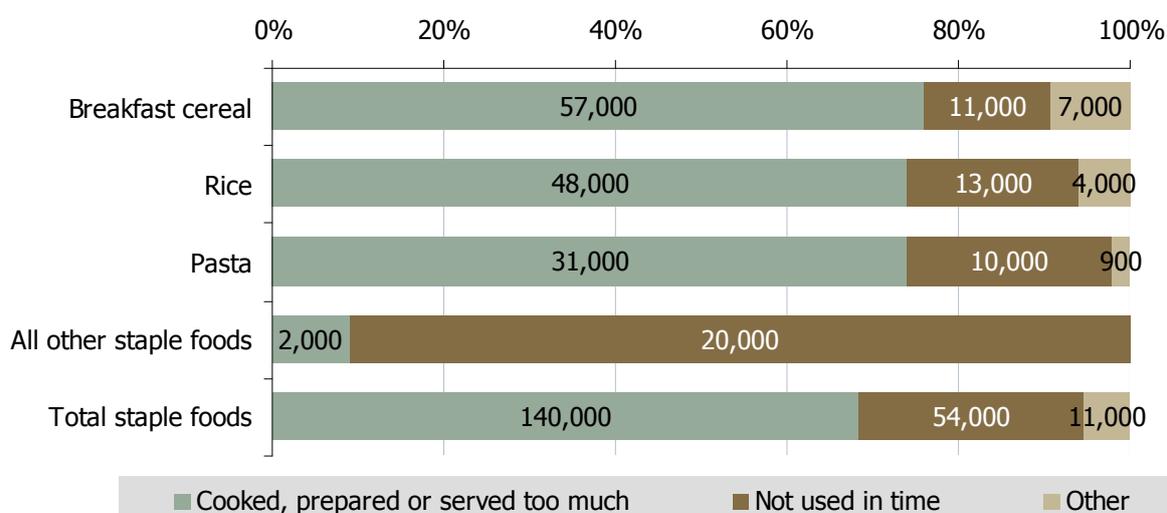
**Table 31:** The amount of staple food waste by type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Breakfast cereal	75,000	<1,000	<1,000	75,000	£210
Rice	64,000	<1,000	<1,000	64,000	£150
Pasta	42,000	<1,000	<1,000	42,000	£85
All other staple foods	23,000	<1,000	<1,000	23,000	£21
<b>Total staple foods</b>	<b>200,000</b>	<b>&lt;1,000</b>	<b>&lt;1,000</b>	<b>200,000</b>	<b>£470</b>

### 12.2.3 Breakdown of avoidable staple food waste by reason for disposal

Most of these relatively inexpensive, dried staple foods are disposed of because too much has been prepared, rather than it going off. This likely reflects their price, long shelf-life, and, potentially, difficulties in cooking the correct amount due to expansion during cooking.

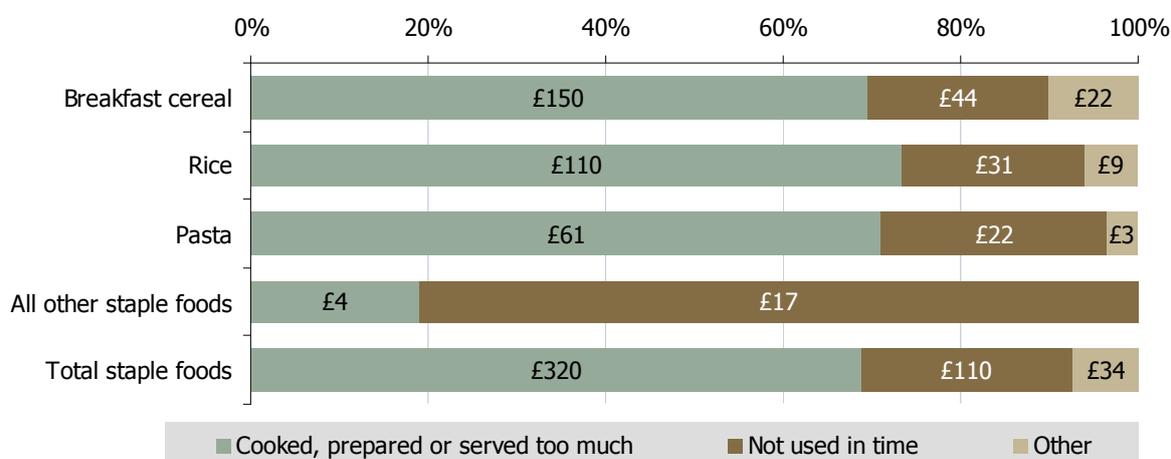
**Figure 45:** Weight of avoidable staple food waste by type, split by reason for disposal



*Figures within bars state waste in tonnes per year*

The profile of disposal reasons for 'all other staple foods' differs from the rest of this food group, with most avoidable waste classified as 'not used in time'. This grouping includes flour, couscous, polenta etc. Once prepared, these foods will frequently be classified as another food group – for example flour may move to bakery, cakes and desserts, or homemade meals. For this reason, the amount classified as 'cooked, prepared or served too much' is low.

**Figure 46:** Cost of avoidable staple foods waste by type, split by reason for disposal



Figures within bars state waste in £ million per year

## 12.3 Cakes and desserts

### 12.3.1 Categorisation cakes and desserts

This group includes all sweet items that could be consumed at the end of a meal, but many of the items are also consumed as snacks. The sweet bakery items can be found in this group. Table 32 shows the 10 types of foods included in the bakery group. Notably, savoury bakery items are not included here, but can be found in the bakery group.

**Table 32:** Types of cake and desserts waste

Food Type	What it includes
Cheesecake	Cheesecake
Chocolate pudding / dessert	Chocolate desserts, chocolate pudding
Cakes / gâteaux / doughnuts / pastries	Cake mix, cake, Christmas pudding, Danish pastries, doughnuts, éclairs, egg custard tarts, flapjack, fruit cake, gâteaux, iced buns, Indian cakes, malt loaf, American muffins, profiteroles, scones, Swiss roll
Fruit pie / strudel / crumble	Crumble, fruit pie, mince pies, strudel
Ice Cream	Ice cream, ice lollies, sorbet
Jelly	Jelly, both concentrated and constituted
Milk pudding (custard etc)	Custard, custard powder (and milk used to constitute), rice pudding
Mousse	Mousse
Trifle	Trifle
Other desserts	Banoffee pie, bread and butter pudding, halva, meringue, spotted dick

Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of 'all other cakes and desserts'.

Some cakes and desserts are generally consumed for particular festivals, such as mince pies and Christmas pudding at Christmas, hot cross buns at Easter; and more ice cream may be consumed in warmer weather.

### 12.3.2 Breakdown of cakes and desserts by avoidability

A total of 190,000 tonnes of cake and desserts are thrown away in the UK annually, all of which was avoidable and costs £510 million.

**Table 33:** The amount of cake and dessert waste by type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Cakes / gâteaux / doughnuts / pastries	91,000	<1,000	<1,000	91,000	£280
All other cake and desserts	100,000	<1,000	<1,000	100,000	£240
<b>Total cake and desserts</b>	<b>190,000</b>	<b>&lt;1,000</b>	<b>&lt;1,000</b>	<b>190,000</b>	<b>£510</b>

### 12.3.3 Breakdown of avoidable cake and dessert waste by reason for disposal

Overall for this category, 40% is classified as 'cooked, prepared or served too much', and 47% comes under 'not used in time', with 13% unclassified.

## 12.4 Oil and fat

### 12.4.1 Categorisation of oils and fats

This group excludes fats (and juices) generated by the cooking of meats in the home; also excluded is oil drained from tins of fish, olives, etc.

**Table 34:** Types of oil and fat waste

Food Type	What it includes	What it doesn't include
Oil	Olive oil, flavoured oils, vegetable oils	
Fat	Butter, dripping, margarine, lard, suet	Fat from cuts of meat

*Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of 'all other oils and fats'.*

There are few instances of 'unavoidable' oil and fat waste, and these are from products that have already been reused such as chip fat. The possibly avoidable waste includes all oils and fats which have only been used once (as stated in diary records).

### 12.4.2 Breakdown of oil and fat by avoidability

In the UK we dispose of 90,000 tonnes of oils and fats annually. The avoidable portion is approximately one quarter (20,000 tonnes) and costs £37 million annually.

**Table 35:** The amount of oil and fat waste, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
<b>Total Oil and fat</b>	<b>90,000</b>	<b>5,000</b>	<b>64,000</b>	<b>20,000</b>	<b>£37</b>

### 12.4.3 Breakdown of avoidable oil and fat waste by reason for disposal

This information is not reported due to high uncertainty around estimates.

## 12.5 Confectionery and snacks

### 12.5.1 Categorisation of confectionery and snacks

**Table 36:** Types of confectionery and snacks waste

Food Type	What it includes	What it doesn't include
Chocolate and sweets	Chocolate bars, chocolate sweets, Indian sweets, sweets	
Cereal bar	Cereal bars	
Savoury snacks	Bombay mix, crisps, nuts, popcorn, prawn crackers, savoury snacks, tortilla chips	
Other confectionery and snacks	Chewing gum, fruit and nut mix	
Sweet biscuits	Homemade and shop-bought sweet biscuits	Cheese biscuits, crackers, savoury biscuits

*Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of 'all other confectionery and snacks'.*

The only unavoidable waste in this group identified during the research was nut shells. There was no possibly avoidable waste identified.

### 12.5.2 Breakdown of confectionery and snacks and by avoidability

Annually in the UK, 71,000 tonnes of confectionery and snacks are thrown away by households. Nearly all of this is avoidable (67,000 tonnes per year) and costs £330 million. Of this, 23,000 tonnes per year is savoury snacks such as peanuts and crisps, 24,000 tonnes per year is chocolate and sweets, and 18,000 tonnes per year is biscuits.

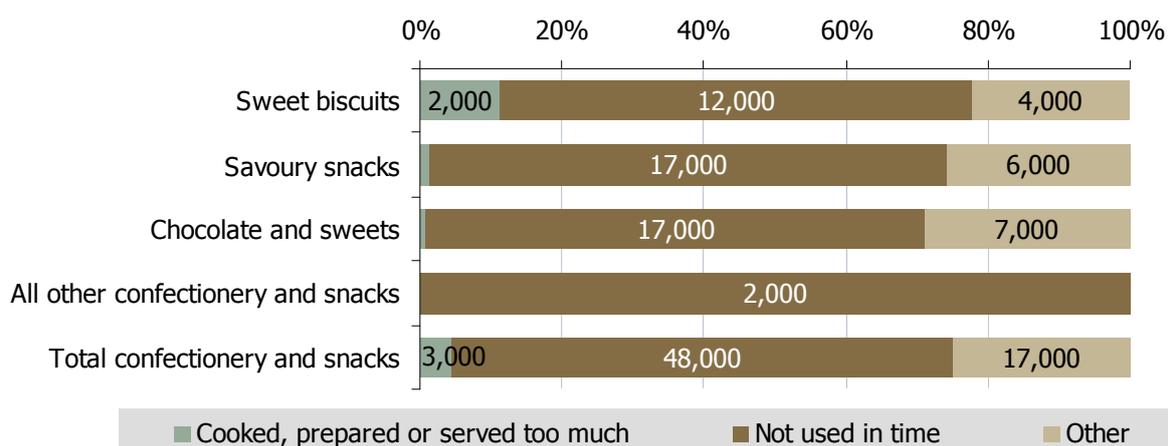
**Table 37:** The amount of confectionery and snacks waste by type, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Savoury snacks	26,000	4,000	<1,000	23,000	£150
Chocolate and sweets	24,000	<1,000	<1,000	24,000	£120
Sweet biscuits	18,000	<1,000	<1,000	18,000	£44
All other confectionery and snacks	2,000	<1,000	<1,000	2,000	£17
<b>Total confectionery and snacks</b>	<b>71,000</b>	<b>4,000</b>	<b>&lt;1,000</b>	<b>67,000</b>	<b>£330</b>

### 12.5.3 Breakdown of avoidable confectionery and snack waste by reason for disposal

The vast majority of avoidable confectionery and snack waste is classified as disposed of because it was not used in time. This classification, based largely on whether the items were packaged at the time of disposal, could include multiple reasons such as being beyond a best before date, looking or smelling bad, being disposed of because several packets were purchased and then weren't liked, or due to a dieter clearing out cupboards.

**Figure 47:** Weight of avoidable confectionery and snack waste by type, split by reason for disposal



Figures within bars state waste in tonnes per year

**Figure 48:** Cost of avoidable confectionery and snack waste by type, split by reason for disposal



Figures within bars state waste in £ million per year

## 12.6 Other

### 12.6.1 Categorisation of 'other'

This group includes unidentifiable food and drink waste and foods that do not fit into another category, e.g. baby food, liquids drained from cans and jars (Table 38). Note that non-food items (medicines and pet food) have been removed from the data set since *The Food We Waste* – this has a negligible impact on the overall results. Possibly avoidable waste includes unidentifiable items (including 'gunge'), and drainings from cans and jars.

**Table 38:** Types of other foods waste

Food Type	What it includes	What it doesn't include
Baby food	Baby food	
Baby milk	Baby milk (formula)	Milk
Gunge	Unidentifiable mush	
Mixed food	Mixed foods across more than one group that aren't a meal	
Other food	Aspic, food colouring, glucose powder, unidentified items, yeast	
Drainings from canned food	Brine, olive oil, vinegar, water; from fish, fruit, hot dogs, olives, vegetables	

Shaded cells indicate categories with insufficient confidence around estimate (see §2.2). These categories have been reported as part of 'Remaining other'.

### 12.6.2 Breakdown of 'other' by avoidability

300,000 tonnes per year of waste can be classified in this diverse category. Of this, 7% is avoidable and 93% possibly avoidable. The most significant fraction is drainings from cans (140,000 tonnes per year), which is all possibly avoidable.

**Table 39:** The amount of other food waste, split by avoidability

Food Type	Weight generated (tonnes per year)				Avoidable waste (£ million per year)
	Total	Unavoidable	Possibly avoidable	Avoidable	
Drainings from canned food	140,000	<1,000	140,000	<1,000	£0
Remaining 'other'	160,000	<1,000	140,000	20,000	£110
<b>Total 'other'</b>	<b>300,000</b>	<b>&lt;1,000</b>	<b>280,000</b>	<b>20,000</b>	<b>£110</b>

### 12.6.3 Breakdown of avoidable 'other' waste by reason for disposal

There is insufficient avoidable waste to analyse the reasons for disposal in this category.

### 13 Food and drink waste quantities at a household level

To most members of the public, the household food and drink waste generated in the UK annually may appear a very large amount – 8.3 million tonnes, of which 5.3 million tonnes is avoidable. To some extent, the size of this number is due to the large population of the UK – over 60 million people living within 25 million households.

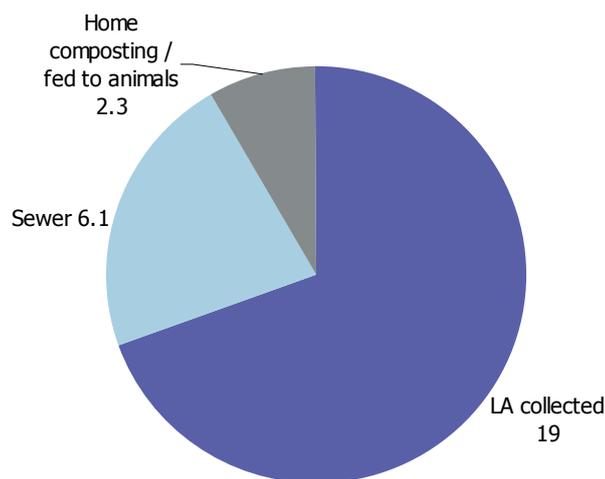
This section attempts to take the annual UK figures and report them in manner more relevant to individuals. The figures quoted are for an 'average' household in the UK, i.e. by taking the total amount wasted in the UK and dividing by the number of households. No household in the UK will exactly conform to this average or generate this precise amount of waste; indeed, it would not be possible for a household to contain the average number of occupant, being approximately 2.4. However, it is a useful way of reporting something that is typical for the UK. By producing an average in this way, the many influences on household waste are taken into account in proportion to their prevalence in the UK population – for example, whether people compost at home, dietary influences of culture or religion, the frequency with which people eat out.

In addition, the results are presented for a month, rather than for a whole year, as this should allow the reader to relate to the information more easily.

#### 13.1 Weight of food and drink waste generated by an average household in a month

In our 'average' household, 27 kg of food and drink waste is generated in a month. Of this, approximately 19 kg goes into the bin or food waste collections, 6 kg is poured down the sewer, and 2 kg is fed to animals or home composted<sup>29</sup> (Figure 49).

**Figure 49:** Weight of food and drink waste per household, by disposal route



*Figures state waste in kg per household per month*

Not all of the 27 kg of food and drink waste is avoidable food waste (Figure 50). Some of it will be items that cannot be eaten – eggs shells, tea bags, chicken bones, orange peel – and some people would not classify these as food. These 'unavoidable' items make up 4.9 kg per household per month.

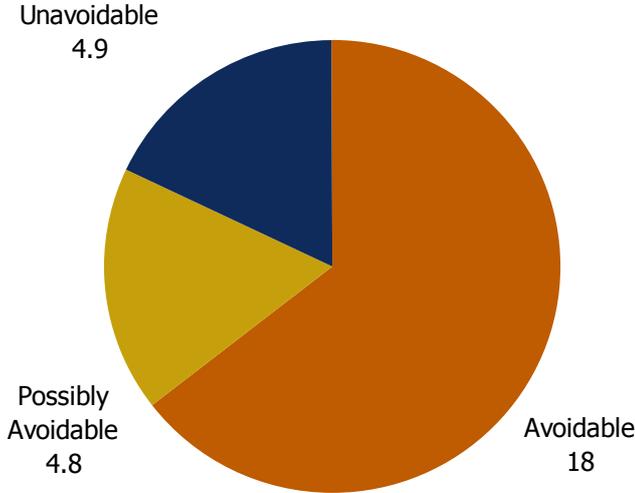
A further 4.8 kg corresponds to items that can be eaten when a food is prepared in a certain way, but not in others, or are eaten by some people but not others. This fraction is termed 'possibly avoidable'. A third of this category is made up of potato peelings, and other contributions come from other edible peelings, bread crusts and the skin of meat and fish.

This leaves approximately 18 kg of food and drink waste – the overwhelming majority of which could have been eaten had it been better managed in the home ('avoidable'). This includes leftovers – food and drink that was prepared and / or served but not consumed – and food and drink that was disposed of because it was not used in time, either passing a use-by date, or going mouldy. The 18 kg of avoidable waste per month corresponds to

<sup>29</sup> As this is an average, households that do not home compost will dispose of no waste via this method; similarly households without pets, are unlikely to dispose of waste in this way. In contrast, households with pets and compost bins will, on average, dispose of a higher percentage of food and drink waste via these routes.

more than half a kilogram (1 lb) every day per household. This is a considerable amount given that this does not include unavoidable or even possibly avoidable food and drink.

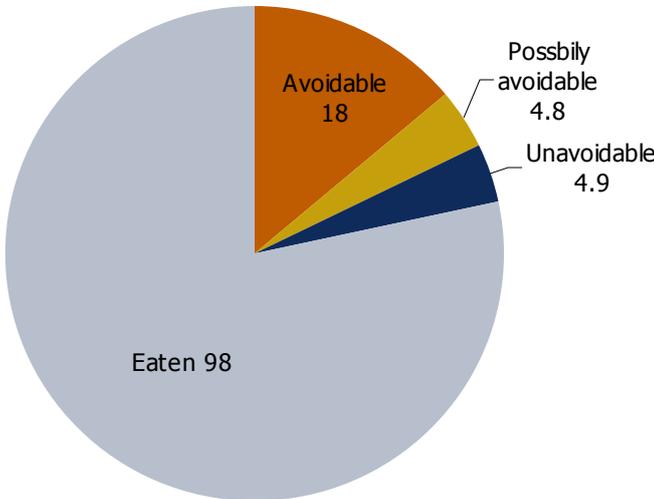
**Figure 50:** Weight of food and drink waste per household, by avoidability



*Figures state waste in kg per household per month*

The average household of 2.4 people purchase 125 kg of food and drink per month. 22% of this is not consumed: approximately 4% is disposed as inedible waste; a further 4% is possibly avoidable; avoidable food and drink waste represent 14% of purchases (Figure 51).

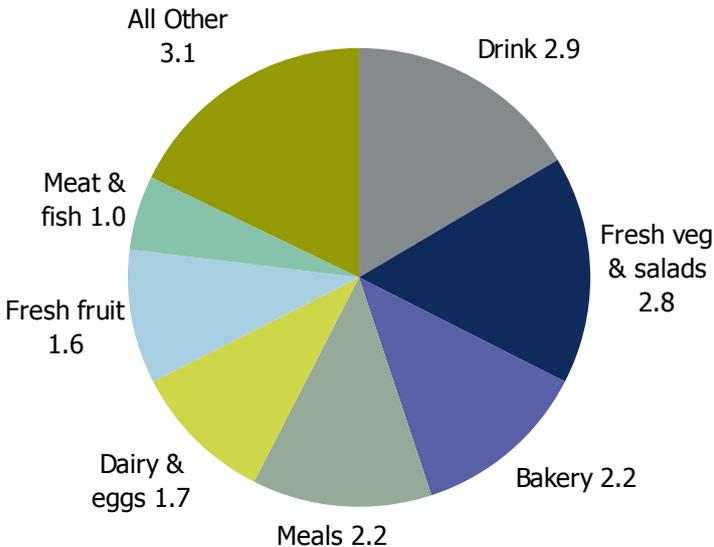
**Figure 51:** Weight of food and drink waste per household – by avoidability – in comparison to a monthly shop



*Figures state waste in kg per household per month*

The avoidable food and drink waste is not dominated by any one particular type of food. Rather, a diverse range of foodstuffs contribute to household waste (Figure 52). There is a large contribution from fresh produce – fresh fruit, vegetables and salad make up around one-quarter (4.4 kg per month) of the 18 kg of avoidable waste. Drinks contribute a further 2.9 kg per month – and this excludes the tap water used to constitute drinks in the home (e.g. for diluting squash or brewing tea). Bakery – mainly bread – makes up a further 2.2 kg. Meals – both homemade, ready meals and takeaways – also contribute 2.2 kg. Dairy and eggs contribute another 1.7 kg per month, two-thirds of which is milk.

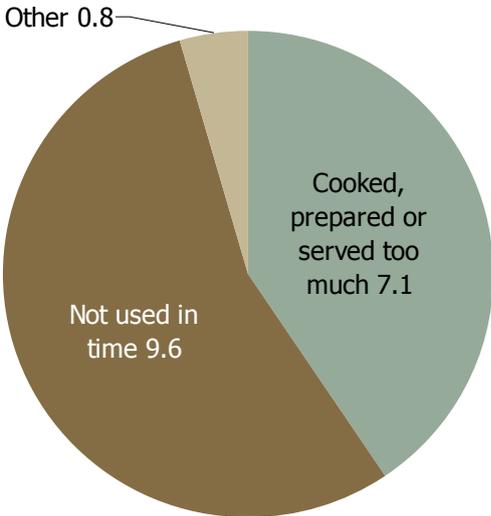
**Figure 52:** Weight of avoidable food and drink waste per household, by food group



*Figures state waste in kg per household per month*

The reasons why this avoidable food and drink is wasted are varied – from leaving lettuce in the bottom of the fridge until it is no longer appetising, to serving too much pasta and throwing away what isn’t eaten. These reasons can be grouped into two broad categories: ‘not used in time’, which includes food going off, becoming mouldy or being thrown away because it is past a use-by or other date; and ‘cooked, prepared or served too much’ covering leftovers. The research indicates that both of these reasons contribute strongly to the total, with an average household generating 9.6 kg per month from food not used in time and 7.1 kg per month from cooking, preparing or serving too much (Figure 53).

**Figure 53:** Weight of avoidable food and drink waste per household, by reason for disposal



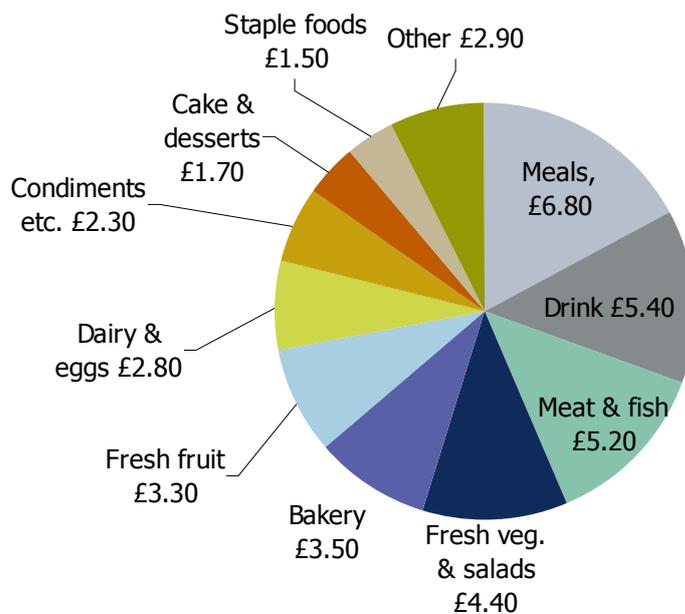
*Figures state waste in kg per household per month*

### 13.2 Cost of avoidable waste generated by an 'average' household in a month

For the average household, the retail price of the avoidable food and drink waste is £40 per month, or more than £1 per day. This compares to an average monthly food and drink expenditure of £260 per household<sup>30</sup>. Therefore avoidable food and drink waste accounts for approximately 15% of the shopping budget.

This is split between the different food and drink groups, although not in the same proportions as the weight, as the cost per kilogramme varies between food groups. £6.80 is spent on meals (both homemade and pre-prepared) that are not eaten, £5.40 on drinks and a similar amount on meat and fish (Figure 54).

**Figure 54:** Cost of avoidable food and drink waste per household, by food group



*Figures state waste in £ per household per month*

### 13.3 Environmental impact of food and drink waste generated

To produce, package, distribute, store, and, (where applicable) cook food and drink that is subsequently not eaten requires the use of resources – energy and fuel, water, and land. Each of these stages emits greenhouse gases, contributing to climate change.

How much does food and drink waste contribute? The average household generates 210 kg of avoidable food and drink waste per year and this is associated with roughly the equivalent of 0.8 tonnes of CO<sub>2</sub>. This compares to total greenhouse gas emissions associated with consumption in the UK of approximately 33 tonnes CO<sub>2</sub> equivalent per household per year. So, food and drink waste accounts for 2.4% of the total greenhouse gas emissions.

To illustrate the scale of these emissions, they are similar in magnitude to:

- All members of a household taking an annual return flight from London to Vienna;
- One quarter of the annual mileage driven by the members of that household; or
- The savings associated with installing 270 mm of loft insulation in a house that previously contained none<sup>31</sup>.

In other words, if avoidable food and drink waste were no longer generated, there would be an important cut in greenhouse gas emissions.

<sup>30</sup> Family Food and Expenditure Survey, figures for UK, 2007.

<sup>31</sup> <http://www.energysavingtrust.org.uk/Energy-saving-assumptions>

## 14 Conclusions

This report provides evidence on the scale of household food and drink waste in the UK. Whether expressed as an absolute amount, or as the proportion of household purchases of food and drink, there is a sizeable quantity generated and the majority of it could have been avoided. The amount of waste generated is larger than previously estimated due to improved estimates of waste disposed via the sewer.

Considerable resources are used unnecessarily to create and dispose of the food and drink that is produced but not consumed. These resources include land and water for agriculture, inorganic fertilisers, transport fuel, packaging materials, and electricity for storage at low temperature. Indeed, a small but significant proportion of the UK's total greenhouse gas emissions are used to produce food and drink that is not eaten. Reducing the amount of food and drink waste could ease pressure on all of these resources or make them available for other purposes. Given that many food stuffs are traded worldwide (e.g. as commodities), reducing food and drink waste would reduce global demand, putting downward pressure on prices and allowing more food to be available for those in greatest need. It could also have a positive impact on land-use change such as deforestation.

Households are not alone in generating food and drink waste; there are also considerable arisings from agriculture, food manufacturers, retailers, and the hospitality sector. As with households, not all of the food and drink waste from these sectors is avoidable. However, where reductions in food and drink waste can be made, these reductions are likely to have both financial and environmental benefits. In other words, positive contributions could be made by all sectors to tackle this issue in its totality.

The report includes information on the amount and types of food and drink waste currently found in waste streams collected by Local Authorities. By collecting this component separately – either in food-waste collections, or combined with garden waste – it can be diverted from landfill and used as feedstock for anaerobic digestion or in-vessel composting. Using these methods allows nutrients to be returned to agricultural land, reduces the amount of waste going to landfill, and, in the case of anaerobic digestion, produces biogas, which can be burnt to produce heat and power. There is likely to be some interaction between collections schemes and the amount of waste generated – there is some anecdotal information to suggest that when food-waste collections are introduced, there is a reduction in the amount of waste generated, possibly due to households being able to see how much they are throwing away. In addition, there is likely to be a reduction in the arisings of household food and drink waste as a consequence of food-waste prevention activities from national and local governments, retailers, food manufacturers and WRAP.

For members of the public, this report demonstrates that reducing food and drink waste can save most households a substantial amount of money. Furthermore, reducing food and drink waste is one method of making a substantial, positive contribution towards reducing greenhouse gas emissions. These reductions are similar in magnitude to insulating a loft, or foregoing one flight to mainland Europe per year. In short, reducing food and drink waste makes financial and environmental sense.

# Appendix A: Details of Calculations

This appendix details the calculations made to estimate the household food and drink waste in the UK. For each route, the source and the data used are outlined and the methods to combine them are laid out. Assumptions within the original research or inherent within the calculations are made explicit. Furthermore, the confidence interval around the headline figures is estimated.

## A.1 Estimate of total food and drink waste collected by Local Authorities

As detailed in §1.5, the total amount of food and drink waste collected by Local Authorities is estimated from WasteDataFlow and the material split from the Defra-commissioned *Review of Municipal Waste Composition*.

The WasteDataFlow figures are for the reporting period 2006-07. This time period was chosen as it most closely matched the information from the *Review of Municipal Waste Composition*. For this reason, the estimates obtained are for 2006-07, and therefore similar – though not identical – to the time period of *The Food We Waste* research (late 2007). The estimate of the flow of material by waste stream from WasteDataFlow relates to Unitary Authorities and Waste Disposal Authorities in the UK (Table 40, first column of data).

**Table 40:** UK estimates of household waste by waste stream, 2006-07

Waste Stream	Total weight of waste stream (tonnes per year)	% food and drink waste	Total food and drink waste (tonnes per year)
Kerbside collections	22,512,072	25.08%	5,646,301
HWRCs	6,576,348	1.86%	122,039
Bulky waste collections	263,381	0.07%	179
Household bring recycling	785,945	0.31%	2,444
<b>Total</b>	<b>30,137,746</b>	<b>19.1%</b>	<b>5,770,963</b>

Compositional analyses or waste audits were collected from Local Authorities, Defra’s Local Authority Support Unit, the Waste Information Network and contractors who carry out compositional analyses. In all, 870 compositional analyses were gathered, covering all major municipal waste streams. The number of studies collected for the important household waste streams are detailed in Table 41. To be included in the quantitative analysis of the *Review of Municipal Waste*, three criteria had to be fulfilled by a study:

- Compositional analysis started 2005 or later;
- Two or more phases of analysis occurring at different times of year – i.e. at least some attempt to account for seasonal variations; and
- When obtaining an estimate for whole Local Authority area, stratification of results by type of household or neighbourhood.

The number of studies meeting these criteria is also given in Table 41. It should be noted that these studies are for English Local Authorities as an insufficient number of compositional analyses meeting these criteria were available for Wales, Scotland and Northern Ireland<sup>32</sup>. Another point to note is that compositional analyses selected performed compositional analyses over the period 2005 to 2008, with the majority of analyses occurring in 2006 and 2007. Given this and the year of WasteDataFlow information used, the information in Table 40 best described 2006-07, but has been obtained using some information from 2005 and 2008.

**Table 41:** Information on studies considered for *Review of Municipal Waste Composition*

Waste Stream	No. of Studies Collected	No. of Studies Meeting Criteria
Kerbside residual	317	120
Kerbside organics inc. garden waste and food waste	102	40
HWRCs	56	39

<sup>32</sup> It should be noted that some compositional studies passed the criteria for Northern Ireland, but these represented a limited geographical coverage.

A relatively large number of studies were collated and selection criteria applied. Consequently, the estimates of food and drink waste in the municipal waste streams have relatively small confidence intervals and are less likely to be subject to sampling biases.

The percentage of food and drink waste within each of the major household waste streams was obtained from the *Review of Municipal Waste Composition* and is shown in Table 40 (second column of data). For kerbside collections, this estimate includes 70,000 tonnes per year of food waste assumed to be in the fines, 20% of total weight of fines. It should be noted that these percentages were obtained from compositional analyses in England, but have been applied to waste flow data for the UK. Information on the fraction of food and drink waste in municipal waste streams is being obtained for Scotland and Wales via a co-ordinated programme of compositional analyses across each nation. These estimates of food waste can be updated when this information reports, but they are unlikely to alter the estimates substantially.

The resulting estimate of household food and drink collected by Local Authorities in the UK is 5,770,000 tonnes per year (to 3 significant figures). The vast majority (98%) is from kerbside collections (both residual and recycling), with a small contribution from household waste recycling centres (HWRCs). This food waste from HWRCs is found in the residual stream and is likely to have come from a range of sources, including households and small businesses<sup>33</sup>. It is not possible to divide the total HWRC between these sources, and for the purposes of this research, it has been included in the household total. Given the small amount of material associated with this route, this inclusion will not substantially alter the total. The food and drink waste found in bulky collections and household bring recycling is negligible.

One source of uncertainty is due to sampling of compositional analysis studies within the *Review of Municipal Waste Composition*. Not all areas of England had a compositional analysis pertaining to them. The studies that were collated were used to make an estimate for the whole of England. This leads to a 95% confidence interval of  $\pm 190,000$  tonnes per year on the total household food and drink waste, or 3.2% of the total.

It should be noted that uncertainty from sources other than sampling are likely to be present, e.g. bias relating to areas chosen for compositional analyses, and the disproportionately small number of analyses over the Christmas period. It is problematic to quantify their effect, and, for this reason, are not included in the confidence intervals quoted in this report. Thus, these confidence intervals are a lower bound on the total uncertainty.

## A.2 Estimate of food types collected by Local Authorities

For the reasons outlined in the previous section, information from WasteDataFlow and the *Review of Municipal Waste Composition* are the most appropriate sources currently available for calculating the total amount of household food and drink waste in the UK. However, these sources give very little detail about the types of food and drink waste collected by Local Authorities.

The dataset from *The Food and Drink We Waste* research was used to obtain estimates of the split of types of food and drink disposed of by households, and this information pertains to England and Wales. Recent research, entitled *The Food and Drink We Waste in Scotland*, has obtained an analogous dataset for Scotland. These two datasets have **not** yet been joined for the following reasons:

- There is no study of municipal waste analogous to the *Review of Municipal Waste Composition* to give a Scottish figure for total food and drink waste, therefore any use of *The Food and Drink We Waste in Scotland* dataset would only impact on the types of food and drink waste generated.
- Inclusion of this dataset would add another layer of complexity to the methodology.
- Given that Scotland represents around 10% of the UK's population, inclusion of the dataset is unlikely to have a substantial impact on any of the references.

In the future, WRAP will explore the possibility of combining the Scottish food waste dataset with that of England and Wales.

### Weighting

To obtain an estimate of the types of food and drink wasted, *The Food We Waste* dataset was weighted by household size (i.e. number of occupants) to be representative of the households in the UK. Household size was used as it correlates more strongly with the amount of food and drink waste generated than any other single factor (§3.4). In general, the higher the number of occupants in a household, the greater the amount of food waste generated.

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<sup>33</sup> Technically, waste from small businesses should not be disposed of via this route. However, some non-household waste is disposed of via HWRCs.

Weighting the dataset by further factors was considered. To include an additional weighting factor, the factor should meet the following criteria:

- The information has been collected in the questionnaire that accompanied the compositional analysis;
- A high percentage of households supplied this information in the questionnaire;
- It is possible to obtain information on the number of UK households – e.g. from the Census or household surveys – split by both the proposed weighting factor and the household size;
- Once stratified by household size and the proposed weighting factor, the sample sizes in each group should be greater than a critical number (c. 30); and
- Weighting by the proposed factor has a significant impact on the results.

**Table 42:** Weighting factors considered for analysis of *The Food We Waste* dataset

Proposed Weighting Factor	Comments
<b>Age</b>	There is no evidence to suggest the sample of <i>The Food We Waste</i> under- or over-represents this group, and therefore the impact of weighting by age would be negligible.
<b>Socio-economic class</b>	A relatively large proportion of questionnaire respondents (>10%) did not supply information about their occupation, which was used to determine their socio-economic class. These households would have to be omitted from the analysis if calculations were weighted by socio-economic class. Furthermore, differences in the amount of food waste between socio-economic classes were minimal and therefore the impact on the results would be slight.
<b>Home composting</b>	Information not obtained in household surveys alongside household size.

In conclusion, it is unlikely that inclusion of further weighting factors would significantly impact the results. Furthermore, practical problems are presented in the inclusion of many weighting factors. Therefore, weighting was performed by household size alone. As a small number of larger households were sampled, those containing 6 or more people were grouped together for weighting purposes.

### Calculations

To obtain an estimate for the amount of a food type wasted in the UK, the following method was used:

- 1 For each household, an estimate of the weekly waste of each food type was obtained. For households with fortnightly collections of residual or food waste, information from the compositional analysis was divided by two;
- 2 For each household size, the average waste generated for each food type was calculated;
- 3 These averages were combined in proportion to the distribution of household sizes in the UK;
- 4 This estimate for the UK was scaled such that the total food and drink waste collected by Local Authorities was consistent with the estimate obtained from combining information from WasteDataFlow and *The Review of Municipal Waste Composition*.

The same method is applicable to any other subdivision of the total food and drink waste, e.g. analysis by avoidable or reason for disposal.

It should be noted that, by applying step 4 in the above methodology, the estimate of total household food and drink waste collected by Local Authorities in the UK comes from WasteDataFlow and *The Review of Municipal Waste Composition*, rather than *The Food We Waste*. Estimates obtained from this research will have sampling uncertainty due to the number of households surveyed and the variability between households. However, there will also be non-sampling uncertainties due to the following:

- Non-participation bias – households were given the opportunity to opt out of the research (see methodology in original report for details). If the household waste generated from these households differed from those included in the survey, this would lead to bias.
- Very few flats were sampled due to methodological problems, namely difficulties linking waste in a communal waste receptacle to a specific household. Omission of flats is partially counteracted by weighting of the calculations, which takes into account that flats generally have fewer occupants than houses. However, this

weighting does not take into account any other differences between flats and houses that impact food and drink waste generated.

It is difficult to estimate the uncertainty associated with these non-sampling errors. For this reason, the confidence intervals quoted – which take into account only sampling effects – are a lower bound of the total uncertainty.

### A.3 Sewer research

The report *Down the Drain* research has been used to obtain estimates for the amount and types of food and drink waste disposed of via the sewer. The research consisted of diaries being kept for a week by household occupants to record disposal of any food and drink via the sink, toilet, or any other household inlet of the sewer system. Fieldwork occurred in February 2008, and 319 diaries were kept for the full research period.

The information from the diaries was used to obtain estimates for the UK. Similar to *The Food We Waste*, it was found that household size (number of occupants) was the most important factor relating to the amount of food and drink waste generated. For this reason, the data were weighted by household size, with households of 4 or more people grouped together.

As described in §1.4.3, water added in the homes to foods and drinks (e.g. to make tea or gravy) was excluded from the analysis. This had a negligible impact on the estimate of cost, but substantially influences the estimate of weight. The reason for this decision is that it allows us to estimate the amounts of purchased food and drink that are thrown away, to inform discussions with the food industry and the consumer-facing campaign.

### A.4 Kitchen Diary research

The *Kitchen Diary* research is similar in nature to the sewer-based research, the former involving diary based research comprising 286 households, recording food and drink waste disposed of by all routes. The fieldwork occurred in February 2007. The *Kitchen Diary* dataset was used because it details amounts and types of food and drink waste disposed of fed to animals and composted at home.

Given these similarities, the data were treated in a similar manner. There was one methodological difference, namely the weighting of the *Kitchen Diary* data used 'household type' rather than household size as the latter information was not available. Household types are single occupancy, households with children, and households comprising only adults. It is unlikely that this methodological difference will have a large impact on the overall estimates of food and drink waste.

### A.5 Tea waste

There is potential to misclassify waste relating to tea. Unused tea bags are classified as avoidable. Furthermore, liquid tea is classified as avoidable if it is disposed of rather than drunk. The reasoning behind this classification is that the waste could have been avoided if, for instance, a smaller pot or mug of tea was prepared. In principle, this 'avoidable' tag relates to all material used to create the tea – milk and sugar where applicable, and the tea bag or tea leaves.

Instances of undrunk tea were only found in the *Down the Drain* research, and the cost of these avoidable components (milk, sugar, tea bags and / or tea leaves) is estimated from information in the diaries<sup>34</sup>. Furthermore, the weight of the milk and sugar is estimated from the diaries, but not the tea bag or tea leaves<sup>35</sup>, as these are disposed of via the residual bin or home composting (>90% of tea bags and tea leaves are disposed of via the residual bin). However, all used tea bags and tea leaves disposed of via these routes would have been classified as unavoidable, given that it would have been impossible to tell if the cup of tea they were used to make was drunk or not. Hence, a small but substantial proportion of the tea bags disposed of via the residual bin should be reclassified as avoidable.

The amount of tea disposed of annually via the sewer is 1.14 million tonnes (including added water). At 325 ml per cup, this equates to the equivalent of 3.5 billion cups of tea. If each cup of tea were made using one tea bag and the average tea bag weighs 5 grammes when disposed of, then approximately 17,500 tonnes of 350,000 tonnes of used tea bags and tea leaves found in the compositional analysis are associated with the avoidable tea

<sup>34</sup> Assumptions are made regarding the composition of tea – see *Down the Drain* for further details.

<sup>35</sup> In the current report, the water used to make tea is not considered.

disposed of via the sewer. This 17,500 tonnes has been reclassified from unavoidable to avoidable waste and the results in the main part of this report reflect this.

The same procedure is **not** required for the cost, as the avoidable tea waste disposed of via the sewer includes the cost of the tea bags or tea leaves.

## A.6 Combined confidence intervals

For each of the data sources used to calculate the total UK household food and drink waste, the 95% confidence interval was calculated. For the Local Authority collections, the variability between authorities was used to obtain the confidence intervals. For all other research, the variability in the amount of waste between households was used. Where household weighting has been applied (e.g. by household size), the confidence interval was calculated for each household-size grouping and these were combined to obtain the combined confidence interval around the overall (UK) estimate. The results of these calculations are given in Table 43. Although the distribution of waste is non-normal – the distribution is skewed with a right-hand tail – the error structure around the mean was assumed normal, invoking the central limit theorem. This approach should be valid given the number of households in each sample group (>30). These estimates from each disposal route were combined according to equation A1:

$$(\delta t)^2 + (\delta s)^2 + (\delta h)^2 = (\delta t)^2 \quad (\text{eq. A1})$$

where  $\delta l$ ,  $\delta s$ , and  $\delta h$  are 95% confidence intervals around the estimate for the different disposal routes (respectively, Local Authority collections, sewer, and home composting & fed to animals) and  $\delta t$  is the 95% confidence interval around the total estimate. Thus, the confidence interval around the figure for all disposal routes is **not** the sum of the confidence intervals for each disposal route.

**Table 43:** 95% confidence intervals by disposal route

Disposal Route	Estimate of food waste (tonnes per year)	95% confidence interval (tonnes per year)	95% confidence interval (% of estimate)
Local Authority collection	5,800,00	190,000	±3.2%
Sewer	1,800,000	220,000	±12%
Home composting and fed to animals	690,000	140,000	±20%
<b>All disposal routes</b>	<b>8,300,000</b>	<b>320,000</b>	<b>±3.9%</b>

To a suitable level of precision, the amount of UK household food and drink waste generated annually is 8,300,000 ±300,000 tonnes. As mentioned previously in this appendix, the 95% confidence interval quoted includes only sampling uncertainty and is thus a lower bound on the total uncertainty.

For calculating the confidence interval for a **food type**, a similar approach was adopted to that described above. For two of the disposal routes – sewer and home composting and fed to animals – the calculations were exactly analogous to those above.

For Local Authority collections, the calculation to estimate the amount of a food type wasted had more stages (Appendix A.2); to calculate the combined confidence interval for this estimate, the separate confidence intervals for all values used in the calculation (from *The Food We Waste* and *The Review of Municipal Waste Composition*) were combined.

## A.7 Inclusion of information in the report

In this report, figures are only included if they have at least a minimum level of confidence relative to the figure being quoted. The appropriate level of confidence is determined by the use to which the data are to be put. Given the varied potential uses of this food-waste data, this report takes an inclusive approach: food types are included if their 95% confidence interval is less than 30% of the estimate, e.g. for a food type which is estimated to contribute 100,000 tonnes of waste annually in the UK, it would be included if the 95% confidence interval is less than ±30,000 tonnes per year. If a food type passes this threshold, it will be included in further analysis within the report. Given that reporting of subdivisions of food types occurs, e.g. splitting by avoidability, the confidence interval for a small number of figures relating to these subdivisions may exceed ±30%.

In general, the confidence interval is smaller when more instances of a food type occurred in a survey. This higher frequency of occurrence in the survey tends to be associated with more common types of food waste. Hence, for food and drink types that contribute more to the total, the confidence interval tends to be smaller. The confidence intervals for all food types included in this report are given in Table 44.

**Table 44:** 95% confidence intervals around total waste for all food types included in this report

Food Type	95% CI relative to estimate (%)	Food Type	95% CI relative to estimate (%)
Tea - leaves or bags	±8%	Other root vegetables	±19%
Standard bread	±9%	Drainings from canned food	±20%
Banana	±9%	Leafy salad	±21%
Potato	±9%	Fish and shellfish	±21%
Composite meal	±10%	Other condiments etc	±21%
Poultry	±11%	Rice	±22%
Onion	±13%	Spring onion	±22%
Egg	±13%	Savoury products	±22%
Cakes / gâteaux etc.	±14%	Chocolate and sweets	±23%
Orange	±14%	Fruit juice and smoothies	±23%
Cucumber	±15%	Lamb	±23%
Potato	±15%	Squash	±23%
Carrot	±15%	Cook in sauce	±23%
Lettuce	±15%	Pepper	±24%
Mixed vegetables	±16%	Mushroom	±24%
Stone fruit	±16%	Carbonated soft drink	±25%
Speciality bread	±16%	Other citrus	±26%
Pork / ham / bacon	±17%	Sweet biscuits	±26%
Milk	±17%	Leek	±26%
Cheese	±17%	Cauliflower	±26%
Soft / berry fruit	±17%	Bean (all varieties)	±27%
Cabbage	±17%	Gravy	±27%
Melon	±18%	Pasta	±27%
Coleslaw and hummus	±18%	Pasta	±27%
Savoury snacks	±18%	Breakfast cereal	±28%
Yoghurt / yoghurt drink	±18%	Morning goods	±28%
Apple	±19%	Water	±29%
Tomato	±19%	Broccoli	±29%
Sandwich	±19%	Soup	±30%
Sweetcorn	±19%		

## A.8 Number of households in the UK

There are a number of estimates of the number of households in the UK, some of which are inconsistent. For this report, the following sources were used to obtain the number of households (Table 45):

**England** – ONS Labour Force Survey 2007

**Scotland** – Scottish Household Survey 2007, and 2001 census

**Wales** – Living in Wales Survey 2007

**Northern Ireland** – Household estimates for 2007 provided by Northern Ireland Statistics and Research Agency  
The Scottish Household survey only reports households in the following categories: 1, 2, and 3+ occupants. The 2001 census data for Scotland was used to split the 3+ category into 3, 4, 5, 6+ categories.

**Table 45:** Number of households in UK (to the nearest thousand), split by household size

Number of Occupants	Number of Households in UK
1	7,412,000
2	8,872,000
3	4,006,000
4	3,457,000
5	1,192,000
6+	498,000
<b>Total</b>	<b>25,438,000</b>

# Appendix B: Classification of Food and Drinks

The following pages list all the food types, arranged by food group, used for classification during compositional analysis and diary keeping in *The Food We Waste, Down the Drain* and *Kitchen Diary* research. As discussed in §2.2, not all of these food types have been reported separately; in cases where the relative confidence interval around the estimate was greater than 30%, they were reported as a combined category (e.g. 'all other bakery'). The definitions accompanying each food group and type are found in the Chapters 5-12.

## Fresh vegetables and fruit

Aubergine	Leafy salad	Spinach
Bean (all varieties)	Leek	Spring onion
Broccoli	Lettuce	Sprout
Cabbage	Mixed vegetables	Sweetcorn / corn on the cob
Carrot	Mushroom	Tomato
Cauliflower	Onion	Other root vegetables
Celery	Pea (all varieties)	Other vegetables and salad
Courgette	Pepper	
Cucumber	Potato	

## Drinks

Coffee	Milkshake and milk drink	Water
Fruit juice and smoothies	Carbonated soft drink	Wine
Hot chocolate	Squash	Other alcohol
Lager, beer and cider	Tea - leaves or bags	Other drink

## Fresh fruit

Apple	Mixed fruit	Soft / berry fruit
Banana	Orange	Stone fruit
Kiwi	Pear	Other citrus
Melon	Pineapple	Other fruit

## Bakery

Cracker / crisp bread	Morning goods	Yorkshire pudding and other batter
Bread sticks	Pastry	Other bakery
Dough	Speciality bread	
Dumpling	Standard bread	

## Homemade or pre-prepared meals

Composite meal	Savoury products
Sandwich	Soup

Each food type within this category is further subdivided into homemade and pre-prepared.

## Meat and fish

Pork / ham / bacon	Lamb	Bone (unidentifiable / mixed)
Beef	Poultry (chicken / turkey / duck)	Game
Fish and shellfish	Meat & fish based sandwich spread	Other meat

Two categories 'pork / ham / bacon' and 'poultry' are further subdivided:

### Pork

Bacon	Sausage	Other pork product
Unprocessed carcass	Sliced Ham etc.	

### Poultry

Carcass meat / bones	Chicken product	Sliced Poultry
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### Dairy and eggs

Milk	Cream and crème fraiche	Yoghurt / yoghurt drink
Cheese	Egg	Other dairy

### Processed vegetables and salad

Baked beans	Mixed vegetables	Spinach
Bean (all varieties)	Mushroom	Vegetable based sandwich spread
Broccoli	Non-leafy salad	Sprout
Cabbage	Onion	Sweetcorn / corn on the cob
Carrot	Pea (all varieties)	Tomato
Cauliflower	Pepper	Other root vegetables
Coleslaw and hummus	Potato	

### Condiments, sauces, herbs and spices

Cook in sauce	Jam	Salt
Dip	Ketchup	Sugar
Gravy	Mayonnaise / salad cream	Sweet spread
Herb / Spice	Olives	Other condiments etc
Honey	Pickle	

### Staple foods

Breakfast cereal	Pasta	Other staple foods
Flour	Rice	

### Cakes and desserts

Cheesecake	Ice Cream	Trifle
Chocolate pudding / dessert	Jelly	Other desserts
Cakes / gâteaux / doughnuts / pastries	Milk pudding (custard etc)	
Fruit pie / strudel / crumble	Mousse	

### Oil and fat

Oil	Fat
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### Confectionery and snacks

Chocolate and sweets	Savoury snacks	Other confectionery and snacks
Cereal bar	Sweet biscuits	

### Processed fruit

Apple	Mixed fruit	Soft / berry fruit
Banana	Orange	Stone fruit
Kiwi	Pear	Other citrus
Melon	Pineapple	Other fruit

### Other

Baby food	Gunge	Drainings from canned food
Baby milk	Mixed food	Other food

# Appendix C: Reasons for Disposal

## C.1 Compositional Analysis

The following table describes how, for compositional analysis, the reason for disposal is derived from the food state and the packaging associated with an item. Full definitions for the food states are given in the original research<sup>36</sup>.

**Table 46:** Classification for reason for disposal from the food state and presence of packaging

Food State	Packaging present?	Reason for Disposal
A. Fresh / raw (in natural state)	Any packaging state	Not used in time
B. Home cooked or prepared	No	Cooked, prepared or served too much
B. Home cooked or prepared	Yes	Not used in time
C. Pre-cooked (ready to eat when purchased)	No	Other
C. Pre-cooked (ready to eat when purchased)	Yes	Not used in time
D. Cooked	Any packaging state	Cooked, prepared or served too much
E. Pre-prepared and cooked	Any packaging state	Cooked, prepared or served too much
F. Pre-prepared but not cooked	Any packaging state	Not used in time
G. Sliced meats	Any packaging state	Not used in time
H. Tinned	No	Other
H. Tinned	Yes	Not used in time
J. Other	Any packaging state	Other

It is not always possible to determine the reason for disposal from compositional analysis. However, the scheme above classifies the majority of food items well, even though there will be some exceptions for which the scheme does not work. These minor shortcomings should be borne in mind when interpreting the information.

For food state A (fresh / raw) and sliced meats (G), then it is assumed that all this material has not been used in time – had it been prepared or served, then it would fall under state B or D.

If the food has been cooked in the home (states D or E), then the food is classified as 'cooked, prepared or served too much'. For home-cooked or prepared food (state B), this is classified as 'cooked, prepared or served too much' if there is no evidence of packaging; if packaging is present, it is assumed it has been further stored, and therefore is classified as 'not used in time'.

For state C (ready to eat when purchased) and tinned food (state H), if the waste was disposed of in its packaging, it is assumed that it was not used in time. However, if no packaging was present, it was classified as 'other' as it is not possible to tell if it was disposed of because it was served and rejected, or not used in time.

For food that was bought pre-prepared and required cooking (F), but was thrown away uncooked (e.g. raw fish fingers), it was assumed that this was not used in time.

## C.2 Sewer Research

The information on reasons for disposal from the *Down the Drain* research is more detailed and likely to be more accurate than the reasons derived from compositional analyses. This is a consequence of the diary methodology, allowing the respondent to record their reason directly, rather than the reason being inferred from the state of the waste.

Because of this additional level of detail in this sewer-based research, it was necessary to group the reasons for disposal into broader categories so that they were consistent with information derived from *The Food We Waste* research. The mapping between from the sewer-based research to the broader categories was performed according to the information in Table 47.

<sup>36</sup> [www.wrap.org.uk/thefoodwewaste](http://www.wrap.org.uk/thefoodwewaste)

**Table 47:** Mapping of reasons for disposal between the sewer research and the current report

Original reason (from diary)	Reason used in current research
Leftover - unspecified type	Cooked or prepared too much
Leftover - unspecified type - baby	
Leftover - preparation and cooking	
Leftover - after serving	
Leftover - after serving - baby	
Leftover - after serving - adult	
Ruined	
Cleaning / washing	Not used in time
Gone off	
Clearing out / replaced	
Out of date	Other
Unspecified	

### C.3 *Kitchen Diary* Research

The *Kitchen Diary* research was, as the name suggests, also a diary-based piece of research. Therefore the comments on the reason for disposal for the sewer-based research also apply to the *Kitchen Diary* work. The mapping procedure was performed according to the information in Table 48.

**Table 48:** Mapping reasons for disposal between the *Kitchen Diary* research and the current report

Original reason (from diary)	Reason used in current research
Leftovers from plate	Cooked or prepared too much
Leftovers from cooking	
Smelt / tasted bad	Not used in time
Out of date	
Mouldy	
Looked bad	
In fridge / cupboard too long	
Other	Other
Unspecified	

# Appendix D: Proportion of food and drink brought into the home that is wasted

To give context to the information provided in the main report, it is useful to consider the proportion of food and drink brought into the home that is wasted. This appendix provides this information for the UK, alongside the methodological problems in comparing purchases and waste. It should be noted that the analysis in this appendix is preliminary; WRAP is working alongside the Family Food group in Defra to overcome the methodological issues discussed.

## D.1 Estimate of amount of food and drink brought into UK homes

Data on food and drink brought into the home (from retail, takeaways and sources of free food<sup>37</sup>) come from Defra's Family Food Survey for the calendar year 2007<sup>38</sup>. Amounts of free food were low, and so in this appendix the term 'purchases' is used as a short-hand for 'purchases and free food brought into the home'.

The food types used in this report were aligned as closely as possible with the classification of food and drink in the Family Food dataset<sup>39</sup> and then estimates for amounts of purchases at the food group level were obtained. The information from the Family Food dataset was converted from grams per person per week into tonnes in the UK each year<sup>40</sup>.

## D.2 Methodological issues associated with comparison of purchases and waste

In essence, we would like to establish the proportion of food and drink brought into the home – be it retail or takeaway – that is disposed of rather than consumed. There are a number of challenges to be overcome in determining this information. Some foods and drinks are combined in the home during cooking or preparation, and some food types change weight during processing. The following sections discuss each of these in turn.

### D.2.1 Combining food types

Some foods are purchased as ingredients and, as such, are usually consumed after combining with other food stuffs; examples include flour, sugar, and cocoa. Furthermore, some food types can be either eaten or drunk by themselves or combined as an ingredient, e.g. milk, vegetables, fruit, and meat. For both these categories, it is likely that some disposal will take place of the ingredient itself and some of the item that was prepared (Figure 55). If the amount of these ingredient-type foods thrown away is compared with the amount purchased, the result will be an underestimate. Conversely, for food types that are commonly made in the home from ingredients, the estimate of the proportion wasted is likely to be an overestimate.

This effect only impacts calculations of the proportion of food types wasted: the estimates of the absolute amount wasted – as detailed in the rest of the report – are not affected. Furthermore, the headline estimate (for all food and drink) of the proportion wasted is unlikely to be impacted because, although processing in the kitchen can alter the food type, the food or drink will still be classified as kitchen waste if it is disposed of.

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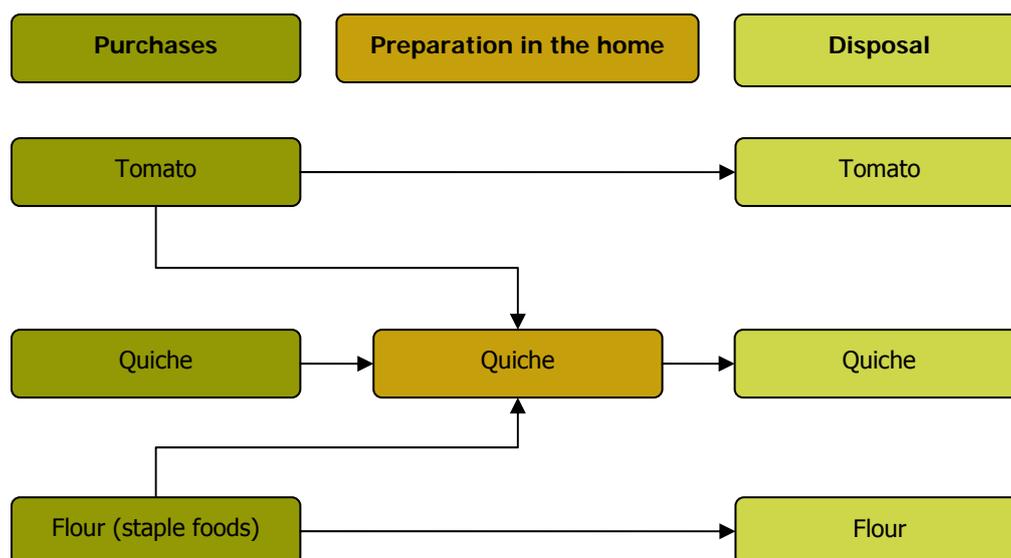
<sup>37</sup> Free food encompasses home-grown, foraged, 'meals on wheels' and other free sources such as hampers won in raffles.

<sup>38</sup> <https://statistics.defra.gov.uk/esq/publications/efs/default.asp>

<sup>39</sup> The dataset includes takeaway food that is brought into the home, but excludes takeaway food otherwise. For this reason the alignment of household purchases with the household waste stream is good.

<sup>40</sup> 2007 UK population figure used was 60,975,300 from the Office of National Statistics

Figure 55: Schematic of combining food types (food group shown in brackets)



### D.2.2 Weight change during cooking

Some foods and drinks may change weight due to processing in the home, usually via the absorption or loss of liquid. For instance, dried pasta will absorb water during cooking and consequently increases its weight. Some items will undergo evaporation during cooking (e.g. baked beans cooked uncovered) and items such as meat will release juices (mainly fat and water) during cooking.

This effect impacts on the current analysis only if:

- The weight gain comes from tap water, or food or drink that was not purchased via retail or takeaway (and therefore not covered in the analysis in this appendix); or
- The material lost is not recorded by the disposal routes considered in the report (e.g. evaporation of water)

No account is taken of this effect in the current calculations; although this effect may be significant for some food types (pasta, rice), it is unlikely to have a large impact on the headline proportion of food and drink purchases that are wasted.

### D.2.3 Summary

In conclusion, there are various issues relating to analysis of the amount of food and drink purchases that are disposed of. At the headline level, the important factor is how much weight change on preparation and cooking occurs. For analysis at the food-group level, there is the added effect of material changing food group through preparation.

Table 49 summarises these effects and gives a qualitative indication of the likely magnitude of these effects on the resulting proportion of food and drink brought into the home that is wasted. For most groups, the analysis is likely to give a good – though by no means perfect – indication of the proportion wasted. However, for two groups, 'meals' and 'other', these estimates are likely to be affected significantly:

- For 'meals', a large proportion of the waste is home-made meals, which are made up of foods purchased as ingredients (vegetables, meat, fish, staples, etc.)
- A large amount of the 'other' category was classified as 'gunge', unidentifiable semi-liquid material; however 'gunge' results from food preparation/disposal and is not purchased.

**Table 49:** Qualitative impact of factors identified on estimates of proportion of purchases wasted

Food group	Do we make this into something at home?	Do we make this at home?	Weight change? <sup>41</sup>	Estimate of proportion wasted likely to be ...
Bakery	Yes (e.g. sandwiches)	Small amounts	Minor loss (toast)	Slight underestimate
Cake and desserts	No	Yes	No	Overestimate
Condiments, sauces, herbs & spices	Yes	No	No	Underestimate
Confectionery and snacks	No	No	No	Similar
Dairy and eggs	Yes	No	No	Underestimate
Drink	No, but milk and sugar are added to some types to make 'a cup of tea'	No	Minor gain (teabags)	Slight overestimate
Fresh fruit	Yes (desserts)	No	Losses on long storage	Slight underestimate
Fresh vegetables and salads	Yes (mainly meals)	No	Losses on long storage	Underestimate
Meals (home-made and pre-prepared)	No	Yes	Minor loss (evaporation), gain (absorb water)	Large overestimate
Meat and fish	Yes (mainly meals)	No	Loss (juices)	Underestimate
Oil and fat	Yes (meals, cakes)	No	No	Underestimate
Processed fruit	Yes (desserts)	No	No	Similar
Processed vegetables and salad	Yes (mainly meals)	No	No	Underestimate
Staple foods	Yes (mainly meals, also desserts)	No	Gain (absorb water)	Overall similar
Other	No	Yes (gunge)	No	Vast overestimate

*'No' means none or negligible amounts*

### D.3 Estimate of proportion of food and drink purchases that are wasted

Table 50 shows the estimated total food and drink brought into UK homes, and the amount of food and drink waste expressed as a percentage of that purchased. Overall, 22% of food and drink brought into the home ends up as 'kitchen waste' (avoidable, possibly avoidable and unavoidable waste). 14% of food and drink brought into the home ends up as avoidable waste<sup>42</sup>.

When split into food and drink as separate categories, it can be seen that avoidable drink waste is 8% of purchases, and avoidable food waste is 16% of purchases.

<sup>41</sup> Tap water added to items disposed of via the sewer is not included in the analysis, giving better alignment between purchases and waste. However, a small amount of tap water will be present in some waste (e.g. absorbed in teabags, added to cooking). This latter affect has not been adjusted for.

<sup>42</sup> Due to the methodology used in the compositional analysis, the estimate of avoidable waste contains a small amount of unavoidable material from items thrown away whole that are composed of avoidable and unavoidable fractions. This is likely to have a small impact on the overall results.

**Table 50:** Estimates of proportion of food and drink wasted in the UK

Category	Food and drink [000 tonnes per year in the UK]					Effect of issues
	Purchased	All waste		Avoidable waste		
		Amount	Proportion wasted	Amount	Proportion wasted	
Drink	10,700	1,300	12%	870	8%	Small (over)
Food	27,800	7,000	25%	4,500	16%	
<b>All food and drink</b>	<b>38,500</b>	<b>8,300</b>	<b>22%</b>	<b>5,300</b>	<b>14%</b>	

It is likely that the figure quoted for the proportion of drinks wasted is a slight overestimates. For tea and coffee, tap water used to make these drinks is excluded from the estimate of waste, but the milk and sugar added to these drinks is included and thereby classified as 'drink' waste. As this milk and sugar would have entered the home in a state classified as food, this leads to an overestimate of the proportion of drinks brought into the home that are subsequently wasted. Tea and coffee make up a small proportion of the avoidable waste associated with drinks, and thus the overall effect is likely to be small: e.g. increasing the estimate of the proportion of drinks brought into the home that becomes avoidable waste by approximately one percentage point.

**Table 51:** Estimates of proportion of food purchases wasted by food group

Food group	Purchased [000 tonnes / year in UK]	All waste		Avoidable waste		Effect of issues
		Amount [000 tonnes / year in UK]	Proportion wasted	Amount [000 tonnes per year in UK]	Proportion wasted	
Drink	10,700,000	1,300,000	12%	870,000	8%	Small (over)
Fresh fruit	2,700	1,100	40%	500	18%	Small (under)
Bakery	2,100	800	37%	680	32%	Small (under)
Staple foods	1,300	200	16%	200	16%	Small
Confectionery and snacks	1,200	71	6%	67	6%	Small
Processed fruit	190	30	16%	30	16%	Small
Dairy and eggs	6,800	580	9%	530	8%	Under
Fresh vegetables and salads	4,200	1,900	46%	860	20%	Under
Meat and fish	2,700	610	23%	290	11%	Under
Processed vegetables and salad	1,500	210	14%	210	14%	Under
Cake and desserts	1,400	190	14%	190	14%	Over
Condiments, sauces, herbs & spices	1,000	210	20%	200	20%	Under
Oil and fat	540	90	17%	20	4%	Under
Meals (home-made and pre-prepared)	1,900	690	35%	660	34%	Over
Other	240	300	126%	20	8%	Over
<b>Total</b>	<b>38,500</b>	<b>8,300</b>	<b>22%</b>	<b>5,300</b>	<b>14%</b>	

*Green shading indicate food groups with a moderate level of impact from factors discussed in Appendix D.2; red shading indicates a high level of impact.*

Table 40 shows the total purchases for each food group in the UK. 37% of bakery purchases become kitchen waste, whilst 32% of purchases become avoidable waste. About a sixth of fresh and processed fruit purchases result in avoidable waste; however, there is also a considerable amount of unavoidable waste associated with fresh fruit. 16% of staple food purchases end up being wasted. 8% of drink purchases become avoidable waste, and for confectionery & snacks the figure is 6% avoidable.

## D.4 Estimate of proportion of types of food and drink purchases that are wasted

It is possible to directly compare waste of some food types with purchases. In some cases, the classification of waste and purchases is better aligned at the level of food types than it is for food groups. A selection of food types are shown in Table 52.

**Table 52:** Estimates of proportion of purchases wasted of selected food types

Food type	Purchased [000 tonnes per year in UK]	All waste		Avoidable waste		Effect of issues
		Amount [000 tonnes per year in UK]	Proportion wasted	Amount [000 tonnes per year in UK]	Proportion wasted	
Milk	5,200	360	7%	360	7%	Under
Standard bread	1,800	660	36%	540	29%	Under
Fresh potato	1,700	770	45%	290	17%	Under
Carbonated soft drink	3,200	280	9%	280	9%	Small
Alcoholic drinks	2,600	140	5%	140	5%	Small
Squash	2,600	53	2%	53	2%	Small
Fruit juice & smoothies	1,100	160	14%	160	14%	Small
Bottled water	850	69	8%	69	8%	Small
Poultry	800	300	38%	81	10%	Under
Fresh banana	730	310	43%	83	11%	Small
Processed potato	600	74	12%	74	12%	Under
Fresh apple	570	260	46%	180	31%	Small
Lettuce and lettuce/leafy salads	190	100	55%	97	52%	Under

*Only a selection of food types are shown, those which have a high level of avoidable waste and for which purchases and waste are likely to be comparable*

*Some food types relating to waste are combined to fit purchasing data*

It is estimated that 7% of milk purchased is subsequently wasted. This is likely to be an underestimate due to its use as an ingredient. The results would indicate that approximately 13% of purchased yoghurts are thrown away.

Wasted bread accounts for 29% of that purchased (compared to 32% of bakery). This will be an underestimate due to not capturing bread made into sandwiches etc.

The proportion of fresh potato purchased that subsequently become avoidable waste is 17%, slightly higher than for processed potato products (12%). In part, this is attributable to the lower perishability of the latter. In addition, a substantial amount of fresh potato peelings are disposed of by households (possibly avoidable waste); no such waste is associated with processed potatoes. Overall 45% of fresh potato brought into the home is disposed of.

Lettuce is associated with very high relative waste to purchases (more than half). This high level is likely to be a combination of two factors – lettuce has a relatively short (fridge) shelf life (60% of avoidable lettuce waste is 'not used in time') and it is often served as a garnish that is not consumed (40% of lettuce waste is 'prepared or served too much').

Bananas are not only the nation's most purchased fruit, they also seem to be very popular for eating, as their avoidable waste is only 11% of that purchased compared to 18% for fresh fruit overall. However, this still equates to 1 in 10 bananas not being consumed.

Apples are above the group average for the amount wasted: 31% of avoidable waste. There may be some effect here from windfall apples making their way into household waste – seen in the compositional analysis by single disposal events involving large quantities. Presumably, these apples are damaged or in excess to the needs of the

households. As windfall is preliminarily a phenomenon associated with late summer and autumn, this leads to an abnormal amount of waste during these months. As this period partially coincides with *The Food We Waste's* compositional analysis, it is likely to have an effect on annual estimates relating to apple waste (and, to a lesser extent, a small number of other food types affected by windfall or seasonality – e.g. plums and pears). However, it is not always possible to identify which items of waste are associated with windfall in the compositional analysis and therefore it is highly problematic to quantify this effect accurately. Furthermore, the home composting estimates come from February, a month likely to experience little of this effect and thus partially counteracting this effect.

In summary, the estimates associated with apples, pears and plums shown throughout this report should be regarded as slight overestimates.

# Appendix E: Greenhouse gas emissions relating to avoidable food and drink waste

## E.1 Overview

The purpose of these calculations is to obtain **an approximate** value for the greenhouse gas emissions associated with avoidable food and drink waste using up-to-date estimates. This is not intended as a comprehensive review of all life-cycle literature relating to food and drink.

The analysis covers contributions to emissions from agriculture, food manufacture, packaging, distribution and transport, retail, storage and preparation in the home and waste treatment and disposal<sup>43</sup>. The figures do not take into account for changes to land-use resulting from demand for food stuffs. Furthermore, contributions from a range of greenhouse gases are incorporated into the estimate including:

- CO<sub>2</sub> (e.g. burning of fossil fuels for transportation);
- N<sub>2</sub>O (e.g. from use of nitrogen fertiliser in agriculture); and
- CH<sub>4</sub> (e.g. emissions from cattle).

The emissions of each greenhouse gas are converted into the equivalent global-warming potential of CO<sub>2</sub>. For the majority of sources used, the information has come from peer reviewed publications that have followed ISO14040.

Other environmental metrics would be useful indications of the impact of avoidable food waste, e.g. eutrophication, use of resources such as water, land, and energy. However, for reasons of brevity, these are **not** covered in this section.

The underlying principle behind this assessment is that if the avoidable waste were not generated, then the resources used for e.g. production, transportation, cooking, etc. would not have been consumed, or would be available for other purposes.

## E.2 Methodology

Two approaches have been adopted to estimate the greenhouse gas emissions associated with avoidable food and drink waste: the top-down analysis totals the impact of sectors associated with food and drink, whereas the bottom-up approach sums the effect of food types which make up avoidable food and drink waste in the UK.

### E.2.1 Top-down calculation

The analysis summed greenhouse gas emissions associated with key sectors associated with food and drink production in the UK. These emissions were adjusted to include the impact of imports and exports, taking into account the different types of foods produced overseas in comparison with UK production. This gave an estimate of the total greenhouse gas emissions associated with all food and drink consumed in the UK.

The total greenhouse gas emissions were divided by the total weight of food and drink **consumed** in the UK, resulting in a factor that converts weight of food and drink to greenhouse gas emissions. This factor was multiplied by the weight of avoidable food and drink **waste** in the UK to give an estimate of the greenhouse gas emissions associated with avoidable waste.

This method has the benefit of covering the major emissions from all major sectors involved in the food and drink supply chain. However, the key assumption in this method is that the greenhouse gas emissions associated with waste in proportion to those associated with purchases. As different fractions of each food groups are wasted, ranging from under 10% to over 30%, this could have some impact on the calculation results. Because of this assumption, a second – bottom-up – method was also employed and the two compared.

### E.2.2 Bottom-up calculation

In contrast to the top-down calculation, this method sums the greenhouse gas emissions of food and drinks that make up a large proportion of avoidable food and drink waste. Where information was not available, or a food

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<sup>43</sup> The impact of disposal via the sewer has been omitted due to insufficient data.

type made up only a small proportion of avoidable waste, a representative figure from the same food group was used.

This method has the advantage that it uses information on the relative amounts of food types wasted, rather than inferring information from UK purchases. It does rely on assumptions relating to individual food types that can have an influence on the emissions, e.g.:

- production method (e.g. intensive versus organic production);
- country of origin; and
- storage in retailer and household (frozen, chilled, ambient).

References used for this work are listed in Appendix E.5. Where multiple references were available for a food type, preference was given to sources that used a weighted basket reflecting UK purchasing and cooking behaviour. Furthermore, preference was given to studies referring to UK consumption. If the lifecycle information omitted a certain stage of the life cycle (e.g. transportation to the home), a standard figure was used.

### E.3 Results

The results of these methodologies are shown in Table 53. The two approaches give very similar figures – around 3.8 tonnes of CO<sub>2</sub> equivalent is emitted for each tonne of avoidable food and drink waste. This means that the greenhouse gas emissions associated with avoidable food and drink waste generated in the UK annually is c. 20 million tonnes CO<sub>2</sub> equivalent. This compares to an estimate of 18 million tonnes CO<sub>2</sub> equivalent per year in *The Food We Waste*, which used a figure of 4.5 tonnes CO<sub>2</sub> equivalent / tonne of food waste.

**Table 53:** Estimates of greenhouse gas emissions associated with food and drink waste

Method	Greenhouse gas emissions (tonne CO <sub>2</sub> equivalent / tonne of waste)		
	Food and drink	Food	Drink
Top down	3.8		
Bottom up	3.8	4.2	1.5

A separate calculation by Defra estimates that the greenhouse gas emissions associated with the food and drink consumed in the UK is 158 million tonnes CO<sub>2</sub> equivalent<sup>44</sup>. If it is assumed that emissions from food and drink consumed inside the home are similar to those consumed outside the home, a figure of 3.6 tonnes of CO<sub>2</sub> equivalent per tonne of food and drink waste is obtained – i.e. similar to those produced for this report.

There is a large variation in the greenhouse gas emissions associated with different types of food and drinks – more than an order of magnitude. Furthermore, there is variation in emissions with the time of year, sourcing, types of production. Therefore the average figure quoted is not representative of any one product.

### E.4 Calculations of equivalent impacts (cars off the road)

In 2007, there were 26,878,000 private cars licensed in Great Britain with an average annual mileage of 8,870 miles<sup>45</sup>. Applying suitable factors taking into account the split of private vehicle types<sup>46</sup> leads to an average emission of c. 3 tonnes CO<sub>2</sub> equivalent per car per year. Thus the emissions from the journeys of private cars in the UK total 81 million tonnes CO<sub>2</sub> equivalent, four times greater than that associated with food and drink waste.

### E.5 References for environmental impact calculations

References used for the bottom up calculation of environmental impact of food and drink waste are listed below. It should be noted that some references contained information for a number of different food types, or a number of different items which would fall under the same food type.

- Berlin, J. 2002. Environmental life cycle assessment (LCA) of Swedish semi-hard cheese. *International Dairy Journal*, 12(11), pp. 939-953.

<sup>44</sup> <http://www.defra.gov.uk/evidence/statistics/environment/eivp/pdf/eivp2008.pdf>

<sup>45</sup> <http://www.dft.gov.uk/pqr/statistics/datatablespublications/tsqb/2008edition/sectionninevehicles.pdf> (Table 9.1)

<sup>46</sup> <http://www.defra.gov.uk/environment/business/reporting/conversion-factors.htm>

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In addition, information from the following databases was used:

- Cranfield University agricultural life-cycle inventory models, release 2, <http://www.cranfield.ac.uk/sas/naturalresources/research/projects/is0205.jsp>.
- ESU, <http://www.esu-services.ch/cms/index.php> (purchased data).
- LCA Food Database, <http://www.lcafood.dk/>.

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