

Eat Me First!

Development and Evaluation of the Food: Too Good
to Waste Household Food Waste Prevention
Program in Honolulu, Hawaii, USA

Alexandra Lavers

Uppsats för avläggande av masterexamen i naturvetenskap
30 hp
Institutionen för biologi och miljövetenskaper
Göteborgs universitet



Table of Contents

1. Introduction	1
1.1. Purpose	1
1.2. Specific objectives	1
1.3. Scope	1
2. Background	2
2.1. Problem Description	2
2.2. Food Waste Prevention Studies and Campaigns	5
2.2.1 Community Based Social Marketing and the 4Es	6
2.2.2 Motivations/Benefits and Barriers for Behavioral Change in Waste Prevention	7
2.3. The Basis for the <i>Food: Too Good to Waste</i> Program	9
2.4. Study Site Description: Honolulu	11
3. Hypotheses	11
4. Method	12
4.1. Cookbook and Toolkit Production	13
4.2. Pilot Study	13
5. Results	15
5.1. Cookbook	15
5.2. Pilot Study Participant Demographics	17
5.3. Pilot Study Participant Retention Data	18
5.4. Food Waste Data – A Quantitative Analysis	18
5.4.1. Preventable Food Waste	18
5.4.2. Non-Edible Food Waste	25
5.5. Qualitative analysis	27
5.5.1. Anecdotal data	27
5.5.2. Follow Up Survey Data	28
5.6. Summary	30
6. Conclusions and recommendations	32
7. References	33

[Accessed 12 May 2013]

Appendix A: Pilot Materials

A.1 Presentations

A.2 Worksheets

A.3 Toolkit

Appendix B: Interview Questions for Chefs

List of Tables

Table 1: Previous FTGTW Case Studies	10
Table 2: Demographic profile of study participants	17
Table 3: Participant Retention Rate	18
Table 4: Average Preventable Food Waste, All Households.....	19
Table 5: Change in Cumulative Preventable Food Waste, per Household and per Capita	20
Table 6: Percent Change in Preventable Food Waste.....	22
Table 7: Preventable Food Waste by Week.....	22
Table 8: Change in Cumulative Non-Edible Food Waste, per Household and per Capita	25
Table 9: Cumulative Non-Edible Food Waste	26
Table 10: Percent Change in Non-Edible Food Waste	26

List of Figures

Figure 1: Food Supply, Intake, and Waste in America (Hall et al, 2009).....	4
Figure 2: Waste Management Hierarchy (EPA, 2012b).	4
Figure 3: Food Recovery Hierarchy (EPA, 2012a)	4
Figure 4: The MOA model (Thøgersen, 2010).	6
Figure 5: The 4Es. Defra UK Sustainable Development Strategy. “Securing the Future” (Defra, 2005).....	7
Figure 6: Preventable and Non-Edible Food Waste Bins Provided to Pilot Participants	14
Figure 7: Table of Contents for CCH Cookbook	16
Figure 8: Preventable Food Waste per Household, by Week.....	19
Figure 9: Relative Composition of Preventable Food Waste	23
Figure 10: Person-Meals vs. Preventable Food Waste by Household	24
Figure 11: Non-Edible Food Waste per Household by Week.....	27
Figure 12: Ranking of Toolkit	28
Figure 13: Follow Up Survey: Tool Usage.....	29
Figure 14: Follow Up Survey: Attitudes and Behavior	29

List of abbreviations

4 Es	encourage, enable, exemplify, engage
CBSM	community-based social marketing
CCH	City and County of Honolulu
EPA	United States Environmental Protection Agency
EPA WCCMMF	EPA West Coast Climate and Materials Management Forum
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FTGTW	Food: Too Good to Waste
g	gram
GHG	greenhouse gas
H-POWER	Honolulu Program of Waste Energy Recovery
HRA	Hawaii Restaurant Association
kg	kilogram
lbs	pounds
LFHW	Love Food Hate Waste
MOA	motivation, opportunity, ability
mos	months
MSW	municipal solid waste
ND	no data
NRDC	National Resource Defense Council
OECD	Organization for Economic Co-Operation and Development
OSW	United States Office of Solid Waste
UK	United Kingdom
US	United States of America
WRAP	United Kingdom Waste and Resources Action Programme
WTE	waste to energy

Preface and Acknowledgements

This is a thesis for Master of Science degree in Environmental Sciences and is equivalent to 30 higher education credits.

The work was performed during the spring and summer of 2013 in Honolulu, Hawaii, USA and Gothenburg, Sweden in cooperation with the United States Environmental Protection Agency, the City and County of Honolulu, Chalmers Technical University and the University of Gothenburg.

I would like to thank my advisor, Assistant Professor Yuliya Kalmykova for her steady support, supervision and guidance (even via long-distance!); this thesis would not have been possible without you. Thank you to Dan Strömberg, Lennart Bornmalm, and my examiner Sten-Åke Wängberg for their advice and assistance.

I would like to especially express gratitude to Suzanne Jones, Eileen Helmstetter, and the Refuse Division ohana in the Department of Environmental Services in Honolulu; it was a pleasure working with you and I am very grateful for my experience with you all. Thank you to Steven Ledbetter from Ledbetter Kennedy Creative for your patience and for helping to create a beautiful cookbook.

I would like to give sincere thanks to Ashley Zanolli, Shannon Davis, and Veronica Pardo from the EPA West Coast Climate and Materials Management Forum and Vicky Sonntag at EcoPraxis; your support was essential to making this project successful.

An enormous thanks to my pilot study participants; I truly appreciate your willingness to try something new while providing me with vital data. Keep up the good work! I hope you found the experience as valuable as I did. Mahalo!

Thank you to my family and friends who have supported me with encouragement, kind words, and coffee. I am lucky to have such wonderful people in my life.

Abstract

Food waste is a growing environmental problem; some studies show that forty percent of food purchased by Americans is thrown away. Wasted food represents wasted water, fertilizers, pesticides, and emissions caused by transportation and more. This study develops and implements portions of the United States Environmental Protection Agency West Coast Climate and Materials Management Forum developed program "*Food: Too Good to Waste*" in the City and County of Honolulu in order to evaluate how effective these community-based social marketing strategies and tools are in preventing and reducing residential food waste in Honolulu.

Food: Too Good to Waste educates and inform consumers on food waste facts as well as guide them in ways to reduce and prevent food waste. The strategies titled "Smart Shopping", "Smart Preparation", "Smart Eating", and "Smart Storage" were incorporated into a cookbook with recipes contributed by local chefs in order to entice customers to read more and to reevaluate their food waste. These strategies were then tested in seventeen households in Honolulu over a four-week period. A shopping list/meal planner, an "Eat Me First" sign for the refrigerator, and a food storage guide were included as food waste prevention tools in addition to the cookbook developed for Honolulu.

The pilot study was divided into two two-week phases; during Phase 1, households measured both preventable and non-edible food waste without changing shopping and waste habits. Pilot participants were then informed on the strategies, given the tools, and measured food waste for an additional two weeks. The study tested three hypotheses: 1. Preventable food waste will decrease in Phase 2 compared to Phase 1; 2. Decreased preventable food waste may lead to increased non-edible food waste, and 3. A greater number of meals eaten outside of the home will correlate to greater preventable food waste.

Cumulative preventable food waste decreased by 19.6 percent in participating households post-strategy implementation. Over the course of four weeks, eight households reduced preventable food waste, one did not generate any preventable food waste, three households did not participate in the entire study, and five households saw an increase in preventable food waste. Preventable food waste consisted primarily of spoiled produce and uneaten leftovers. No connections were made between the number of meals eaten away from home and the amount of preventable food waste. There were no predictable patterns in the quantity of non-edible food waste.

The study indicates that the *Food: Too Good to Waste* toolkit is an effective method in reducing food waste in residential homes. A food storage guide, an "Eat Me First" sign, and a food waste measurement tool are valuable and popular tools in reducing preventable food waste and should be included in a public food waste prevention program.

Abstrakt

Matsvinn är ett växande miljöproblem; vissa studier visar att fyrtio procent av mat som köps av Amerikaner slängs, outnyttjad. I matsvinnet ingår vattenförbrukning, miljöaspekter från transporter, användning av konstgödsel, med mera. Denna studie bygger på United States Environmental Protection Agency (nationella miljömyndigheten) "West Coast Climate and Material Management Forum" program *Food: Too Good to Waste* i Honolulu kommun med syfte att granska effektiviteten av framtagna verktyg inom området. Programmet är baserat på "Community-Based Social Marketing" ("sambandsbaserade social marknadsföring") och har målet att minska mängden matsvinn i hemmet.

Uppkomsten av matsvinn förebyggs genom att först informera konsumenter på miljöeffekterna av matsvinnet och därefter ge råd och tips hur man undviker och förebygger uppkomst av matsvinn. Strategierna "Smart Shopping", "Smart Preparation", "Smart Eating", och "Smart Storage" inkluderades i en kokbok med recept från lokala kokkar och restauranger som sen ska distribueras av kommunen. Verktygen och strategierna testades över en fyra veckors period som en pilotstudie där sjutton hushåll deltog; verktygen inkluderade en shoppinglista med måltidsplanering, en "Eat Me First" skylt för kylskåpet, en matförvaringsguide samt kokboken producerat för Honolulu.

I pilotstudien ingick två faser: det första fas pågick i två veckor då hushållen vägde sitt matsvinn och oätbart matavfall (till exempel banan och lökskal) utan att göra några förändringar av matinköps och släng vanor för att få en utgångspunkt. Fas 2 pågick i också två veckor där deltagarna informerades om och genomförde ovannämnda strategierna. Studien testade tre hypoteser: 1. matsvinn kommer minska i de sista två veckor i jämförelse med första två veckorna; 2. minskad matsvinn kan orsaka en ökning av oätbart matavfall; och 3. ett hög antal måltider förtärda hemifrån är kopplad till en större mängd matsvinn.

Resultaten i pilotstudien visade att matsvinnet minskade med 19.6 procent hos de medverkande hushållen i Fas 2. Studien visade att åtta hushåll minskade matsvinn, ett hushåll hade inget matsvinn alls, tre av hushållen drog sig ur studien, och fem hushåll ökade matsvinnet. Matsvinnet bestod framförallt av ruttna grönsaker och frukter samt ej uppätta matrester. Det var inte möjligt att koppla matsvinn till hur många måltider som intogs utanför hemmet och det fanns inga klara mönster till uppkomsten av oätbart matavfall.

Studien visar att verktygen och strategierna från "*Food: Too Good to Waste*" är effektiva metoder för att minska matsvinnet i hushåll. En rekommendation är att en matförvaringsguide, en "Eat Me First" skylt, samt ett matsvinnmättningsverktyg är inkluderade i ett kommunalt program för minskning av matsvinn.

1. Introduction

Food waste from residential homes is an environmental issue that must be addressed by both consumers and governments. Food waste prevention programs are being developed and implemented to tackle food waste from different sources and by different methods. This paper looks at one potential method that uses Community-Based Social Marketing (CBSM). The study is comprised of two parts: 1) development of a cookbook and “smart food tips” guide to be distributed to Honolulu residents and 2) a pilot study testing the effectiveness of these strategies.

1.1.Purpose

This study expands and evaluates portions the United States Environmental Protection Agency (EPA) food waste prevention program “*Food: Too Good to Waste*”. A cookbook and smart food tips guide was developed using both EPA and local resources. These tools were then tested to study the food waste reduction potential.

1.2. Specific objectives

The specific objectives of the study are divided into two parts:

Part One:

- Produce a *Food: Too Good to Waste* Cookbook and Smart Food Tips guide with local chef-contributed recipes and food waste prevention tips for distribution in the City and County of Honolulu (CCH) in Hawaii.
 - Recruit restaurants to provide recipes and tips
 - Produce tools to encourage implementation of strategies based on EPA research
 - Complete and distribute Cookbook to CCH residents via participating restaurants

Part Two:

- Perform a pilot study to test strategies and tools developed in Part One
 - Recruit households to participate in pilot
 - Quantitatively evaluate food waste in participating households for 2 weeks
 - Educate households in food waste reduction strategies (using the cookbook and tools developed in Part One)
 - Quantitatively evaluate the food waste during implementation of the strategies for 2 weeks
 - Qualitatively evaluate the food waste reduction strategies (motivation, engagement, feasibility)

1.3.Scope

This pilot is comprised of seventeen households in Honolulu, HI, USA.

2. Background

2.1. Problem Description

Food waste is a growing environmental problem involving several challenges: volume reduction, collection, sanitation, and disposal are just a few. The Food and Agriculture Organization of the United Nations (FAO) estimates that 1.3 billion tons (approximately one third) of food produced in the world for human consumption is lost or wasted (Gustavsson et al, 2011). In Europe and North America it has been estimated that 280 to 300 kg of food is wasted per person per year and the National Resource Defense Council (NRDC) estimates that 40 percent of all food purchased by Americans is thrown away (Gunders, 2012; Galbrath, 2012). The EPA estimates that 13.9 percent of the 2010 municipal solid waste (MSW) stream consisted of food waste and several waste composition studies found that food is the largest component by weight in household trash (EPA, 2010).

Food waste comes from a variety of sources in the chain from farmer to table, and thus has many definitions. For the purpose of this paper, food waste is any post-consumer waste product from the purchase and consumption of food (Okazaki et al, 2008); food waste can be classified as avoidable, possibly avoidable, and unavoidable as well separated into edible and non-edible kitchen waste (e.g. egg shells) (Lamb et al, 2010). Avoidable food waste will be referred to as “preventable food waste” in this paper.

According to the European Union (EU) and the NRDC, common causes for food waste in households are:

1. Lack of awareness
Households are unaware of how much food waste they generate and also why food waste is an environmental issue. The NRDC notes that food has become inexpensive and easily available so wasted food is not perceived as a problem. This may come as a surprise, considering food waste is estimated to cost the average family of four in the United States (US) \$1365 to \$2275 per year.
2. Lack of planning prior to grocery shopping
Grocery shopping without meal planning or writing a list may result in purchasing too much food. This, along with inaccurate estimates of quantities needed and unplanned restaurant meals increase the risk of purchased food spoiling.
3. Misinterpretation of and confusion over dates on food products
Consumers are unaware of which dates are federally regulated and often act cautiously, following arbitrary “best-by” dates set by the manufacturer.
4. Suboptimal storage conditions and improper packaging
Many consumers unknowingly store food improperly, hastening spoilage. They are also frequently unaware of how to best utilize their freezer. Many refrigerators are overcrowded which can lead to forgotten food.
5. Cooking styles or making too much food
Cooking portions (and average dinner plate size) have increased significantly in the last fifty years, which increases the risk of uneaten leftovers.

(Wansink et al, 2007; EU, no date a; Gunders, 2012)

The NRDC reports that two thirds of household waste in the United Kingdom (UK) is due to food spoilage and the remaining one third is caused by cooking or serving too much food. Interestingly, food waste habits can vary significantly by generation; for example, people who survived the Great Depression or World War II wasted significantly less food than other age groups (Gunders, 2012).

Food waste represents wasted water, land use, fertilizers, pesticides, and fossil fuels. Some estimate that 25% of US water and 4% of US oil (300 million barrels) is consumed by food that is thrown away. In the US, most waste is landfilled where rotting food creates methane, a greenhouse gas twenty-five times more potent than carbon dioxide (Hall et al, 2009). Discarded food has an immense environmental footprint (Anonymous, 2010). Food production is connected to greenhouse gas emissions and climate change as many production methods require high inputs of energy; for example, heated greenhouses, air freight, synthetic nitrogen fertilizers, post-retail consumer transport and storage (EPA WCCMMF, 2012). One study estimates that preventable food waste from the US alone contributes 112.9 million metric tons of greenhouse gases (GHG) every year, approximately 2% of net US GHG (Venkat, 2011).

As the global population increases and standard of living improves, it is increasingly important to decouple waste growth from economic growth; waste prevention and reuse must be emphasized (Read et al, 2009). Currently, in developed and developing countries, the quantity of MSW is increasing in parallel with time (D'amato et al, 2012). The United States Office of Solid Waste (OSW) estimated that 4.4 pounds (lbs) of solid waste were generated per person per day in 1993, compared to 2.7 lbs per day per person in 1960. (Environmental Science Technology, 1995). Hall et al mapped the steady increase in food waste per capita in the United States, showing a steadily increasing trend (Figure 1) (2009).

The solid waste management hierarchy (Figure 2) ranks source reduction, which can be interpreted as waste prevention, as the most preferred method of dealing with waste. The next step is recycling/composting, followed by energy recovery, which is the conversion of waste into useable heat, electricity, or fuel. The final step in the pyramid is landfilling (EPA, 2012b). The Food Recovery Hierarchy (Figure 3) takes a similar approach, but notes that food should be used to feed hungry people and animals, and that it can be composted. Incineration (energy recovery) and landfilling are the final step. (EPA, 2012a).

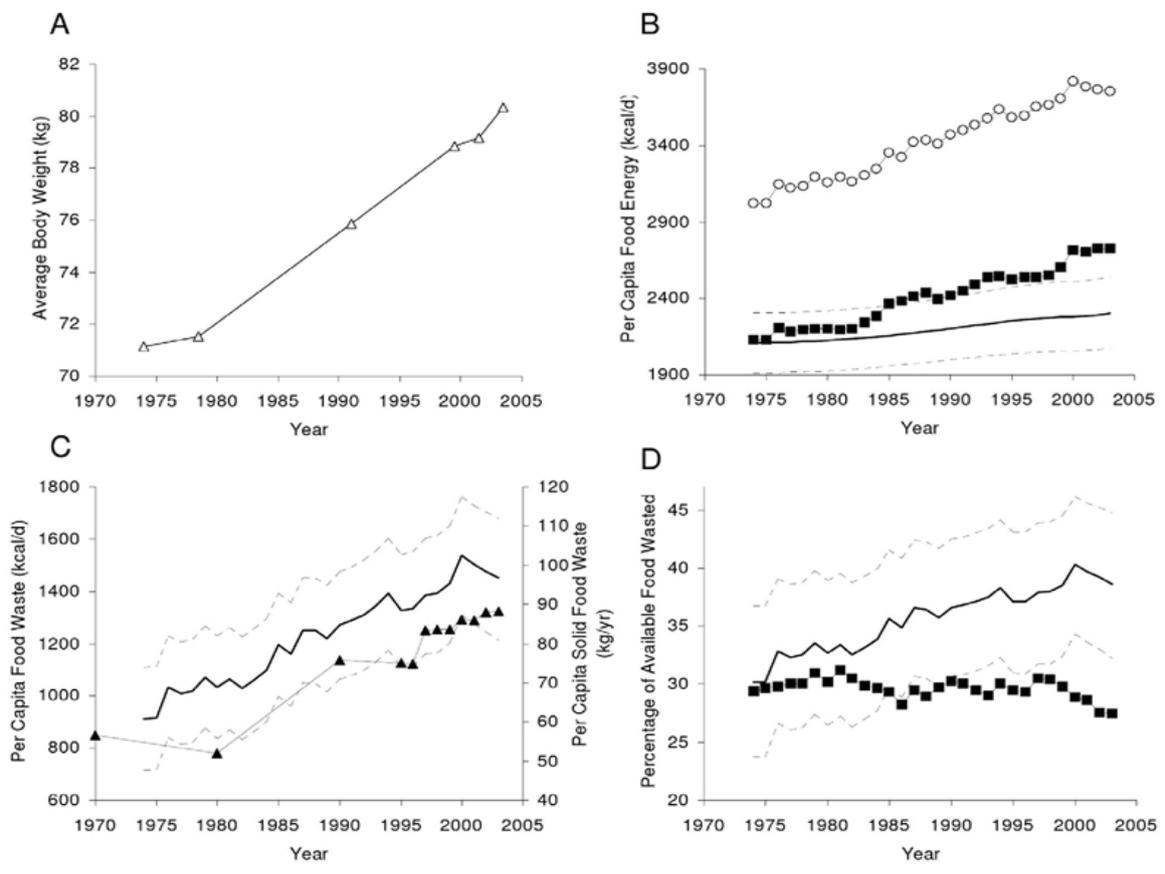


Figure 1. Food Supply, Intake, and Waste in America. (A) The average adult body weight (Δ) as measured by the National Health and Nutrition Examination Survey. (B). Per capita U.S. food availability unadjusted (\circ) and adjusted for wastage (\blacksquare) according to the United States Department of Agriculture (USDA). The solid curve represents the mathematical model prediction of average food intake change (dashed curves indicate $\pm 95\%$ confidence intervals). (C) Energy content of per capita U.S. food waste predicted using our mathematical model (solid curve, left axis). The right axis plots the per capita annual mass of municipal solid food waste (\blacktriangle). (D) Percentage of available food energy wasted as calculated by previous USDA estimates (\blacksquare) and predicted using our mathematical model (solid curve).
doi:10.1371/journal.pone.0007940.g001

Figure 1: Food Supply, Intake, and Waste in America (Hall et al, 2009)



Figure 2: Waste Management Hierarchy (EPA, 2012b).



Figure 3: Food Recovery Hierarchy (EPA, 2012a)

The Organization for Economic Co-Operation and Development (OECD) defines waste prevention as “strict avoidance (not generating waste in the first place); source reduction; product reuse (in its original form); as well as reducing the hazardousness of waste.” This definition intentionally excludes recycling (composting) and remanufacturing (Cox et al, 2010). Waste prevention is dependent on changing the behavior of consumers; however, Cox et al report that “there is no standard set of [behaviors] which is widely accepted as comprising ‘household waste prevention’...unlike recycling, which is a more singular act, prevention comprises many small individual actions....prevention behavior tends to be private and invisible, so there is much less likelihood of a social norm developing” (2010). Food waste prevention and reduction are thus critical elements of sustainability but are complex behaviors to target.

2.2.Food Waste Prevention Studies and Campaigns

Waste prevention and reduction is dependent on behavioral change. However, behaviors are multifaceted and are affected by a variety of factors that need to be addressed in different ways. Instigating behavioral change may thus require tailored campaigns and methods to reach different parts of society (Read et al, 2009). Waste prevention requires a combination of policy measures that include “prevention targets, producer responsibility, householder charging, public sector funding for pilot projects, and collaboration between public, private, and third sector organizations, supported by long term and intense public intervention and communications campaigns” (Cox et al, 2010). The NRDC states that in order to have the largest possible effect, that is, the greatest success in reducing food waste, local and national governments should implement food waste prevention campaigns (Gunders, 2012). Current programs are in place or in development in both Europe and the US, and a significant amount of research has been conducted to assess the most effective methods.

The programs currently in place are based on a wide range of behavioral and psychological studies that have looked at both barriers and motivations for the necessary behavioral change. One existing model is the so-called MOA model based on studies looking at recycling behavior in Denmark. The MOA theory reasons that pro-environmental behavior is contingent on the motivation, opportunity, and ability of the consumer. Motivation (awareness, values) is crucial for voluntary pro-environmental action but must be combined with opportunity (infrastructure, availability) and ability (skills, know-how, self-efficacy) in order to be effective (Thøgersen, 2010). There is also conflicting evidence regarding what is known as *environmental spillover*; some believe that environmentally-friendly behavior like composting, buying organic food, etc. “spills over” into other behavioral domains and that individual is more likely to exhibit other environmentally-friendly behavior (i.e., positive environmental spillover) while others may perform certain “easy” environmentally-friendly tasks to avoid more demanding ones (i.e., negative environmental spillover). It is likely that the nature of the spillover effect is dependent on the specific environmental issue and the ease to which a behavior can be adopted (Thøgersen and Ölander, 2003).

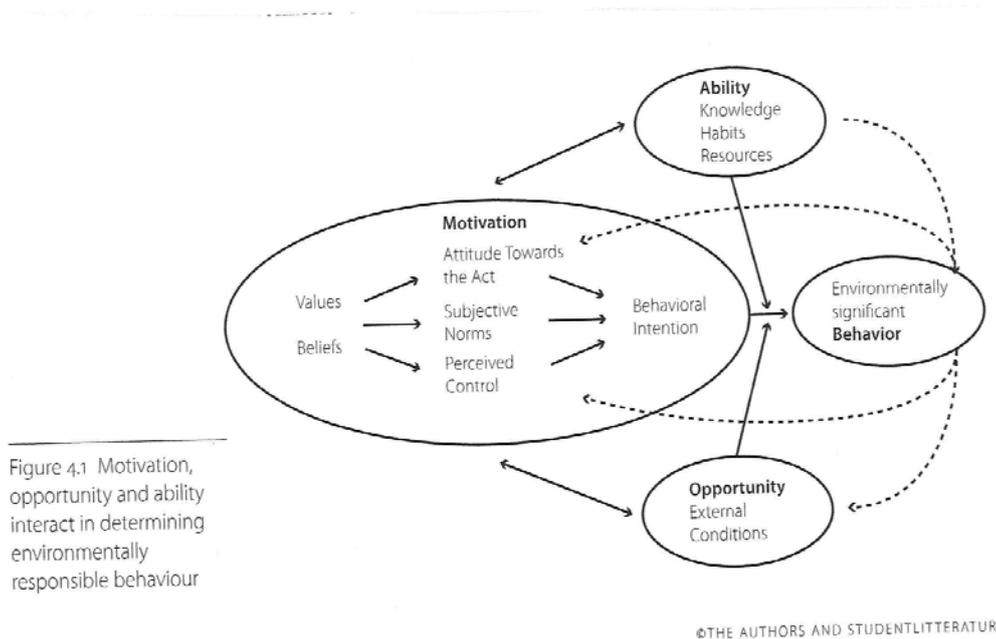


Figure 4: The MOA model (Thøgersen, 2010).

In addition to MOA, there are two commonly used methods of encouraging behavioral change: Community-Based Social Marketing and “the 4Es”.

2.2.1 Community Based Social Marketing and the 4Es

Community Based Social Marketing (CBSM) aims to drive behavioral change by removing barriers to desired behaviors while emphasizing the advantages of adopting those behaviors. This type of approach is dependent on social-psychological tools that reinforce desired behaviors; these tools may include commitments, prompts, and signals. The six steps of the CBSM approach are described below:

- a. Identify desired behaviors
- b. Identify barriers and benefits of desired behaviors
- c. Design pilot program with behavior change strategies and messaging
- d. Implement pilot program
- e. Evaluate pilot program
- f. Replicate successful strategies from pilot

(EPA West Coast Climate and Materials Management Forum (EPA WCCMMF), 2012)

The 4 Es are Enable, Engage, Encourage, and Exemplify and were introduced by the UK Sustainable Development Strategy. The idea is that for each desired behavior, many factors are addressed simultaneously and thus facilitate change (Figure 5) (Cox et al, 2010).

CBSM and the 4Es are social marketing methods designed to encourage voluntary behavior of a specific audience; however, the 4Es includes the legislative and regulatory measures to complete a “package of measures” (Darnton, 2008).

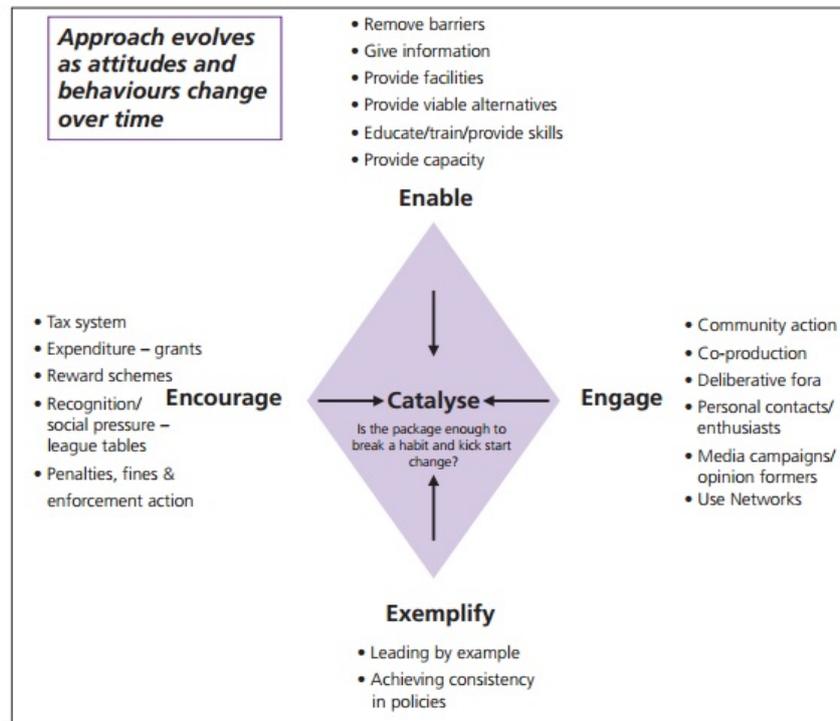


Figure 5: The 4Es. Defra UK Sustainable Development Strategy. “Securing the Future” (Defra, 2005)

2.2.2. Motivations/Benefits and Barriers for Behavioral Change in Waste Prevention

Most studies find the following motivations for waste-prevention behavior:

1. Values, also known as universal values...where collective benefits are valued more than personal gain
2. Personal responsibility – cited as a primary requirement for prevention behavior
3. Self-efficacy – the skills, knowledge, and personal capabilities to implement the behavior.
4. Cost – saving money
5. Social norms (knowing that someone else is also taking action)
6. Habits (can be both a motivator and a preventive hurdle)

The same study found that barriers are quite similar to the motivations. Barriers may include:

1. Apathy
2. Thinking that the problem (and solution) is “someone else’s responsibility” (for example, businesses and retailers should take responsibility rather than consumers)
3. Inconvenience (or even the perception of inconvenience)
4. Cost

5. Weak self-efficacy and a sense of powerlessness
6. Social norms do not favor waste prevention (consumption-based society with quick turnover of items)
7. Dominance of the recycling norm

(Cox et al, 2010)

After evaluating the benefits/motivations and barriers to the desired behavior change, it is possible to develop targeted programs; a few examples are presented below.

Europe

The European Union (EU) Waste Framework Directive (Council Directive 2008/98/EC) requires all EU member states to implement national waste prevention programs by 12 December 2013. The programs are required to include benchmarks, targets, and indicators for waste prevention measures (Council Directive 2008/98/EC; EU, 2012). As a result, there are several outreach campaigns in Europe; Love Food Hate Waste in the UK is one of the largest. In fact, the European Parliament designated 2014 as the “European year against food waste” and adopted a non-legislative resolution to reduce food waste by 50% by 2020 (EU, 2012).

United Kingdom:

The UK’s Waste and Resources Action Programme (WRAP) reported in 2008 that UK households throw away 6.7 million metric tons of food daily. The non-profit organization established in 2000 and funded by England, Northern Ireland, Scotland and Wales governments launched a “Love Food Hate Waste” (LFHW) campaign in 2007 in order to comply with EU legislation and reduce preventable food waste. By partnering with chefs, celebrities, community organizations, local authorities and more, the LFHW campaign targets several demographics (WRAP, no date; Eccleston, 2007).

The UK program uses the 4 Es and has even created a “Waste Prevention Toolkit” intended to aid in the production and development of a food waste prevention plan (WRAP, 2013).

According to the WRAP website, the annual UK household food and drink waste fell by 1.1 million tonnes (13%) between 2007 and 2009. The reduction is attributed to three factors: rising costs of food and drink; the LFHW campaign; and the Courtauld Commitment voluntary agreement that targets grocery retailers, brand owners, manufacturers, and suppliers to reduce packaging, household food, and supply chain waste. (WRAPa and b, 2013)

Other recent programs include:

- Bruxelles Environment (local authority in Brussels): cooking classes for households in 2009 reached 1000 people
- FoodwasteTV, NGO in Germany, 2010: YouTube channel with tips on how to prevent and “rescue” food waste
- Generation Awake, 2011, EU
- Morrisson’s – Retailer in UK “Great Taste Less Waste” 2009

- NW Europe, “Green Cook” – tools on food
- Eten is om op te Eten Holland, 2010
- Stop Food Waste, Ireland, EPA 2009
- Stop Spild Af Mad (Stop Wasting Food), NGO, Denmark 2008 (EU, no date)

USA

There are few food waste prevention or reduction programs in the United States that currently address residential food waste. Eureka Recycling, a non-profit organization located in Minneapolis and St. Paul, Minnesota encourages food waste prevention with a downloadable meal planner and fruit and vegetable storage guide. This guide is exceptionally detailed and was chosen to be part of the toolkit provided to pilot study participants (Eureka Recycling, 2012).

2.3.The Basis for the *Food: Too Good to Waste* Program

The CBSM steps described in Section 2.2 were conducted by the EPA WCCMMF in 2012 (EPA 2012). The program was developed by over twenty-five state, city and county government partners in the US, in addition to EcoPraxis, Colehour + Cohen, and Tetra Tech in an effort to encourage sustainable food consumption.

First, in order to identify desired behaviors, a significant amount of background research was conducted. Estimates of per capita consumer-level food waste were analyzed by food type, which found that vegetables, fruit, and meat were the largest offenders. Fruit and vegetable losses combined account for nearly half of all food waste (41%) but meat and dairy have the highest environmental footprint. The study also evaluated food waste based on socio-demographic factors, finding that people younger than 45 years wasted more than those older. In addition, the study found that higher income individuals, full-time employed people, and households with younger children wasted more than their counterparts. An Austrian study also found that higher levels of education and full time employment correlated with more food waste. The EPA study cites WRAP’s findings that the most common reason for household food waste is that it “was not used in time” (61% of avoidable food waste) (EPA WCCMMF, 2012).

The EPA determined four major focus areas: fruit and vegetable waste, young professionals and families with young children, using food that is purchased (and buying less), and focus on high-impact foods like meat and dairy. The behaviors targeted were shopping (both buying less at a time and using a shopping list), storage, preparation, and eating. The next step was to identify barriers and benefits to change. Potential barriers include habits (automatic behavior), convenience, dynamic lifestyle, skills, time and more. By identifying barriers, the messaging can be geared to emphasize how advantageous new habits would be more beneficial than the initial barrier, e.g. saving money and simply not having to throw things away (waste aversion) (EPA WCCMMF, 2012).

Three counties initially piloted the messaging materials, Boulder County, San Benito County, and King County in Colorado, California, and Washington, respectively. A summary of these pilot studies is presented in Table 1.

Table 1: Previous FTGTW Case Studies

Location	Audience/Number of Participants	Implementation	Duration	Findings
King County	Families with young children, targeted 4 th grade class and families. 47 households initially participated, 13 completed the entire study, 11 participated intermittently	Distributed food measurement bags (volume only) and worksheets. First week was used for baseline data. Week 2, all 5 behavior strategies introduced. Provided a new “tip” each week 2-5 (e. g. How to make a waste free lunch). Created blog space for participants to ask questions	October 8, 2012 to November 12, 2012 (5 Weeks)	Saw a 28% reduction in food waste from households over 5 week period. Preparing too much food and food expiration documented highest reasons for food waste. Out of 11 survey respondents: Shopping list, keeping food fresh and eat older items first considered most helpful strategies.
San Benito	10 food bank customers initially indicated interest; 3 completed pilot. Of 60 senior citizens, 10 indicated interest; 2 participants completed pilot. Mom’s group provided 7 participants.	Used photo diary method to document food waste. Provided shopping list with meals in mind and food storage guide to participants.	October 2012 to November 2012 (4 Weeks)	Higher amounts of legumes and grains wasted. Lettuce main vegetable wasted.
Boulder	Young adults (age 20-30); targeted through office and local university. 8 participants from the office indicated interest, and none followed through. 106 from the local university indicated interest, 65 initiated project by picking up materials, 59 responded to the week 1 email; ultimately 5 questionnaires and 1 datasheet were returned at week 4	Measured food waste in weeks 1 and 4. 3 raffle prizes were offered as incentives. The participants were engaged via weekly email reminders until the pilot wrap up.	October 2012 to November 2012 (4 Weeks)	No real data collected due to lack of retention and participation.

The main messaging materials (infographics, message plan, etc.) were provided by the US EPA Sustainable Materials Management Web Academy and WCCMMF.

The *Food: Too Good to Waste* program is expected to expand to the national scale, however, more data is necessary to determine which portions will be included. Based on what is presented above, most food waste prevention programs do not encourage measuring food waste, and focus on awareness and providing tools that target the usual causes of household food waste.

2.4. Study Site Description: Honolulu

Food waste prevention programs are growing in popularity but need more background data. In partnership with the CCH, the EPA WCCMMF, Chalmers University of Technology, and the University of Gothenburg, the *Food: Too Good to Waste* program was expanded upon and evaluated in a four week pilot study in Honolulu.

This study focused on reducing food waste in residential households in Hawaii, USA. The CCH on the island of Oahu has a particular interest in reducing food waste for several reasons; Oahu is one of eight Hawaiian islands in the Pacific Ocean, and has limited area for landfills and other forms of waste management. Oahu has an area of 1545.3 km² of which 8% of the land area is federally-owned (State of Hawaii Databook, 2011). It is also the most populated island, with a population over 975000 that represents approximately 70% of the population of the entire state of Hawaii (US Census Bureau, 2012). The majority of residential MSW in Honolulu is processed at the Honolulu Program of Waste Energy Recovery (H-POWER) waste to energy (WTE) facility on Oahu (RW Beck, 2008).

According to a study conducted in 2011, approximately 15% of the refuse collected for delivery to H-POWER is food waste, a value slightly higher than the 13.9% national estimate (CCH, 2011; EPA, 2010). Food waste is considered a low-energy fuel and does not burn well in incinerators designed for high-energy waste such as plastics and paper (Environment Canada, 2010). The need for food waste reduction measures is intensified by the fact that the state of Hawaii, although being one of the most geographically isolated places in the planet, is heavily dependent on importing food and imports approximately 85% of all food consumed (Leung et al, 2008) Transport is a major contributor to fossil fuel consumption and greenhouse gas emissions. Food waste therefore contributes indirectly to climate change as it wastes the water, fertilizers, and pesticides used to produce the food as well as the fuel used to transport the products.

3. Hypotheses

The pilot study tests the effectiveness of food waste prevention strategies. The hypotheses are as follows:

1. Based on previous studies, preventable food waste is expected to decrease in Weeks 3 and 4 compared to Weeks 1 and 2 after households have learned the strategies and received the toolkit.
2. A decrease in preventable food waste may lead to an increase in non-edible food waste as households cook more to prevent food from spoiling.

3. There is a connection between preventable food waste and the number of meals outside of the home; it is expected that a greater amount of person-meals (meals eaten away from home) will correlate to greater preventable food waste.

4. Method

This section presents the methodology for the study. As stated in Section 1.2, the study is divided into two parts: Part One is the production of a *Food: Too Good to Waste* Cookbook and Smart Food Tips Guide for the CCH and Part Two is the development and implementation of a pilot study to test the strategies and tools developed in Part One.

Both the final cookbook and pilot study are based on the EPA WCCMMF pilot study background report and implementation guide described in Section 2.3 (EPA WCCMMF, 2012a and b).

Based on discussions and conference calls with members of the EPA WCCMMF, the main messages were reduced from 5 to 4. The original program had the following strategies:

1. Make a list with meals in mind
2. Buy what you need
3. Prep now, eat later
4. Keep fruit and vegetables fresh
5. Eat what you buy

For the Honolulu cookbook and pilot study, “Buy what you need” was included as part of the “make a list with meals in mind” strategy and renamed “Smart Shopping”. The final food waste prevention strategies are presented below:

Strategy 1. **Smart Shopping:** Households are encouraged to meal plan prior to grocery shopping and utilize a shopping list that is brought to the grocery store and adhered to.

This strategy directly combats one of the main causes to food waste: lack of planning, inaccurate estimates of quantities or items needed, and over-purchasing of groceries.

Strategy 2. **Smart Storage:** Households are given a fruit and vegetable storage guide to properly keep produce longer as well as utilizing the freezer more.

This strategy targets suboptimal storage conditions and arms users with knowledge (“self-efficacy”) to help prevent avoidable food waste.

Strategy 3. **Smart Preparation:** Households prepare and store produce immediately after grocery shopping.

More frequent preparation can lead to faster turnover of stock and thus “use up” produce before it spoils.

Strategy 4. **Smart Eating:** Households focus on prioritizing eating what they have on hand and utilize an “Eat Me First” sign in the refrigerator. This also includes learning about dates on labels.

As stated earlier, 61% of food waste in UK households is caused by food not being eaten in time. “Smart eating” draws attention to food that needs to be eaten first and encourages eating leftovers

or “remaking” them using the recipes provided in the book. Consumers are educated about label dates in order to discourage discarding food unnecessarily based on arbitrary “best by” dates.

4.1.Cookbook and Toolkit Production

The CCH Food: Too Good to Waste cookbook was produced in coordination with the WCCMMF, the Hawaii Restaurant Association (HRA), and participating restaurant chefs. Members of the HRA located on Oahu were initially contacted via email to publicize the project and encourage participation. The project was also mentioned in the January 2013 HRA newsletter to garner interest. Due to limited response, additional restaurants, cafes, and delis were cold-called to ask for participation. Restaurants that responded to either outreach method were interviewed regarding the food waste reduction strategies implemented in their restaurants (as well as other environmental practices) and were asked to provide one recipe for the cookbook that used up typically leftover ingredients such as wilted vegetables. The interview questions are presented in Appendix B.

The following restaurants were featured in the cookbook:

- Gyotaku: a family-style Japanese restaurant with multiple locations on Oahu
- Hula Grill: a Waikiki restaurant specializing in Hawaiian and local cuisine
- Down to Earth: a vegetarian grocery store with a deli and ready-to-eat department with multiple locations on Oahu
- Da Kitchen: a Maui-based chain serving “Island Soul Food”
- The Beet Box Café: a small vegetarian café located in the North Shore of Oahu
- Cactus Bistro: a Central and South American restaurant

The restaurants represent a wide range of cuisines and styles, intended to appeal to a wide range of potential readers. Additional recipes and quick tips were pulled from a multitude of online resources.

The infographics, logos, color scheme, and basic messaging materials were provided by the EPA; the cookbook is centered on the four strategies outlined above: Smart Shopping, Smart Storage, Smart Preparation, and Smart Eating. A new meal planner shopping list tool was developed by combining concepts from the NSW Australia Love Food Hate Waste program and the EPA example. Ledbetter Kennedy Creative provided graphic design services which were funded by the CCH Department of Environmental Services, Refuse Division. A new “Eat Me First” sign was developed as well to keep color scheme and logo consistent for all tools.

4.2.Pilot Study

Pilot participants were recruited from the CCH Recycling Branch of the Refuse Division and from a Honolulu running club email database.

Seventeen households agreed to participate in the pilot study. Each household measured preventable and non-edible food waste in their homes for a total of four weeks. Preventable food waste was defined as “food you bought to eat but has since spoiled or food that was prepared but was not eaten and then thrown away including spoiled uncooked/unprepared fruits and vegetables, spoiled or uncooked/unprepared other foods, uneaten leftovers, and expired foods.” Non-edible food was defined

for participants as “food waste includes food parts that are typically discarded during food preparation or consumption such as egg shells, bones, fruit/vegetable pits and peels.”

Participants were given a Kamenstein digital food scale, two 4-liter graduated bins (with lids) marked “preventable” and “non-edible” along with plastic liners for the bins (Figure 6). After an initial “kick-off” presentation, the households measured their food waste without changing any habits for two weeks, submitting a worksheet each week. A private Facebook group was created to encourage communication, active discussion, and to provide a forum for questions (e.g., “does bacon grease count as non-edible or preventable food waste?”)



Figure 6: Preventable and Non-Edible Food Waste Bins Provided to Pilot Participants

Participants then attended a presentation on food waste reduction strategies and were given a “toolkit” containing the following items (all documents except for the Cookbook are presented in Appendix A).

- A draft of the CCH *Food: Too Good to Waste* Cookbook
- A fruit and vegetable storage guide (both quick reference and full guide) from Eureka Recycling
- An “Eat Me First” sign for the refrigerator
- Two shopping list/meal planner sheets (one for each week) (the Australia LFHW version was used for the pilot, the final Cookbook has a specific CCH version).

Participating households were requested to provide the following data on a weekly basis (See Appendix A for worksheets developed for this study):

- Number of household members
- Number of “person-meals” (meals eaten away from home)
- Number of grocery trips
- Weight of preventable food waste (and number of bins filled)
- Volume of preventable food waste
- Composition of preventable food waste (optional)

- A rough estimate of percentage uneaten leftovers, spoiled fruit/vegetables, spoiled other, or expired food
- Weight of non-edible food waste (and number of bins filled)
- Volume of non-edible food waste
- Notes on any unexpected or unusual events that may affect quantity of food waste

Participants could submit worksheets in person by hand, scanned in and emailed, or photographed and sent via multimedia text message. A quantitative analysis has been conducted based on these worksheets and is presented in the following sections.

5. Results

5.1. Cookbook

The CCH *Food: Too Good to Waste* cookbook opens with a “Did You Know” section that explains why food waste is a problem environmentally, financially, and societally. The next portion of the book describes each of the strategies (Smart Shopping, Smart Storage, Smart Preparation, and Smart Eating) and the third section of the book provides recipes as well as a short profile of the environmental practices implemented at each featured restaurant. The last portion of the book is the “toolkit” and provides a tear-out version of the shopping planner, an “eat me first” sign, and a list of web resources including mobile applications (“apps”), websites, and articles. The cookbook includes a tear-out mail-in survey with pre-paid postage that can also be accessed online using Survey Monkey so residents can provide feedback.

The final *Food: Too Good to Waste* Cookbook and Smart Food Tips guide will be available on the CCH website, www.opala.org. The Table of Contents is presented in Figure 7. The book will be printed using government funding and is thus in the process of getting approval; it is expected to be available for Honolulu residents by the end of summer 2013. It will be distributed at the featured restaurants and at farmers markets on Oahu.

Contents

	What's Up With All the Food Waste? 2 Smart Food Tips 4-9 Smart Shopping Smart Storage Smart Preparation Smart Eating
	Recipes for Leftovers 10-21 Leftover Meat, Fish, and Poultry Cactus Bistro - Mint Chimichurri Da Kitchen – Mahi Mahi Cakes Gyotaku – Quiche Chicken Soup Jook Leftover Rice, Pasta, and Bread Down to Earth - Baked Quinoa and Bean Patties Leftover Fruits and Vegetables The Beet Box Café - Ironman Juice Hula Grill Waikiki – Vegetable Frittata Broccoli Stalk Soup Leftover Lettuce Soup Banana Bread Leftover Coffee, Cookies, Candy Wine, Egg Whites
	Getting Organized Tools 22-26 Learn More, Resources & Web Links Shopping Planner Eat Me First Sign
	
	
	
<hr style="border-top: 1px dashed black;"/>	
<i>Food To Good To Waste</i>	<i>1</i>

Figure 7: Table of Contents for CCH Cookbook

5.2. Pilot Study Participant Demographics

Prior to starting the study, participants were requested to fill out a survey intended to provide demographical data, including age, income, along with current waste-prevention strategies used in the household. The data collected is summarized in Table 2. Households 8 and 13 were given a scale and pilot materials, but did not attend an information meeting and did not fill out a pre-pilot study participant profile.

Table 2: Demographic profile of study participants

Code #	No. in Household	Ages	Annual Income (USD)	Veg	Food waste reduction habits in home prior to pilot
1	2	37, 32	> 70k	N	"really hate to throw away edible foods", eat what is purchased and prepared
2	1	34	40-40k	N	Uses worm bins to compost, eat what is going to go bad soonest, bring leftovers, "guilt"
3	1	59	40-49 K	N	Freeze leftovers, freeze ripe fruit/veggies, give extra food to neighbors, share with friends large batches of food such as large Costco purchases
4	2	35, 32	> 70k	N	None
5	1	29	20-29k	N	None
6	1	43	> 70k	N	Uses "Green Bags" for produce
7	3	44, 33, 9 mos.	> 70k	N	Compost fruit/veggies
8	2	ND	ND	ND	ND
9	1	28	> 70k	N	Buys locally from the farmers markets for most fruits and vegetables (buys smaller quantities). Tries to buy enough for 4-5 dinners. Eat leftovers of previous meals for breakfast and lunch. Prep as much food from farmers market as soon as arrives home (clean, cut)
10	1	57	NA	N	Make soup at end of week, give away food to friends
11	2	48, 48	> 70k	N	grow own produce
12	1	32	> 70k	N	None
13	ND	ND	ND	ND	ND
14	3	36, 28, 31	> 70k	N	eat leftovers, juice produce
15	2	43, 6	40-49K	N	Uses an "eat me first" box and tries to plan meals and use vegetables & fruit before they spoil. Try to prepare correct portions. Eat leftovers for lunch
16	3	51, 34, 31	> 70k	N	None
17	2	28, 29	>70k	1 Y, 1 N	None

ND = no data, Veg = vegetarian/vegan, No. = number, mos = months

As shown in Table 2, five households had 2 members, three households had 3 members, and the remaining eight were single-member households. The average age of the participant was 36.6. Most households identified as earning greater than \$70000 per year, and all but one household were above the \$25000 boundary for middle class. "Middle class" can be generalized to those who earn between \$25000 and \$100000 annually (Chinni, 2005). Only one member of one household identified as a vegetarian, and only two households included a child.

5.3. Pilot Study Participant Retention Data

Seventeen households indicated interest in participating in the pilot study. Table 3 presents the weekly retention rate. Household 13 was given the pilot study materials, but did not attend any meetings and did not submit data for any week. Household 8 did not attend the kick-off information meeting, but submitted data for Weeks 1 and 2. Households 4 and 8 did not submit data for Weeks 3 and 4. Only ten households submitted the follow-up survey despite multiple attempts to encourage and remind households to participate.

Table 3: Participant Retention Rate

Event	Number of Participating Households	Retention Percentage
Pick up of pilot test materials	17	100%
Phase 1 “Kick-Off” Presentation	15	88.24%
Week 1 Data Submission	16	94.12%
Week 2 Data Submission	16	94.12%
Phase 2 Presentation	15	88.24%
Week 3 Data Submission	14	82.35%
Week 4 Data Submission	14	82.35%
Follow up Survey	10	58.82%

5.4. Food Waste Data – A Quantitative Analysis

Fourteen of the seventeen households submitted the worksheets described in Section 4.2 and presented in Appendix A for all four weeks of the study; results from these worksheets are presented and analyzed in this section. Phase One is comprised of Weeks 1 and 2, during which households were asked to weigh their preventable and non-edible food waste without making any changes in their food purchasing and eating habits. Phase Two is comprised of Weeks 3 and 4, during which households were asked to select one or all of the food waste prevention strategies and continue to measure their preventable and non-edible food waste.

5.4.1. Preventable Food Waste

Preventable food waste was defined for study participants as “food you bought to eat but has since spoiled or food that was prepared but was not eaten and then thrown away.”

Results per Household

In general, the pilot study results confirmed Hypothesis 1: preventable food waste was reduced. The majority of households (eight out of fourteen) decreased their preventable food waste when comparing Phase One (Weeks 1 and 2) to Phase Two (Weeks 3 and 4). However, as shown on Figure 8, preventable food waste varied significantly by week and household. The black line on Figure 8 represents the weekly average mass of preventable food waste for all households; these values are also presented in Table 4 where we see that Week 1 shows the highest average mass of preventable food waste for the entire study and Week 4 shows the lowest average mass of preventable food waste for the entire study.

Average values do not include households that did not participate in a particular week, e.g. Household 13 is not included in any value, Household 14 is not included in Week 2, and Households 4 and 8 are not included in Weeks 3 and 4.

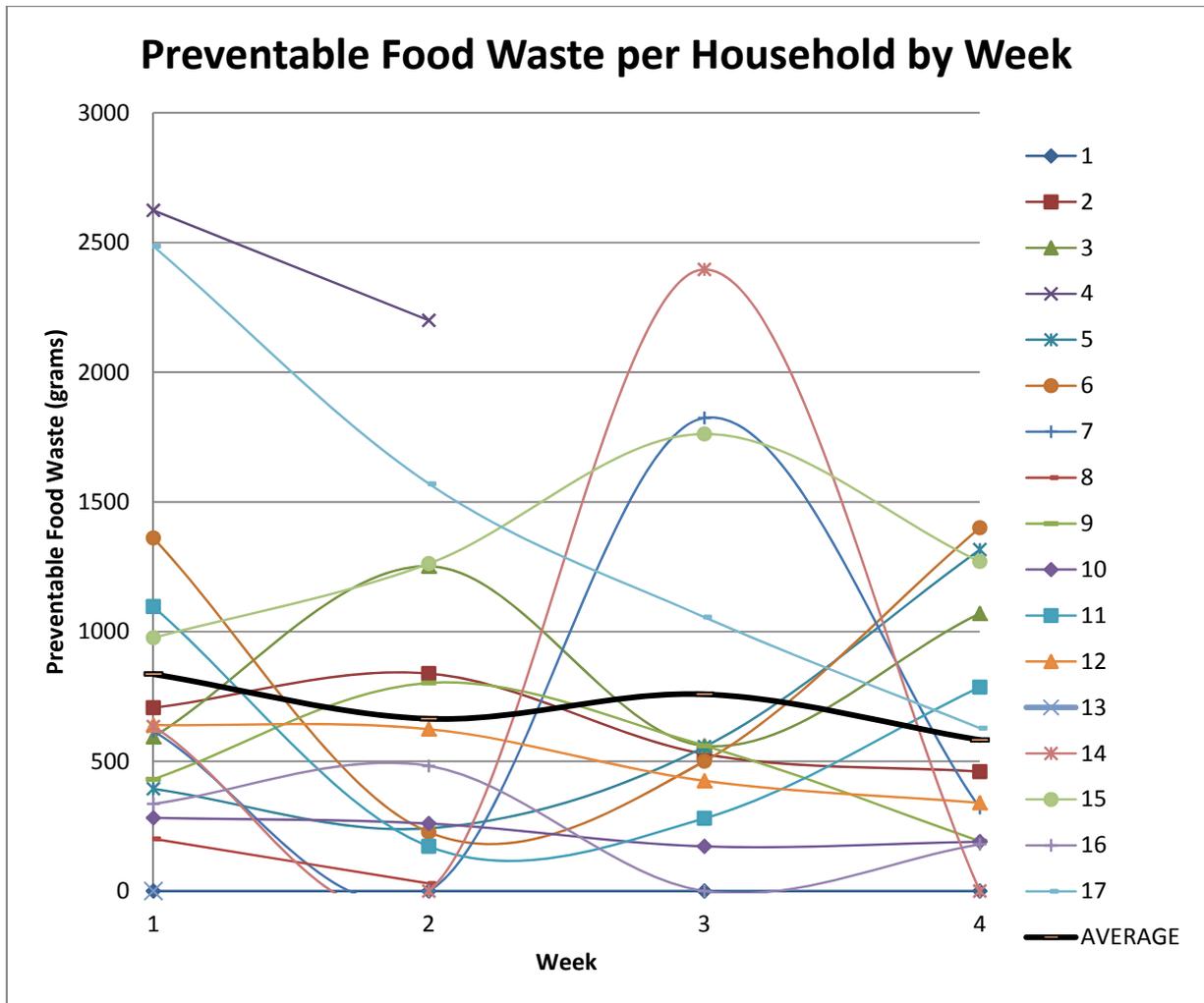


Figure 8: Preventable Food Waste per Household, by Week

Table 4: Average Preventable Food Waste, All Households

	Week	Average Preventable Food Waste (g per household)
Phase One	1	833
	2	664
Phase Two	3	758
	4	582

In order to compare Phase One (Weeks 1 and 2) to Phase Two (Weeks 3 and 4), the cumulative values for each Phase was calculated for each household. These values were then divided by the number of

household members to determine a “per capita” value and are presented in Table 5. Households 4, 8, and 13 were not included in this analysis as they did not complete the full study. The accumulated preventable food waste for Household 4 for Weeks 1 and 2 summed to 4824 g (2412 g per capita), and the accumulated preventable food waste for Household 8 summed to 230 g (115 g per capita). The average of these households’ values falls in the range of the typical participating household.

Irregular events led to an increase in preventable food waste for all households. Other factors that may increase preventable food waste are the presence of children and the reliance on pre-prepared food. As shown on Figure 8 and in Table 5, Households 5, 6, 7, 14, and 15 showed an increase in preventable food waste in Phase Two compared to Phase One; Households 5, 7, and 14 reported irregular events. For example, Household 7 was unaware that a non-resident family member had placed a large quantity of food in the refrigerator until it had spoiled. Household 5 moved to a new residence and Household 14 stayed at a different residence during Week 2 so that a lot of food spoiled while they were away. Households 6 and 15 showed an increase in food waste between the different phases by approximately 350 g per capita without noting any irregular events. Household 15 was one of only two households that included a child (the other household was Household 7), and Household 6 did not provide any values for “Non-edible Food Waste” which may indicate that this household does not cook and simply purchases pre-made food that one cannot control portion size. It may, however, simply indicate that the household did not read the worksheet thoroughly. Household 1 did not report any preventable food waste throughout the study (they did report non-edible food waste, however).

Table 5: Change in Cumulative Preventable Food Waste, per Household and per Capita

Household No.	Difference between Phase One and Phase Two, preventable food waste (grams)	Difference between Phase One and Phase Two, preventable food waste per capita (grams)
1	0.0250	0
2	-556	-556
3	-216	-216
4	ND	ND
5*	+1236	+1236
6	+312	+312
7*	+1528	+509
8	ND	ND
9	-481	-481
10	-180	-180
11	-202	-101
12	-499	-499
13	ND	ND
14*	+1762	+587
15	+794	+397
16	-638	-213
17	-2372	-510

ND no data; * irregular event

As shown in Table 5, eight households showed a decrease in preventable food waste between Phase One and Phase Two. These households can be grouped by the amount of food waste reduction: Cluster 1 is comprised of Households 2, 9, 12, and 17; these four households reduced their preventable food waste by approximately 500 g per capita (i.e., per household member). Cluster 2 is comprised of Households 3, 10, 11, and 16, who reduced preventable food waste by 100-200 g per capita.

Cluster 1 consisted of younger participants and predominantly single-member households. The annual income for each household was either 40-49k or >70k. Two of these households had noted food waste reduction practices in place prior to taking part in the study, but two listed "None". All but one household (Household 17) had one member, and the ages ranged from 28 to 34 (average age: 30.2). No children were present in the households with the greatest preventable food waste reduction.

Cluster 2 included all pilot study participants who were over the age of 45. The annual income for each household was either 40-49k or >70k. All but one household (Household 16) had listed at least one food waste reduction technique in place prior to taking part in the study. The households had 1, 1, 2, and 3 members, respectively. Although the ages ranged from 31 to 59, only two members were below the age of 45. No children were present in Cluster 2 households.

Table 6 compares Cluster 1 and 2, where it is apparent that the difference in preventable food waste reduction can be attributed to the fact that Cluster 2 households started with less food waste and thus had less potential for reduction; Cluster 1 simply started with a larger amount of food waste. The cumulative food waste per capita for Phase One for Cluster 1 households summed to approximately 5,640 g whereas Cluster 2 households summed to 3,384 g.

Cluster 1 showed a fairly uniform 36 to 47 percent reduction in preventable food waste whereas Cluster 2 had varying results ranging from 11 to 78 percent. As noted earlier, Households 5, 6, 7, 14, and 15 showed an increase in preventable food waste and Household 1 had approximately zero preventable food waste for all weeks of the study.

The fact that Cluster 2 had less preventable food waste than Cluster 1 is consistent with the previous studies described in Section 2.3 that found that people younger than 45 years wasted more than those older.

Table 6: Percent Change in Preventable Food Waste

Household		Phase One Sum, Per Capita	Phase Two Sum, Per Capita	Percent Difference
Cluster 1	2	1540	988	-36.0
	9	1230	752	-39.0
	12	1260	765	-39.5
	17	1610	842	-47.8
	TOTAL	5640	3347	-40.7
Cluster 2	3	1850	1630	-11.7
	10	542	362	-33.2
	11	720	533	-26.0
	16	272	60.0	-78.0
	TOTAL	3384	2585	-23.6
Non- clustered households	1	0.0025	0	N/A
	5	636	1872	+194
	6	1590	1900	+19.7
	7	205	715	+248
	14	211	799	+278
	15	1120	1520	+35.5

Results Normalized per Capita

Table 7 presents cumulative preventable food waste that has further been broken down per capita, that is, by the number of household members. Cumulative values show slightly different results than averaged values. The trend shows that preventable food waste decreased if one compares Phase One (Weeks 1 and 2) to Phase Two (Weeks 3 and 4), resulting in a nearly 20% decrease in cumulative preventable food waste per household and a 16.9% decrease per household member. The low rate of 5.78% reduction in preventable food waste by the average household member indicates that some members had significantly more success than other households.

Table 7: Preventable Food Waste by Week

WEEK	Cumulative Preventable Food Waste (g) (preventable food waste from all household, summed)	Cumulative Preventable Food Waste per Capita (g) (preventable food waste from each household divided by number of household members, then summed)	Average Preventable Food Waste per Capita (g) (cumulative preventable food waste divided by cumulative number of participants each week)
1	13377	8214	461
2	9960	7108	369
SUM, Phase One	23337	15322	830
3	10618	6256	442
4	8182	6477	340

WEEK	Cumulative Preventable Food Waste (g) (preventable food waste from all household, summed)	Cumulative Preventable Food Waste per Capita (kg) (preventable food waste from each household divided by number of household members, then summed)	Average Preventable Food Waste per Capita (g) (cumulative preventable food waste divided by cumulative number of participants each week)
SUM, Phase Two	18771	12733	782
PERCENT CHANGE	-19.58 %	-16.89 %	-5.78%

Preventable Food Waste Composition

Households had the option to estimate the composition of their preventable food waste by determining the percentage “uneaten leftovers”, “uncooked or spoiled fruit or vegetables”, “uncooked or spoiled other”, or “expired food”. As this portion of the worksheet was optional, the number of households that provided this information fluctuated from week to week.

For each week, the percentage for each category was summed and then divided by the number of households that provided the data. A summary is presented on Figure 9. 13 households contributed preventable food waste composition data in Week 1, 9 in Week 2, 7 in Week 3 and 8 in Week 4.

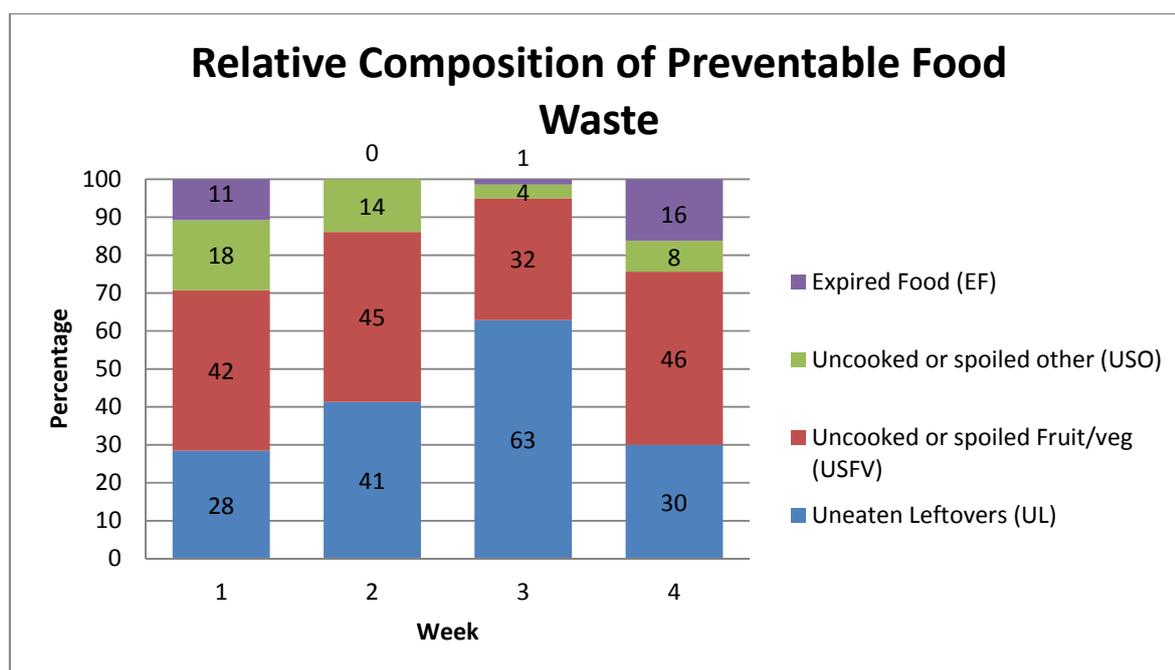


Figure 9: Relative Composition of Preventable Food Waste

As seen on Figure 9, the majority of food waste comes from uneaten leftovers and uncooked or spoiled fruit or vegetables, which is consistent with previous studies (Section 2.2). The spike in uneaten leftovers in Week 3 may be due to households trying to prevent uncooked food from spoiling by cooking more of the purchased food to try to reduce food waste. Due to the fact that not all households submitted

composition data, it is not possible to connect changes in food waste composition to the clustered households described earlier.

Person-Meals and Preventable Food Waste

Study participants were asked to provide the number of person-meals eaten away from home for each week. To calculate person-meals, participants added up the number of meals eaten away from home for all residents. For example, if two household members ate lunch away from home on Wednesday, they wrote a “2” under the column marked “Wednesday” in the row marked “Lunch”. The unit “person-meal” was used in the previous *Food: Too Good to Waste* pilots but has not been used in other studies.

Not all participants provided this information on their data sheets, but for those that did, Figure 10 compares the mass of preventable food waste to the number of person-meals. It was expected (Hypothesis 3) that a high number of person-meals would correlate to more preventable food waste, however there is no clear indication that this is the case.

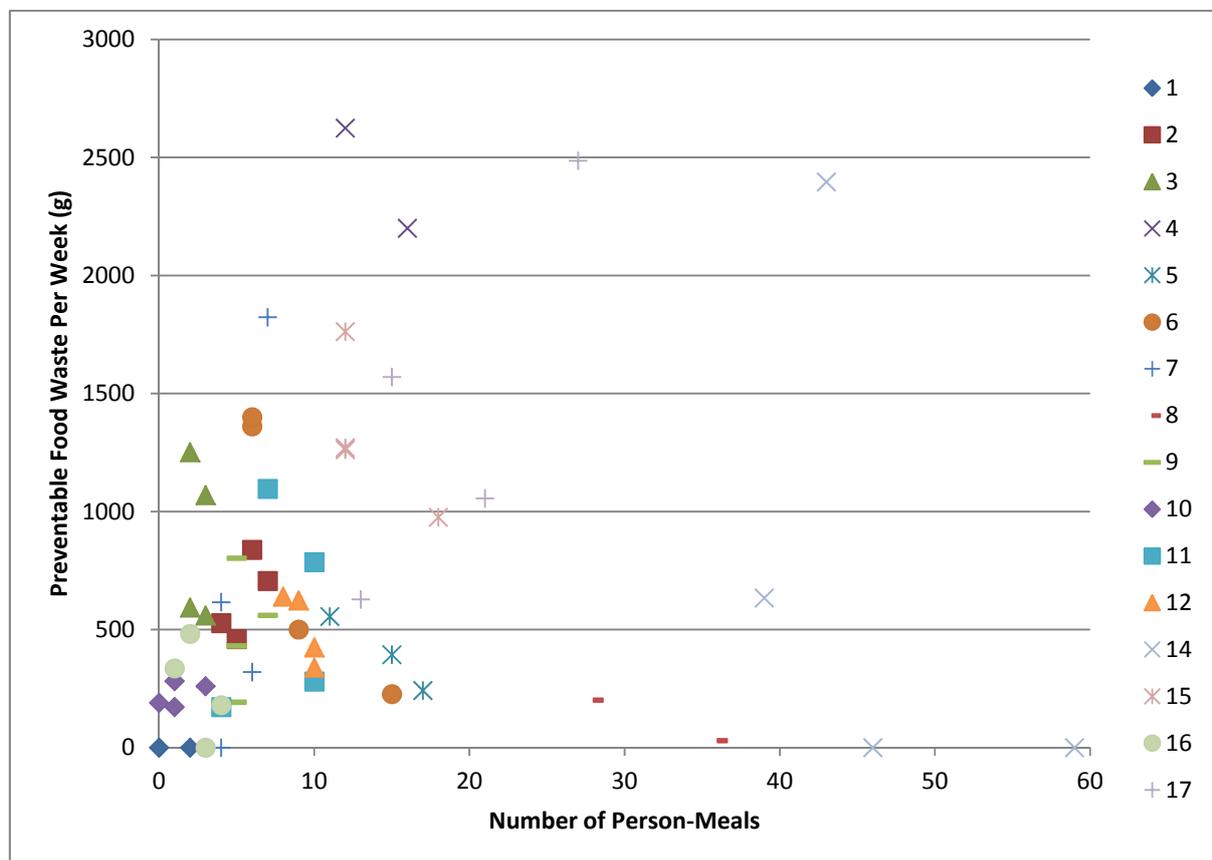


Figure 10: Person-Meals vs. Preventable Food Waste by Household

As shown on Figure 10, this measurement was not capable of showing the relationship between person-meals and preventable food waste and illustrates conflicting patterns. This may be due to the fact that some households are aware that they eat out frequently and adjust grocery habits accordingly while others do not.

Effectiveness of Food Waste Prevention Strategies

One goal of this study was to determine which strategies were most effective. Unfortunately, most households were not consistent with their choice of strategy and did not always mark which strategy was being used. As a result, it is not possible to connect strategy with effectiveness.

5.4.2. Non-Edible Food Waste

Non-edible food waste was defined for study participants as “items such as egg shells, bones, fruit pits, and non-edible peels - parts that are typically discarded during food preparation or consumption.” Study participants were asked to provide the amount of non-edible food waste produced each week in an effort to see if the food waste strategies affected these values as well. These values are presented in Table 8, Table 9, and Figure 11.

Although the average mass of non-edible food waste did not result in any clear trends, the cumulative value of non-edible food waste per capita decreased slightly (Table 9). Cumulative non-edible food waste for all households, however, had varied results as 8 households saw an increase in non-edible food waste and 5 households saw a decrease between Phase 1 and Phase 2.

Measuring non-edible food waste was intended to observe if a reduction in preventable food waste could result in an increase in non-edible food waste (Hypothesis 2, due to households cooking more in an effort to reduce preventable food waste). However, as seen on Figure 11, no such trend is visible.

Table 8: Change in Cumulative Non-Edible Food Waste, per Household and per Capita

Household No.	Difference between Phase 1 and Phase 2, non-edible food waste (grams)	Difference between Phase 1 and Phase 2, non-edible food waste per capita (grams)
1	-1262	-631
2	-157	-157
3	+774	+774
4	-1488	-744
5	-436	-436
6	0	0
7	-415	-208
8	ND	ND
9	-118	-118
10	+254	+254
11	+287	+144
12	-1022	-1022
13	ND	ND
14	+2232	+744
15	+1020	+510
16	-422	-141
ND	no data	

Table 9: Cumulative Non-Edible Food Waste

WEEK	Cumulative Non-Edible Food Waste (g)	Cumulative Non-Edible Food Waste per Capita (g)
1	18249	11077
2	14982	10881
3	17175	10345
4	13820	9536

The non-edible food waste from Cluster 1 and Cluster 2 households from Section 5.4.1 and Table 6 were compared and the results are presented in Table 10. Three of the four households in Cluster 1 reduced non-edible food waste while three of the four households in Cluster 2 increased non-edible food waste. There is therefore no conclusive indication as to how a reduction in preventable food waste may affect non-edible food waste.

Table 10: Percent Change in Non-Edible Food Waste

Household		Phase One Sum, Per Capita	Phase Two Sum, Per Capita	Percent Difference
Cluster 1	2	1680	1520	-9.52
	9	1820	1700	-6.59
	12	2155	1133	-4.74
	17	1490	1550	+4.03
	TOTAL	7150	5900	-17.5
Cluster 2	3	3730	4504	+20.8
	10	1286	1540	+19.8
	11	1840	1980	+7.68
	16	796	655	-17.7
	TOTAL	7650	8680	+13.5
Non-clustered households	1	1380	750	-45.6
	5	1040	604	-41.9
	6	0	0	N/A
	7	537	499	-7.08
	14	341	1090	+2.19
	15	1846	2356	+27.6

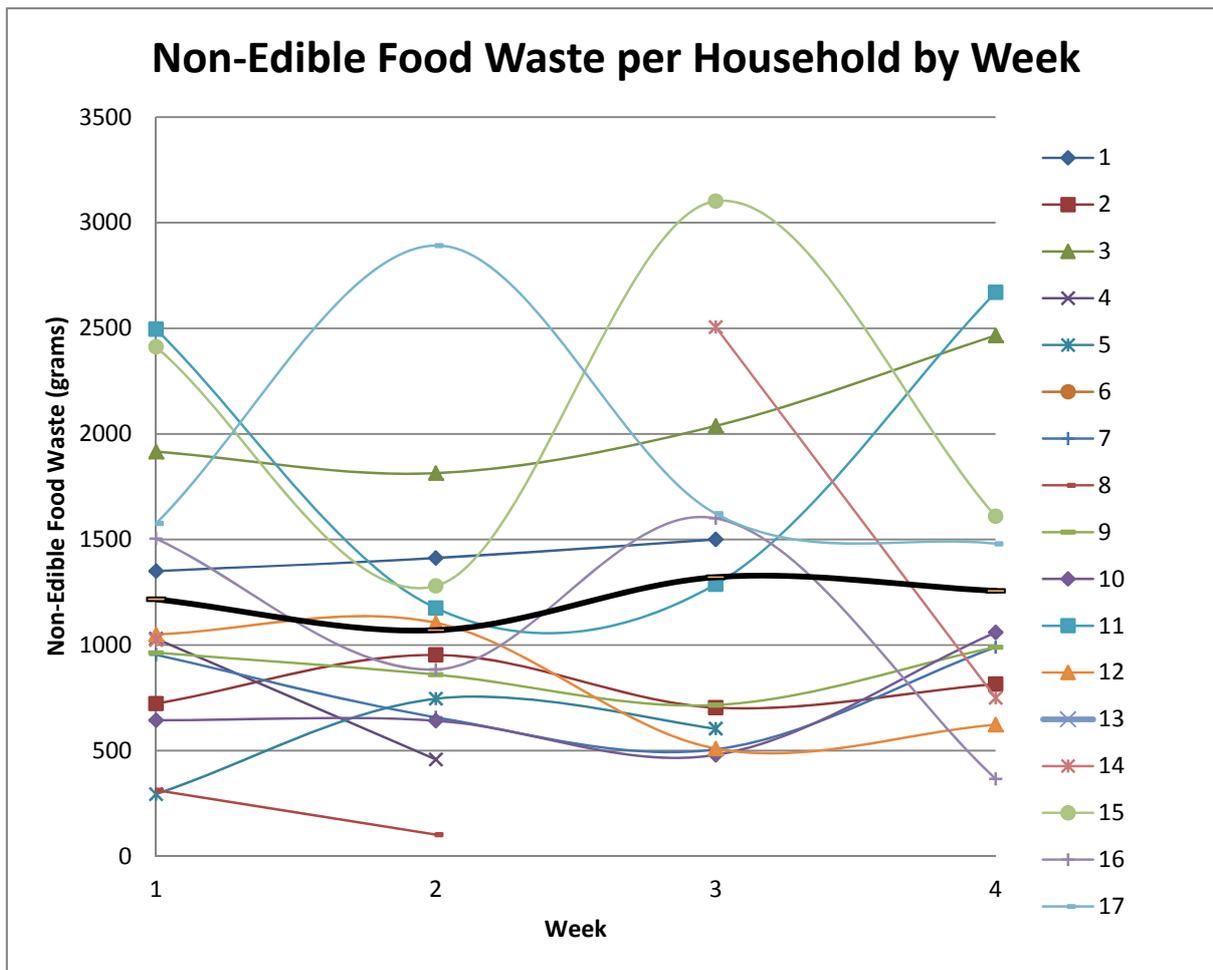


Figure 11: Non-Edible Food Waste per Household by Week

5.5. Qualitative analysis

This section describes observational and non-quantitative data that is relevant for further analysis.

5.5.1. Anecdotal data

During the presentation that took place halfway through the pilot study, many participants enjoyed sharing how the experience had been so far. Although they were asked not to make any changes, several participants noted that when they went grocery shopping, they remembered their food waste bins at home. This may be indicative of the so-called “Observer Effect”, where people may change their behavior if they are aware of being watched (or, in this case, aware that their data will be analyzed) (AQR, no date). This may explain the reduction of preventable food waste between Weeks 1 and 2 (Table 4 and Figure 8 in Section 5.4.1).

One key observation was that many ate out at restaurants much more frequently than they initially thought and realized that they went grocery shopping unnecessarily. For the most part, participant attitude was positive towards the experience and many reported being surprised at how much food

waste they produced, both preventable and non-edible. This led to a discussion on composting and the potential uses for food waste. The Facebook group garnered little activity and was used by only a three or four participants, whose participation waned throughout the pilot.

5.5.2. Follow Up Survey Data

The pilot study participants were requested via email to fill out a follow-up survey immediately after submitting the fourth and final worksheet. Only ten of the seventeen households submitted the survey and the results are presented in this section and the questions can be found in Appendix A.

The first section of the follow up survey asked which strategies households had implemented prior to the food waste challenge. 30% of respondents marked “None” while the remaining 70% chose one or more of the options (Smart Shopping, Smart Storage, Smart Preparation, Smart Eating, or Other). 30% of survey respondents marked “Smart Shopping” and “Smart Storage”, respectively, 40% of respondents marked “Smart Eating” and only 10% of respondents indicated that they used “Smart Preparation” prior to the challenge. One household selected “Other” and wrote in “Smart Portions, preparing enough to eat and a little more for lunch the next day”. In the initial demographic survey (Table 2), nine households (60%) had indicated some kind of food waste reduction habits (not including composting).

The study participants were asked to rank portions of the toolkit from 1 to 4 as to which one they liked the most (chef-created recipes, food storage tips, opportunity to save money, shopping list template). Summing these values, food storage tips was the most popular, as shown on Figure 12.

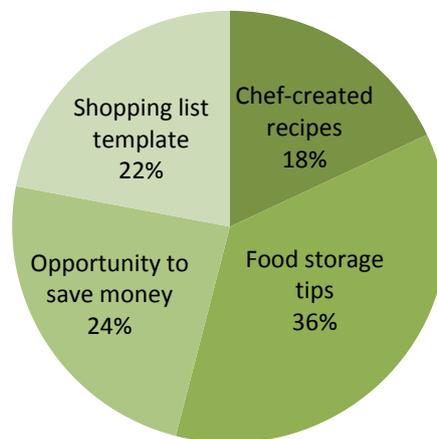


Figure 12: Ranking of Toolkit

Only nine of the ten survey respondents answered the questions regarding usage of the tools in the toolkit, presented in Figure 13. Although 80% respondents did not use the recipes in the cookbook, one respondent noted that they “plan to”. Nearly 60% of the respondents used the shopping list and 80% used the refrigerator sign in the toolkit.

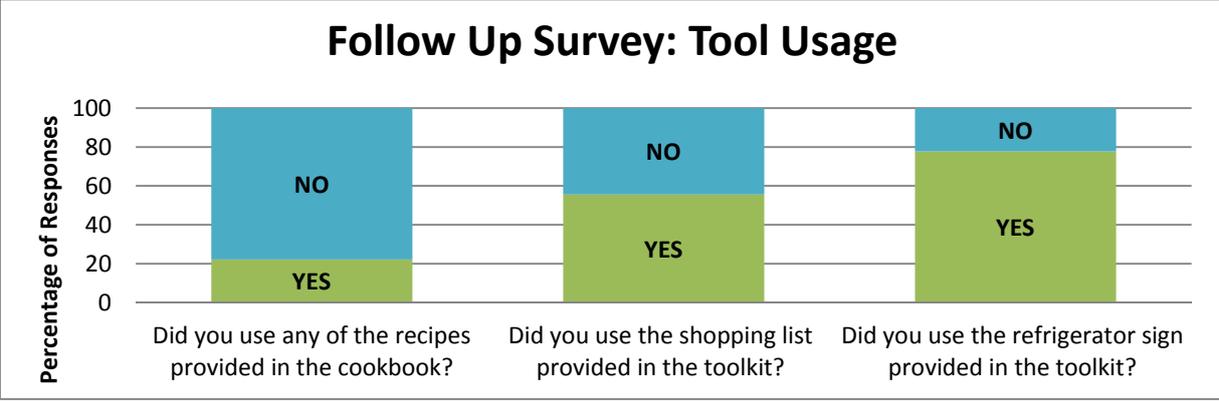


Figure 13: Follow Up Survey: Tool Usage

The survey also asked participants to gauge their own changes in attitude and behavior by selecting “Strongly Disagree” “Disagree” “Neutral” “Agree” or “Strongly Agree” to a series of statements. The results are shown on Figure 14. All survey respondents found the tips helpful and a majority either agreed or “strongly agreed” that they changed their habits and were applying tools from the study.

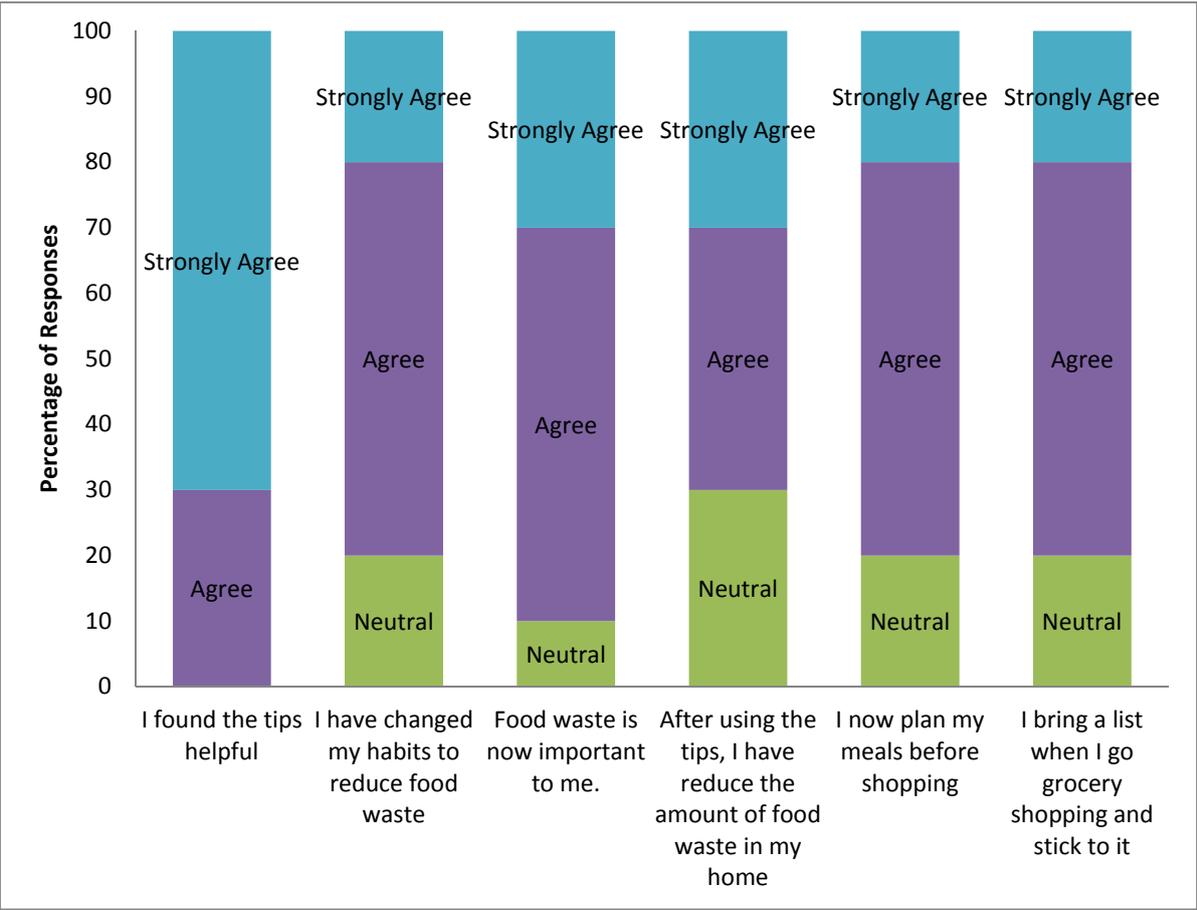


Figure 14: Follow Up Survey: Attitudes and Behavior

The survey provided an opportunity for study participants to provide written-in feedback on the following questions:

- *Which tips did you find the most useful?*
- *Which tips did you find the least useful?*
- *Do you have any suggestions for improvements or is there anything you would like to add?*
- *What, if anything, do you think you will do differently in the future to reduce your food waste?*
- *What did you take away from this experience?*

Seven of the households listed the food and storage tips as the “most useful” followed by the “Eat me first” sign. Meal planning was selected as the “least useful” tip by four of the households, but primarily due to difficulty (“*I am a poor planner*”). Two households wrote “*none*”.

Based on the survey data (both Figure 12 and the written-in answers), food storage tips and the “Eat Me First” sign were the most popular items in the toolkit. Many of the written comments noted how the project raised their awareness (“*shocked at how much food we waste*”) and that they were “*busier than anticipated*” and were adjusting their behavior accordingly. Many noted that habits take a few weeks to form and that a longer “Food Waste Challenge” may be more effective in cementing new habits; however, participants also noted that it would be difficult to motivate to participate in a long food waste measurement study.

In the future, it would be interesting to survey pilot participants three and six months from now to see which strategies are still being utilized. The goal is lasting, long-term behavioral change to prevent food waste from occurring in homes.

5.6. Summary

This pilot study does not provide statistically significant data on food waste from residential homes in general. Participants were recruited from a familiar group of individuals and were self-selected. All data was reported by the households and were thus impossible to be validated. This also resulted in inconsistent reporting (e.g., certain fields were filled in incorrectly or illegibly). There was no “control group”, i.e. a household that did not implement any strategies in order to see if simply measuring food waste for four weeks would potentially reduce preventable food waste.

In order to reduce food waste, a certain amount of effort and motivation is required from the participants. This requirement may be a reason for households dropping out of the study. It is impossible to force participants to implement strategies (or to for households to implement strategies one hundred percent of the time). On a large scale, it is unlikely that all members of society will take efforts to reduce food waste regardless of the number and types of strategies offered. For some, economy-based drivers (like more expensive food) or better packaging may be more effective in reducing food waste.

Some of the strategies, if used improperly, may lead to increased food waste. For example, by preparing food in advance (“Smart Preparation”), households expose greater surface area of produce to oxygen which may hasten spoiling rates. This strategy may only reduce preventable food waste if the

households find early preparation convenient, make it part of their routine, and actually use the prepared produce.

Despite these limitations to the study and strategies, the data and feedback are useful for further development of the *Food: Too Good to Waste* program in addition to food waste prevention programs in general. These consumer-based food waste prevention programs may have the largest effect on reducing food waste when combined with initiatives that work with food producers and retailers to impact the entire farm-to-table chain.

Three hypotheses are presented in Section 3; the results in Section 5 support the first hypothesis in that the majority of households decreased preventable food waste in Phase 2 when compared to Phase 1. However, the data do not support hypotheses two and three: non-edible food waste did not increase clearly in response to a decreased preventable food waste. Nor is it possible to correlate the number of meals eaten away from home with the amount of preventable food waste produced.

There was significant variability in the food waste collection data in this study, both for preventable and non-edible food waste. Nonetheless, there were some possible patterns seen. For example, two distinctive clusters of households showed clear similarities. Households with members aged 28 to 34 with initially high food waste achieved the largest absolute reduction (referred to as Cluster 1); this can be contrasted to the group of households in Cluster 2 that were primarily over the age of 45 and started with less food waste, but also successfully reduced the amount of preventable food waste. Also, most participating households achieved a reduction in preventable food waste and the majority of those that did not had irregular events that affected their success.

The previous pilot studies (Table 1 in Section 2.3) showed limited success in participant retention and data collection. The King County pilot saw a 28% reduction in food waste in households; this value is higher than the 19.6% reduction in food waste seen in this study. This may be attributed to the different type of participants (4th grade families) and a longer study duration (five weeks instead of four). The other two studies (San Benito and Boulder) do not have values to compare to. Popular strategies were consistent: the smart storage (keep food fresh) and smart eating (eat older items first) strategies were found most helpful in King County; however, families found the shopping list more helpful than the Honolulu participants did. This may be a key difference between single and/or young professionals which were the majority of the Honolulu study and families.

Although there was no control group, food waste reduction may be a side effect of measuring food waste and observing how much is thrown away. Sorting and measuring preventable food waste is an effective tool for future food waste prevention programs as it raises awareness. Awareness may encourage residents to implement strategies that otherwise would not be of interest. Food waste prevention is a behavior that everyone has control over (self-efficacy), and should thus be a target of any sustainable development plan. Food waste prevention and measurement could potentially lead to a conversation on composting and raise awareness for food waste and its possibilities.

6. Conclusions and recommendations

The EPA *Food: Too Good to Waste* program provides tools that are effective in reducing residential preventable food waste. Pilot participants saw a 19.6% reduction in preventable food waste in weeks using food waste prevention strategies compared to baseline weeks.

In the future, a large-scale program should include storage tips and guidelines to help households increase longevity of produce and improve self-efficacy. An “Eat Me First” sign is a popular and useful tool to provide households, as is the option of measuring food waste. Measurement of food waste is an effective tool in raising awareness and thus encourages households to learn and adopt strategies. Although the meal planner was not very popular in this study, based on previous pilots, it should also be made available so that multiple audiences can be targeted. A long term measurement study would be interesting as well as useful in determining further behaviors to target.

Behavioral change requires awareness, opportunity, and motivation. Motivation can be triggered by both the measurement tool and providing information (in this case, by distributing the CCH FTGTW Cookbook) which in turn increases awareness. Opportunity is present in every household that purchases food. The barriers to behavior change are thus removed or lessened, resulting in the desired outcome: reduced preventable food waste.

In the future, survey responses from the published version of the CCH FTGTW Cookbook should be analyzed and compared to the qualitative data presented in this study. It would also be interesting to see how these strategies could be applied nationally or internationally on a large scale.

7. References

- Anonymous, 1995. Solid waste assessment. *Environmental Science & Technology*, 29 (3), 111A-111A
- Anonymous, 2010. "Waste Land: Does the Large Amount of Food Discarded in the U.S. Take a Toll on the Environment?" *Scientific American* [Online] Available at: <http://www.scientificamerican.com/article.cfm?id=earth-talk-waste-land> [Accessed 23 May 2013].
- Association for Qualitative Research (AQR) Online, no date [online]. Available at: <http://www.aqr.org.uk/glossary/?term=observereffect> [Accessed 15 May 2013]
- Chinni, D, 2005, "One more Social Security quibble: Who is middle class?", *Christian Science Monitor*, 10 May, Academic Search Elite, EBSCOhost, [Accessed 28 May 2013]
- City and County of Honolulu (CCH), 2011. Curbside Recycling Program Evaluation and Strategic Planning: Phase I. Islandwide Automated 3-Cart Residential Collection System. November. [Online] Available at: http://www.opala.org/solid_waste/pdfs/curbside_recycling_eval_nov2011.pdf [Accessed 15 May 2013]
- Council Directive 2008/98/EC of 19 November 2008 on waste and repealing certain Directives. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:01:EN:HTML> [Accessed 15 May 2013]
- Cox, Jayne et al, 2010. Household waste prevention – a review of evidence. *Waste Management and Research*. 28, 193-219.
- D'Amato, Alessio, Shunsuke Managi and Massimiliano Mazzanti, 2012. Economics of waste management and disposal: decoupling, policy enforcement and spatial factors. *Environmental Economics and Policy Studies*. 14(3), 323-325.
- Darnton, A., 2008. Reference Report: An overview of Behaviour Change Models and their Uses. A Report to the Government Social Research Unit. Available at: http://www.gsr.gov.uk/downloads/resources/behaviour_change_review/reference_report.pdf [Accessed 15 May 2013]
- Defra, 2005. *Securing the future: The UK Government Sustainable Development Strategy*. March [Online] Available at: http://www.sd-commission.org.uk/data/files/publications/SecFut_complete.pdf [Accessed 12 May 2013]
- Eccleston, P., 2007. Help the environment, reduce food waste. *The Telegraph*, [online], 2 Nov. Available at: <http://www.telegraph.co.uk/earth/earthnews/3312730/Help-the-environment-reduce-food-waste.html>. [Accessed 28 Apr 2013].
- Environment Canada, 2010. Technical Document for Batch Waste Incineration. [online] Available at: <http://www.ec.gc.ca/gdd-mw/default.asp?lang=En&n=F53EDE13-1>. [Accessed 12 May 2013]

- EPA West Coast Climate and Materials Management Forum (WCCMMF), 2012a. "Food: Too Good to Waste Pilot: Background Research Report". September. [Online] Available at: ftp://ftp.epa.gov/reg10ftp/Food_Too_Good_To_Waste/Background_Research/Food_Too_Good_To_Waste_Background_Research_Report.pdf [Accessed 12 May 2013]
- EPA WCCMMF, 2012b. Toolkit Implementation Guide for the Food: Too Good to Waste Pilot. 19 September 2012. [Online] Available at: ftp://ftp.epa.gov/reg10ftp/Food_Too_Good_To_Waste/02_ToolKit_Implementation_Guide_for_the_Good_Too_Good_to_Waste_Pilot.pdf . [Accessed 12 May 2013]
- US Environmental Protection Agency (EPA), 2010. Municipal Solid Waste Generation, Recycling and Disposal in the United States: Facts and Figures for 2010. [Online] Available at: http://www.epa.gov/osw/nonhaz/municipal/pubs/msw_2010_rev_factsheet.pdf [Accessed 26 May 2013]
- EPA, 2012a. Reducing Food Waste for Businesses. Available at: <http://www.epa.gov/foodrecovery/> [Accessed 12 May 2013]
- EPA, 2012b. "Solid Waste Management Hierarchy" Available at: <http://www.epa.gov/wastes/nonhaz/municipal/hierarchy.htm> [Accessed 12 May 2013]
- EU, no date, a. *Causes of food waste*. [Online] Available at: http://ec.europa.eu/food/food/sustainability/causes_en.htm [Accessed 12 May 2013]
- EU, no date, b. *Good practices*. [Online] Available at: http://ec.europa.eu/food/food/sustainability/gp_awareness_information_education_en.htm [Accessed 12 May 2013]
- EU, 2012a. Parliament Calls for Urgent Measures to Ban Food Waste in the E.U., " *European Parliament News*, 19 January 2012, www.europarl.europa.eu/news/en/pressroom/content/20120118IPR35648/html/Parliament-calls-for-urgent-measures-to-halve-food-wastage-in-the-E.U. [Accessed 12 May 2013]
- EU, 2012b. *Waste Prevention: Legislation*. [online] Available at: <http://ec.europa.eu/environment/waste/prevention/legislation.htm> [Accessed 12 May 2013]
- Eureka Recycling, 2012. *Prevent Wasted Food*. [online] Available at: <http://makedirtnotwaste.org/at-home/prevent-wasted-food>. [Accessed 12 May 2013]
- Galbrath, K., 2012. "The Battle Against Food Waste" *New York Times*. Published 15 January 2012. Available at: http://www.nytimes.com/2012/01/16/business/global/the-battle-against-food-waste.html?_r=0
- Gunders, D., 2012. *Wasted: How America Is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill*. National Resource Defense Council. [Online] Available at <http://www.nrdc.org/food/files/wasted-food-ip.pdf> [Accessed 12 May 2013]

- Gustavsson et al, 2011. *Global Food Losses and Food Waste: Extent, Causes and Prevention*. Food and Agriculture Organization of the United Nations. [Available at: <http://www.fao.org/docrep/014/mb060e/mb060e00.pdf/>](http://www.fao.org/docrep/014/mb060e/mb060e00.pdf) [Accessed 15 May 2013]
- Hall KD, Guo J, Dore M, Chow CC, 2009. "The Progressive Increase of Food Waste in America and Its Environmental Impact." *PLoS ONE* 4(11).
- Lamb, Georgina and Fountain, Lisa, 2010. *An Investigation into food waste management: Waste in Action*. [Available at: <http://www.actiondechets.fr/upload/medias/group_b_report_compressed.pdf/>](http://www.actiondechets.fr/upload/medias/group_b_report_compressed.pdf) [Accessed 23 May 2013].
- Leung et al, 2008. "Economic Impacts of Increasing Hawaii's Food Self-Sufficiency". *Economic Issues*.16:1-7.
- Okazaki, WK, Turn, SQ, et al, 2008. Characterization of food waste generators: a Hawaii case study. *Waste Management* 28 (12): 2483-94.
- Read, et al, 2009. An evaluation of four key methods for monitoring household waste prevention campaigns in the UK. *Resources, Conservation and Recycling*. 54 2009 9-20.
- RW Beck, 2008. *City and County of Honolulu Integrated Solid Waste Management Plan Update*. October. [Online] [Available at: <http://www.opala.org/solid_waste/pdfs/Draft_Revised_ISWMP_Update.pdf/>](http://www.opala.org/solid_waste/pdfs/Draft_Revised_ISWMP_Update.pdf) [Accessed 23 May 2013].
- State of Hawaii Databook, 2011. [Online] [Available at: <http://dbedt.hawaii.gov/economic/databook/db2011/>](http://dbedt.hawaii.gov/economic/databook/db2011/) [Accessed 12 May 2013]
- Thøgersen, J., 2010. "Pro - environmental consumption." I K.M. Ekström (Ed.), *Consumer behaviour. A Nordic perspective*. (95-115). Lund: Studentlitteratur.
- US Census Bureau, 2012. State and County Quickfacts. [Online] [Available at: <http://quickfacts.census.gov/qfd/states/15/15003.html/>](http://quickfacts.census.gov/qfd/states/15/15003.html) [Accessed 12 May 2013]
- Venkat, Kumar, 2011. "The Climate Change and Economic Impacts of Food Waste in the United States." *International Journal on Food System Dynamics* 2 (4), 431-446.
- Wansink, B. et al, 2007. "Portion Size Me: Downsizing Our Consumption Norms," *Journal of the American Dietetic Association*, 107 (7), 1103-1106.
- WRAP, no date. *Company structure and governance*. [online] [Available at: <http://www.wrap.org.uk/content/governance-1/>](http://www.wrap.org.uk/content/governance-1) [Accessed 12 May 2013]
- WRAP, 2013. *Waste Prevention Toolkit*. [Online]. [Available at: <http://www2.wrap.org.uk/applications/waste_prevention_toolkit/page.rm?id=24149&activity_id=1695/>](http://www2.wrap.org.uk/applications/waste_prevention_toolkit/page.rm?id=24149&activity_id=1695) [Accessed 12 May 2013]

WRAP, 2013b. *Information Sheet: The Courtauld Commitment*. [Online]. Available at: <http://www.wrap.org.uk/sites/files/wrap/Courtauld%20Commitment%203%20-%20Information%20Sheet%20May%202013.pdf> [Accessed 12 May 2013]

Appendix A: Pilot Materials

A.1 Presentations

A.2 Worksheets

A.4 Toolkit

Appendix B: Interview Questions for Chefs

1. How long have you been working in the food industry?
2. How long have you been at your restaurant?
3. What type of cuisine do you specialize in?
4. Why do you try to reduce food waste in your restaurant's kitchen?
5. What practices do you use to prevent and reduce food waste? Do you have any **"quick tips"** to offer?
6. What would you recommend to the average chef/cook to help them reduce food waste?
7. What do you do with food waste in your restaurant's kitchen?