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Research to explore the current and historic trends in food sampling with particular reference to sampling and surveillance undertaken by Local Authorities and Port Health Authorities

Greenstreet Berman Ltd and Royal Agricultural University*

Report for the Food Standards Agency

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GLOSSARY

Food hygiene samples

This refers to microbiological analyses of contamination conducted as part of food hygiene regulation.

Food standards samples

This refers to chemical analyses to assess labelling, composition and presentation, conducted as part of food standards regulation.

Monitoring

The Food Law Code of Practice (England) April 2012 (p74) states, "'Monitoring' means conducting a planned sequence of observations or measurements with a view to obtaining an overview of the state of compliance with feed or food law, animal health and animal welfare rules".

Samples

The Food Law Code of Practice (England) April 2012 (p76) states, "All samples which are sent to an Official Laboratory constitute official control samples".

Sampling for analysis

The Food Law Code of Practice (England) April 2012 (p74) states, "'Sampling for analysis' means taking feed or food or any other substance (including from the environment) relevant to the production, processing and distribution of feed or food or to the health of animals, in order to verify through analysis compliance with feed or food law or animal health rules".

Sampling strategy

A *sampling strategy* is the approach used to select the units of the target population subject to official controls e.g. businesses, foodstuffs, etc[1].

Statutory sampling

Statutory sampling is the sampling undertaken at PHAs or LAs where the products to be tested as well as frequency of the said testing is set out in law to control specific health risks.

Surveillance

The Food Law Code of Practice (England) April 2012 (p74) states, "'Surveillance' means a careful observation of one or more food businesses, or food business operators or their activities".

Suspect sampling – enforcement related sampling

Suspect sampling is the selection of an individual product or establishment in order to confirm or reject a suspicion of non-conformity.

[1] Typology of sampling strategies. Eurostat European Commission. Working group "Food Safety Statistics". May 2010. https://circabc.europa.eu/sd/d/2fc47bd9-237a-4c79-93e0-6a4665cf3591/201_Typology_sampling_strategies.pdf. Downloaded 19/9/2013

Verification

The Food Law Code of Practice (England) April 2012 (p74) states, *"'Verification' means checking, by examination, and the consideration of objective evidence, whether specified requirements have been fulfilled".*

Types of sampling

The type of sampling can be categorised as follows;

1. Routine surveillance – where samples are taken to check compliance levels and detect previously unidentified issues. Routine surveillance may be risk-based, with samples selected to match some form of risk rating. Surveillance may be planned and funded at a national level, such as through Food Standards Agency (FSA) grant funding or locally determined, such as in inland and PHA local sampling plans. Local sampling plans may be informed by national priorities as well as local assessment of risks.
2. Statutory – where the frequency of samples is prescribed in law for a selection of products identified as posing a known high risk. These tend to apply at approved points of entry (ports) for imported food and feed.
3. Suspect sampling or enforcement related sampling – where samples are taken as part of investigations into, for example, food poisoning, alerts, recalls, prosecutions and so forth.

Key findings

This study assessed trends in UK food sampling, the reason for these trends, the probability of detecting unsatisfactory results and identified potential improvements.

Port Health Authorities (PHA)

- PHAs are completing more samples of Food Not Of Animal Origin (FNOAO) due to the additional European Commission (EC) regulated official sampling requirements implemented in 2010. As the expenses associated with this statutory sampling are cost recoverable from the importer, they present no funding issues. The total number of FNOAO samples rose by 104% between 2009/10 and 2011/12; and
- The funds available from local budgets are insignificant in comparison and do not impact greatly on the overall number of samples. Most PHA sampling is either to fulfil EC requirements or in line with Food Standards Agency (FSA) grants.

Inland local authority (LA) food sampling

- The volume of food samples analyses by inland LAs in the UK has fallen by about 33% since 2008/09 due to reductions in budgets and staffing levels, whilst also having to sustain the prescribed rates of premises inspections;
- There is evidence of an increase in the rate of decline in the number of samples taken since 2009/10;
- The reduction in budgets and staff has prompted more risk based and intelligence led food sampling;
- The decline in sampling by inland LAs is far greater for food standards, a 53% fall once FSA grant funded sampling is excluded, due to food standards staffing declining more than food hygiene staffing, the relatively higher cost of food standards tests, the relatively lower level of national co-ordination and the lack of ring fenced funding for food standards sampling;
- There is very little testing by inland LAs of imported food unless problems are identified through intelligence or the FSA funds specific initiatives. Only one third of LAs surveyed say they test imported foods; and
- The level of testing of imported food by inland LAs has remained at a low level.

It was also found, using national UK Food Surveillance System (UKFSS) data, that enough sample analyses are taken to detect very low rates, such as 0.1%, *for products as a whole* at a national level. The data was also assessed for sub categories of products, such as cheese or herbs and spices. The number of analyses per year for many sub-categories of product is less than the number needed to detect unsatisfactory results, (at a 95% probability limit), particularly where the rate of unsatisfactory results is 1% or less. In some cases the number of analyses per type of product is far above the number needed to detect unsatisfactory results.

In addition, the estimated rate of unsatisfactory results (using national level data) is uncertain for some categories of products due to the relatively small number of analyses. In other cases, the larger number of analyses, when assessed at a national level, provides more confident estimates of the rates of unsatisfactory results. The confidence intervals would be far wider (and so there is far more uncertainty about the “true” rate of unsatisfactory results) if assessed for a single LA or group of LAs.

Executive summary

The FSA (the Agency) state[2] that:

> "*Food sampling forms an integral part of local authority food law enforcement and it can provide useful information to help effective enforcement of food law and contribute to improved food safety and standards*".

The Agency's Evidence Requirement said there is a "*perceived downturn in the number of routine surveillance samples that are taken at UK points of entry and inland*" (Pg 2).

Aims of this study

The aims of this study included:

1. To investigate how the balance has changed between routine sampling and surveillance conducted by UK PHAs and LAs.
2. To evaluate whether there is the possibility for incidents or emerging risks to go undetected at UK borders as a result of the decline in surveillance sampling.
3. To suggest improvements to the current PHA/LA approach to routine surveillance.
4. To establish how the Agency can best support PHAs/LAs to ensure that the level of surveillance and sampling work (other than that specifically required in legislation e.g. 669/2009) is improved and maintained.

Approach to the work

The work had four main research questions.

1) What are the trends in food sampling?

This entailed an analysis of Local Authority Enforcement Monitoring System (LAEMS) and UKFSS data held by FSA regarding the number of sample analyses per year, interviews with stakeholders about trends and asking LAs and PHAs to report trends.

2) What are the reasons for these trends?

This entailed: a) exploratory interviews with LAs, PHAs and stakeholder representatives and b) a rapid survey of LAs and PHAs regarding the cause of trends and local sampling policy. The analysis of LAEMS data on food samples also revealed differences in sampling practices between types of LAs and countries that indicated some additional factors.

3) What is the probability of detecting unsatisfactory results?

UKFSS data for 2012 was assessed to determine the statistical probability of detecting unsatisfactory results per category of products and type of analyses.

4) What potential improvements could be made?

Suggestions for potential improvements were drawn from stakeholder feedback, research findings and consideration of parallel Agency studies into risk-based sampling.

Results

Port Health Authorities (PHAs)

- PHAs are completing more samples of FNOAO due to the additional EC regulated

[2] http://www.food.gov.uk/enforcement/monitoring/samplingresources/#.UnJIhRAymlE (viewed October 2013)

official sampling requirements in 2010. As the expenses for the statutory sampling are cost recoverable from the importer, there are no funding issues. The total number of FNOAO samples rose by 104% between 2009/10 and 2011/12; and

- The funds available from local budgets are insignificant and do not impact greatly on the overall number of samples. Most PHA sampling is either to fulfil EC requirements or in line with FSA grants.

Inland food sampling

- The volume of food samples analyses by inland LAs in the UK has fallen by about 33% since 2008/09 due to reductions in budget sand staffing levels, whilst also having to sustain the prescribed rates of premises inspections;
- There is evidence of an increase in the rate of decline in the number of samples taken since 2009/10;
- The reduction in budgets and staff has prompted more risk based and intelligence led food sampling;
- The decline in sampling by inland LAs is far greater for food standards, a 53% fall once FSA grant funded sampling is excluded, due to food standards staffing declining more than food hygiene staffing, the relatively higher cost of food standards tests, the relatively lower level of national co-ordination and the lack of ring fenced funding for food standards sampling;
- There is very little testing by inland LAs of imported food unless problems are identified through intelligence or the FSA funds specific initiatives. Only one third of surveyed LAs say they test imported foods; and
- The level of testing of imported food by inland LAs has remained at a low level.

Probability of detecting unsatisfactory results

It was also found, using national UKFSS data, that enough sample analyses are taken to detect very low rates, such as 0.1%, *for products as a whole* at a national level. The data was also assessed for sub categories of products, such as cheese or herbs and spices. The number of analyses per year for many sub-categories of product is less than the number needed to detect unsatisfactory results, (at a 95% probability limit), particularly where the rate of unsatisfactory results is 1% or less. In some cases the number of analyses per type of product is far above the number needed to detect unsatisfactory results.

In addition, the estimated rate of unsatisfactory results (again using national level data) is uncertain for some categories of products due to the relatively small number of analyses completed. In other cases, the larger number of analyses, when assessed at a national level, provides more confident estimates of the rates of unsatisfactory results. The confidence intervals would be far wider (and so far more uncertainty about the true rate of unsatisfactory results) if assessed at the level of a specific LA or group of LAs.

Potential improvements

Overall 42% of the LAs and PHAs interviewed said that changes were needed locally, 51% regionally and 57% nationally. County councils were most likely to say improvements were needed. PHAs, London and Metropolitan authorities were the least likely to say improvements were needed within their areas, noting that London and Metropolitan LAs report the lowest rates of food sampling in the UK.

It should be noted that the feedback from PHAs was that, whilst improvements could be

made, current arrangements were not “broken”. The researchers noted that sampling levels at PHA have increased and that the costs of statutory sampling are recovered from businesses.

The research indicates that there are a number of options for improving food sampling in the UK, particularly amongst inland LAs, with respect to the number of samples, the targeting of samples and the use of the results. The themes for these options are noted below, with those that the Agency could lead on noted as such:

a) The Agency could provide advice on how to make **better use of current food sampling resources** through:

   1. Better co-ordination between national, regional and local bodies. The Agency may need to help further develop national co-ordination arrangements and advice on regional co-ordination arrangements;

   2. More risk based and intelligence led sampling by the Agency and LAs;

   3. Better sharing of results/data, including amendments to UKFSS by the Agency; and

   4. More efficient working practices by LAs.

b) **Changing funding arrangements**, with a range of options for increased funding but also ‘ring fencing’ food sampling funds, and defining expected levels of sampling to be conducted by LAs. The Agency could lead on this option.

c) **Increasing level and scope of national sampling programmes** directed or conducted by national agencies (FSA and Public Health England (PHE)), with less onus placed on LAs to plan or conduct food sampling. The Agency would need to lead on this option, in collaboration with PHE.

d) To **increase the extent/use of food sampling**, following official sampling methods, **undertaken by businesses** through, for example, **third party certification schemes**, with requirements for sharing all results with LAs, FSA and PHE. The Agency would need to lead on the development of this option and advising LAs on its implementation.

The suggestions do need to be considered as a whole, as increasing the scope of national sampling programmes, for example, would reduce the onus placed on LA funding. Similarly, if third party certification schemes conducted independent food sampling activity, this might reduce the onus on LAs. Indeed, a number of options could be combined into a cohesive national sampling strategy. At the same time, some options have their limitations. For example, third party certification schemes do not currently operate in all food sectors. This study was limited to identifying and summarising such options. Further work could be undertaken to assess the costs and benefits of the varying options. A parallel study into risk based food sampling for the FSA addresses some of these options in more detail.

Our own review of the probability of detecting contamination etc and confidence intervals attained by current UK food sampling indicate that consideration could be given by the Agency to the statistical element of planning food sampling, the purpose of food sampling and whether results are assessed at a LA, regional or national level. This leads to a further theme of potential improvement concerning the **statistical element of planning food surveillance sampling.** A combined statistical and risk analysis approach to planning food sampling is reported in Belgium. Elements of the Belgium method could be drawn upon, particularly the adoption of statistical criteria, risk criteria and formula for estimating the number of samples needed. The type of statistical approach adopted in Belgium would help improve the confidence that can be placed in UK food sampling surveillance results.

1 INTRODUCTION

1.1 Aims of this work

The aims of this study included:

1. To investigate how the balance has changed between routine sampling and surveillance conducted by UK PHAs and LAs as part of their local sampling plans, and other sampling and surveillance conducted by them that either can be charged for (e.g. border controls under EC Regulation 669/2009) or grant-funded by the FSA.

2. To evaluate whether there is the possibility for incidents or emerging risks to go undetected at UK borders as a result of the decline in surveillance sampling.

3. To suggest improvements to the current PHA/LA approach to routine surveillance, taking into account work that is already underway by the Agency to develop risk based sampling guidance (research project FS222001).

4. To establish how the Agency can best support PHAs/LAs to ensure that the level of surveillance and sampling work (other than that specifically required in legislation e.g. 669/2009) is improved and maintained at UK points of entry and inland and where necessary, exploring possible alternative approaches to the current system or advances in new technology.

The study did not aim to cost proposed improvements or formally assess their feasibility. Also the work focused on surveillance sampling rather than suspect or enforcement related sampling. The work was limited to food sampling in the UK.

1.2 Background

1.2.1 The role of food testing

The FSA (the Agency) state[3] that:

> "*Food sampling forms an integral part of local authority food law enforcement and it can provide useful information to help effective enforcement of food law and contribute to improved food safety and standards*".

The Food Law Code of Practice (England) April 2012[4] (p120) states that:

> "*Effective routine sampling is an essential part of a well-balanced enforcement service and should, therefore, feature in the Sampling Policy of all Food Authorities."*

Food sampling completed at national and local levels helps to:

1. Determine the actual level of compliance at a moment in time and the trends in the level of compliance over a period of time for a food business operator (FBO), or a batch or other unit of measure.
2. Understand more accurately local food safety, food standards issues, or issues that

[3] http://www.food.gov.uk/enforcement/monitoring/samplingresources/#.UnJIhRAymlE (viewed October 2013)
[4] http://www.food.gov.uk/enforcement/enforcework/foodlawcop/copengland/#.Ujw1iz-1ulE Downloaded 19/9/2013

affect at-risk populations (e.g. pregnant women).

3. Provide a broad brush overview of how food safety and food standards are controlled.
4. Verify the compliance of existing FBO checks and food safety management systems in line with official controls such as EC 882/2004, EC 669/2009, EC 1152/2009 and EC 2073/2005 on microbiological criteria for foodstuffs.[5]
5. Investigate suspected food poisoning and food borne-disease outbreaks or suspected accidental or criminal activity associated with food.
6. Verify whether postulated new, emerging or re-emerging risks are a factor within the food supply chain.
7. Generate data for risk profiles and risk assessments.

As stated in the Agency's evidence requirement for this study[6] "*Routine surveillance is an important facet of enforcement work as it helps to monitor the safety of imported food and feed as well as the identification of new and emerging risks. The benefits of such surveillance work were illustrated after the emergence of a carcinogenic dye, Sudan I in adulterated chilli powder. Once the risk had been identified, necessary controls were introduced*." The more recent 'horsemeat scandal' also highlights the benefit of routine surveillance, in that the matter was first discovered by tests of samples of beef products in Ireland.

The Food Law Code of Practice (England) April 2012 goes on to say (p111-114)

> "...that samples may also be taken for the purposes of surveillance, monitoring and providing advice to FBOs. A Food Authority's Sampling Policy and Programme should cover all types of sampling work undertaken."
>
> Sampling policy should cover "...national, regional and local co-ordinated programmes."
>
> "The Sampling Policy should commit the Food Authority to providing the resources necessary to carry out its food Sampling Programme."
>
> "The Sampling Policy and the Sampling Programme should be prepared ...on a local or regional basis."

FSA guidance[7] advises that a risk based approach should be applied to sampling. Since 2003, the FSA has provided at least £1million annually (£2million more recently) in sampling grants to PHAs and inland LAs in support of their sampling and surveillance of imported food and feed. The Agency also develops the Multi-Annual National Control Plan (MANCP) which details the roles and responsibilities of the organisations involved in the monitoring (including food sampling) of compliance with and enforcement of feed law[8,9] and the annual national co-ordinated risk based food and feed sampling programme.

LAs produce Local Service Plans that include arrangements for carrying out local surveillance and monitoring as part of their Sampling Policy. This may be co-ordinated

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[5] http://ec.europa.eu/food/food/controls/foodfeed/sampling_testing.pdf

[6] To investigate the overall effectiveness of food and feed sampling and surveillance in the UK by Local and Port Health Authorities. Food Standards Agency Evidence Requirement. Supplied October 2013.

[7] Practical sampling guidance for food standards and feeding stuffs. Part 1: Overall Objectives of Sampling. Food Standards Agency. May 2004. http://www.food.gov.uk/multimedia/pdfs/samplingguidancepart1.pdf Downloaded 19/9/2013

[8] http://www.food.gov.uk/multimedia/pdfs/enforcement/ukmancp201315.pdf

[9] http://www.food.gov.uk/enforcement/regulation/europeleg/feedandfood/ncpuk#.Ud_NNxbvyu5

locally, regionally or nationally. LAs reported 92,181 food sample analyses in 2011/12, and a further 8,394 by PHAs.

EU prescribed sampling

Regulation (EC) No 882/2004 established a harmonised framework of general rules for the organisation of official controls at Community level. This includes the official controls on food and feed from third countries (i.e. non EU)[10]. In addition, it provides for a list to be drawn up of feed and food items of non-animal origin (FNOAO) that on the basis of a known or emerging risk is to be subject to an increased level of official controls at the point of entry[11]. The Commission Regulation (EC) 669/2009 as amended by Commission Implementing Regulation (EC) No 889/2012 lays down rules concerning the increased level of official controls to be carried out on imports of feed and food of non-animal origin at the points of entry into the European Union (EU) and the detail is referred to in Annex I to Regulation (EC) No 882/2004[12]. The product of animal origin (POAO) sampling strategy is tied into the MANCP via the Veterinary Medicines Directorate (VMD) sampling programmes. The Trade Control and Expert System (TRACES) is used to facilitate POAO sampling and provides PHAs with alerts on problem products and sets the criteria for sampling the next ten batches of a product entering any EU port[13].

1.2.2 Concerns about potential trends in testing

As noted in the Agency's Evidence Requirement there is a "*perceived downturn in the number of routine surveillance samples that are taken at UK points of entry and inland*" (Pg 2). As stated this is a perceived viewpoint rather than based on hard data.

The concern about the downward trend in testing is not new. The Agency commented on trends in 2004[14], as follows:

> "The figures show a general decrease between 2003 and 2004/2005 for .. the total number of samples taken, by 6%, and the number of formal samples by 12%" (p5-6)
>
> "These changes may reflect moves by LAs to improve compliance through support and advice, or through better focused sampling programmes.." (p7)
>
> "In 2004/2005 LAs were required to adopt "alternative enforcement strategies" for the lowest risk premises (risk categories E and F for hygiene, and risk category C for standards)."

More recently the City of London PHA stated, in 2012 that:

> "*A considerable increase in sampling activity has taken place due to new legislation and emergency control provisions, particular note should be made to the budget available for sampling associated with Common Entry Document (CED) work. Sampling costs associated with this work are recoverable; however, this extra activity has an impact on the routine surveillance sampling work. The budget for Non POAO sampling has been frozen to meet departmental spending cuts*"[15].

Also, in 2011 the Scottish Food Enforcement Liaison Committee said:

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[10] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:194:0011:0021:EN:PDF
[11] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:194:0011:0021:EN:PDF
[12] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:263:0026:0031:EN:PDF
[13] https://webgate.ec.europa.eu/sanco/traces/
[14] FSA 06/02/04 Agenda item 6, 9 February 2006. Local authority monitoring data on food law enforcement
15 http://www.cityoflondon.gov.uk/services/port-health-and-animal-health/port-health/import-controls/Documents/LPHA%20FESP%202012.pdf

> "Food sampling activity by Scotland's environmental health departments has reduced markedly not only from the notional standards of the 1980s but in comparison to actual activity six years ago. This reduction has, in most cases, been driven by financial pressures due to the public service now entering a period where significant cuts are likely in service budgets. Food sampling will be particularly vulnerable to these cuts as, with its attendant expenditure on analysis by outside providers (i.e. Public Analysts), it may be seen as a soft option for LAs striving to make politically acceptable savings in local budgets." (p5[16])

From 25 January 2010 imports of certain feed and food of non-animal origin, from third countries, that are considered to be 'high-risk' are imported via approved designated points of entry (DPEs) where official controls will be carried out.

Similarly, another research study (Manning *et al,* 2012[17]) for the Agency on risk-based food and feed sampling found that:

> "*The majority of sampling carried out (at the PHA) is based on legislative requirements and as a result of the alert systems previously described and issues reported through the RASFF system. Monitoring is undertaken to identify products on the high risk list*." (PHA) (p14)
>
> "*Apart from the statutory sampling required by EC No 669/2009, sampling is intelligence-led... The PHA acts on RASFF alerts, for example when Sweden reported high levels of pesticide residues on imported oranges. Other sampling is done with FSA grant money. Grants are applied for sampling certain produce of interest to the FSA and which are imported into this port*..." (PHA) (p14)

The study also had feedback from LAs that:

1. Sampling is intelligence led, through forums, in response to alerts for example, or completed for verification purposes as part of premises inspections;
   a) Proactive sampling is limited to high risk premises and is completed for inspection verification purposes;
   b) There is no statutory sampling and so all sampling is either: reactive sampling, from complaints and outbreaks; verification sampling at high risk premises; or purposive sampling using prior sampling results to identify priority premises;
   c) Very few LAs have sampling quotas or proactive sampling plans; and
   d) The extent of sampling is said to be related to budget rather than risk.
2. LAs do not have specific sampling budgets.

On the other hand the House of Commons' Environmental, Food and Rural Affairs (EFRA) Committee report[18], entitled 'Food Contamination', noted that budget cuts should not have an impact on food sampling carried out by LAs and that "*Local authorities have a duty to carry out appropriate food testing and must ensure that they do so*." (p31, para 11)

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[16] Scottish Food Enforcement Liaison Committee, Enforcement Resources Group. September 2011. Effective food sampling, Guidance for local authorities. http://www.food.gov.uk/multimedia/pdfs/enforcement/effectivefoodsamplingguidance.pdf. Accessed 26th November 2013

17 Development of risk-based sampling guidance for enforcement officers. Research study for the Food Standards Agency. 2011-2014, ongoing. Manning L, McKellar D and Wright M, Greenstreet Berman Ltd and Royal Agricultural University, Interim report 2, September 2012. Unpublished.

[18] http://www.publications.parliament.uk/pa/cm201314/cmselect/cmenvfru/141/141.pdf

1.3 Approach to the work

The work had four main research questions.

1) What are the trends in food sampling?

This entailed an analysis of LAEMS and UKFSS data held by FSA regarding the number of sample analyses per year, interviews with stakeholders about trends and asking LAs and PHAs to report trends subjectively. The following organisations were consulted:

- Chartered Institute of Environmental Health (CIEH)
- Association of Port Health Authorities (APHA)
- Trading Standards Institute (TSI)
- National Trading Standards Board (NTSB)
- Five Port Health Authorities (airports and ports)
- Seven inland Local Authorities covering England, Scotland, Wales and Northern Ireland from rural and urban areas, counties, metropolitan and combined authorities.

The list of organisations consulted was agreed with the Agency. Public Analysts were being consulted in another Agency project.

2) What are the reasons for these trends?

This entailed a) exploratory interviews with LAs, PHAs and stakeholder representatives and b) a rapid survey of LAs and PHAs regarding:

- The cause of trends,
- Local sampling policy and practice.

The analysis of LAEMS data on food samples also revealed differences in sampling practices between types of LAs and countries that indicated some additional factors.

3) What is the probability of detecting unsatisfactory results?

UKFSS data for 2012 was assessed to determine the statistical probability of detecting unsatisfactory results per category of products and type of analyses.

4) What potential improvements could be made?

The Agency's Evidence Requirement said that the Agency was "*particularly interested in whether the Agency needs to think more radically about how to improve the current situation.*" (pg. 7).

Suggestions for potential improvements were drawn from:

- The aforementioned interviews with LAs, PHAs and stakeholder representatives
- A rapid survey undertaken with LAs and PHAs, with 123 responses from England, Scotland, Wales and Northern Ireland and all types of LAs and PHAs;
- First principles based on the review findings;
- Consideration of the results of current FSA studies into risk-based sampling; and
- A second round consultation with three stakeholder organisations (PHE; APHA, CIEH), one LA and three PHA.

Some ideas on how the Agency can help progress potential improvements are noted in section 5.2 of this report.

2 TRENDS IN FOOD SAMPLING

2.1 Main findings

The main trends in sampling are summarised below and elaborated in sections 2.2 to 2.3.4. The detailed analysis of LAEMS data is given in section 7. The reasons cited by respondents for these trends are discussed in section 3.

The analysis of LAEMS data and rapid survey responses indicates that:

Port Health Authorities (PHAs)

- PHAs are completing more samples of FNOAO due to the introduction of additional EC regulated official sampling requirements in 2010; and
- The funds available from local budgets are insignificant and do not impact greatly on the overall number of samples. Most PHA sampling is either to fulfil EC requirements or with FSA grants.

Inland food sampling

- The volume of food samples analyses by inland LAs in the UK has fallen by about 33% since 2008/09; and
- The 41% decline in the rate of samples taken seen in the period 2008/09 to 2012/13 (about 10% per year) is greater than the 18% decline seen in the period 2003 to 2006/07 (about 6% per year). Thus, there is evidence of an increase in the rate of decline in the number of samples taken since 2008/09.

Food hygiene versus food standards sampling

There are large differences between trends in food hygiene and food standards sampling.

- The decline in sampling by inland LAs is far greater for food standards, a 53% fall once Agency grant funded sampling is excluded;
    - Routine/surveillance sampling funded by FSA grants (mostly food standards) has remained roughly level, with some respondents reporting a small increase. This is reported to be a small proportion of inland testing;
- Food hygiene sampling has remained steady or declined less than food standards, especially in England; and
- Food standards sampling has decreased far more than food hygiene sampling especially in England.

Inland testing of imported foods

- There is very little testing by inland LAs of imported food unless problems are identified through intelligence or non-compliance or FSA fund specific initiatives; and
- The level of testing of imported food by inland LAs has remained level (at a low level) in accordance with FSA funding.

Suspect and enforcement sampling

- Suspect and enforcement sampling has remained fairly constant, with a possible rise in food hygiene and standards suspect sampling due to an increase in the range of aflatoxins that can be tested for and more awareness of their potential presence in foodstuffs;

- Enforcement sampling tends to be reactive, e.g. sampling in response to complaints or local intelligence;
- Enforcement sampling tends to be at low level, a small fraction of surveillance sampling (and so has little impact on trends in surveillance sampling). Indeed, a city council respondent stated that:

"Hardly any formal samples are taken for enforcement purposes. Analysts seem reluctant to do formal samples that will lead to court proceedings. Sample turnaround times from analyst just not suitable for formal action – too long. 20 years ago 200 samples a year would have been taken now about 20 as a maximum. The more samples that are taken will impact further on turnaround times." (Inland city council)

England versus Scotland, Wales and Northern Ireland

- The trends differ between England and other countries.
    - Sampling levels have remained higher and more constant over the years in Northern Ireland, Scotland and Wales than in England,
    - The rate of food sampling is far higher in Scotland, Northern Ireland and Wales, and
    - In Scotland, Northern Ireland and Wales the number of samples taken is related to the number of establishments in each LA – suggesting a practice of linking the volume of sampling to the size of the food sector in these countries.

District, county, unitary, London and Metropolitan authorities

- The rate of sampling is not related to the number of food establishments in English LAs (except within county councils), suggesting that there may be a higher degree of locally determined policy and practice in England; and
- Some English LAs carry out zero or very low rates of food sampling.

2.2 Trends for PHAs

It is clear, as per Figure 1, that there has been a large increase in testing of non-animal food imports since 2010 after the introduction of new high risk food and feed test requirements for FNOAO. The total number of samples rose from 4,122 in 2009/10 to 8,394 in 2011/12, a rise of 4,272 (104%) between 2009/10 and 2011/12, before falling to 6,404 in 2012/13.

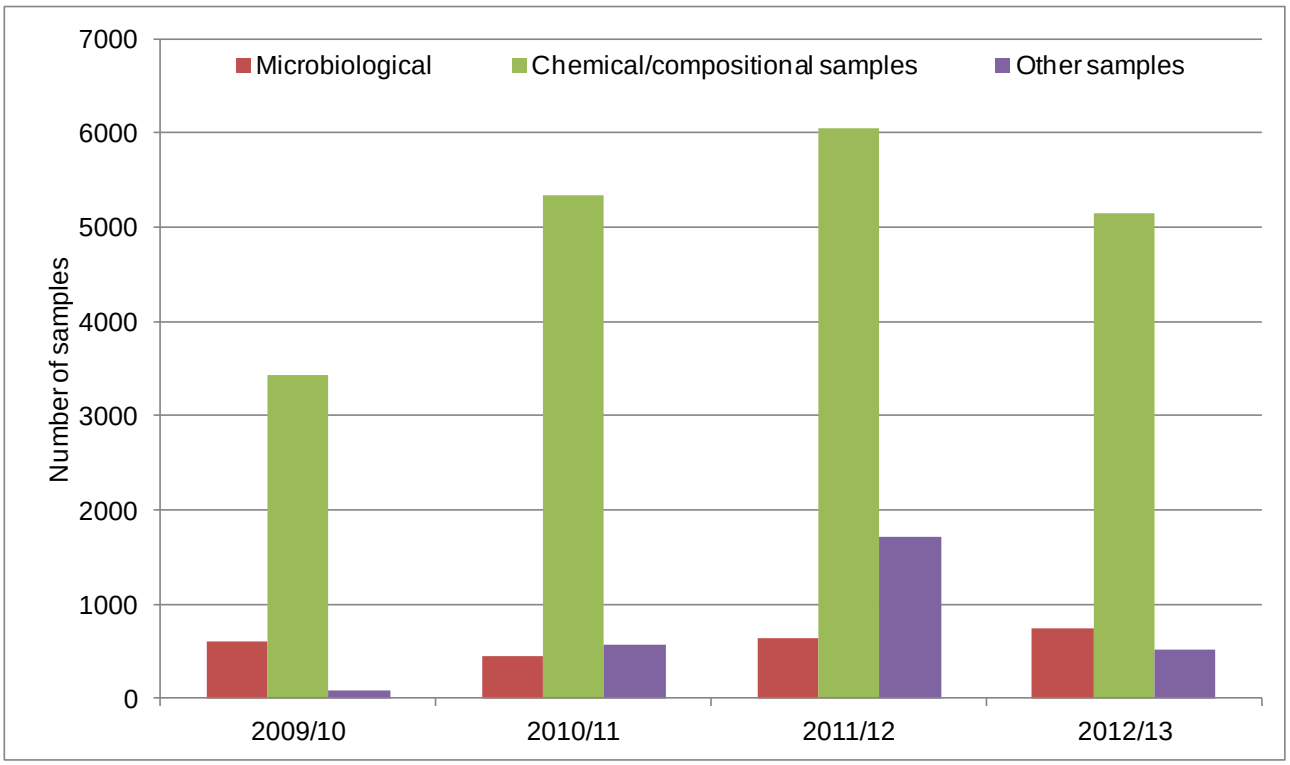
Samples are categorised as microbiological, chemical/compositional and finally "other". Agency data indicates that for 2009/10 to 2011/12:

- 38% of the increase is due to more "other" samples;
- 61% of the increase is due to more chemical/compositional samples – of which 77% were of FNOAO in 2011/12; and
- Only 0.7% of the increase is due to microbiological samples.

Samples of FNOAO equalled 79% of all PHA samples in 2011/12.

During the period 2009/10 to 2012/13 the number of consignments fell by 4%.

Figure 1: Trend in number of animal and non animal food tests at UK ports



2.3 Trends in inland LAs

2.3.1 Analysis of LAEMS

Figure 2 shows by type the decline in the number of analyses. Broadly speaking microbiological analyses relates to food hygiene whilst composition, labelling and presentation relate to food standards. It can be seen that:

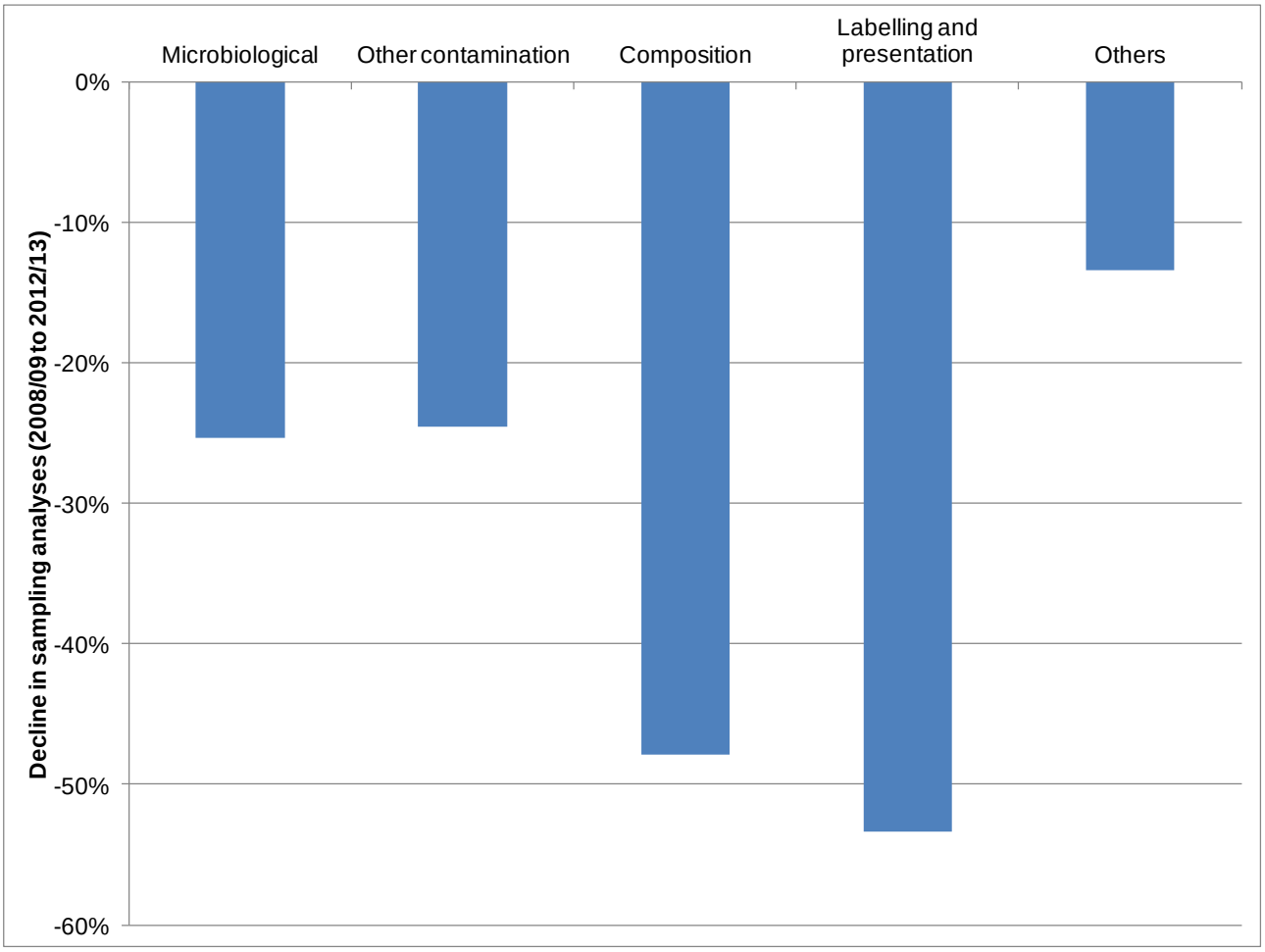
- The number of composition, labelling and presentation analyses has declined far more than microbiological analyses;
- There is a 47% fall for compositional testing;
- There is a 53% fall for labelling; and
- There is a 25% fall in microbiological testing.

As per the data shown in Table 5:

- Composition, labelling and presentational analyses have fallen from being 41% of all analyses to 31% of all analyses; and
- In 2012/13 microbiological testing equated to 62% of samples analyses, compared to 53% 2008/09.

The Agency funded national sampling programme equates to just 1% of all microbiological tests. Thus, any changes in the Agency national programme would not impact the overall trend in microbiological testing.

Figure 2: Change in sampling analyses by type of analysis (UK)



2.3.2 Rapid survey results

Figure 3 and Figure 4 show the nature of trends, cited by rapid survey respondents, for the level of food hygiene and food standards sampling respectively. It can be noted that the food hygiene and food standards trends are similar. Sampling as part of prosecutions and investigations is, for most respondents, unchanged. FSA funded sampling has increased. Locally funded sampling and PHE funded sampling has declined. EU prescribed sampling has remained the same for most (inland) respondents. Most PHAs report an increase in EU prescribed sampling.

Food hygiene

- Official samples taken as part of prosecutions or response to incidents have remained the same for two thirds of respondents, with a minority reporting increase and a minority reporting decreases in these types of samples;
- Official samples taken to fulfil EU prescribed sampling requirements have remained about the same for two thirds of respondents, decreased for a quarter and rose for about 12%;
- The majority of respondents (59%) report a decline in food hygiene samples funded by their LA, with just 9% reporting an increase, and 32% reported no change;

- FSA grant funded food hygiene sampling is reported to have increased by half of respondents (49% - mostly split between a little and moderately), a third reporting no change and just 15% a decline; and
- PHE funding for food hygiene sampling is reported to have declined by 44% of respondents, stayed the same by 42% and risen by 14%.

Thus, the main trends for food hygiene sampling are less locally funded and less PHE funded sampling, with an increase in FSA funded sampling from close to none to a very small amount.

For food standards

- Official samples taken as part of prosecutions or response to incidents have remained the same for two thirds of respondents, with a quarter reporting increase and about 13% reporting decreases in these types of samples;
- Official samples taken to fulfil EU prescribed sampling requirements have remained about the same for two thirds of respondents, decreased for a quarter and rose for about 17%;
- The majority of respondents (62%) report a decline in food standards samples funded by their LA, with just 9% reporting an increase, 29% reported no change;
- FSA grant funded food standards sampling is reported to have increased by half of respondents (49% - mostly split between a little and moderately), a third reporting no change and just 13% a decline;
- PHE funding for food hygiene sampling is reported to have declined by 30% of respondents, stayed the same by 60% and risen by 10% - (with 20 respondents for this question noting that PHE primarily funded microbiological testing).

Thus, the main trends for food standards sampling are less locally funded and less PHE funded sampling, with more FSA funded sampling.

Figure 3: Food Hygiene sampling trends

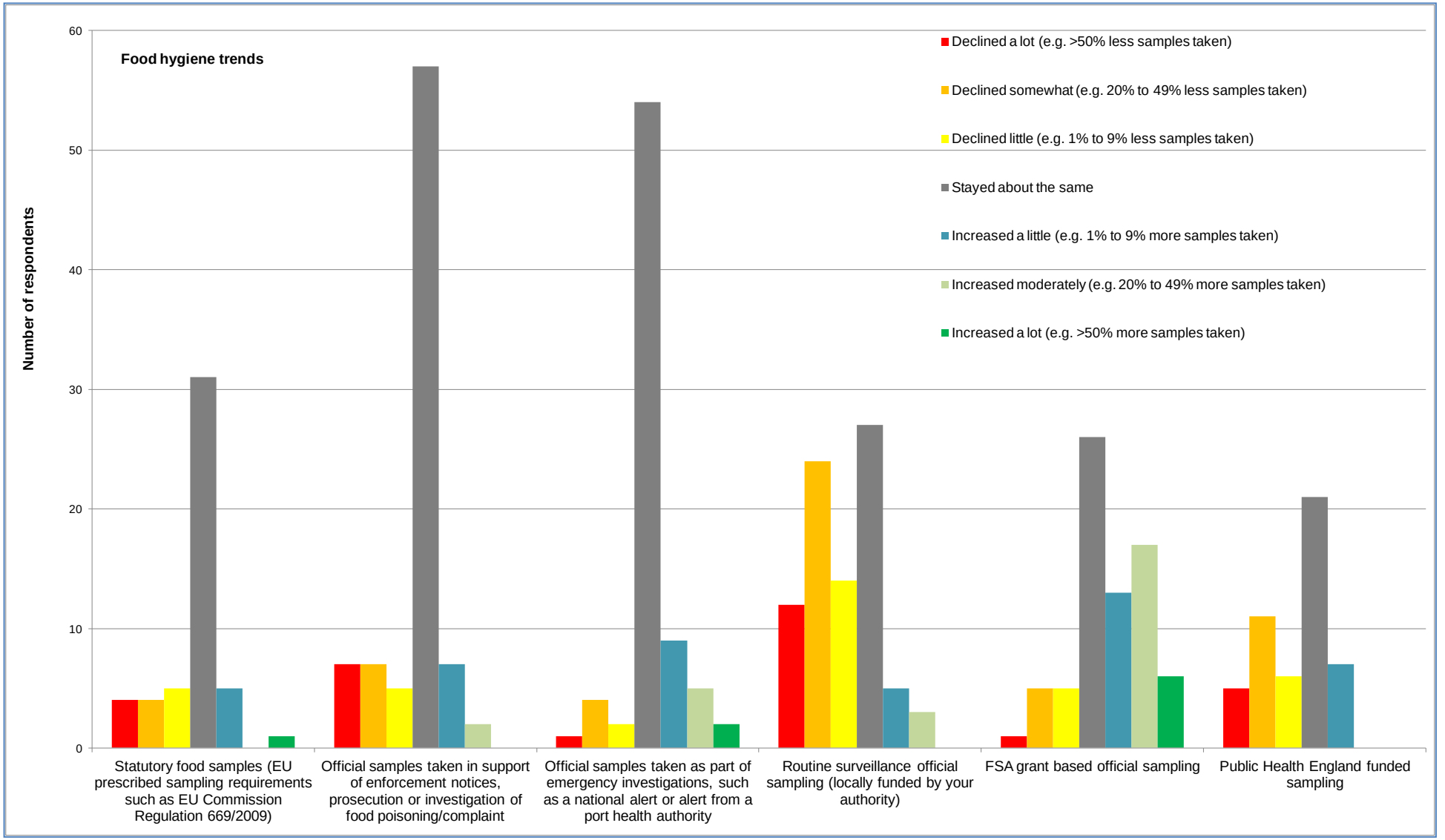
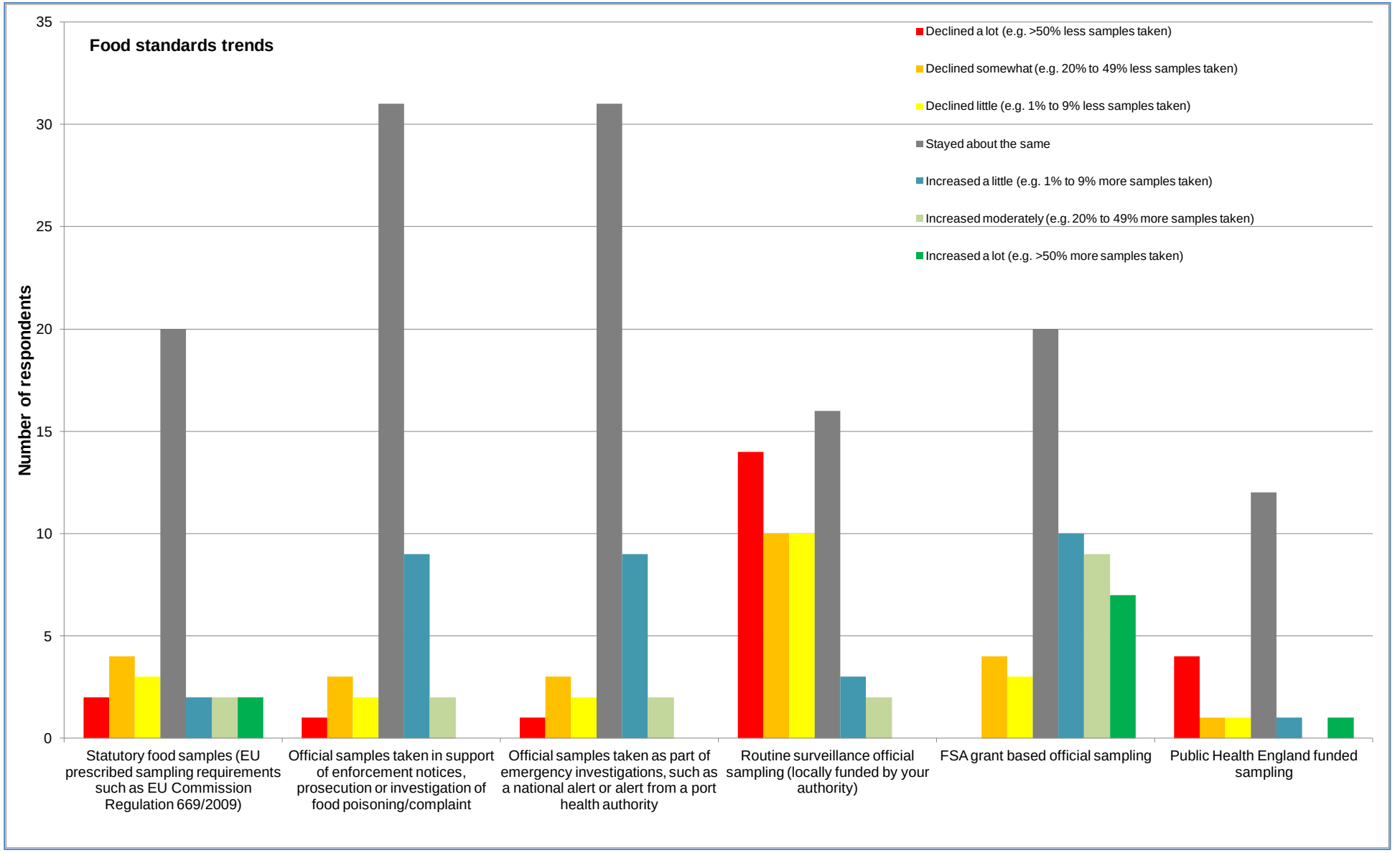


Figure 4: Food standards sampling trends



2.3.3 Comparison of trends by country

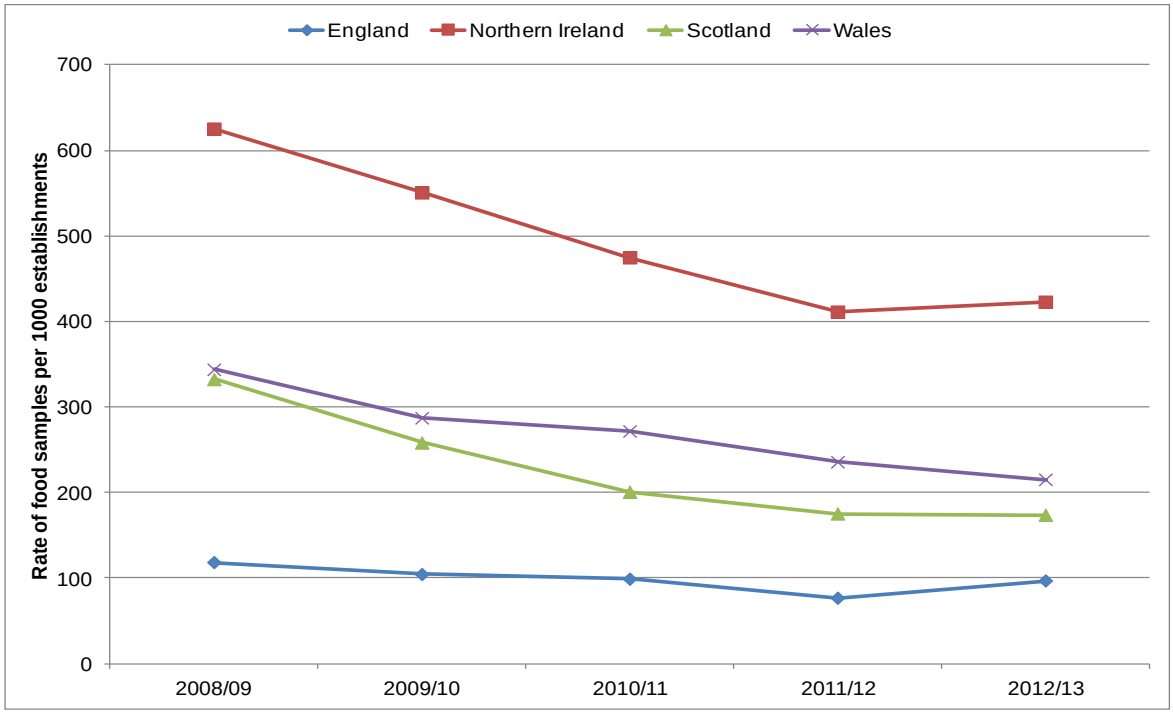
There were major differences in the rate and pattern of sampling between UK countries and types of LAs, as well as between food hygiene and food standards.

Northern Ireland, Wales and Scotland have reported higher rates of food sampling than England since about 2004/05. This remains the case in 2012/13.

Figure 5 shows total food samples per country for 2008/09 to 2012/13. The rate of sampling declined in all countries, 29% in the UK, and 48% in Scotland, 18% in England, 32% in Northern Ireland and 37% in Wales.

Data is not available to assess trends for food hygiene and standards separately for each country. In England and Wales the rate of food standards sampling fell by 38% compared to a 19% fall in food hygiene sampling between 2009/10 and 2011/12.
Thus, the rates of samples have fallen most in Scotland, Wales and Northern Ireland but from a far higher starting point than England. Rates of sampling remain far higher in Scotland, Wales and Northern Ireland in 2012/13 despite the particular falls in these countries. It should be noted that the number of samples in 2012/13 may have been "boosted" by the response to the "horsemeat scandal".

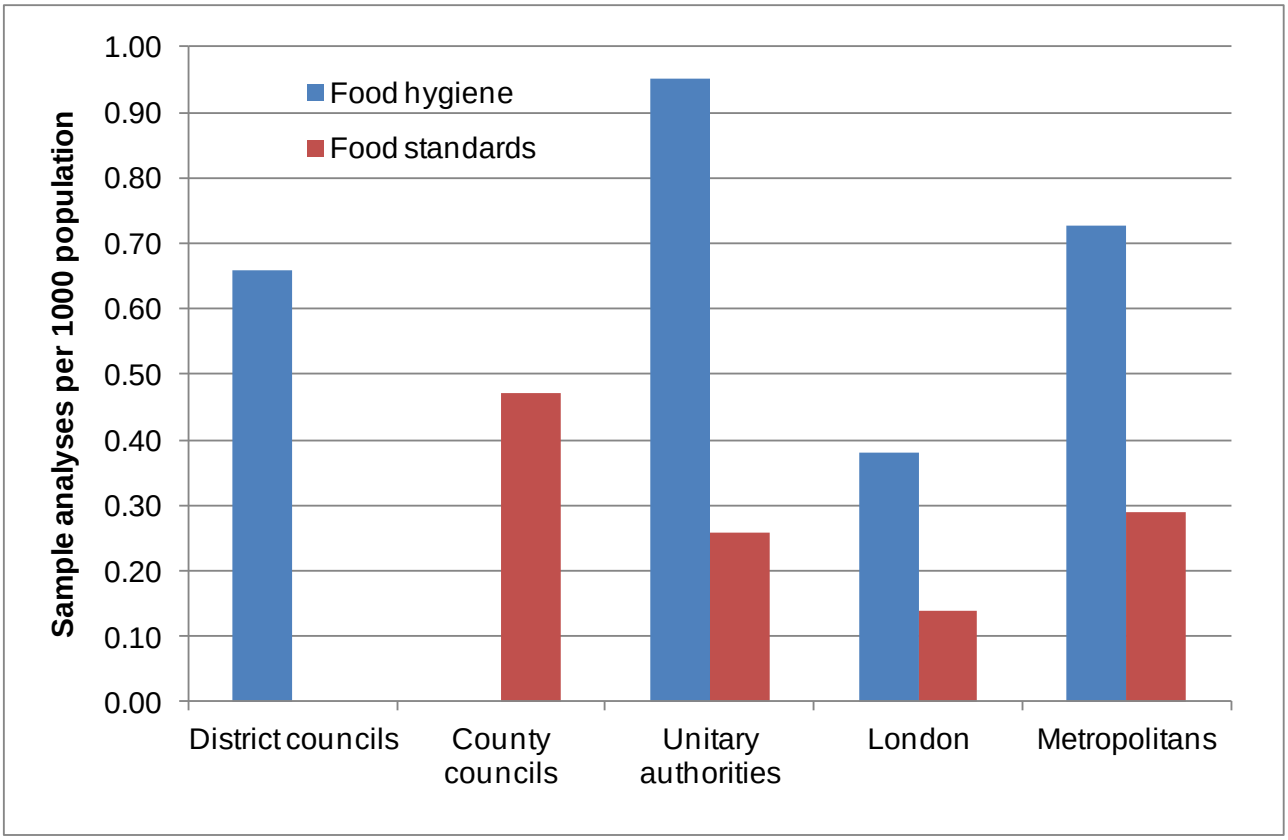
Figure 5: Trends in food (hygiene & standards) sampling by country (2008/09 to 2012/13)



2.3.4 Comparison by type of English LA

As shown in Figure 6, the rate of sampling varies greatly between the types of English LAs, with London borough councils reporting the lowest rate of sampling. It should be noted that English county councils do not enforce food hygiene and English district councils do not enforce food standards.

Figure 6: Sample analyses per 1000 population (English LAs, 2012/13)



3 CAUSE OF TRENDS

3.1 Overall findings

The main reasons cited by rapid survey respondents for changes in the level of sampling are shown in Figure 8 and Figure 9.

Main factors

The reasons for trends cited by rapid survey respondents are ranked from most to least cited in Table 1. It can be noted that:

- The prioritisation of other work is the highest rated reason for the decline in food standards sampling, followed by tightened budgets and risk based sampling; and
- The adoption of risk based sampling is the highest rated reason for the decline in food hygiene sampling, followed by prioritisation of other work and changes to budgets.

Further it should be noted that the factors need to be considered as a whole, in that:

- Reduced budgets and staff combined with the need to maintain statutory levels of premises inspections lead to less food sampling and so a greater demand for risk based sampling; and
- As there are no prescribed levels of food sampling (whilst there are statutory inspection frequencies) there is greater flexibility to reduce the level of sampling than the level of inspection.

The free text comments about food hygiene sampling from the rapid survey respondents focused on budget cuts more than the ratings of reasons given by rapid survey respondents in Figure 9. Examples of free text responses are given in Table 2 and Table 3 that illustrate the cited reasons for the sampling trends.

Differences between food hygiene and food standards

The main reasons cited by rapid survey respondents for trends differ *somewhat* between food hygiene and food standards. The main differences being:

- Central funding and national co-ordination from PHE for food hygiene sampling has helped to reduce the amount by which food hygiene sampling has declined;
- As food standards tests cost more than food hygiene tests, they are a greater candidate for budget savings;
- There has been a greater reduction in staff and budgets for food standards than food hygiene;
- There may have been an impact from the dilution of Trading Standards skills in respect of food, and;
- There could be a possible prioritisation by Trading Standards of non-food issues, such as doorstep crime.

Differences between England, Scotland, Wales and Northern Ireland

The national variance in sampling rate reflects different policy approaches in each country whilst the differences between English LAs reflect local food sampling policy.

Table 1: The reasons for trends cited by rapid survey respondents (ranked from most cited to least cited)

Food hygiene	Food standards
The adoption of more targeted/risk based sampling.	Prioritisation of other inspection, regulatory and/or enforcement activities.
Prioritisation of other inspection, regulatory and/or enforcement activities.	Reduced or tightened budgets.
Changes in your budget for and / or number of EHO employed.	The adoption of more targeted/risk based sampling.
Reduced or tightened budgets.	Changes in the budget for and / or number of EHO employed.
Changes in the FSA's national food sampling surveillance programme.	Changes in the FSA's national food sampling surveillance programme.
Concerns about the value and/or effectiveness of surveillance.	Prioritisation of non-food work.
Changes in the skill base of officers undertaking sampling.	Concerns about the value and/or effectiveness of surveillance.
Prioritisation of non-food work.	Changes in the number or type of premises to be inspected (inland only).
Using ATP meters &/or other devices to screen foods.	Changes in the skill base of officers undertaking sampling.
Changes in the number or type of premises to be inspected (inland only).	Increases in statutory food sampling.
Increases in statutory food sampling.	Using ATP meters &/or other devices to screen foods.
The ability to charge for sampling and testing.	The ability to charge for sampling and testing.

3.2 Differences between food hygiene and food standards sampling trends

A number of factors are reported by stakeholder interviews and rapid survey respondents to have contributed to a lesser decline in microbiological testing, including those listed above in the differences in trends between food hygiene and food standards sampling. As chemical testing costs more than microbiological tests, reductions in funding may particularly impact on food standards testing. Increased FSA funding was cited as a factor in reducing the extent of the decline in food standards sampling.

The differences in reasons for trends, cited by rapid survey respondents, between food hygiene and food standards are not great. The same five reasons are ranked 1 to 5 for food hygiene and standards, if in different order (see Table 1). The increase in statutory prescribed sampling is not commonly cited as a factor (except for PHAs), whilst concern about the value of testing comes about half way down the list of reasons for both categories. As food hygiene sampling has been funded mostly by PHE, changes in FSA

grants (for which microbiology is a small part) has not had a major impact on food hygiene sampling.

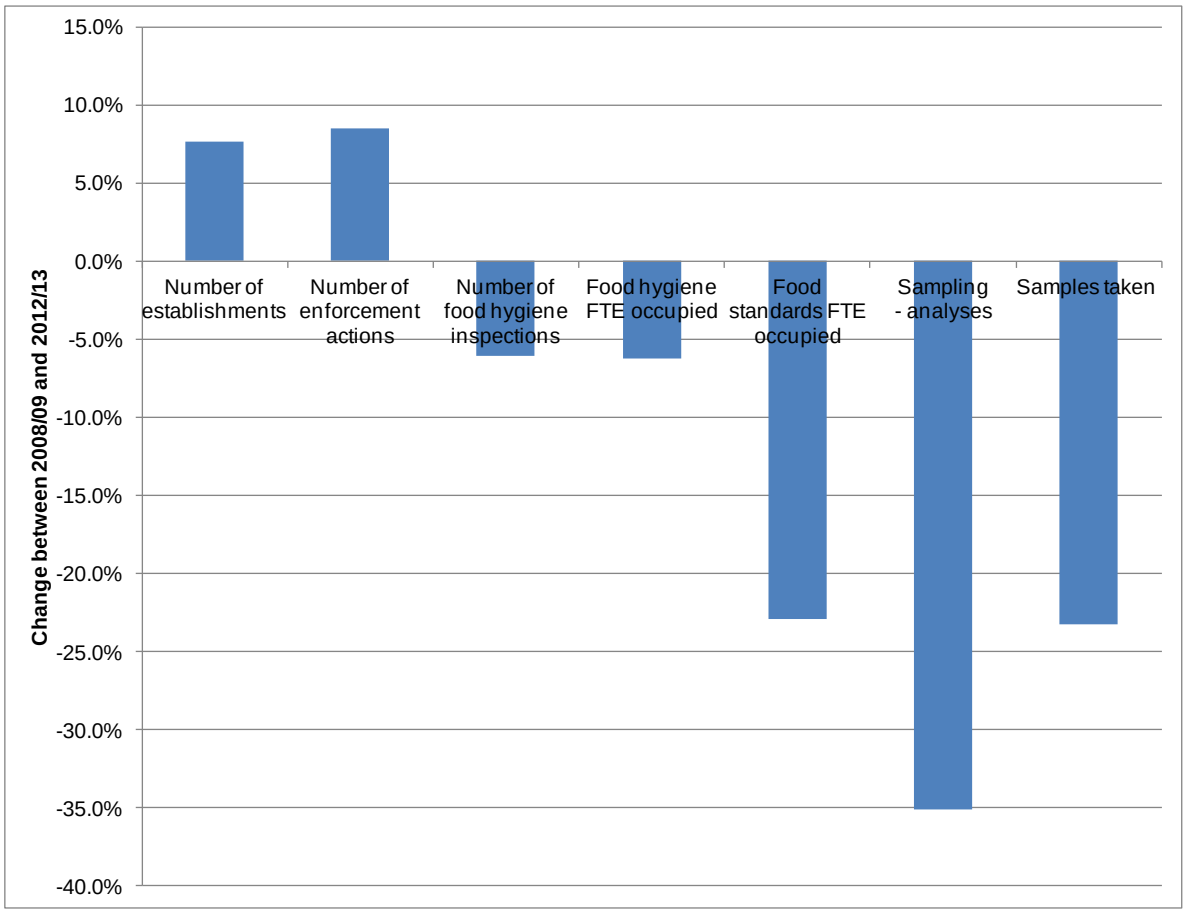
Some stakeholder interviewees noted that the use of ATP meters has led to a decline in samples being sent for official testing.

Trends in establishments, inspections, enforcement, officers and sampling

Figure 7 presents the percentage change in the number of establishments, inspections, enforcement, officers and sampling between 2008/09 and 2012/13. It can be noted that:

- The decline in the number of sampling analyses exceeds the decline in the number of samples taken – with 15% fewer analyses per sample taken;
- There has been a greater decline in food standards officers than food hygiene professionals – a 6% fall versus a 23% fall;
- The 23% decline in samples taken far exceeds the 6% decline in the number of Full Time Equivalent (FTE) food hygiene professionals but is the same as the 23% decline in FTE food standards professionals;
- The number of food hygiene inspections has decreased by 6%, which matches the 6% decrease in food hygiene professionals; and
- The number of establishments has increased along with the number of enforcement actions, both by about 8%.

Figure 7: Percentage change in establishments, inspections, enforcement, officers, and samples taken and sample analyses (UK)



It was also found that the number of people reported by the Environmental Health Registration Board[19] to have gained a degree in Environmental Health remained steady in the period 2004 to 2010 (at about 200 per year) but then fell by 70% between 2010 and 2013 (60 registered), with falls in 2011 and 2012 also reported. The number of new registered degrees in 2000 to 2010 was 200 compared to 262 in 1990 to 1999. This does not indicate a major change in newly qualified Environmental Health professionals until 2011, i.e. after the number of food samples started to decline.

Food hygiene sampling

The feedback on funding was mixed. It was suggested that the central funding system operated by PHE and the maintenance of funding was a key factor in the extent of microbiological sampling. However, it was identified that the level of PHE funding and the availability of staff to carry out sampling have reduced. Food hygiene samples are paid for (sample analysis and courier fees) by PHE public health grants and thus there has been less change in the number of microbiological samples being taken. PHE allocate sample credits to each LA and historically this has been based on the size of population in the LA area. It is reported that there is an allocation system with PHE so that LAs can choose what to sample up to the limit. PHE covers the costs of the food examination, not the administration and interpretation costs of the LA. LAs would need to pay for their EHO's time to collect the samples and the associated administration costs.

The national co-ordinated sampling programme is managed by the PHE. Sampling programmes are risk-based and are selected through consultation with the National Food Hygiene Group and associated intelligence gathering. The LAs sign up to the national sampling programme and decide how much they would sample depending on their local issues and the staff resources they can allocate.

Factors of particular importance for food standards

These points are elaborated below:

a) Changes in funding.

- Whilst most food standards samples used to be locally funded, the reduction in LA funding has led to a greater decline in food standards samples, with greater reliance on central funding from the FSA in many, but not all, cases;
    - A stakeholder noted that *"Reduced budgets have had an effect on the availability of qualified officers for sampling work. Some LAs may not have enough qualified officers to actually do FSA grant work and hence do not make bids for FSA sampling projects. There is a growing trend to employ external contractors (e.g. retired Trading Standards Officers) for Trading Standards visits but these contractors would unlikely be doing sampling work."*
    - A stakeholder noted that "*Although not uniform across all LAs, there has been a LA budget reduction of approximately 30%. With such severe budget restrictions, food sampling work does not have same prioritisation as it once had. Fewer people are now doing more work."*
- The reduction in local funding varies between inland LAs;
- Apart from FSA grants there is no other direct (national) funding for Trading Standards food sampling;

[19] http://www.ehrb.co.uk/registers.html

- Food standards analysis fees are relatively expensive and LAs are unable to afford much sampling work outside the FSA grant projects;
- There are far fewer Trading Standards Officers in the food safety area than in Environmental Health food hygiene, reducing the capacity for food standards sampling;
- LA budgets have been decreasing and there has been a change in LA priorities; and
- Food sampling is just one of many areas that LAs service. Within Trading Standards teams, more resources are required for other areas such as doorstep crime.

Some quotes to illustrate this include:

> *"In the last few years there has been much more of a reliance on FSA grant money for food standards surveillance sampling. Food standards sampling this year will most likely be entirely funded by the FSA. ...Over 90% of food standards sampling work relies on FSA grant monies and the LA is moving towards their feed and food standards surveillance sampling being almost completely funded by the FSA. Any decrease in this FSA funding would result in a drop in (LA) sample numbers."*

In one case FSA funding has led to more sampling:

> *"...in the last three to four years there has been a wider scope of sampling work with the FSA specialised projects*." (County council)

The variable reduction in local funding is illustrated as follows:

> *"There has been a reduction in the sampling budget but the LA has probably been less hard hit than other LAs, regarding reduced LA-funded sampling budgets, due to the .. local economy being strongly based on farming and food."* (Rural county council)

> *"Sampling in the ...LA has remained fairly high and high-risk products are sampled as much as possible. The food safety budget has been kept the same and the sampling allocation has been maintained.... The value of the sampling programme is recognised and sampling budgets have been maintained. In the LA's area there are a large number of shops selling imported foods"* (Urban LA)

The latter two examples highlight cases where the LA considers food safety to be a particularly important issue and so justifies maintaining food sampling programmes.

In addition respondents stated that:

- Chemical sample analysis costs are very high and this has resulted in fewer samples being taken;
- A stakeholder noted that:

  > *"As food fraud is becoming more sophisticated, Public Analyst (PA) laboratories need to buy more, expensive, newly-developed instruments. In some instances this has had a knock-on effect where sample fees have been extremely high for new tests and LAs cannot afford to submit samples for those tests. Although new test fees do decrease over time, they are difficult for a LA to justify initially."*

- LAs do not necessarily allocate a budget specifically for sampling;
- The reduction in LA self funding has led to surveillance sampling being more risk-based. One example is:

  > *"More time is being spent on trying to get information on raw material costs for detecting potential food adulteration issues. For example, if the price for*

almonds increases there is a higher risk that almonds could be adulterated with cheaper peanuts and then more verification sampling would need to be done instead of routine sampling." (Stakeholder)

- Sample analysis fees have become more expensive with the reduction in the number of laboratories;
- PA laboratories have closed and so LAs have a limited choice. The loss of PA skill sets may have had an effect on the number of food surveillance samples being submitted. Some PAs have high set-up fees and struggle with economy of scale.

b) Changes in skill base.

One stakeholder noted that:

- The number of specialised officers is declining and more generalist officers are working for LAs. Some LAs are not large enough to support specialised officers and officers are now doing a wider range of work;
- With cuts in LA managerial positions, it is more common to find managers who have had no Trading Standards background and these people are not the best advocates for promoting Trading Standards activities.

Another stakeholder noted that:

"There are concerns that the formal sampling skill base of Trading Standards officers is being diluted by having so many informal samples being taken."

c) Non food priorities.

A stakeholder noted that:

"*With Trading Standards officers being used in other, non-food, work there is continual loss of expertise in the food product safety area. The number of regulations keeps increasing and it is difficult for LAs to maintain an adequate level of expertise in food safety.*

Trading Standards doorstep work has increased and there have been more instances of burglars posing as traders. Protecting vulnerable members of the public would always take priority over other Trading Standards work."

Figure 8: Reasons for trends in level of food standards sampling

Figure 9: Reasons for trends in level of food hygiene sampling

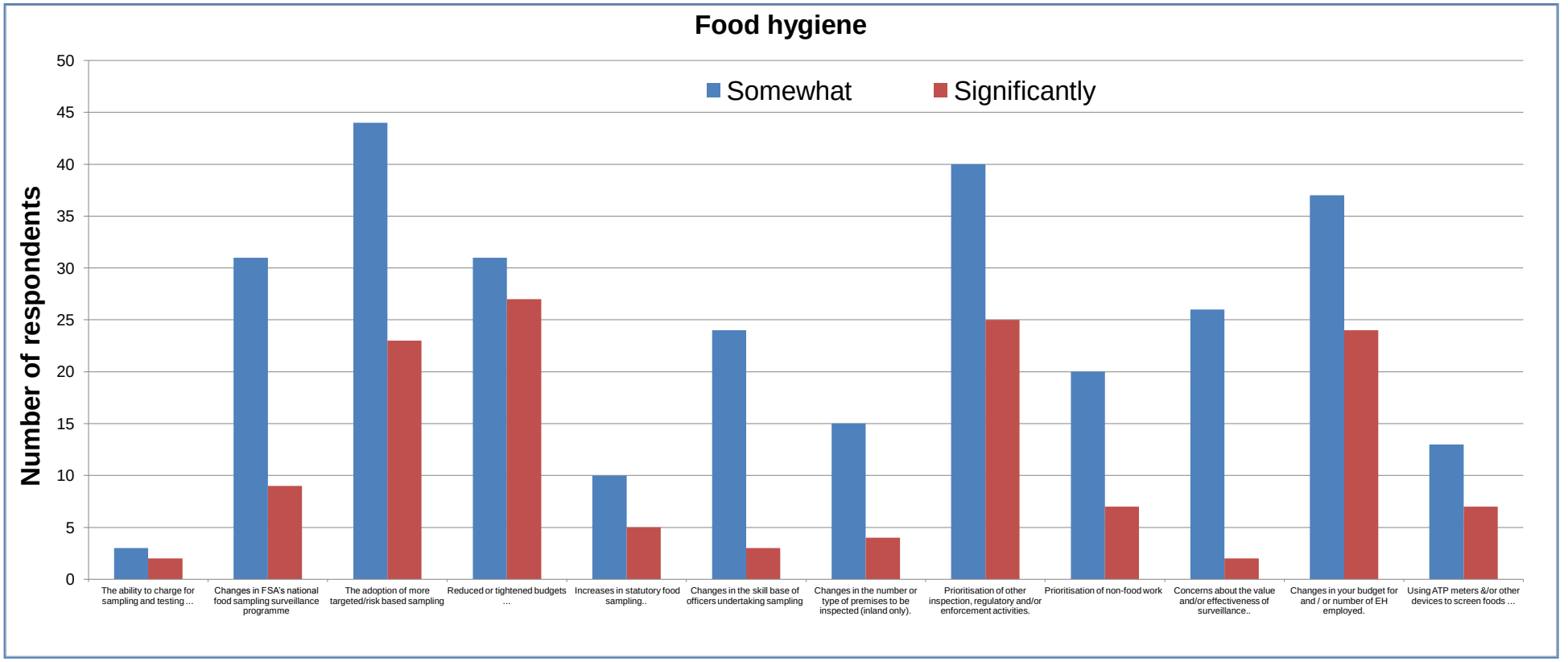


Table 2: Summary of free text responses on reasons for trends in food standards sampling

Risk based sampling	FSA funding	Other funding comments	Funding reductions and changes in priorities
Rapid survey comments "Routine sampling has become more targeted and this has resulted in fewer samples being taken." "The levels of routine surveillance sampling have changed mainly due to changes in risk rating, competing priorities and more targeted working."	Rapid survey comments "FSA funding has helped to increase the amount of sampling." "Increased a little due to FSA Wales funded sampling, via survey work - including regional working and reactive sampling work, i.e. horse meat."	Rapid survey comments "Our sampling budget has been cut over a number of years and is now only able to fund sampling connected with investigations, where we already believe there are infringements. The only surveillance sampling we undertake is that funded through the FSA National Sampling Programme, which we try to maximise. We have suffered a reduction of more than 50% in the number of officers who are food qualified, so the remaining officers now work extremely hard to complete food work and retain it as a priority in the authority." "Budget pressures mean we have fewer officers who are expected to complete a wider range of work where they used to be food only. Some senior expertise has been lost. Budget for samples is under pressure and relies on FSA funding." "Greatly reduced sampling budget and reduced staff resource."	Rapid survey comments "Most significant is the cut in budget for analysis. There has also been a move away from routine survey work as this is thought to have less impact than other Trading Standards work which is 'intelligence led' i.e. based on complaints, or business support." "The reduction in budgets and competent qualified staff has meant for a more structured approach in every aspect of food enforcement including sampling. We have to take a more intelligence led approach." "Staff having to take on non food standards duties including merging Animal Health, Feed Standards, Age Restricted Goods enforcement."

Table 3: Summary of free text responses on reasons for trends in food hygiene sampling

Risk based sampling	Ring fenced funding	Budget & staffing	Statutory inspection rates	Screening
Rapid survey responses "Reduction in budgets. Move to intelligence led enforcement." "Reducing staff resources and having to maintain other statutory activities, e.g. inspections, complaint investigation against a backdrop of continual, annual reduction in Env. Health budgets."	Stakeholder interview responses "Sampling and testing undertaken each has its own credit allocation. Far easier than trying to determine financial budgets." (District council, stakeholder interview) "The local budget for sampling has been protected unlike other LAs. Local funding is via the .. (Region) and the area grouping. In the last three years sampling (in this district council) has gone up. This is driven by the six authorities in (the area) having a credit allocation for sampling divided between them. If some authorities do not use their whole allocation this can be used by another LA within the group. One LA does very little sampling so more being done in (this council)." (District council, stakeholder interview)	Rapid survey responses "Lack of officer time as greater emphasis is placed on reaching food hygiene inspection targets." "Due to LA cuts the sampling officer was made redundant in 2011 which resulted in a significant reduction in the number of samples taken as this was coincided with another 2 members of the team being made redundant at the same time." "Budgetary constraints - food sampling is an 'easy hit'." "Numbers of samples taken at this authority have declined by approx 10 - 15% in the last three years. The primary reason for this is a decline in	Rapid survey responses "Lack of officer time as greater emphasis is placed on reaching food hygiene inspection targets." "Savings were offered in respect of food sampling as there was not prescribed level of sampling required and this efficiency saving was accepted. It resulted in moving from having a full time food sampling officer to having a part time food sampling officer." "Due to staff cuts, our priorities are inspections, regulatory and enforcement activities."	Rapid survey responses "Microbiological swab sampling was not done before 2008 as this facility was not available. Since the introduction of swabs there has been an increase in swab/dish cloth sampling to support visit findings and enforcement." (Inland Unitary Authority)

Risk based sampling	Ring fenced funding	Budget & staffing	Statutory inspection rates	Screening
		staffing levels meaning that there is less staff time available for sampling activities.”		

3.3 Reasons for trends within PHA sampling

The trends in sampling by PHAs are primarily driven by statutory testing requirements.

It is reported from stakeholder interviews that:

Role of 669/2009 controls

The volume of required checks/sampling under EU legislative controls has increased due to 669/2009 controls.

As the costs for the statutory sampling are cost recoverable from the importer, there are no funding issues. As stated:

> "*Since the introduction of 669/2009 and 1152/2009 controls from 01.01.2010 funding of FNOAO official controls has greatly improved."* (PHA)

One PHA also noted that:

> "*The sampling is also influenced by Annex K in the Defra National Monitoring Plan – here frequency set to 1% of all physicals i.e. 100 samples send 1 to Defra."*

The scope of testing reflects the scope of official controls as follows:

> *"Although PHA's can recover costs for statutory* FNOAO*, they cannot recover costs for* POAO *unless they specifically fall under an EU legislation. For example, cooked and peeled prawns previously imported used to have high bacterial plate counts and now, with increasing volumes of raw prawns being imported, sampling needs to be done but these costs would need to be paid out of the PHA's budget. Sampling Peruvian seafood for hepatitis, on the other hand, would be cost-recoverable because that falls under EU legislation."* (Stakeholder)

It is reported that:

> *"The cost recovery elements of the statutory controls are a significant advantage to sustain the operation of the service."* (PHA)

> *"The funds available from local budgets are insignificant and therefore will not impact greatly on the overall service."* (PHA)

> *"There has been a tightening of the PHA's budget and so most sampling is either statutory or with FSA grants."* (PHA)

Non statutory sampling

Sample numbers for non statutory sampling have remained constant, at relatively low levels. It was also reported that:

- There is a small amount of PHA money for sampling non-statutory products that are more likely to have a potential failure;
- There has been an increasing reliance on FSA grant money in order to conduct surveillance sampling;
- FSA food surveillance sampling has remained constant;
- Statutory sampling does influence the available resources to conduct other surveillance work; and
- Very little sampling is done outside the recoverable statutory sampling.

It is reported that:

"*Routine sampling has decreased as PHA budget allocations have diminished. Apart from emergency sampling, a good reason is needed to take a routine sample*." (Stakeholder)

"*Some City Councils have the attitude that their PHA ought to be just taking statutory samples as those food products have already been identified as being high-risk."* (Stakeholder)

"There is a small sampling allocation set aside for emerging risks or linked risks, e.g. Brazil nuts imported from Brazil are on the 669/2009 list for aflatoxin testing but non-statutory samples are taken for the same nuts being imported from Peru." (PHA)

[We] "*Aim to sample food products stated on Rapid Alert System for Food and Feed (RASFF) alerts but this can get expensive. It can take a long time for repetitive RASFF products to get on the 669/2009 statutory list where cost recovery can be implemented."* (PHA)

Thus, some PHAs do aim to do some sampling outside of statutory requirements, at a relatively low level due to budgetary issues. This may focus on emerging risks and products cited on RASFF alerts.

A stakeholder stated that:

"*At some ports, .. the volume of imports is currently at their highest level. There is no new funding for extra staff .. so staff resourcing is restricting any further non-statutory sampling. There is competition among the operators of the larger ports so trade is constantly changing and PHAs would typically not have the staff resources to do extra sampling if volumes of imported higher-risk food products increased."*

A large PHA goes on to say that:

[They] "*Would like to do more non-statutory surveillance sampling, especially with non-statutory RASFF alerts, but this type of sampling would need to be taken out of the limited PHA budget. Fortunately, if there are a high number of RASFF alerts for a particular product, then emergency controls would come into effect and then sampling activity would be cost recoverable."*

Factors having little impact

Changes in staff competence and other enforcement work are reported to have had no affect on the level of sampling activity by PHAs. If anything, PHA assistants help take samples, presumably to help meet increased testing workload.

The extent to which non-statutory sampling has changed reflects local view of importance of sampling, as illustrated below:

"..the (non statutory sampling) budget is still in place; the value is recognised by the PHA."

A caution

Whilst changes in PHA staff competence are not cited as a factor to date, one respondent noted that:

"*Some authorities are starting to introduce the locality working concept where authority staff are expected to be generalists and work in different roles such as a food officer, a pollution officer, housing officer, etc...There is a concern that generalist workers would take much longer to be good food safety regulators. Generalist staff would not be trained fully and would not have had the depth of work experience to keep up with changes in legislation, food sampling protocols, etc."* (PHA)

The rapid survey noted that comments from PHAs also cited the role of EU prescribed sampling requirements.

> "*Changes in the quantity of sampling undertaken at the port is the result of changes in Annex 1 of 669/2009 on a regular basis. It is also due to the implementation and/or revocation of specific European legislation."* (A PHA)
>
> *"Increases in the volume of sampling has mainly been due to changes in European legislation, mostly Annex 1 of 669/2009 and will rise and fall in accordance with products which are imported through this port."*
>
> *"Routine surveillance at points of entry is crucial in identifying new and emerging risks in products imported from outside the EU, for this reason our level of sampling and our budget to do so has remained stable."*

3.4 Factors reported to have had no major impact

The following factors were reported within stakeholder interviews to have **not** impacted trends in sampling:

- Prioritisation of other inspection, regulatory and/or enforcement activities. Surveillance sampling work is reported to have not changed due to any other activities;
- Concerns about the value and/or effectiveness of surveillance and monitoring food samples;
- Number of establishments. There have been no major changes in the number of establishments, with one exception namely a Scottish authority that reported registering home bakeries, child minders and nurseries adding to workload;
- Staff competence (food hygiene). There have been no major changes in the competence of food hygiene staff; and
- Statutory testing requirements. As inland LAs are not covered by statutory work this has had no affect on their sampling.

Indeed, as regards to the importance of sampling, it is reported that:

> "*With premise visits decreasing, surveillance sampling has even more importance. Sampling data helps prioritise future visits over routine visits and identifies issues at premises that are not visited."* (Inland Unitary Authority)
>
> [We have] "*No concerns about the value of food sampling and thus no reduction in sample numbers because of this*." (Inland Unitary Authority)
>
> *"Surveillance sampling is very important for detecting new emerging risks and more sampling should be done where possible*." (Small PHA/inland LA)
>
> "*Food sampling is considered effective. If targeted properly, even informal surveillance sampling is very effective*." (Urban LA)

However, it was noted that the reduction in funding has contributed to more risk based and targeted sampling.

3.5 Reason for differences between UK administrations

The lower rate of sampling reported for England than the rest of the UK appears to relate to the local policy regarding sampling and associated budget. As noted below, Scotland

and Northern Ireland have historically had guidelines on the rate of sampling. No guidelines on the rate of food sampling have been advocated by the FSA for England.

Wales

A Welsh unitary authority stated that:

> "*The sampling frequency is unchanged so the trend is constant. LA budget allocation for sampling has stayed static...Budgets have stayed intact for sampling*."

Scotland

A Scottish city council noted though that the number of food hygiene samples had reduced. Whilst previously having a guideline of 3 samples per year per 1000 population for chemical samples and two per 1000 population for microbiology, this is no longer achieved, falling to about one third of this. Nonetheless, the guideline had a role in the number of samples taken.

The Scottish Food Enforcement Liaison Committee said[20]:

> "*Historically, local authorities in Scotland recognised a sampling target of 2 samples per 1000 population for microbiology and 3 samples per 1000 population for chemical samples. Compliance with this target has reduced over the years...*"

Northern Ireland

The Northern Ireland respondent noted that the number of chemical samples taken per year has remained consistent over the past 10 years. This is reported to be due to a policy that the number of chemical samples budgeted each year is based on the population number (approximately 2 samples per 1000 people).

Feedback from the FSA Northern Ireland office indicated that the relatively higher rate of sampling in Northern Ireland was related to a number of points including:

- There had in the past been a standard World Health Organisation guide of 2.5 food standards samples per 1000 population that was advised to LAs. In more recent years a guideline of 1.5 samples per 1000 people has been cited. Whilst LAs in Northern Ireland may not achieve these guidelines, they nonetheless offer a framework for LAs;
- In respect of food hygiene, microbiological sample examination is provided as a service from the Northern Ireland Public Health Laboratory (NIPHL). Sample numbers are agreed between the Laboratory Food Examiner and the Northern Ireland Food Liaison Group (NIFLG). Historically there has been no charge made of District councils;
- LA officers in Northern Ireland have a tendency to use their sampling quotas to help small businesses comply with the range of food compositional and labelling legislation and also use the micro sampling as an educative tool towards validating HACCP/Safe catering and also raising general hygiene practices;
- The Northern Ireland FSA funds five annual visits between the Public Analyst and local Environmental Health Officers. During the visits the officers benefit from the knowledge of the Public Analyst and are able to consider his recommendations regarding future sampling;

[20] Scottish Food Enforcement Liaison Committee, Enforcement Resources Group. September 2011. Effective food sampling, Guidance for local authorities.
http://www.food.gov.uk/multimedia/pdfs/enforcement/effectivefoodsamplingguidance.pdf

- The Northern Ireland Strategic Committee evaluate Northern Irish sampling results on UKFSS and produce annual reports highlighting areas for concern and need for specific targeted sampling. These reports are published annually and made available on the FSA web pages;
- The NIFLG evaluate information on sampling and make recommendations to District councils on what to sample and provide a template for sample planning at a local level.

Thus, guidelines on the rate of food standards sampling and central funding of microbiological sampling combine with a defined role for sampling, a central advisory service for sample plans and a clear process for results being fed into future plans.

3.6 LA food sampling policy

3.6.1 Sampling levels

The rapid survey asked respondents about current food sampling policy and practice. None of the respondents indicated that they had a policy of completing zero food samples. However, the analysis of LAEMS data found that a small minority of LAs had reported zero food samples being taken. As noted in section 7.7, it is apparent from LAEMS data that in 2011/12:

- Six out of 33 London boroughs report zero food standards samples, with three reporting zero food hygiene samples;
- Three of the 37 English metropolitan authorities report zero food standards samples;
- Eight of the 56 English unitary authorities report zero food standard samples, with three reporting zero food hygiene samples; and
- Thirteen of the 201 English district councils report zero food hygiene samples.

By contrast, none of Scottish, Northern Irish or Welsh LAs reported zero food samples.

6% of English LAs reported zero food hygiene samples in 2011/12 and 15% reported less than 1 sample per 100 establishments compared to an average of 1 sample per 6 establishments in Scotland, 1 in 5 in Wales and 1 per 2.4 establishments in Northern Ireland.

In addition, there was an immense variation in the extent to which the number of food samples related to the number of food businesses and population. In some areas, such as London, there was no association between the number of businesses and the amount of food sampling, whilst there was a strong link between the amount of sampling and number of food business/residents in Northern Ireland, Scotland and Wales.

This implies that in parts of England sampling practice reflects the specific policy and priorities of individual LAs rather than the size of the food sector and population, whilst other parts of the UK follow a more common food sampling policy. As noted in section 3.5, this was thought to reflect differences in sampling policy and guidance between the UK devolved administrations.

3.6.2 Sampling policy

The rapid survey also asked after local policy regarding different aspects of food sampling. As noted in section 8:

- Very few (8%) of LAs stated they only do surveillance sampling when funded by the FSA or where costs can be recovered (which is not possible for inland authorities);
- About 70% of respondents have a policy of sampling in support of prosecutions, enforcement and investigations as well as responding to intelligence;
- About 70% aim to participate in FSA national co-ordinated sampling;
- About half have a policy of locally funded sampling; and
- A third aim to sample imported food and somewhat more aiming to identify emerging risks.

It may be noted whilst half have a policy of locally funded surveillance sampling, half do not. Also the majority (two thirds) of LAs do not have a policy to sample imported foods.

3.6.3 Sharing data

The stakeholder interviews also explored food sampling practices. It found:

- There was mixed feedback regarding the extent of communication between authorities;
    - Some respondents stated that test results are communicated via the UKFSS and RASFF systems by many but not all authorities (both PHAs and LAs),
    - As all LAs are allowed to access UKFSS and RASFF databases this (in principle) enables the sharing of results with all authorities,
    - LAs rarely communicate results to PHAs,
    - There would be communication from a PHA with an inland LA if a failed product had moved inland, e.g. labelling problems,
    - The main communication between PHAs is via the RASFF alert system and, although there is no regional system for PHAs, port user groups would communicate issues among the ports,
    - PHAs do not tend to monitor test results from other authorities,
    - In some areas inland and PHAs also communicate amongst themselves via forums and regional groups,
    - There is no formal mechanism to communicate test results between LAs (at a local level) but they may be discussed at food liaison group meetings,
    - As the existence and activity of regional groups varies, the extent of liaison outside of sharing results via UKFSS is mixed in different areas, and
    - Communication outside of UKFSS is usually limited to unsatisfactory results.

    Some examples of “regional” liaison were cited.
- Where unsatisfactory results are communicated, authorities will act on that product or consignment as befits the severity of the issue, such as enforcement or tracing of suppliers.

It was noted that:

"*Turnaround time on samples makes it difficult to communicate unsatisfactory results in a timely fashion*." (Inland LA)

This may be inferred to reduce the motivation for LAs to share results quickly upon receipt from the laboratory.

- Upon sharing results, there is limited feedback from other LAs, Primary Authorities or the FSA unless problems are identified and then cascaded up to them. If there is a serious outbreak, for example, then this is more likely to be communicated with feedback received on actions taken;
- The range of analyses is specified by statutory and FSA grant requirements, with PA directing appropriate tests;
- There was feedback that the results of the FSA's national sampling programme are used and reviewed annually and fed into local surveillance budgets and sampling plans by LAs; and
- Whilst the UKFSS was often cited as a means of communication, respondents reported many issues that limit the role of UKFSS, such as compatibility issues. Not all authorities are on the UKFSS system, preventing the use of the main means of sharing data.

The rapid survey asked after policy and practice regarding the sharing of data and co-ordination between LAs. It was reported that:

- About two thirds aim to collaborate with other authorities to co-ordinate surveillance sampling; and
- About one third aim to use UKFSS to plan surveillance, with about 20% using RASFF and 10% using TRACES/GRAIL.

Thus, with limited reported use of UKFSS (the only formal means of sharing data), co-ordination between LAs and between PHAs relies on the extent to which specific regional food liaison groups co-ordinate food sampling. As noted, the activity of regional food liaison groups was said to vary.

3.6.4 Probability of detecting unsatisfactory results

UKFSS data for 2012 was assessed with respect to answering the following two research questions:

- Were sufficient samples analyses completed to be able to detect one or more unsatisfactory item per category of food?
- What were the 95% confidence intervals for the reported rates of unsatisfactory results per category of food?

The full analysis is given in section 9.

Probability of detecting unsatisfactory results

The statistical probability of detecting non-compliance depends on the number of samples analysed and the rate of non-compliance. For example, if the rate of non-compliance is 1%, the probability of detecting one or more non-compliant item is:

- For 10 analyses a 10% probability of detecting one or more unsatisfactory item;
- For 50 analyses a 40% probability of detecting one or more unsatisfactory item, and

- For 200 analyses it is close to 90% probability of detecting one or more unsatisfactory item.

Analysis of 2012 UKFSS data indicated that the rates of unsatisfactory results (for all analyses of all products) ranged from 0% for Campylobacter, 0.1% for Salmonella, 0.32% for undesirable substances, 0.85 for E. Coli, 1.1% for Listeria, 1.9% for constituents, 3 % for additives, 4.2% for Enterobacteriaceae and 8.8% for substitution.

If an analyst wished to be 99% confident in detecting a non-compliant item for a product with these rates of unsatisfactory results, the approximate numbers of analyses required would be:

- For a 0.1% rate of unsatisfactory results, a sample of 4500 analyses has a 99% likelihood of detecting one or more non-compliant item;
- For a 1% rate of unsatisfactory results, a sample of 500 analyses has a 99% likelihood of detecting one or more non-compliant item;
- For a 10% rate of unsatisfactory results, a sample of 50 analyses has a 99% likelihood of detecting one or more non-compliant item.

It may be noted that the rates of unsatisfactory results in previous major incidents have, on occasion, been in the order of 1%.

The data was assessed per category of foods and per type of analysis, such as substitution vs. Campylobacter.

With regard to the probability of detecting unsatisfactory results, it was found that;

- In most cases, the number of analyses for each category of product is less than the indicated number, suggesting that the ability to detect unsatisfactory results per product category is below 95%;
- In many cases the number of analyses per type of product is far below the number needed to detect unsatisfactory results, such as 4 tests of cheese for substitution; and
- In some cases the number of analyses per product category is far above the number needed to detect unsatisfactory results, such as 1088 substitution tests for restaurant and take-away meals.

It should be noted that the number of analyses per product would be far less than the national total when examined per region or per LA.

Thus, the “high” number of analyses for some products may provide meaningful results at a local level. On the other hand, the very small number of analyses for some categories of products means that unsatisfactory results (in the order of 1%) cannot be confidently detected in these cases at a national or local level.

Confidence intervals

Confidence intervals indicate the range of results you would find from a series of samples, such as a 2010 versus 2011 set of results, due to random variability. The extent to which random variations impact the overall results will depend, in part, on the number of samples taken and the inherent variability in product standards. The larger the number of samples analysed the more representative the results will be of the total population of the product and the narrower the confidence intervals in the results.

The results for substitution analysis and the Enterobacteriaceae testing are used as examples of the width of 95% confidence intervals, i.e. the range of results that would be found on 95% of analyses results.

It was found, using UKFSS data for 2012, that for substitution tests:

- The confidence intervals for some categories of products are very wide, such as 2% to 23% for ‘Poultry - Fresh and Frozen’;
- The confidence intervals are quite narrow for some categories of products, such as 9% to 15% for ‘Meat - Products and Processed (incl. Sausages)’.

The width of the confidence intervals relate to the number of samples analysed, with far more ‘Meat - Products and Processed (incl. Sausages)’ tests (404) than for ‘Poultry - Fresh and Frozen’ (40).

A similar position is noted for Enterobacteriaceae where, for example:

- The confidence intervals are 5% to 8.3% for Poultry - Products and Processed’, with 900 analyses;
- The confidence intervals are 1.1% to 7% for Liquid milk, with 173 analyses.

This suggests that for those categories of products with fewer test results, the calculated rate of unsatisfactory results is uncertain. For products with larger numbers of analyses, the rate of unsatisfactory results is more certain, when assessed at a UK level. The confidence intervals would be far wider if assessed at the level of LAs.

4 POTENTIAL IMPROVEMENTS

4.1 Introduction

Potential improvements were identified by:

- Seeking suggestions from stakeholder interviews, as per section 10.1;
- Seeking suggestions from rapid survey respondents, as per section 10.2;
- A very rapid (not systematic) review of food sampling practice in other countries (see section 11) and latest ideas cited in key publications; and
- A further round of consultation with stakeholders, one LA and three PHAs (as per section 10.3.

The potential improvements are summarised in section 4.3 and elaborated in sections 4.5 to 4.8. Section 4.9 considers to what extent the potential improvements are already cited within a draft risk based sampling framework developed in a parallel project.

4.2 Are improvements needed?

Rapid survey respondents were asked if they considered improvements are needed to the approach to sampling within their authority, regionally or nationally. The responses are shown by type of authority in Figure 10. It can be noted that:

- Overall 42% said changes were needed locally, 51% regionally and 57% nationally;
- County councils were most likely to say improvements were needed; and
- Only one out of five PHAs cited a need for improvements within PHAs and at regional levels,
- London and Metropolitan authorities were least likely to say improvements were needed within their areas. The researchers noted that London and Metropolitan LAs report the lowest rates of food sampling in the UK.

The responses for food hygiene and food standards were very similar.

4.3 Overview of potential improvements

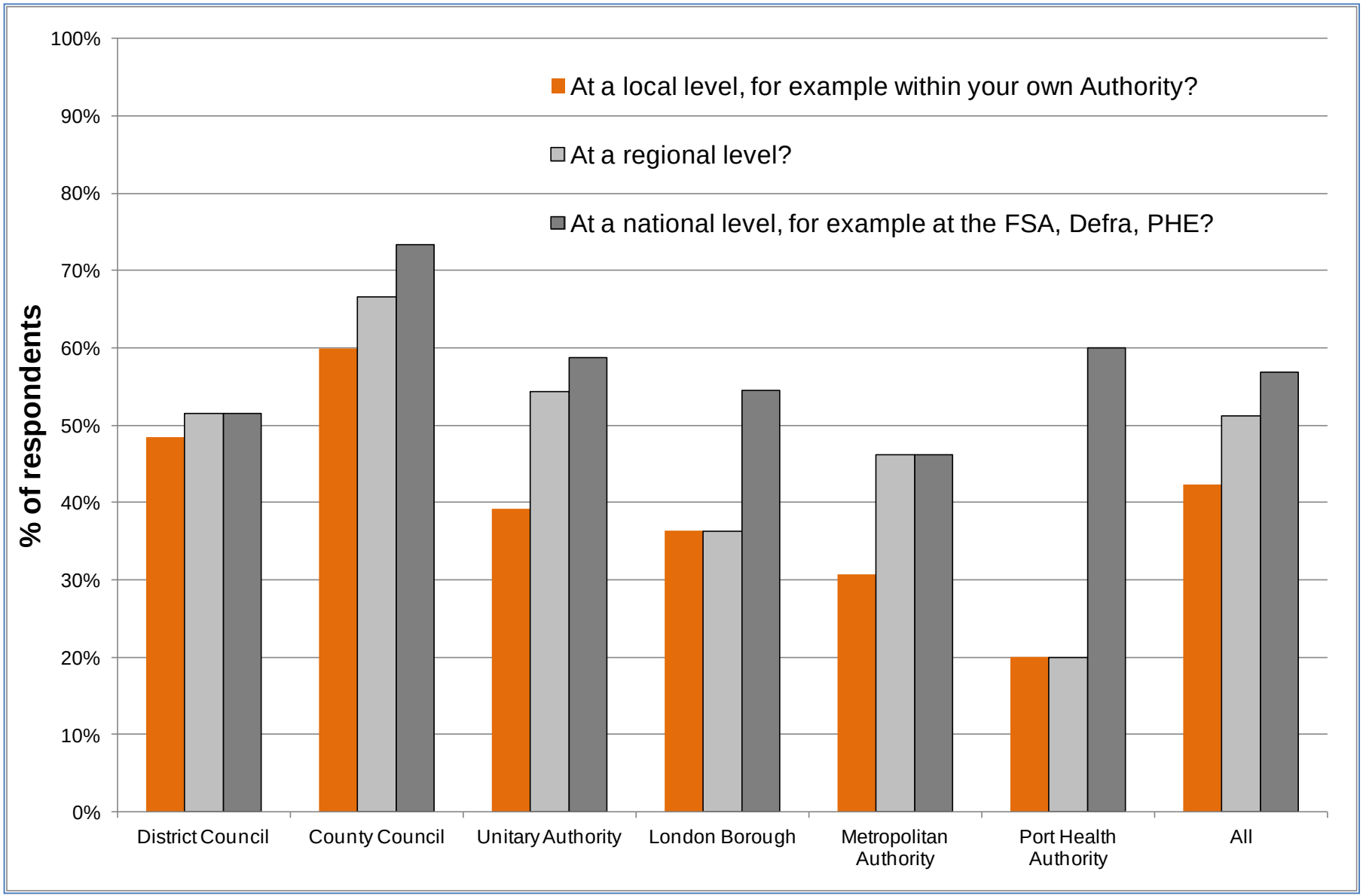
4.3.1 Potential improvements

A number of options are summarised that can be considered with a view to improving existing UK food sampling provision. The scope of this research is limited to identifying and summarising such options. The study was not designed to assess costs and benefits, nor does it aim to specify implementation needs or to quantify impacts. Some qualitative observations are offered on the potential magnitude of impact on UK food sampling.

The research indicates that there are a number of options for improving food sampling in the UK, particularly amongst inland LAs, with respect to the number of samples, the targeting of samples and the use of the results. The themes are:

a) To make **better use of current food sampling resources** through
    1. Better co-ordination between national, regional and LAs;
    2. More risk based and intelligence based sampling;
    3. Better sharing of results/data; and
    4. More efficient working practices.

Figure 10: Are improvements needed?



b) **Changing funding arrangements**, with a range of options for increased funding but also 'ring fencing' food sampling funds, and defining expected levels of sampling to be conducted by LAs.

c) **Increasing level and scope of national sampling programmes** directed or conducted by national agencies FSA and PHE, with less onus placed on LAs to plan or conduct food sampling.

d) To **increase the extent/use of food sampling**, following official sampling methods, **undertaken by businesses** through, for example, **third party certification schemes**, with requirements for sharing all results with LAs, FSA and PHE.

Our own review of the probability of detection and confidence intervals attained by current UK food sampling (see section 9) indicates that consideration could be awarded to the statistical element of planning food sampling, the purpose of food sampling and whether results are assessed at a LA, regional or national level. This leads to a further theme of potential improvement concerning the **statistical element of planning sampling**, as discussed in section 4.4.

The potential improvements are of most relevance to inland LAs. PHAs already recover costs of statutory sampling from food businesses and have FSA funding for an element of surveillance sampling. The feedback from PHAs is that non-EU third party assurance schemes do not provide a basis for accepting sampling results. PHA respondents do indicate there is scope for improved co-ordination and data sharing.

4.3.2 Discussion of potential improvements

The first three themes come from respondents' feedback in the study. The fourth theme was identified by the researchers and also was a recommendation in the interim "Elliott Review"[21]. In particular the Elliot Review stated:

> "*Currently there is no requirement on auditors to carry out product sampling as part of a standard food safety audit.*
>
> *Recommendation 28 - Third party accreditation bodies are ideally positioned to collect and analyse food samples. I would like to see surveillance sampling to the standards set out in section 2.4, incorporated into unannounced audits, to be co-ordinated by the standard holder. This would act as an additional deterrent to food businesses knowingly trading in fraudulent food."* (p35)

The approaches are not mutually exclusive. For example, option (d) would be limited to food businesses and products where, for example, third party certification schemes involve verification through sampling of food. Food surveillance sampling can be made more focused as well as complying with the changing funding arrangements and the changing of the balance of sampling carried out by LAs versus national agencies.

The suggestions do obviously need to be considered as a whole, as increasing the scope of national sampling programmes, for example, would reduce the onus placed on LA

[21] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/264997/pb14089-elliot-review-interim-20131212.pdf

funding. Similarly, if third party certification schemes conducted independent food sampling activity, this might reduce the onus on LAs. Indeed, a number of options could be combined into a cohesive sampling strategy. For example:

a) Regional options. Regional liaison groups could take a greater role in co-ordinating sampling, food sampling expertise could be shared through regional liaison groups, bids for grants could be done on a regional basis and the FSA could provide UKFSS reports per region – placing less reliance on the diminishing resources of individual LAs and also providing a statistically more appropriate sampling rate.

b) Central options. The FSA, Department of the Environment Food and Rural Affairs (Defra), Department of Health (DH) and the PHE could liaise to develop a national risk-based food sampling plan. Through centrally directed working or contracts, they could take on a greater role in food sampling, placing less emphasis on the reduced resources of LAs. The plan could cover known as well as emerging food safety and food standards risks, horizon scanning activities and surveillance activity at a national level, leaving LAs to cover issues particular to them and their specific geographic and cultural context. LAs could provide input into national plans via regional liaison groups. A “formula” could be developed to guide the distribution of sampling funds (or credits) to LAs, based on local risk assessment.

Funding

Whilst better co-ordination and more risk based sampling were the most commonly cited suggestion from respondents, increasing and changing funding (or prescribing sampling frequencies) was considered to have the most impact on the level of sampling. It should be noted that reductions in budgets and staffing was cited as the main cause of declining rates of sampling, with the adoption of risk based sampling a response to reduced resourcing at LA level.

The option of applying (to food standards) the PHE model of directly funding laboratories and then allocating sampling credits to LAs would also act to ‘ring fence’ food standards sampling funds in the future. This would require a formula for allocating food standards sampling credits to LAs as well as determining the national food standards budget. A potential method of estimating national food standards sampling needs is noted in section 4.6.3.

Transferring cost to food businesses

The option of making more use of sampling by businesses and third party certification schemes would, if carried out using recognised sampling and analytical methods, and if all results were shared with LAs and the FSA/PHE, reduce the onus of surveillance sampling on LAs, FSA and PHE. Some businesses, such as small businesses, lack resources or are not members of third party certification schemes so this option has its limitations and alternative strategies would need to be in place for this type of business.

Third party certification schemes are most common amongst food manufacturers and primary producers, with some coverage of processors, and little coverage of retailers and caterers. Third party certification is a pre-requisite to supply into the major multiple retail supply chain. However, whilst this option would cover food sampling for a large part of the UK food retail sector, some sectors of food supply would not be included in its scope. Also third party certification schemes, whilst they require documentary evidence of monitoring and verification activity do not currently as part of the certification process carry out independent food sampling activities as a form of verification. Therefore, this option would require new arrangements and capabilities to be developed and for third party certification schemes and the businesses that require them as a market pre-requisite to accept the

additional cost and understand the role of the food sampling undertaken. It should be noted that food sampling by third party certification schemes has separately been recommended as a way of verifying the performance of certified businesses and verification of the effectiveness of the schemes themselves (Wright et al, 2013[22]).

As noted in 4.9, some of these options are addressed within a draft food sampling framework developed for the FSA in a parallel study.

4.4 Required number of samples

The analyses of probability of detection and confidence intervals attained by current UK food sampling (see section 9) indicate that consideration could be awarded to the statistical element of planning food sampling, the purpose of food sampling and whether results are assessed at a LA, regional or national level.

- If the aim of food sampling is to monitor the level of unsatisfactory results, an adequate number of analyses are required for confidence (such as 95% confidence) to be placed in the estimated rates of unsatisfactory results. Typically a few hundred analysis results are needed to indicate rates of unsatisfactory results within plus or minus a few per cent for any one product or category(ies) of products;
- If the aim is to detect one or more instance of unsatisfactory results, a larger number of samples (e.g. a thousand or more) are needed for those analyses, such as Salmonella, with very low rates of contamination.

Enough sample analyses are being taken to detect very low rates of contamination, such as 0.1%, for products as a whole at a national level, but not for sub-categories of products. No single LA is likely to achieve hundreds of analyses for any one type of product. This suggests that:

- Consideration could be usefully given to the rationale behind the compilation and use of results at local, regional and national levels, and whether sampling is planned at a local, regional and/or national level;
- The approach to achieving statistically robust estimates of the rate of unsatisfactory results and to detecting unsatisfactory items could be reviewed after having clarified the aims of food surveillance sampling and possibly defining criteria for evaluating the rate of unsatisfactory test results.

It is recommended that the approach to determining the required number of analyses applied in Belgium (see section 11.7) is considered. They have adopted a statistical approach to determining the number of analyses to be completed per hazard per product in order for sampling to a) detect non compliance with a specified level of confidence and b) estimate the rate of non compliance with a specified level of confidence. The statistical element of their approach would, in the researchers' view, support statistically valid conclusions to be drawn from food sampling and for a clear logic to be adopted in food sample planning. Key elements of the approach in Belgium include:

- Defining the rate of unsatisfactory results that the planned number of samples is designed to detect;
- Using statistical methods and risk analysis to define the number of samples

[22] Wright, M, Palmer G, Shahriyer A, Williams R and Smith R. Assessment and comparison of third party assurance schemes in the food sector: Towards a common framework. October 2013. Food Standards Agency report. http://www.foodbase.org.uk/results.php?f_category_id=&f_report_id=835

needed.

Elements of the Belgium method could be drawn upon, particularly the adoption of statistical criteria, risk criteria and formula for estimating the number of samples needed. The form of risk analysis is similar to the method drafted for the Agency in the aforementioned parallel study but might not fully meet UK requirements. Notwithstanding this, the type of statistical approach adopted in Belgium would help improve the confidence that can be placed in UK food sampling surveillance results.

It is also recommended that the need to attain statistically valid results, and in particular the implications for the required number of samples, is taken into account when considering improvements or changes to arrangements for food sampling in the UK. For example, if there is a desire to estimate rates of unsatisfactory results and LAs cannot individually attain the required number of sample analyses, this may point towards a need for more co-ordination and sharing of results amongst LAs and/or at a national level.

4.5 More effective sampling

4.5.1 Co-ordination

Improved co-ordination was the single most commonly cited improvement. This included:

- Co-ordination across national government departments and agencies (Defra, FSA, DH/PHE) regarding national sampling priorities;
- Co-ordination amongst LAs within regional groupings regarding what to sample, who to take samples and the number of samples;
- Communication between LAs with a common or cross boundary issue;
- Co-ordination amongst PHAs regarding sampling priorities, who is sampling what products and the protocol for the sharing of results and also incidence of unsatisfactory results especially where the importer may seek to take the rejected material to another port in order to try to gain entry;
- Sharing results more effectively at all levels to better inform local, regional and national sampling plans; and
- Making more use of the Primary Authority process to co-ordinate routine surveillance sampling across the UK.

Whilst regional food liaison groups were acknowledged and considered effective in some areas, the feedback indicated a need to further develop the extent and form of co-ordination of food sampling. This could possibly be achieved via the regional food liaison groups. The submission of regional bids for food sampling grants might also reduce the administrative element of funding for a particular LA.

Therefore, an option is to review current arrangements for the co-ordination of food sampling at national, regional and local level and as necessary, create new arrangements such as a national co-ordination committee, with suitable terms of reference, memberships and processes and secondly to advise regional food liaison groups of the good practice standards in co-ordination of surveillance food sampling.

4.5.2 Sharing resources

Sharing resources between LAs

With a mind to the need to develop succession planning strategies in many LAs, due to the demographics of existing staff and the shrinkage of staffing levels within LAs, the

researchers would suggest the option of groups of LAs sharing specialist staff, whether this is a formal or informal arrangement. If the previous suggestion of increased regional co-ordination was pursued, perhaps with regional sampling plans, the sharing of food sampling and food industry expertise on a regional basis would "naturally" follow on. Specialists could advise on matters such as food sampling plans, identification of local regional issues, interpreting results, sampling techniques, use of UKFSS and use of new technology, for example.

Mentoring and support

A few respondents suggested a mentoring scheme for food sampling officers from smaller LAs, to help them to carry out food sampling more effectively.

The researchers would note that the Northern Ireland FSA funds a number of advisory visits to each LA each year to assist them with their planning. Some respondents in other parts of the UK suggested that support be provided for training staff in food sampling. Thus, another option is for more centrally funded training and advisory support to LAs in respect of food sampling.

Sharing food hygiene and food standards staff

The research results indicated that the decline in food standards staff in LAs is greater than the decline in food hygiene staff. An option may be to train some food hygiene staff in food standards sampling. This may be a lower cost way of retaining adequate food standards sampling capability across both areas of sampling.

4.5.3 Risk based sampling

Further development of risk based sampling approaches was the second most commonly cited improvement for making better use of current resources. A range of suggestions were made with the aim of improving the targeting of food sampling. These include more intelligence-led and more risk-based sampling. Related suggestions were offered regarding improving the information available, such as improvements to UKFSS.

An option is to formulate guidance on risk based sampling[23] as well as further developing information sources such as UKFSS. Various suggestions were offered on how to improve risk based and intelligence based sampling, such as:

- Applying earned recognition when selecting premises and products for sampling;
- Using a wider range of information sources, such as European Anti-Fraud Office;
- Reviewing commodity prices, weather information, market reports to foresee when price changes may influence the potential for food fraud; and
- More use of RASFF alerts.

4.5.4 Supporting data sharing

Some suggestions on sharing of data included:

- Producing a protocol on sharing information;
- Having a central UK body co-ordinate RASFF intelligence and distributing intelligence in real time;
- Improving UKFSS, including:
    - A more robust UKFSS search engine, e.g. picking up misspellings, etc,

[23] As noted in section 4.9 this draft guidance on risk based sampling has been developed in a parallel project.

    - More specific drop-down fields and less free text options to make sample reports more accurate,
    - A reporting strategy and data reports by premises, food business operator,
    - Periodic reports of emerging issues/contaminants and identification of trends, and
    - Provision of training to LAs in the use of UKFSS;
- Developing liaison with other national ports and overseas ports so they can be alerted to rejected imports that may be presented again at another entry point to the EU.

Many respondents suggested that greater use could be made of UKFSS data. As some LAs lack the IT or skills to make full use of UKFSS, an option is for the FSA to analyse and report results on behalf of LAs in a timelier manner, perhaps with regional reports, newsletters and UKFSS alerts.

4.5.5 More efficient working practices

Changes to planning of national programmes

Various suggestions were made about improving the planning of national sampling programmes. Suggestions included:

- More intelligence-led and robust criteria for developing FSA grant funded sampling programmes;
- Inviting Heads of Ports to an annual meeting to agree the priorities that could be put forward when deciding on the annual sampling programme;
- Communicating the rationale for the FSA national priorities based sampling projects so that LAs have a better understanding how they could contribute and feed into the FSA grant sampling work; and
- Review whether grant bid applications are coming from the “right” LAs, and that they address food products covered by the FSA priorities.

More use of new technology

Various suggestions were offered about how to make more use of new technology. These included:

- Using screening tests, such as ATP tests to help screen premises and products for surveillance sampling;
- Digital recording and communication of results,
    - Recording results of food tests and communicating by email to accelerate response times, and
    - The use of Personal Digital Assistants (PDAs) in the field to cut down on time spent filling in forms;
- Online information;
    - A web-based application that would enable an officer on a premise visit to look up information on a particular food product for what bacteriological and chemical risks that product might have,
    - An Imported Food database, having photographs, common names, detailed descriptions etc. would be very useful for officers. At the moment officers

tend to do a Google search to try and find out more information on a particular imported food,

- Scanning barcodes and Quick Response codes (QR-codes) could be useful for obtaining instant information off a food products database,
- Receiving a newsletter from Eurofins which provides updates on new tests the public analysts (PAs) perform.

Respondents suggested that the use of new technology could reduce the resource pressures by making sampling more efficient.

The researchers would judge that a) if the aim is to measure food business performance then screening may lead to sampling being limited to suspect premises and so will not reflect sector performance in terms of the level of compliance as well as non-compliance and b) the main costs (laboratory tests and acquiring samples) would not be eliminated by these ideas.

Improving work of Public Analyst Laboratories

Various suggestions were made about the work of laboratories, including:

- More flexible sample collection arrangements;
- Reducing minimum sample runs as this prohibits quick turnaround of samples;
- Having service level agreements with PAs covering, for example, performance targets such as turnaround times; and
- Standardising chemical test costs across the laboratories.

4.6 Funding arrangements

4.6.1 Increased funding

The reduction in funding is cited as a key reason for the decline in sampling. The feedback indicates that food standards and food hygiene sampling has declined to a greater extent than other areas of work (such as inspection of premises) because there is no requirement to maintain a certain level of sampling and there are defined statutory frequencies for premises inspections.

The option of increasing funding for sampling would obviously address this point. However, an increase in general food standards funding may not lead to a proportionate increase in sampling if the funding is not ‘ring fenced’ to food sampling activity.

In the case of microbiological sampling, a budget is set by PHE and issued to regional groupings of LAs in the form of credits. An increase in the PHE sampling budget would translate into an increase in budget for LAs. There would remain some potential barriers to the utilisation of any increased funding, including availability of suitably skilled staff within LAs to carry out the sampling. There was some feedback that the level of sampling has declined due to the reduction in staff available to administer it.

Estimating national survey needs

In the event that a central budget is developed for food standards sampling, a method would be needed to determine the total budget. An option (identified by the researchers) would be to produce an indicative national survey requirement. For example, the following calculation could be completed:

a) Products could be split into categories (of similar products such as meat pies);

b) Each category of product would have a number of applicable analyses, such as substitution and additives;

c) The expected level of unsatisfactory results would be indicated, such as from historical records or research, to inform the number of samples needed to achieve statistically reliable results; and

d) The number of samples per product would be indicated, taking account of point c) and the required maximum margin of error, such as +/-0.5% for an expected rate of unsatisfactory results of (say) 1%.

For example, if there were 50 categories of products, each with three types of analyses, this would give 150 analyses. If 150 samples per analyses were required to gain statistical reliability this would give 22,500 analyses (50 X 150 X 150). Any region or country specific survey would add to this total, for example, if Wales wished to survey Welsh lamb products separately from UK lamb.

In the event that a central budget was developed, consideration would also need to be given to whether to also provide national guidance on sampling priorities and/or to have higher levels of co-ordination to ensure funding was used effectively.

4.6.2 Specific funding for sampling

If food sampling funding was centrally allocated and based on a formula, this would a) help ensure funding is used for sampling and b) allow LAs to plan ahead knowing their future minimum level of funding.

Surveillance sampling

Some funding is already ‘ring fenced’.

- PHE funding (credits allocated to LAs) for microbiological testing is ‘ring fenced’ in the form of sampling credits;
- FSA national food sampling (mostly food standards) programme funding is ‘ring fenced’; and
- PHAs can recharge cost of sampling for EU prescribed products to food businesses.

An alternative is to increase the element of ‘ring fenced’ funding. One option is for the FSA to create a central budget for food standards surveillance sampling (in addition to the existing national programme) and allocating this to LAs.

The PHE system of allocating credits to LAs is one model, where funds are paid direct to public laboratories, with each LA having credits. PHE credits are allocated to regional groups of LAs, such that if one LA does not take up its allocation, another authority in the group can take up its credits.

Enforcement related sampling

An option is to enable LAs to charge sampling costs direct to food businesses where it is taken as part of formal enforcement, such as a hygiene improvement notice. This may help reduce funding pressures.

The range of conditions when sampling costs can be charged to businesses would need to be considered, such as:

- Prosecutions;
- Notices (prohibition, hygiene improvement notices, etc);

- Investigations, such as tracing source of contaminated product; and
- Informal advice to make improvements.

It is critical that the turnaround time for enforcement related samples is of a sufficient timeframe that there is a viable potential for prosecution if the results suggest non-compliance. As enforcement related samples are a minority (13% of those reported in UKFSS for 2012) of all food samples, cost recovery for enforcement related analyses would cover a small minority of the overall cost of sampling.

4.6.3 Guidance on level of sampling

A number of LA respondents advocated that a minimum level of surveillance sampling was required of LAs. This could be supported by a numerical guideline or by a statutory duty to carry out food surveillance sampling, perhaps within the code of practice. It was suggested that a numerical guideline would lead to LAs being required to allocate resources to food sampling and thus achieve more consistent practice across national LAs.

It is pertinent to note that those countries (Scotland, Northern Ireland and Wales) that cited a WHO guideline[24] on achieving a defined rate of samples per designated number of residents have had and still have higher rates of sampling than England. However, feedback indicates that achievement of the prescribed guideline rate of sampling encountered resourcing difficulties and has now become an aspiration rather than a target.

The researchers would suggest that a numerical target and/or a more defined statutory duty on LAs, or regional groups of LAs, to carry out sampling would support allocation of resources to sampling. As the nature and number of food businesses differ between LAs, the required level of sampling may differ between LAs. Therefore, a numerical guideline on the level of sampling would need to be risk weighted to match the local food risk profile. A risk weighting method could, in our opinion, be developed that would draw on existing data on food businesses held by LAs and the FSA. For example, risk per LA could be assessed based on the number of food premises and their risk ratings (as currently assigned for food hygiene and food standards in the Food Law Code of Practice), perhaps with a weighting per premises according to the types of foods and perhaps with a weighting for local population levels.

Another option is to have a rate of sampling per 10,000 residents set as a baseline, weighted by a risk factor calculated as described above.

4.6.4 Promotion of sampling

Some respondents advocated that the value of food sampling is promoted more strongly to LAs, to encourage them to fund local sampling.

4.6.5 Changes to FSA grant funding

Administration of grants

A number of suggestions were offered regarding the efficiency of the administration of the funding for FSA national sampling programmes, including:

- Advising LAs of their budget earlier in the financial year in which the funds are to be

[24] The Northern Ireland FSA cited a World Health Organisation guideline of 2.5 food standards samples per 1000 population (the original reference has not been discovered by the researchers). The Derry City Council Food Safety Plan (p16, www.derrycitycouncil.gov.uk, accessed January 2014) for 2012-13 says “a more useful baseline upon which to base sample programmes is considered to be anything from 1-5 per 1,000 head of population.” Feedback from Scotland said the Scottish FSA previously had a guideline of 3 samples per year per 1000 population for chemical samples and two per 1000 population for microbiology.

spent;

- Simplifying the grant application process;
- Having regional bids for FSA grants; and
- Using online grant applications tools.

Earlier advice on the success of grant applications may help LAs ensure resources and plans are in place to make use of the grant.

Changes to assumed cost per sample

Respondents indicated that the cost per sample was greater than assumed for FSA grants. It was suggested that the cost be increased to include sample administration time, staff time to acquire and despatch samples, and time to analyse results.

4.7 More national surveys

An alternative to changing the arrangements for funding and co-ordinating LA sampling would be to conduct more nationally co-ordinated sampling programmes, where the FSA and/or PHE define the sample plans. These could be implemented via LAs or contracted out to approved contractors. The FSA already contract out sampling projects via public tender processes. This range of national food sampling programmes could be widened to include for example, a wider range of new or emerging risks and monitoring high risk foods of national relevance and where specific methodology for emerging risks is located in very few laboratories.

This would reduce the reliance on LA funding and local support for food sampling, whilst enabling direct management of national food sampling requirements. It would also mean that if a small number of laboratories were used there would potentially be more consistency and repeatability in sampling method and practice.

4.8 Transferring costs and/or duties of routine surveillance to business

4.8.1 Introduction

An option would be to transfer the cost and duty of surveillance testing to business and perhaps reduce the link between levels of surveillance testing and LA budgets. FSA grant funded surveillance could act as a check on performance of the UK as a whole and a means to research specific issues, with LAs focusing more specifically on suspect and enforcement related sampling which can also have a cost recovery approach built in.

Third party certification schemes cover the production of many of the food products sold through the “supermarket” retail chain in the UK. Therefore, the current scope of third party certification schemes would cover a large range of premises and food products. If major retailers were to report all food sample results obtained through the supply chain this would cover the vast majority of *retailed* food products. However it should be noted that the results will only represent the level of food safety assurance and protocols in place within that type of supply chain and not the wider food sector as a whole.

4.8.2 Transferring duty of food sampling to businesses

Possible options

An alternative to further developing food sampling co-ordinated by national and LAs is to increase the role of businesses in food sampling. Some options include:

1. To have testing completed by approved analytical organisations funded by levies applied to registered food businesses.
2. To have testing completed by approved testing organisations as part of third party certification systems (e.g. BRC Global Standard) – and funded through those schemes.
3. To utilise sampling data from registered food businesses, requiring declaration of all results perhaps through an anonymised shared data system. This could only occur if standard methodology was used.
4. To extend cost recovery from statutory samples to non-statutory routine surveillance samples by inland and port authorities. This could be limited to higher risk food businesses.
5. To place a duty of care on food businesses that produce or supply food to carry out food sampling as part of their food safety and food standards management process.

Implementation requirements

For such arrangements to support regulators, it would be necessary for:

- Sampling methods and protocols to match those in official codes of practice and official sampling criteria;
- All results to be made available to the FSA, PHE and LAs; and
- Arrangements to be in place for adverse results to be rapidly communicated to the relevant authorities.

These options may be limited by a) small firms not having the resources to carry out food sampling, b) third party certification schemes may feel that there is a challenge with commercial confidentiality agreements with their contractual partners and c) the schemes do not operate for all food sectors (Wright et al 2013[25]). Wright et al (2013) found that most third party certification schemes operate within food production and processing, with just two meat retail schemes and no catering schemes (except hospital catering). Notwithstanding this, third party certification schemes such as the BRC Global Food Standards and the Red Tractor cover large parts of the UK food sector. Therefore, this option could reduce the onus on LAs, PHE and FSA to undertake surveillance sampling.

4.8.3 Cost recovery

Another option is for the cost of food sampling to be recovered from businesses. One method for achieving this could comprise of a charge for food sampling (for surveillance purposes) in the registration of food businesses[26] and then for annual renewal charges. This would spread the cost across food businesses rather than have the cost borne solely by those businesses selected for a specific surveillance survey. The charge could be related to the size of the food business.

With this option, it may be necessary to have arrangements to ensure that the funds are “ring-fenced” and spent by LAs on food sampling, such as through the guidance on minimum levels of food sampling that is required.

[25] Wright, M, Palmer G, Shahriyer A, Williams R and Smith R. Assessment and comparison of third party assurance schemes in the food sector: Towards a common framework. October 2013. Food Standards Agency report. http://www.foodbase.org.uk/results.php?f_category_id=&f_report_id=835

[26] Registration is currently free.

4.9 Output from current FSA studies into risk-based sampling

A parallel (ongoing[27]) study into risk based food sampling for the FSA has drafted a framework for food surveillance sampling (excluding statutory and enforcement sampling). The framework addresses some of the potential improvements noted in the report above including advocating:

- Increased co-ordination at a national level between FSA, Defra, PHE, DH and others;
- Improved co-ordination between LAs at regional and local level;
- The implementation of risk-based sampling protocols; and
- The use of UKFSS and other data sources to support the development of sampling plans.

The draft framework outlines advice on the number of samples required to achieve reasonably confident results, with respect to minimising margin of error in the rate of detected satisfactory results. It does not give guidance on the frequency of sampling, such as a rate per 10,000 residents. Instead it advocates that the number of samples taken for any particular product is statistically robust and provides statistical advice on sample sizes.

The framework developed is limited to the sampling completed by national and local regulators and agencies and does not cover the option of transferring sampling duties to businesses. However, the framework logic does include LAs, FSA and PHE not completing surveys of foods where results are available from another survey or set of sample results. Thus, if businesses or third party certification schemes were to complete surveys (using approved methods) and release all the results, the framework would indicate that regulators do not need to repeat the sampling in their survey.

[27] Wright M, Manning L, and Mckellar D. Development of risk-based sampling guidance for enforcement officers. http://food.gov.uk/science/research/choiceandstandardsresearch/enf-research/fs222001/#.UuJELLTLfGg Accessed January 2014

5 CONCLUSIONS

5.1 Trends and causes

The main trends and causes of these trends are noted below.

Port Health Authorities

- PHAs are completing more samples for FNOAO due to the additional EC regulated official sampling requirements in 2010. As the costs for the statutory sampling are cost recoverable from the importer, there are no funding issues. The total number of FNOAO samples rose by 104% between 2009/10 and 2011/12; and
- The funds available from local budgets are insignificant and do not impact greatly on the overall number of samples. Most PHA sampling is either to fulfil EC requirements or with FSA grants.

Inland food sampling

- The volume of food samples analyses by inland LAs in the UK has fallen by about 33% since 2008/09 due to reductions in budget and staffing, whilst having to sustain defined rates of premises inspections;
- There is evidence of an increase in the rate of decline in the number of samples taken since 2009/10;
- The reduction in budgets and staff has prompted more risk based and intelligence led sampling;
- The decline in sampling by inland LAs is far greater for food standards, a 53% fall once Agency grant funded sampling is excluded, due to food standards staffing declining more than food hygiene staffing, the relatively higher cost of food standards tests, relatively lower level of national co-ordination and lack of ring fenced funding for food standards sampling;
- There is very little testing by inland LAs of imported food outside of FSA funded specific initiatives unless problems are identified through specific intelligence. Only one third of surveyed LAs say they test imported foods; and
- The level of testing of imported food by inland LAs has remained level (at a low level) in accordance with FSA funding.

5.2 Potential improvements to arrangements

Overall 42% of LAs and PHAs said changes were needed locally, 51% regionally and 57% nationally. County councils were most likely to say improvements were needed. PHAs, London and Metropolitan authorities were least likely to say improvements were needed within their areas. The researchers would note that London and Metropolitan LAs also report the lowest rates of food sampling in the UK.

It should be noted that the feedback from PHAs was that, whilst improvements could be made, current arrangements were not “broken”. The researchers noted that sampling levels at PHAs have increased and that the costs of statutory sampling are recovered from businesses. National co ordination and data sharing was cited as an area of improvement for PHAs.

The research indicates that there are a number of options for improving food sampling in the UK, particularly amongst inland LAs, with respect to the number of samples, the

targeting of samples and the use of the results. The themes are noted below along with how the Agency could help:

a) Making **better use of current food sampling resources** through

- Better co-ordination between national, regional and LAs

With respect to co-ordination, the Agency could help by i) working with other national organisations to further develop arrangements for national co-ordination of food sampling, ii) encouraging the further development of regional co-ordination amongst LAs and amongst PHAs and iii) advising LAs on the form of regional co-ordination arrangements.

- More risk based and intelligence based sampling by the Agency and LAs;

The Agency could develop and disseminate guidance for national organisations and LAs/PHAs on risk based sampling and how to take account of intelligence within food sampling plans. A draft framework has been developed in a parallel project that the Agency can draw on for this purpose.

- Better sharing of results/data

The Agency could help by further developing the UKFSS in accordance with the feedback from LAs so as to enable greater access to UKFSS. Other options include the Agency providing regular updates on UKFSS results and providing template data sharing protocols for LAs and PHAs.

- More efficient working practices.

The Agency could help by facilitating the sharing amongst LAs of good practice, leading research into new sampling/testing technology, co-ordinating with PHE a review and/or standardisation of Public Analyst contractual arrangements.

b) **Changing funding arrangements**, with a range of options for increased funding but also 'ring fencing' food sampling funds, and defining expected levels of sampling to be conducted by LAs.

The Agency would need to lead the review and development of this option, possibly in liaison with PHE, DEFRA, LAs and stakeholder organisations.

c) **Increasing level and scope of national sampling programmes** directed or conducted by national agencies FSA and PHE, with less onus placed on LAs to plan or conduct food sampling.

The Agency, DEFRA and PHE would need to liaise and co-ordinate the review and elaboration of this option.

d) **Increasing the extent/use of food sampling**, following official sampling methods, **undertaken by businesses** through, for example, **third party certification schemes**, with requirements for sharing all results with LAs, FSA and PHE.

The Agency could help by consulting with third party certification organisations concerning the possibility of food sampling and sharing results and, if the option were to be pursued, defining the arrangements for sharing results with the Agency and LAs.

The approaches are not mutually exclusive. The suggestions do obviously need to be considered as a whole, as increasing the scope of national sampling programmes, for example, would reduce the onus placed on LA funding. Similarly, if third party certification schemes conducted independent food sampling activities, this might reduce the onus on LAs. Indeed, a number of options could be combined into a cohesive sampling strategy.

At the same time, some options have their limits. For example, third party accreditation schemes do not operate in all food sectors.

The aforementioned parallel study into risk based food sampling for the FSA addresses some of these options.

This study was limited to identifying and summarising such options. Further work could assess the costs and benefits of options.

Determining number of samples needed

As noted in section 4.4, consideration could usefully be given by the Agency to:

- The rationale behind the compilation and use of results at local, regional and national levels, and whether sampling is planned at a local, regional and/or national level;
- The approach to achieving statistically robust estimates of the rate of unsatisfactory results and to detecting unsatisfactory items.

The approach to determining the required number of analyses applied in Belgium (see section 11.7) is an example of how to attain statistically valid results. Elements of their method could be drawn upon, particularly the adoption of statistical criteria, risk criteria and formula for estimating the number of samples needed. The form of risk analysis is similar to the method drafted for the Agency in the aforementioned parallel study but might not fully meet UK requirements. Notwithstanding this, the type of statistical approach adopted in Belgium would help improve the confidence that can be placed in UK food sampling surveillance results.

The Agency's statisticians could produce statistical guidance and worked examples on determining the number of samples to be taken. A 'ready reckoner' could be provided to help planners determine the number of samples to be taken and the confidence intervals of results, perhaps as a MS Excel spreadsheet.

Some generic statistical advice is provided in section 12 that the Agency could draw upon.

6 APPENDIX A: METHOD

6.1 Analysis of sampling data

6.1.1 Aims

This part of the study used data to identify trends in sampling frequencies by LAs and whether these are related to changes in other activities or factors. Data on the number of food samples and the type of analyses was assessed for the UK, regions and by type of LA in order to identify trends. The comparison of rates of sampling between countries and types of LAs aimed to identify whether sampling rates may be related to local policy. In addition, trends in sampling were compared with trends in resources, number of establishments and inspection frequencies, as a preliminary assessment of the cause of trends. This included profiling trends in food hygiene versus food standards sampling, again to help explore potential reasons for trends.

The results of this analysis also helped inform the questions posed to stakeholders when discussing the reason for sampling trends.

The aims and scope of the analysis are summarised below.

1. Trends in PHA sampling

The number of samples was presented for 2009/10 to 2012/13. In addition, the change in the number of samples for animal and non animal products was assessed. The aim was to assess if the overall number of samples changed after the 2010 FNOAO requirements were introduced and whether this was reflected specifically in FNOAO samples.

The number of samples could be split into microbiological, chemical / composition and 'other'. This enabled an assessment of whether the trends were consistent for all types of testing or specific to the types affected by the new 2010 FNOAO requirements.

The Agency data available for PHAs does not distinguish between statutory samples and non statutory samples. Therefore, it is not possible to conclude from Agency data whether the increase in the overall number of samples taken by PHAs hides a reduction in non-statutory food samples.

2. Present the overall trends in food sampling (inland authorities)

The trends for inland LAs were presented from 2003 in order to assess if the decline in sampling was limited to recent years. This would inform the judgement of whether trends are related exclusively to recent changes in factors, such as resources, or may reflect other factors that predate the last three to four years.

The trends for 2008/09 to 2012/13 were also shown after excluding Agency grant funded sampling. The aim was to profile trends in locally funded sampling.

3. Show trends per type of sampling analyses (inland authorities)

The aim was to explore whether the trends for inland LAs are consistent across food hygiene and food standards. Data was available for 2008/09 to 2012/13. If certain types of analyses have changed more than others, this may suggest that trends reflect differences in policy and practice between food hygiene and food standards.

4. Compare trends in sampling to trends in other factors (inland authorities)

The change in inland sampling was compared to the change in the number of full time equivalent food hygiene and food standards professionals, the number of enforcements and the number of inspections. The aim was to assess whether trends were consistent across these three points, specifically whether the amount of sampling has changed to the

same amount as the number of professionals, enforcement and inspections. If the trends differ, this might suggest the change in sampling is related to policy.

5. Comparison of sampling between countries and LAs (inland authorities)

The number of samples and the rates of samples per 1000 establishments were compared between Scotland, Wales, Northern Ireland and English district, county, metropolitan and London authorities. The aim was to assess whether the rate of sampling was related to the number of establishments in each area and whether the rate of samples per 1000 establishments was consistent across all areas. If there were large differences in the rate of sampling per 1000 establishments and/or in the rate per 1000 population this might suggest that sampling rates reflect local policy.

The number of LAs with zero or very low rates of sampling was also assessed per area. Again the aim was to assess whether the extent of sampling differed between the countries and types of LA and hence might reflect local policy.

LAEMS data does not distinguish between surveillance/monitoring sampling and suspect samples taken for enforcement purposes, with the exception of Agency grant funded samples. Therefore, the LAEMS data does not indicate whether there has been a greater decline in surveillance/monitoring food samples or suspect enforcement related samples or whether both types of sampling have declined equally. However, UKFSS data indicates that the vast majority of samples are reported as surveillance samples. Therefore, these trends predominantly reflect changes in the number of surveillance samples.

6.1.2 Data acquired

Local Authority Enforcement Monitoring System (LAEMS)

Every LA reports selected data to the Agency each year. The data is available as PDFs online[28]. For the purposes of this study, the following data was copied from the PDFs:

- For 2008/09 onwards:
    - Number of establishments,
    - Number of food hygiene samples,
    - Number of food standards samples,
    - Total % of interventions achieved (excluding unrated),
    - Total number of formal enforcement actions,
        - Seizure, detention and surrender of food,
        - Suspension/revocation of approval,
        - Emergency Prohibition Notices,
        - Prohibition Orders,
        - Simple Cautions,
        - Improvement Notices,
        - Remedial Action & Detention Notices,
        - Written Warnings,
        - Prosecutions;

[28] http://www.food.gov.uk/enforcement/monitoring/laems/mondatabyyear/#.UnOIWRAymlE

- For 2003 to 2007:
    - Total number of inspections,
    - Total number of establishments,
    - Total number of formal samples taken,
    - Total number of informal samples taken.

FSA board minutes

The Annex's to FSA board minutes[29,30] provided the number of full time equivalent food hygiene and food standards professionals for 2008/09 to 2012/13.

These also gave one table outlining sampling visits as a proportion of total interventions in 2010/11.

The references also showed food sampling split into microbiological, other contamination, composition, labelling and presentation, and others for 2008/09 to 2012/13.

PHA sampling

Data on sampling by PHAs was taken from FSA Open Board Meeting Minutes 15 November 2011 FSA 11/11/08 Annexe I[31] and the aforementioned 2012/13 LAEMS report. This included:

- Number of consignments - split between animal and non animal from 2010/11 onwards;
- Number of product samples - split into microbiological, chemical/compositional and other and between animal and non animal products;
- Number of enforcement notices - split between animal and non animal from 2010/11 onwards;
- Number of documentary checks - split between animal and non animal from 2010/11 onwards;
- Number of physical checks - split between animal and non animal from 2010/11 onwards;
- Number of identify checks - split between animal and non animal from 2010/11 onwards.

Office of National Statistics (ONS) pocket book[32]

The ONS pocket book provided number of establishments, enforcements and inspections for 2001 to 2011/12.

UK LAs Imported Food and Feed Sampling Reports[33]

The online PDF copies of UK LAs Imported Food and Feed Sampling Report for 2003/04 to 2010/11 provided the number of samples taken and analyses split into microbiological

[29] FSA Open board 15 November 2011 Annex H and FSA Open board 15 November 2011 Annex G Downloaded October 2013. http://www.food.gov.uk/multimedia/pdfs/board/fsa111108.pdf Accessed 5th December 2013
[30] Annual report on UK local authority food law enforcement 1 April 2012 to 31 March 2013. http://food.gov.uk/multimedia/pdfs/board/board-papers-2013/lafoodlaw-annual-report-1213.pdf
[31] http://www.food.gov.uk/multimedia/pdfs/board/fsa111108.pdf downloaded October 2013
[32] https://www.gov.uk/government/publications/food-statistics-pocketbook-2012
[33] http://www.food.gov.uk/enforcement/monitoring/samplingresources/samplingandsurveillance/#.UnOSMhAymlE Downloaded October 2013

and chemical per year.

Environmental Health Registration Board[34]

The Board publish registers of people with Environmental Health degrees (since 1975) as well as people with Ordinary or Higher Certificates in food premises inspection.

Population data

Population data was acquired from the ONS per LA to enable calculation of rates of samples per 1000 population.

6.2 Stakeholder interviews

6.2.1 Aims

This phase of work comprised an initial exploratory qualitative investigation to solicit opinion on the nature of sampling trends and the reasons for these.

The responses formed a body of evidence in their own right, informed the interpretation of FSA data on sampling and the design of the subsequent rapid survey of LAs and PHAs.

6.2.2 Respondents

The respondents were selected to represent the range of types of LAs and PHAs and to cover both food hygiene and food standards.

The 16 respondents included:

- Seven LAs from England (4), Wales (1), Northern Ireland (1) and Scotland (1) covering county councils, district councils, unitary authorities and metropolitan/London borough councils;
- Five PHAs – covering small, medium and large PHAs; and
- Four stakeholders representing environmental health officers, PHAs and food standards officers.

6.2.3 Topics discussed

A proforma covered:

- Nature of trends in sampling;
- Reasons for trends in sampling; and
- Potential improvements.

Each respondent was directly approached and asked to volunteer for an interview, mostly by telephone. The proforma was issued in advance of interviews to respondents. A copy of the responses was summarised per interview and sent to the respondent for verification.

6.2.4 Analysis

Analysis comprised a compilation of feedback, grouped according to common themes and points.

[34] http://www.ehrb.co.uk/registers.html

6.3 Rapid survey

6.3.1 Aims

A survey of LAs and PHAs was completed in order to gain further insights into:

- The nature and cause of trends in food sampling in the UK;
- Current sampling policy; and
- Respondents' view of the need for improvements and their suggestions / ideas on how to improve sampling policy and practice.

The nature and cause of trends was assessed separately for food hygiene (microbiological) and food standards (chemical) tests.

The survey comprised an online questionnaire. A request was emailed in December 2013 by the FSA to the heads of regulatory services with a request that their LA completes the questionnaire. The request was issued across the UK and to all types of LA (District, County, Unitary, London and Metropolitan) with food hygiene or food standards responsibilities.

6.3.2 Respondents

A total of 123 responses were received. Table 4 shows the response rate by type of LA.

Figure 11 shows the number of respondents by LA type and area of responsibility. It can be noted that responses were received from all LA types and for both food hygiene (94) and food standards (77), with some respondents responsible for both food hygiene and food standards. Figure 12 shows the number of respondents by area. Responses were received from all regions and countries (England (84), Scotland (13), Wales (15) and Northern Ireland (9)). Two respondents did not declare their affiliation. Figure 13 shows the response rate by country. The job roles of respondents are shown in Figure 15 with managers the most common type of respondent.

6.3.3 Response rate

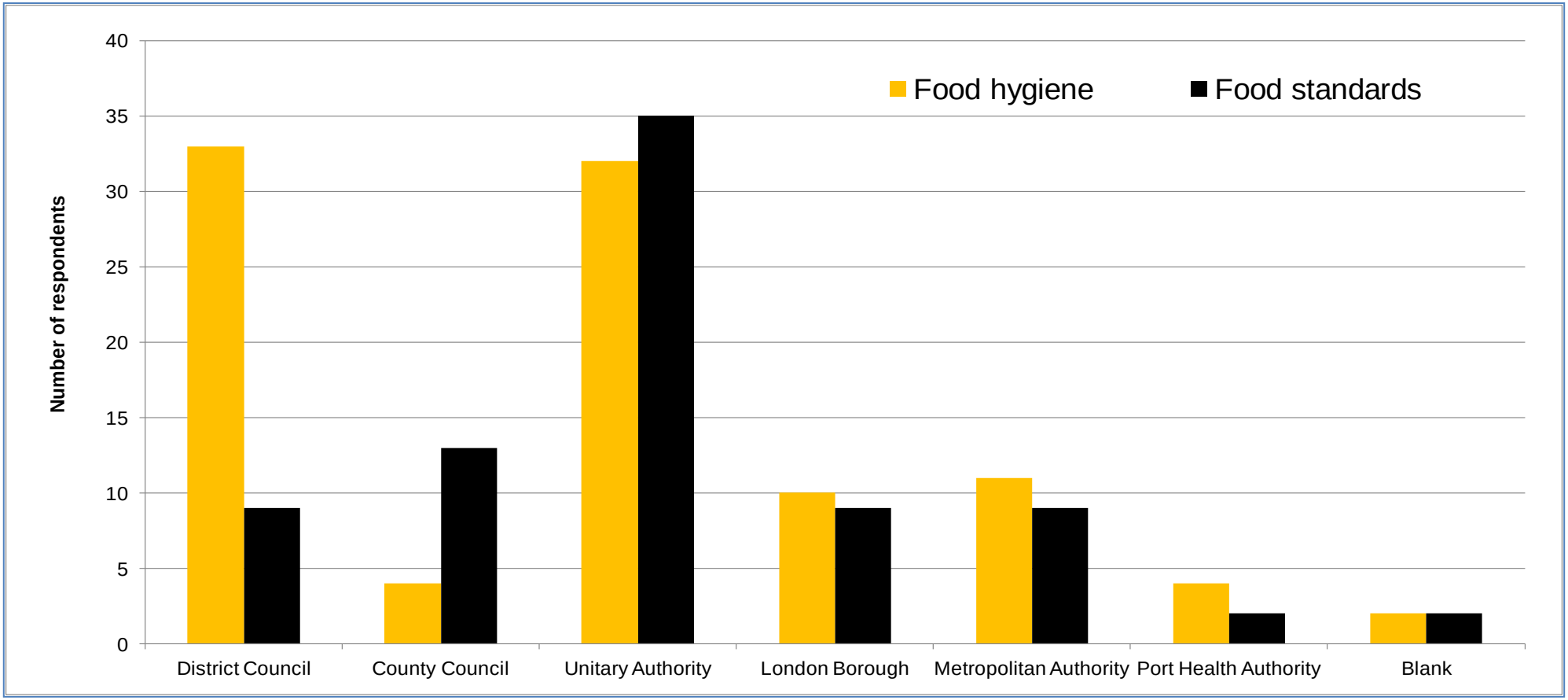
Overall there was a 27% response rate, ranging from just over 20% for England to over 60% for Wales. Figure 14 shows the response rate by LA type. The response rate was at or above 33% for all types of LAs except District Authorities that had a lower response rate of 17%. A 33%+ response rate matches good practice in respect of securing a representative response. A 17% response rate, whilst reasonable, is relatively less reliable.

Table 4: Response rate by LA type

	Response rate	Number of responses
District Council	17%	33
County Council	56%	15
Unitary Authority	34%	46
London Borough	33%	11
Metropolitan Authority	35%	13
Port Health Authority	31%	5

The response rate for (one respondent per authority with cited responsibility) food standards was 35% and 22% for food hygiene. As above, the response rate for food hygiene was lower due to the lower response rate of English District Councils.

Figure 11: Respondents by type of authority and area of responsibility



Note: Blank refers to two respondents who did not declare their affiliation.

Figure 12: Respondents by area

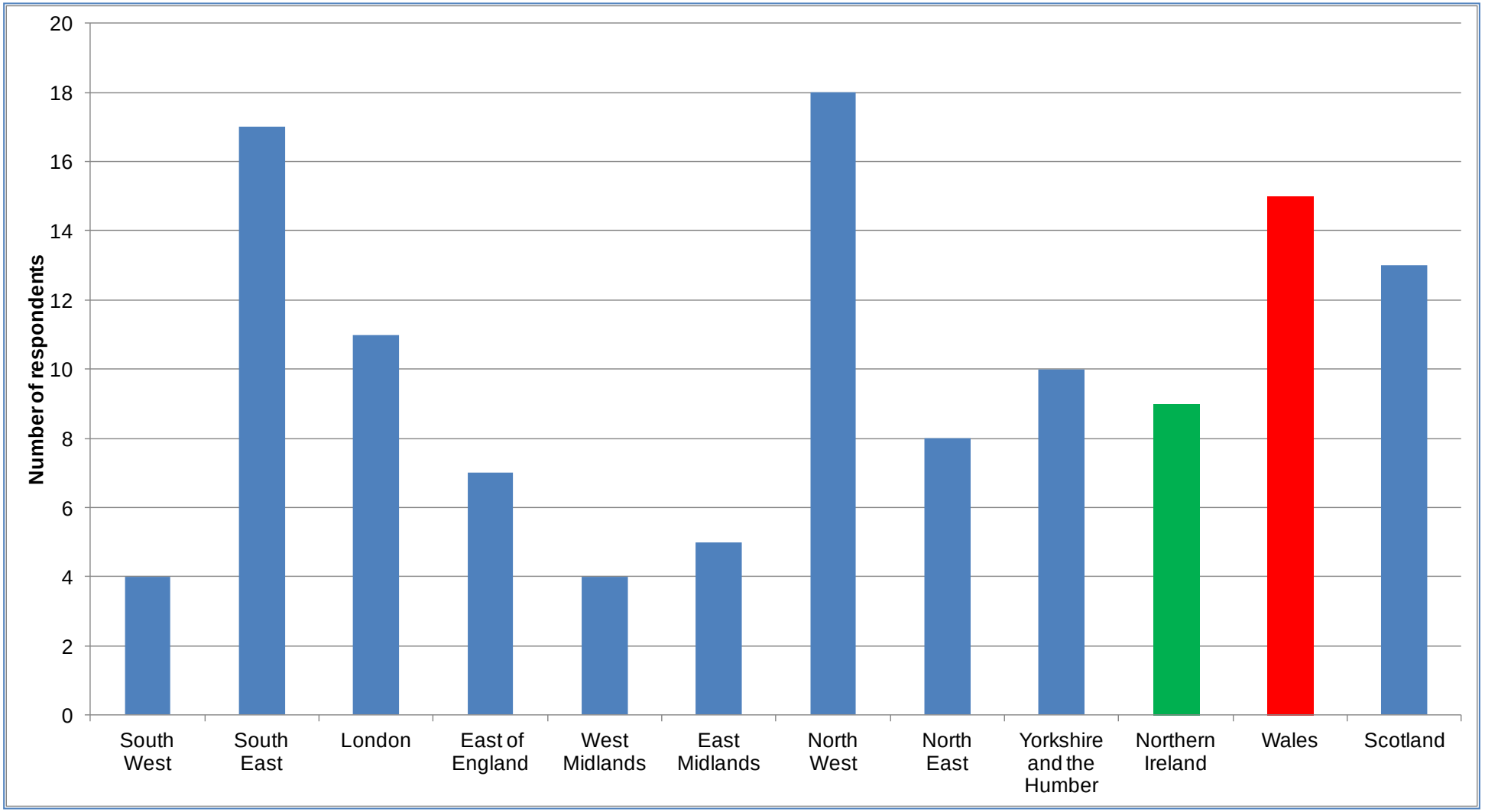


Figure 13: Response rate by country

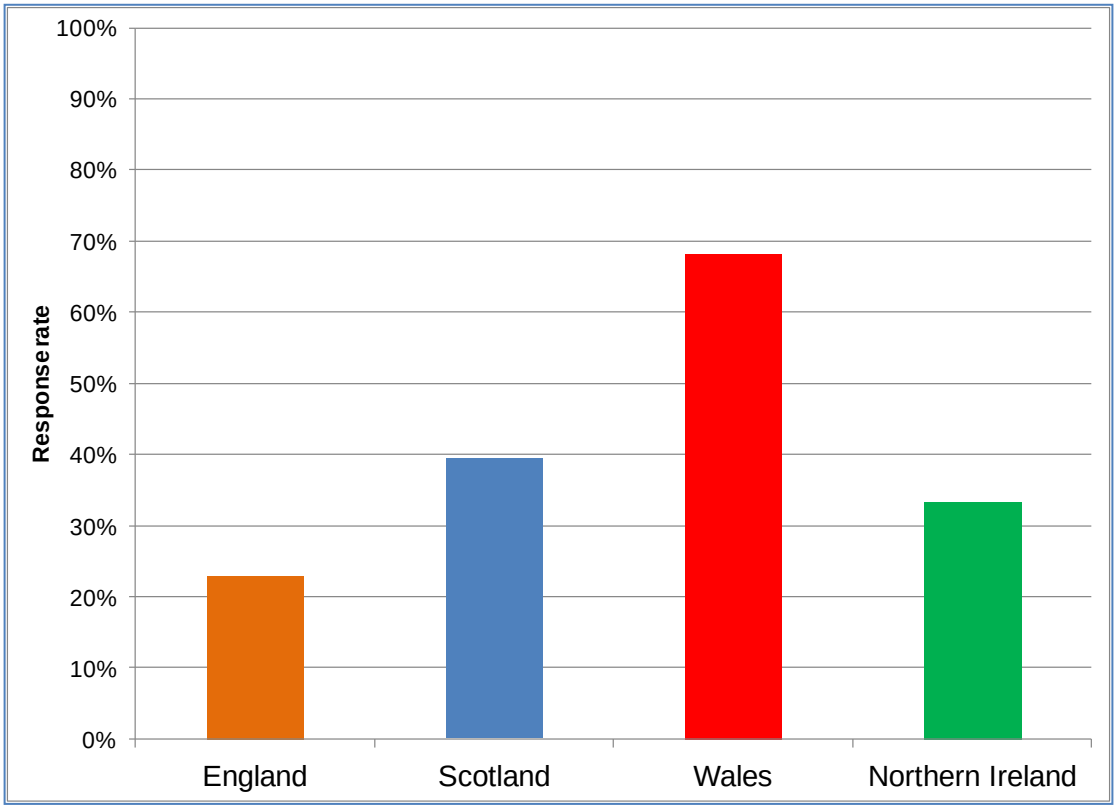


Figure 14: Response rate by LA type

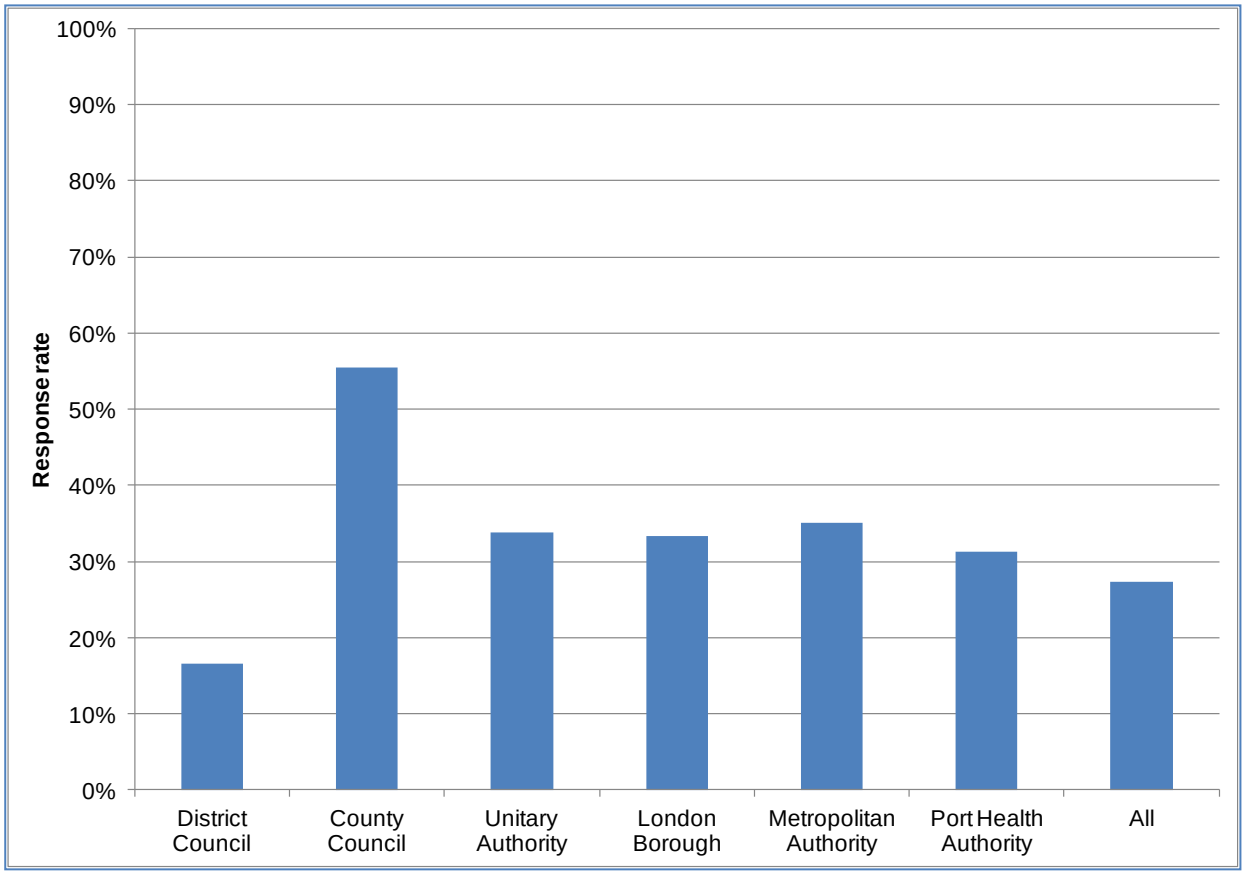
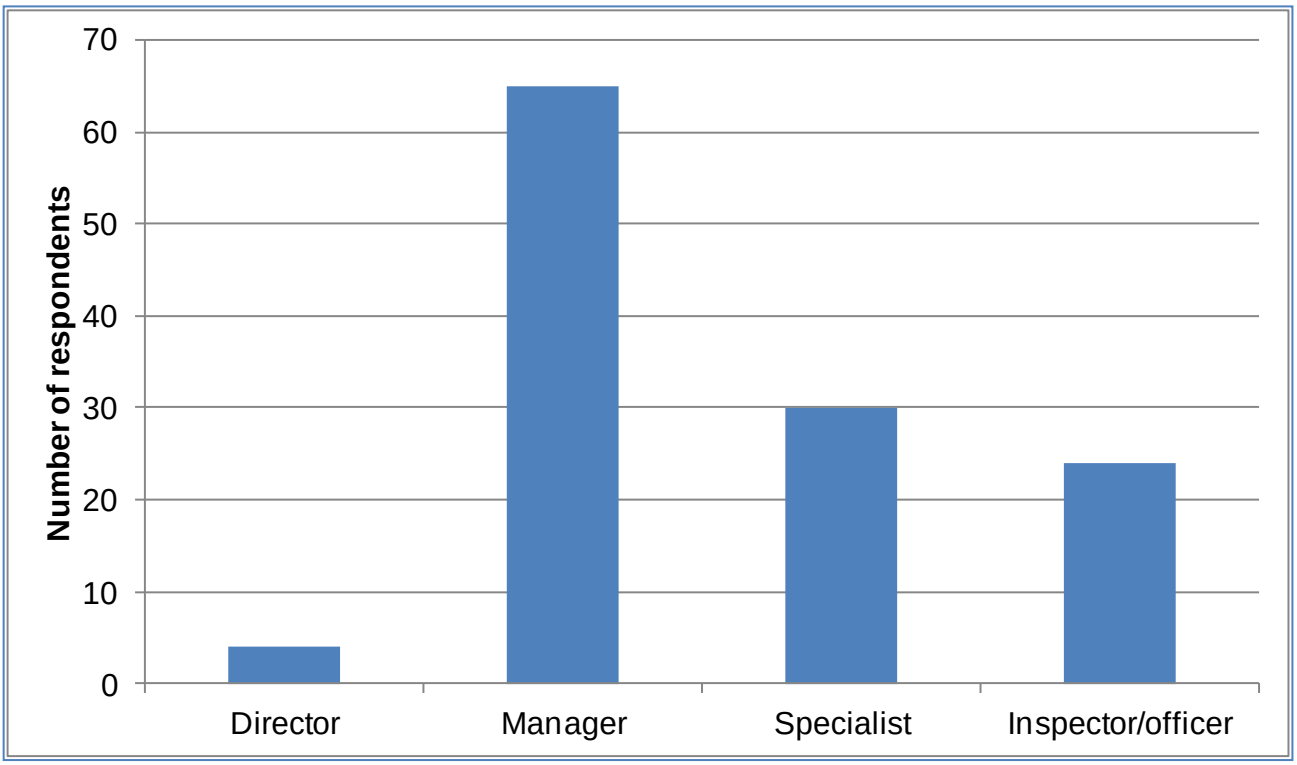


Figure 15: Type of respondent job role



6.3.4 Sample confidence intervals

With 123 respondents from 449 authorities the margin of error (at 95% confidence level) would be 7.6% where 50% of people give a particular answer, 6.5% where 25% give a particular answer and 4.5% where 10% give a particular answer. It should be noted, as per the latter values, that the margin of error is narrower where the per cent who give a particular answer is closer to 1% or 100% rather than closer to 50%.

The margin of errors for each type of LA are greater due to the smaller sample sizes per type of authority, ranging (for when 25% of respondents give the same answer) from 10% for Unitary Authorities to 32% for PHAs. Therefore, care must be taken in interpreting differences in responses between types of LA.

The margin of error for each country was 8% for England, 19% for Scotland, 13% for Wales and 24% for Northern Ireland (for when 25% of people give the same answer). Thus, again care must be taken in comparing results between countries.

The margin of error for food hygiene and food standards responses would be 8% in each case, (again for when 25% of people give the same answer) and 9% when 50% give the same answer. This does allow larger differences (in region of 10% or more) in responses to be identified between food hygiene and food standards responses and more interpretive analysis.

Given these margins of error, results are presented mostly for respondents as a whole, with some comparisons between food hygiene and food standards.

7 APPENDIX B: DETAILED ANALYSIS OF SAMPLING TREND DATA

7.1 Trends for PHAs

It is clear, (Figure 16), that there has been a large increase in testing of non-animal food imports since 2010 after the introduction of new high risk food and feed test requirements for FNOAO. The total number of samples rose from 4,122 in 2009/10 to 8,394 in 2011/12, a rise of 4,272 (104%) between 2009/10 and 2011/12, before falling to 6,404 in 2012/13.

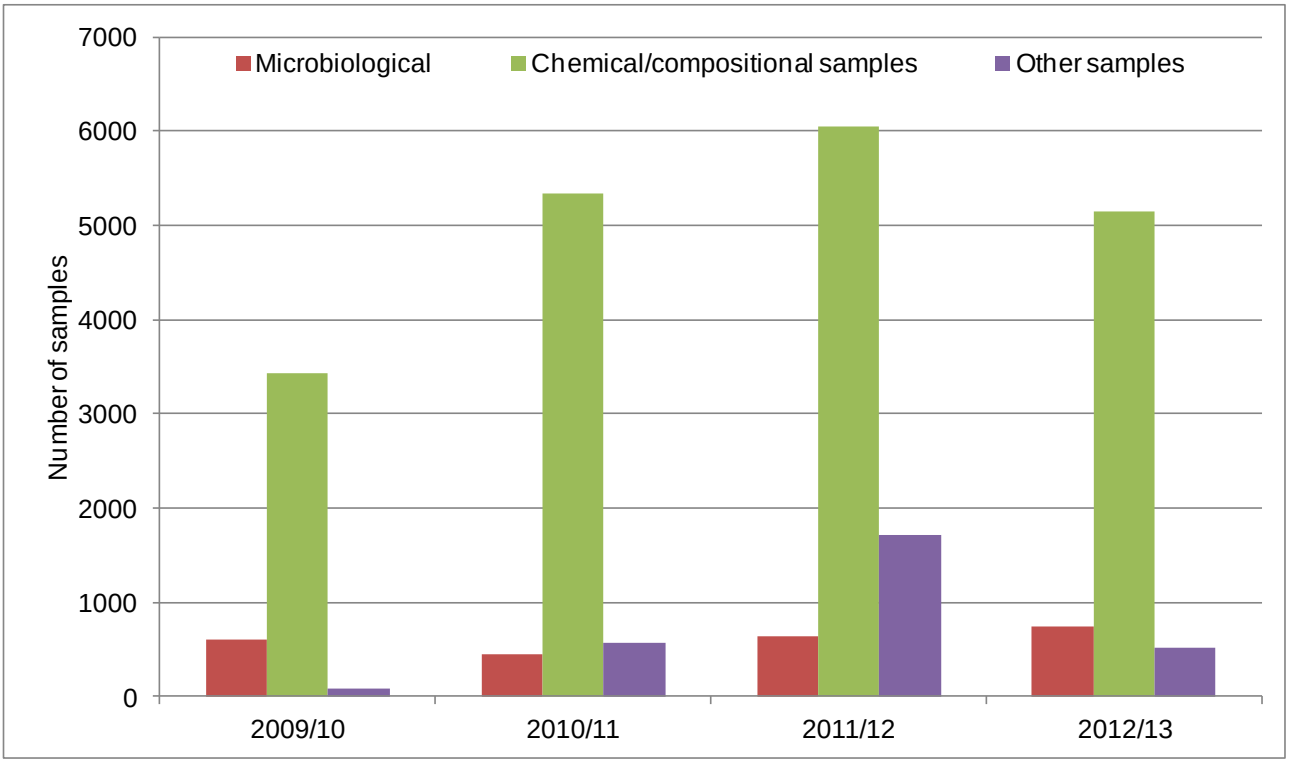
Samples are categorised as microbiological, chemical/compositional and 'other'. Agency data indicates that for 2009/10 to 2011/12:

- 38% of the increase is due to more "other" samples;
- 61% of the increase is due to more chemical/compositional samples – of which 77% were FNOAO in 2011/12;
- Only 0.7% of the increase is due to microbiological samples.

Samples of FNOAO equalled 79% of all PHA samples in 2011/12.

During the period 2009/10 to 2012/13 the number of consignments fell by 4%.

Figure 16: Trend in number of animal and non animal food tests at UK ports



7.2 Overall trends in sampling by inland LAs

7.2.1 Rate of samples taken and analysed

The trend in sampling can be presented as a rate per 1,000 establishments. Data is shown for 2003 to 2006/07 in Figure 17, for microbiological and chemical samples combined. The rate of formal samples declined over the period 2003 to 2006/07, by 18% for the UK as a whole.

The reporting process changed in 2007, so the trend for 2008/09 to 2012/13 is shown separately in Figure 18. Prior to 2007 data is based on formal samples and after 2007 it is based on Official Controls samples. Data for 2007/08 was incomplete and so is not shown.

The number of food establishments rose by 8% between 2008/09 and 2012/13. Figure 18 shows the trend in the rate of samples taken and analyses since 2008/09. The rates have fallen:

- The rate of samples taken per 1,000 establishments fell by 29%; and
- The rate of samples analysed per 1,000 establishments fell by 41%.

The 29% decline in the rate of samples taken seen in the period 2008/09 to 2012/13 (about 7% per year) is similar to the 18% decline seen in the period 2003 to 2006/07 (about 6% per year). Thus, there is evidence of a decline in the number of samples taken since 2003.

Figure 17: Trends in formal food samples taken 2003 to 2006/07 (UK)

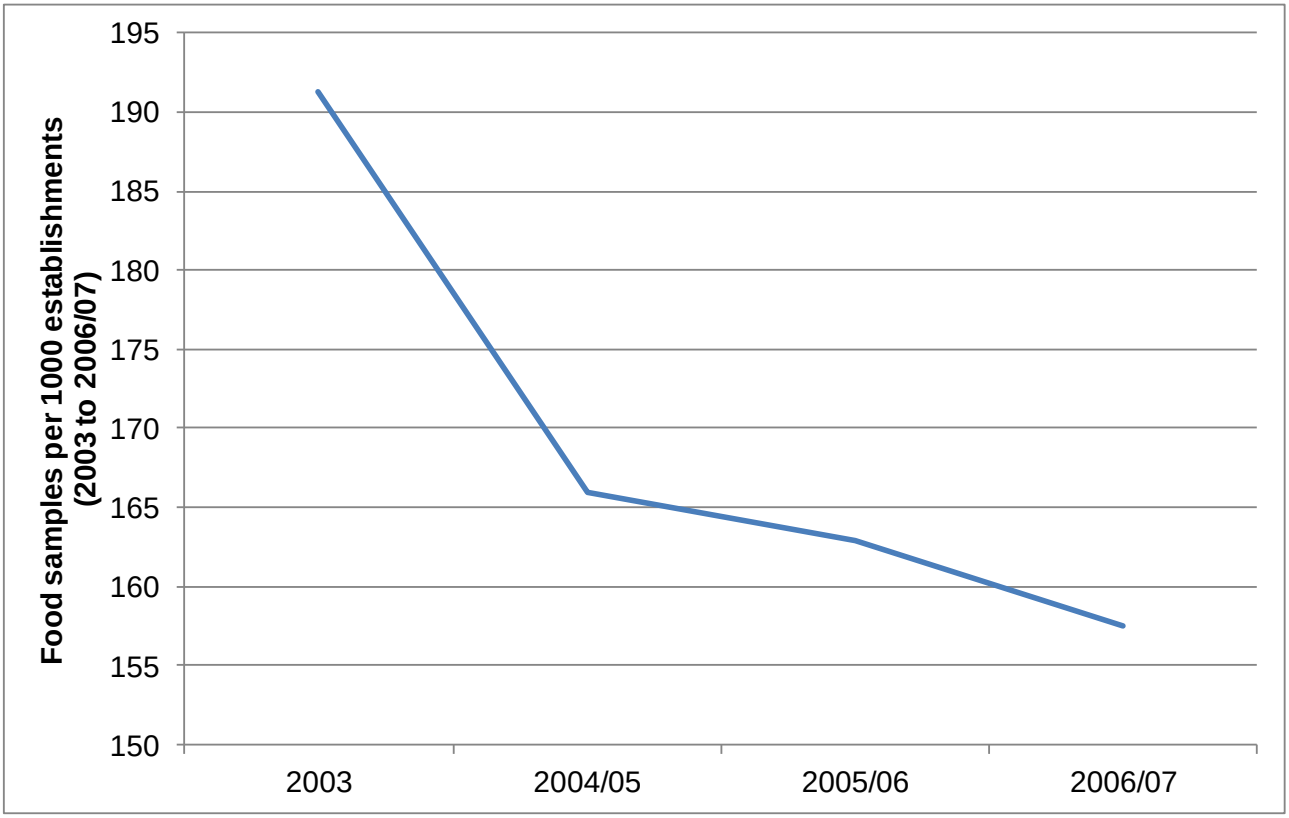
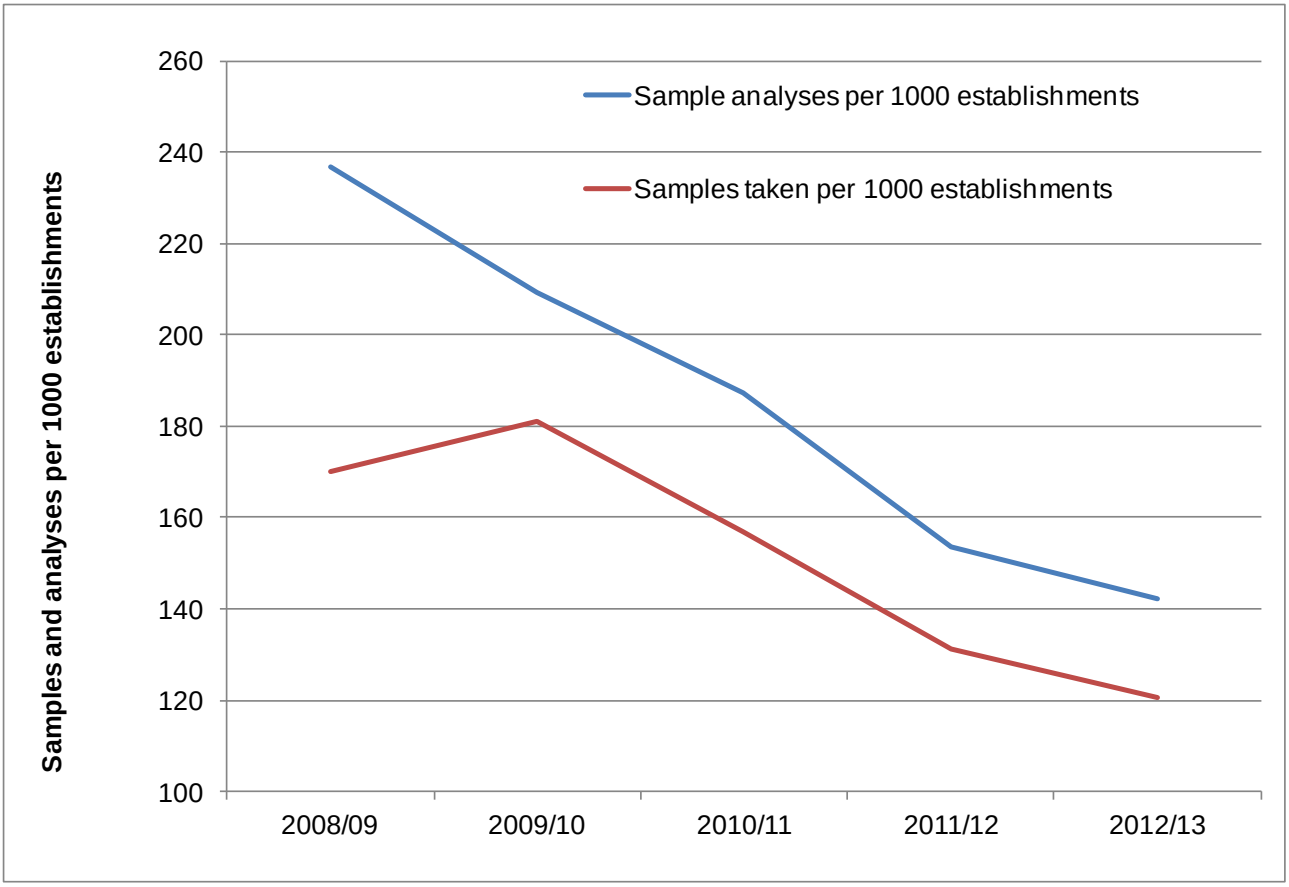


Figure 18: Trend in rate of food samples taken and sampling analyses per 1000 establishments (UK) (2008/09 to 2012/13)



Accounting for Agency grant funded sampling

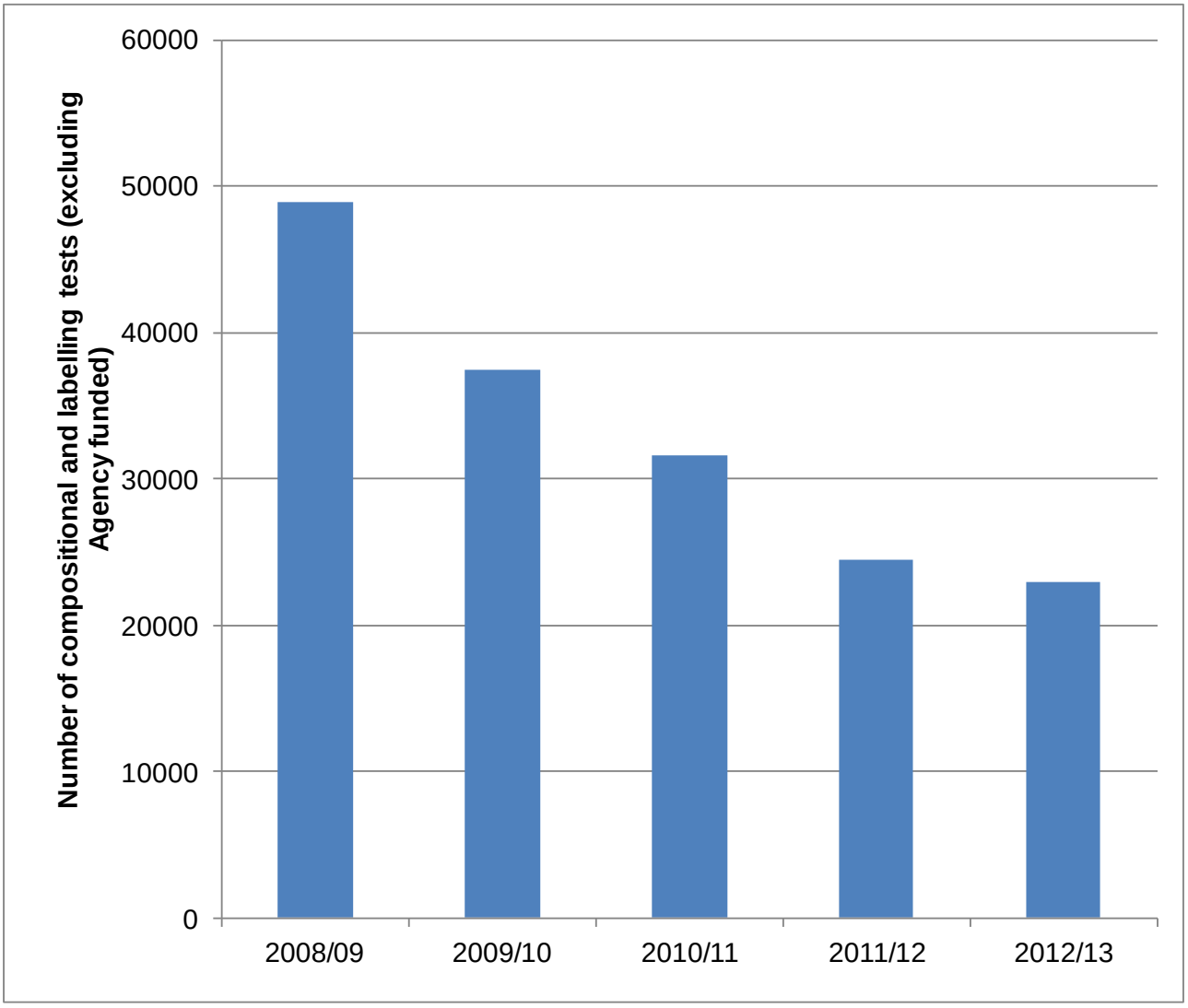
The Agency funds sampling of food, and more recently feed, as part of national co-ordinated sampling programmes[35]. If the samples analyses funded by Agency grants are excluded from the data, the decline in samples analyses between 2008/09 and 2012/13 equals 36%, declining from 127,257 to 81,670 in 2012/13.

The majority (>80%) of Agency grant funded analyses are chemical / compositional. The Agency chemical testing accounted for 9% of all compositional and labelling tests in 2008/09, rising to 19% of all UK compositional and labelling tests in 2011/12 and 15% in 2012/13. Indeed, if you exclude Agency funded compositional tests, the number of compositional and labelling tests has fallen by 53% between 2008/09 and 2012/13 (Figure 19).

The extent of Agency grant funded sampling has been in the region of 4,000 to 6,000 samples in the period 2005/06 to 2012/13. There were 6,406 reported Agency funded analyses in 2011/12 compared to 5,797 in 2008/09, and 4716 in 2012/13.

[35] http://www.food.gov.uk/enforcement/monitoring/samplingresources/samplingandsurveillance/#.UnEzmRAymlE (downloaded October 2013)

Figure 19: Trend in compositional and labelling test (UK, excluding Agency grant funded)



7.2.2 Changes by type of analyses in inland LAs

Figure 20 shows the decline in the number of analyses by type of analyses. Broadly speaking microbiological analyses relates to food hygiene whilst composition, labelling and presentation relate to food standards. It can be seen that:

- The number of composition, labelling and presentation analyses has declined far more than microbiological analyses;
- There is a 47% fall for compositional testing;
- There is a 53% fall for labelling; and
- There is a 25% fall in microbiological testing.

As per the data shown in Table 5:

- Composition, labelling and presentational analyses have fallen from being 41% of all analyses to 31% of all analyses; and
- In 2012/13 microbiological testing equated to 62% of samples analyses, compared to 53% 2008/09.

The Agency funded national sampling programme equates to just 1% of all microbiological tests. Thus, any changes in the Agency national programme would not impact the overall trend in microbiological testing.

Figure 20: Change in sampling analyses by type of analysis (UK)

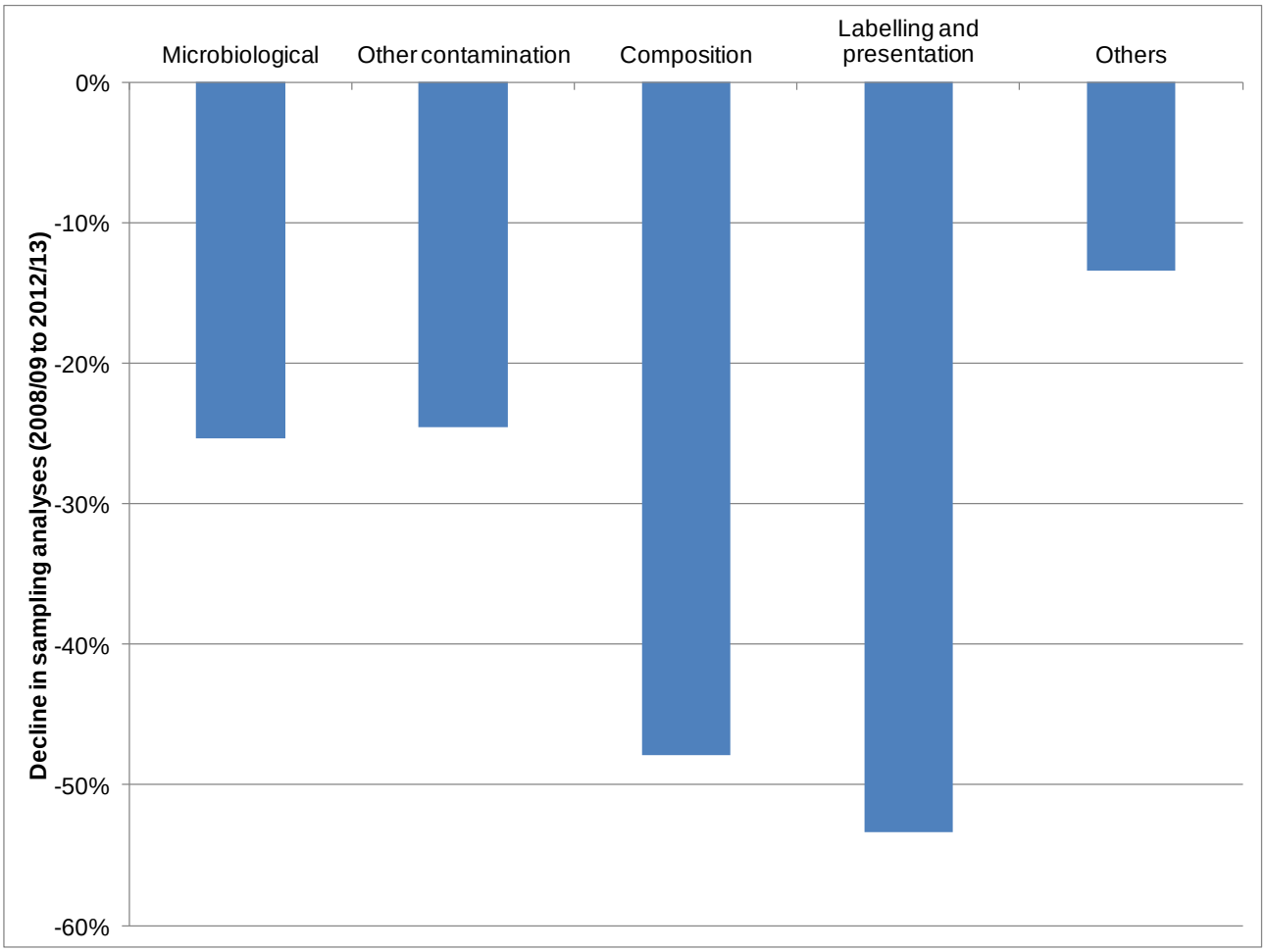


Table 5: Number of sampling analyses by type (UK)

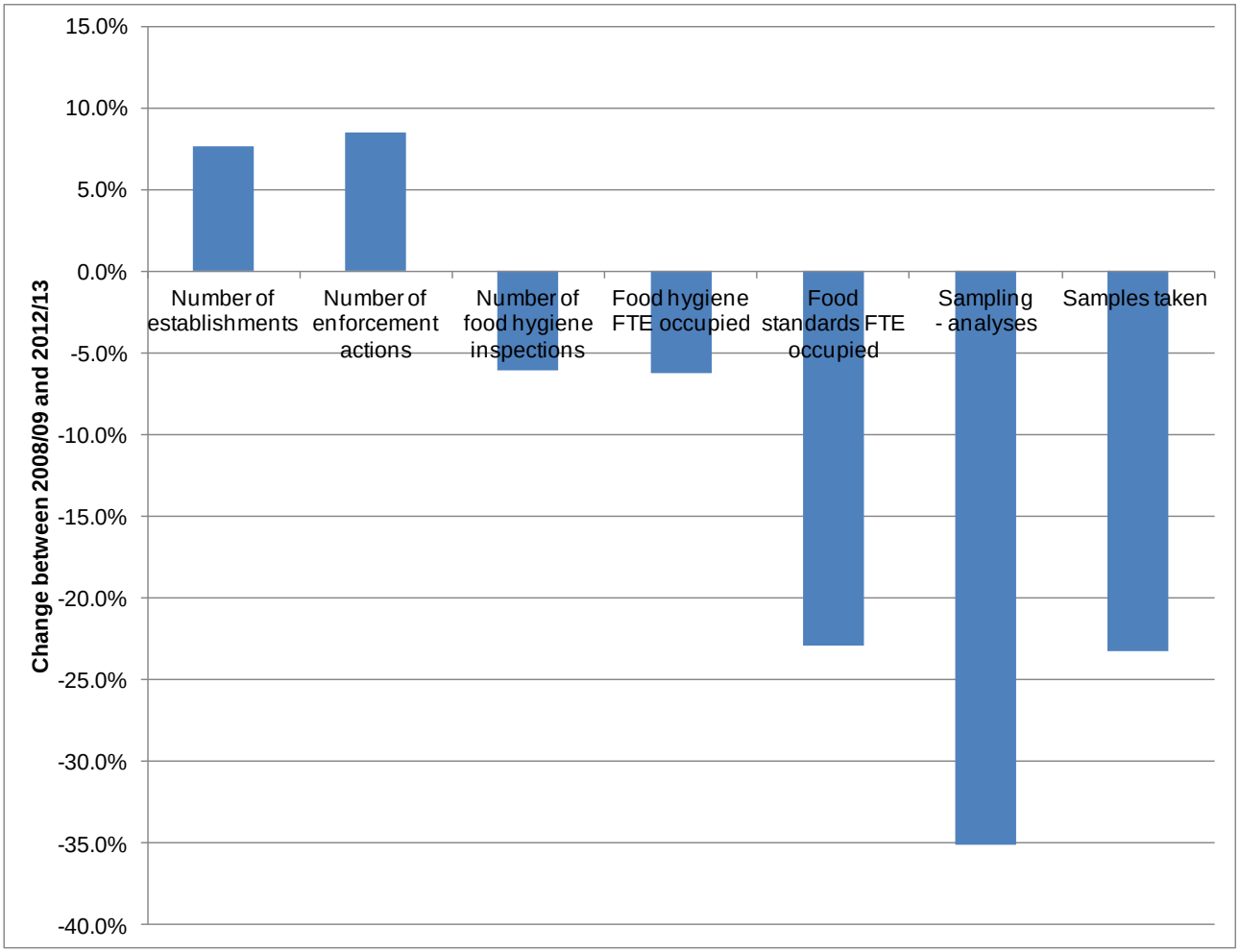
	2008/09	2009/10	2010/11	2011/12	2012/13
Microbiological	71131	70737	67184	55546	53447
Other contamination	5150	5121	4424	4432	3867
Composition	32599	26113	22255	18219	17137
Labelling and presentation	21343	16739	13942	11879	9942
Other	2831	3254	2303	2105	2451

7.3 Trends in establishments, inspections, enforcement, officers and sampling

Figure 21 presents the percentage change in the number of establishments, inspections, enforcement, officers and sampling between 2008/09 and 2012/13. It can be noted that:

- The decline in the number of sampling analyses exceeds the decline in the number of samples taken – with 15% fewer analyses per sample taken;
- There has been a greater decline in food standards officers than food hygiene professionals – a 6% fall versus a 23% fall;
- The 23% decline in samples taken far exceeds the 6% decline in the number of Full Time Equivalent (FTE) food hygiene professionals but is the same as the 23% decline in FTE food standards professionals;
- The number of food hygiene inspections has decreased by 6%, which matches the 6% decrease in food hygiene professionals; and
- The number of establishments has increased along with the number of enforcement actions, both by about 8%.

Figure 21: Percentage change in establishments, inspections, enforcement, officers, and samples taken and sample analyses (UK)



It was also found that the number of people reported by the Environmental Health Registration Board[36] to have gained a degree in Environmental Health remained steady in the period 2004 to 2010 (at about 200 per year) but then fell by 70% between 2010 and 2013 (60 registered), with falls in 2011 and 2012 also reported. The number of new registered degrees in 2000 to 2010 was 200 compared to 262 in 1990 to 1999. This does not indicate a major change in newly qualified Environmental Health professionals until 2011, i.e. after the number of food samples started to decline.

7.4 Comparison of trends by country

7.4.1 Rate per 1000 businesses

There were major differences in the rate and pattern of sampling between UK countries and types of LAs, as well as between food hygiene and food standards.

Northern Ireland, Wales and Scotland have reported higher rates of food sampling than England since about 2004/05. This remains the case in 2012/13.

Figure 22 shows the trends in food sampling per country for 2003 to 2006/07 as a rate per 1000 food establishments. Whilst Northern Ireland had the highest reported rate of formal samples it also had the greatest decline, a 36% decline. The rate of sampling did not clearly change in Scotland, with declines in England and Wales.

Figure 22: Comparison of food sampling (hygiene and standards) trends in each country (2003 to 2006//07)

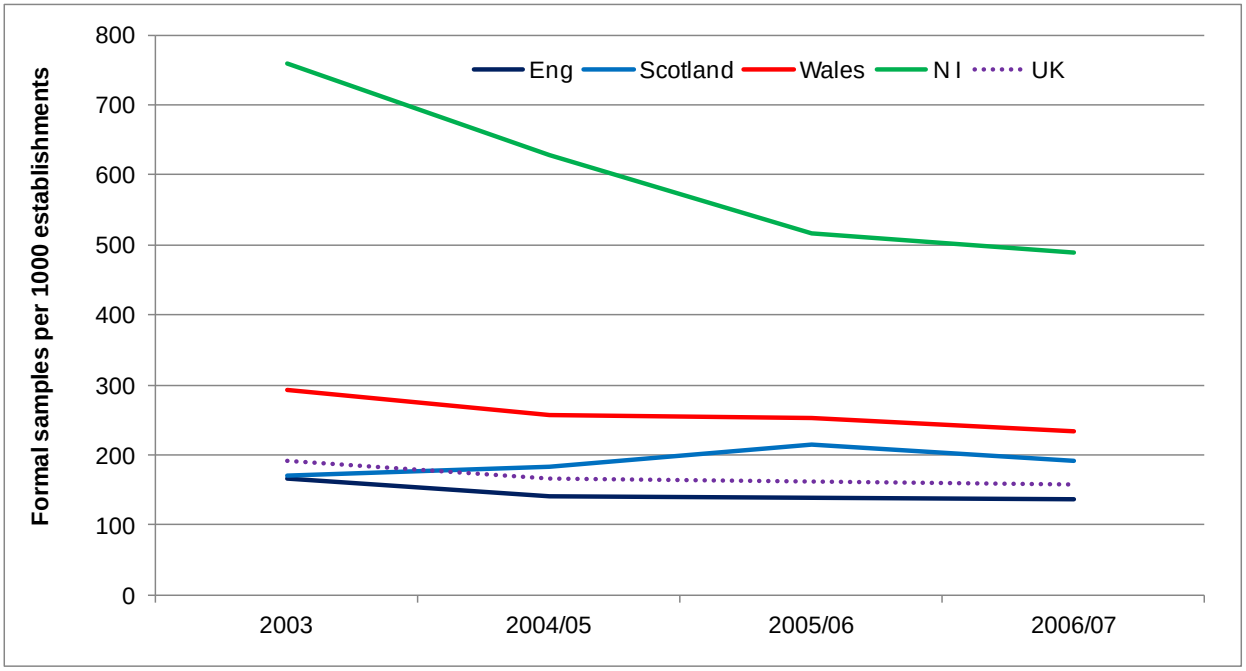


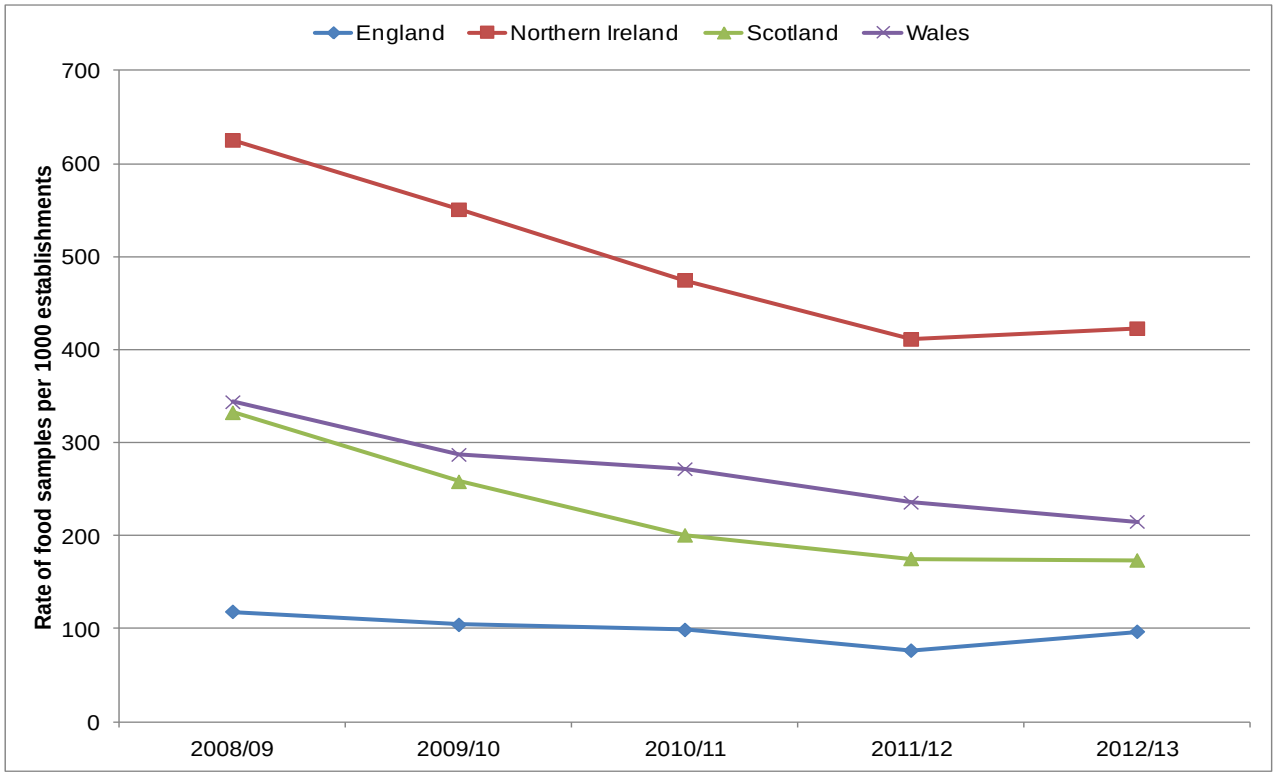
Figure 23 shows total food samples per country for 2008/09 to 2012/13. The rate of sampling declined in all countries, 29% in the UK, and 48% in Scotland, 18% in England, 32% in Northern Ireland and 37% in Wales.

[36] http://www.ehrb.co.uk/registers.html

Data is not available to assess trends for food hygiene and standards separately for each country. In England and Wales the rate of food standards sampling fell by 38% compared to a 19% fall in food hygiene sampling between 2009/10 and 2011/12.

Thus, the rates of samples have fallen most in Scotland, Wales and Northern Ireland but from a far higher starting point than England. Rates of sampling remain far higher in Scotland, Wales and Northern Ireland in 2012/13 despite the particular falls in these countries. It should be noted that the number of samples in 2012/13 may have been "boosted" by the response to the "horsemeat scandal".

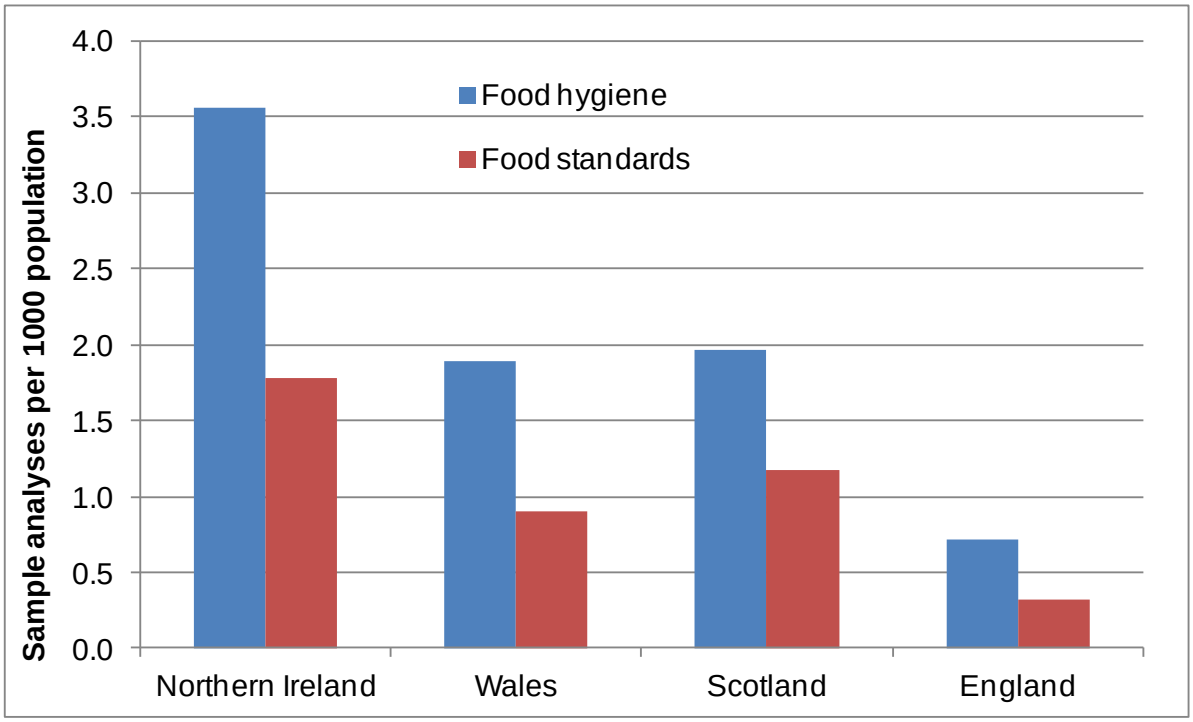
Figure 23: Trends in food (hygiene & standards) sampling by country (2008/09 to 2012/13)



7.4.2 Rates of food samples by country

As shown in Figure 24, the rate of samples per 1000 population is far higher in Scotland, Wales and Northern Ireland than in England.

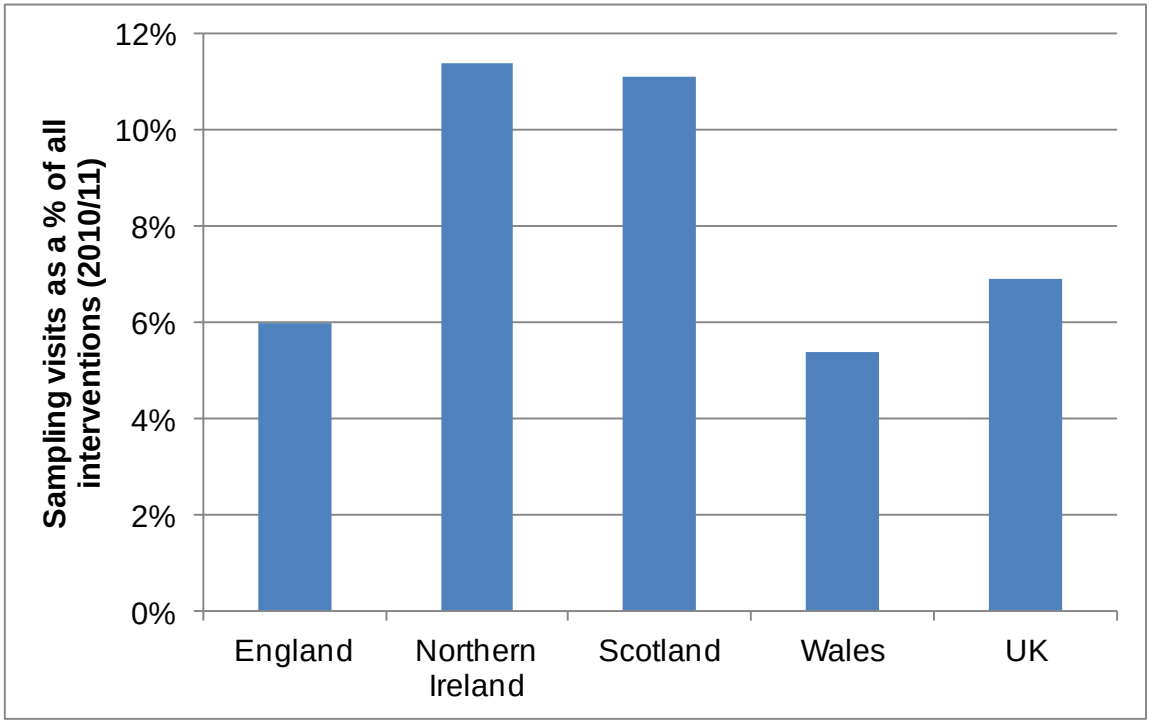
Figure 24: Sample analyses per 1000 population (2012/13)



Sampling visits as a proportion of total interventions

Figure 25 shows sampling visits as a proportion of total interventions by country. Northern Ireland and Scotland have higher proportions of sampling visits.

Figure 25: Sampling visits as a % of total interventions by country (2010/11)



7.5 Comparison by type of English LA

As shown in Figure 26, the rate of sampling varies greatly between the types of English LAs, with London borough councils reporting the lowest rate of sampling. It should be noted that English county councils do not enforce food hygiene and English district councils do not enforce food standards. All other types of LAs enforce both food hygiene and food standards.

Figure 26: Sample analyses per 1000 population (English LAs, 2012/13)

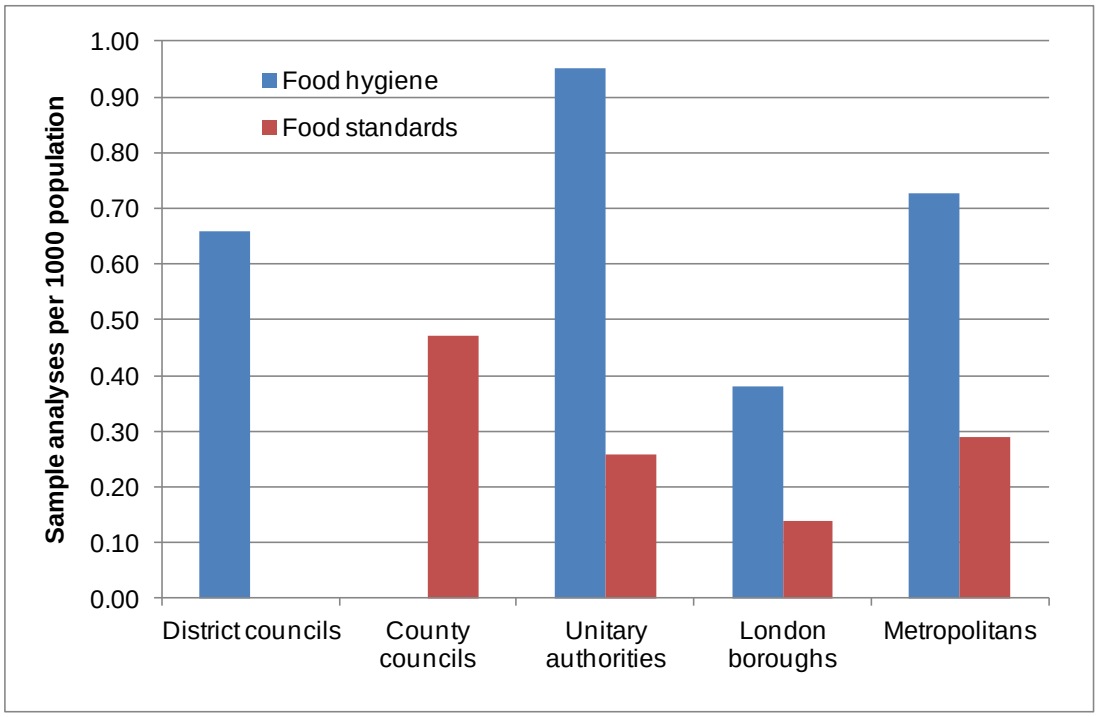
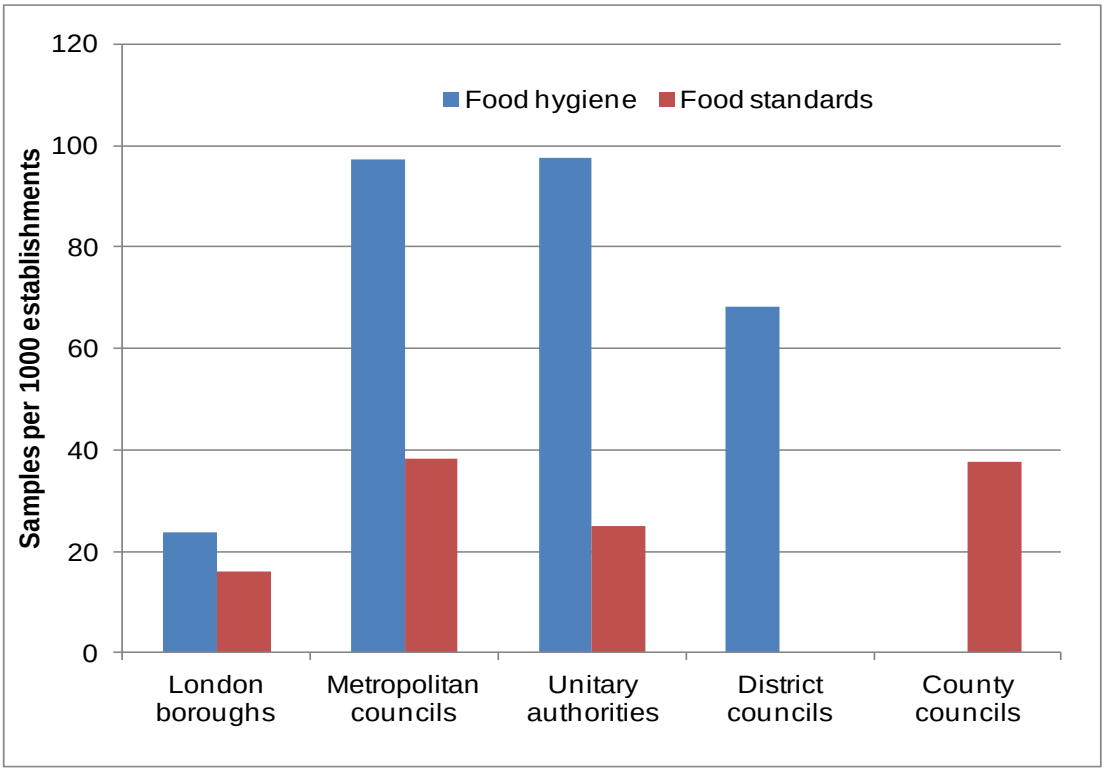


Figure 27 shows the rate of samples per 1000 establishments. It can be noted again that London boroughs have the lowest rate of sampling, with unitary authorities having relatively low rates of food standards samples.

Figure 27: Food hygiene and food standards samples per 1000 establishments (English LAs, 2011/12)



7.6 Number of samples versus number of establishments and population

7.6.1 Samples per number of establishments and people

The number of food samples was compared to the number of establishments in each local authority, using sampling and establishment data taken from LAEMS 2011/12. The correlation (R value) between the number of samples, the number of establishments and the number of people in 2012/13 has been determined (Table 6).

The R values indicate the strength of association between two variables, with zero indicating no association, going to R = 1 representing a very strong relationship where both variables increase or decrease together, and R = -1 reflecting a strong association where one variable increases whilst the other one decreases.

- London and English metropolitan LAs have:
    - No demonstrable relationship between the number of establishments or people within each borough and the number of food hygiene samples taken by each borough LA,
    - A weak relationship between the number of establishments or people within each borough and the number of food standards samples taken by each borough LA, and

    The metropolitan LAs tend to take fewer samples in areas with more people and establishments;
- There is no association between the number of people within each English district council and the number of food hygiene samples, with a weak association shown between food hygiene samples and the number of establishments;
- There is a moderate relationship (R = 0.28) between the number of food hygiene and food standards samples and the number of people and establishments in English unitary authorities;
- There is a strong relationship between the number of food standards samples and the number of people and establishments in English county councils (R = 0.65; R = 0.61);
- A strong association is shown in Scotland between establishments and the number of samples for both food hygiene and food standards, and a strong relationship between people and food hygiene samples (R= 0.71; R=0.68; R=0.66;);
- There is a strong association in Wales between the number of people and food hygiene and food standards samples (R=0.46; R=0.57), and a moderate relationship with the number of establishments;
- There is a very strong association between the number of establishments/people and the number of samples in Northern Ireland (R =0.94).

This suggests that Northern Ireland, Scotland, Wales and English county councils (to some extent unitary authorities) have a practice that links the number of samples to the number of establishments (which reflect the number of people), whilst other types of English LAs do not pursue a consistent approach that links the number of samples to the size of the number of establishments or residents in their areas.

Table 6: Correlations (R values) between number of samples and number of establishments, and with the number of people (2012/13)

	N	Samples and number of establishments		Samples and number of people	
		Food hygiene	Food standards	Food hygiene	Food standards
Northern Ireland	26	0.96*	0.86*	0.95*	0.89*
Wales	22	0.46**	0.57***	0.62*	0.70*
Scotland	32	0.71*	0.68*	0.66*	0.55*
Unitary authorities (England)	56	0.28**	0.28**	0.31**	0.45*
County councils (England)	27	N/A	0.65*	N/A	0.61*
District councils (England)	200	0.23*	N/A	0.02	N/A
London (England)	33	-0.02	0.10	-0.09	0.27
Metropolitans (England)	37	-0.01	-0.15	-0.08	-0.15

*p<0.002 **p<0.05 ***P<0.01

These results are exemplified in Figure 28 to Figure 41. Where appropriate best fit lines and R^2 values (% of variance accounted for by the best fit lines) are shown in the figures. The figures reinforce the correlations shown in Table 6 with the exception of indicating that there is no clear association between the number of establishments and food samples in London or English metropolitan boroughs.

Figure 28: English district LAs – food hygiene samples and establishments (2012/13)

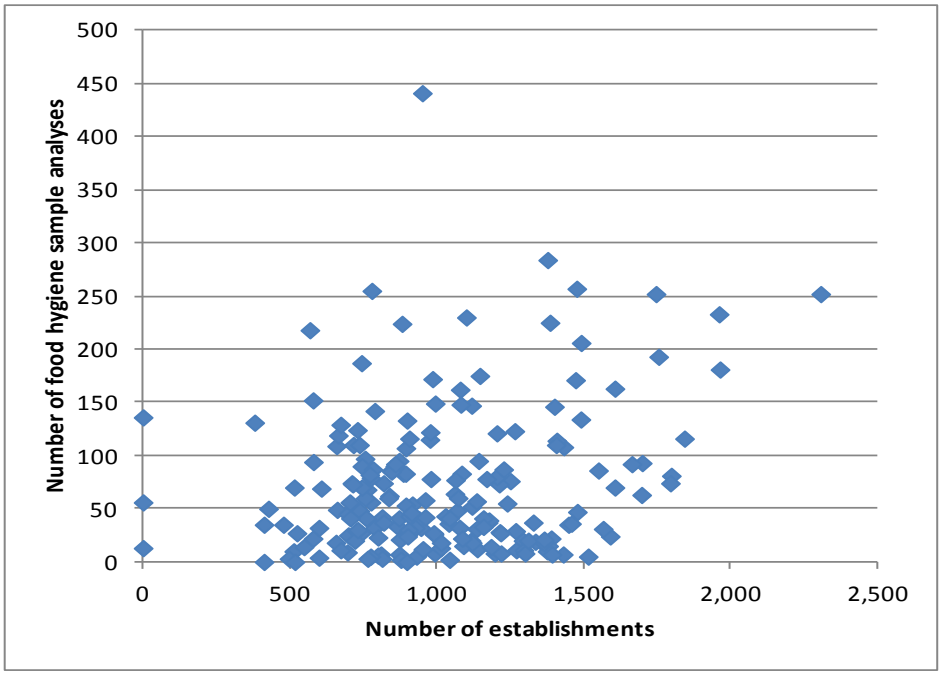


Figure 29: English county councils – food standards samples and establishments (2012/13)

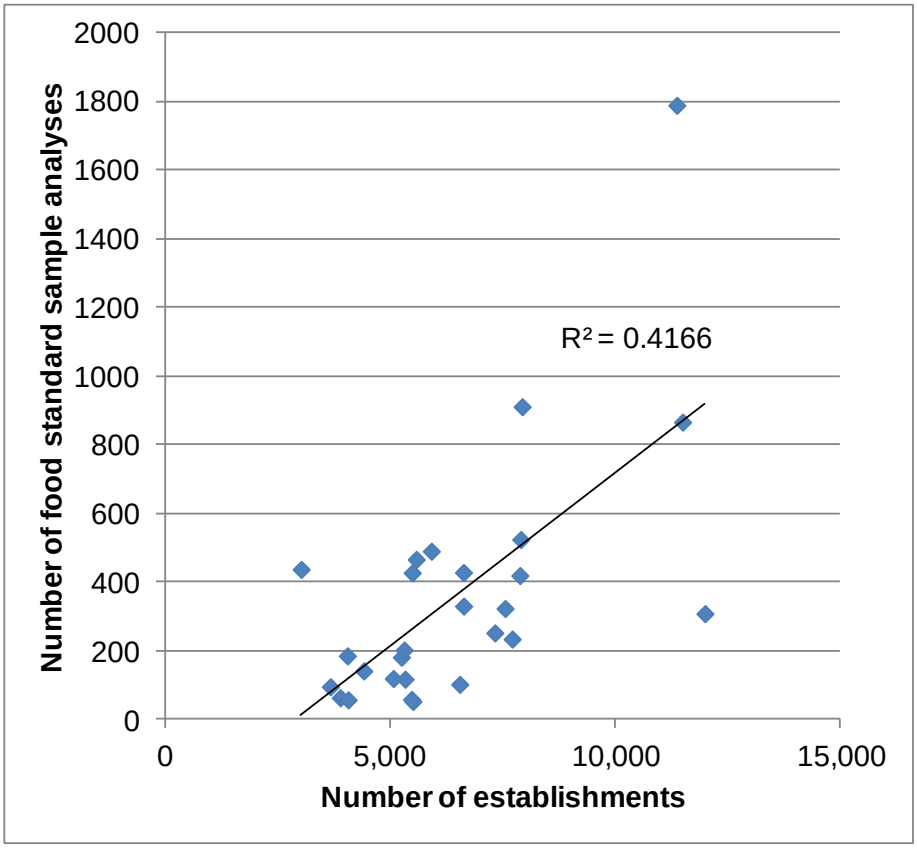


Figure 30: London boroughs – food hygiene samples and establishments (2012/13)

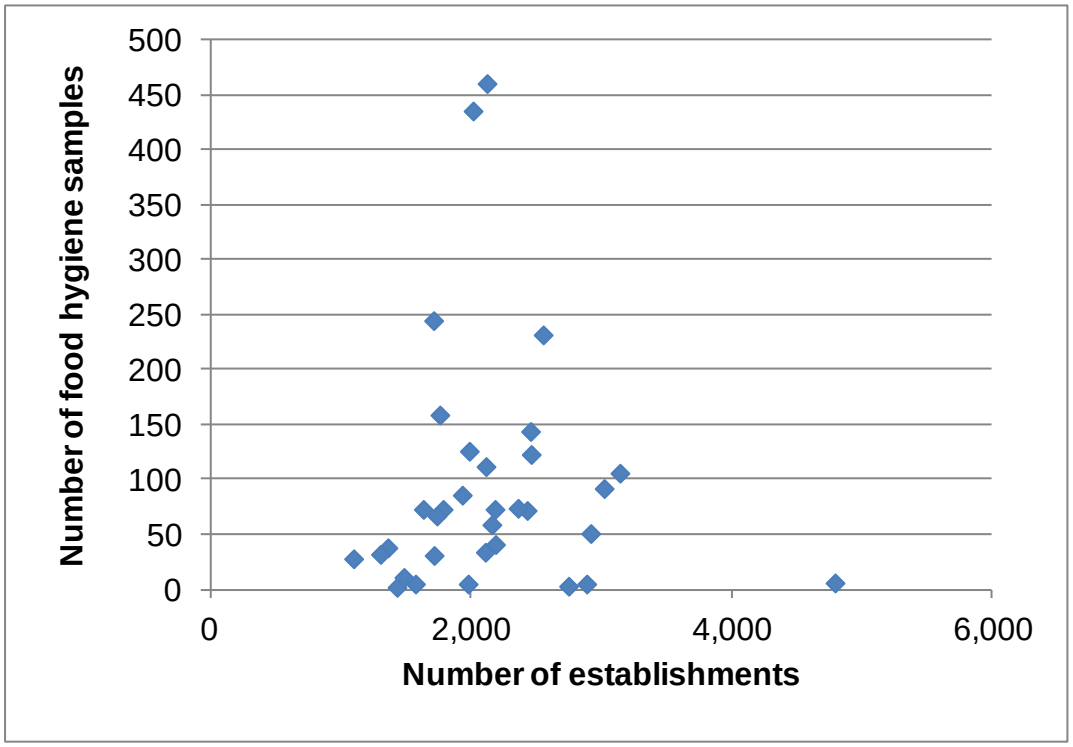


Figure 31: London boroughs – food standards samples and establishments (2012/13)

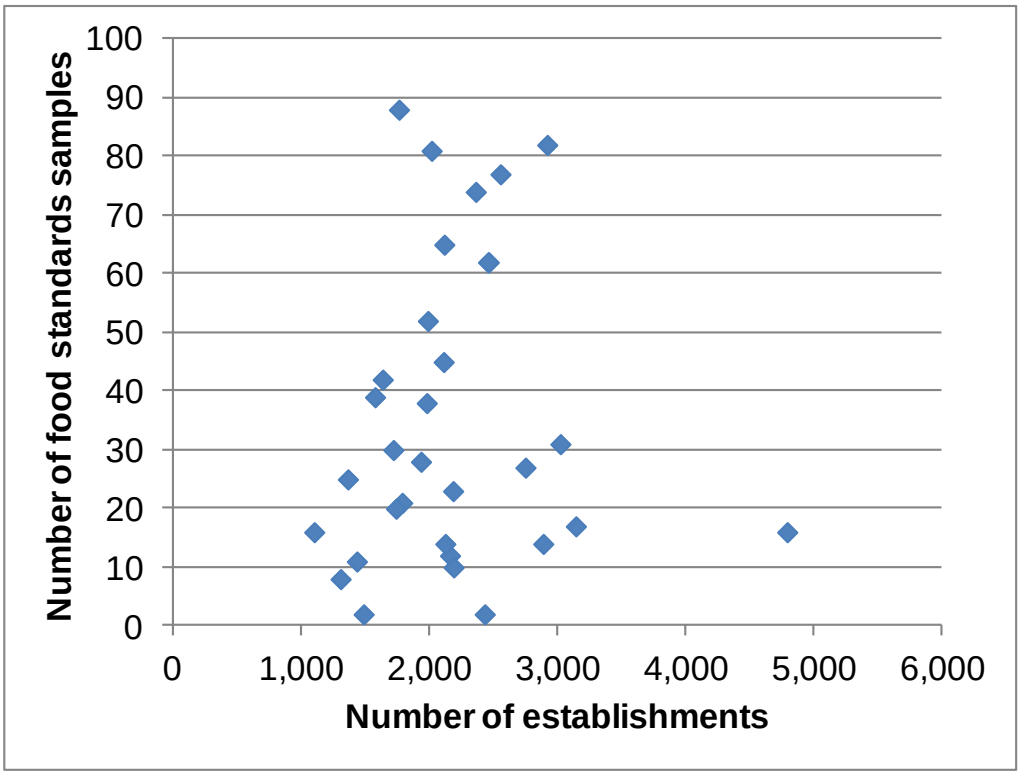


Figure 32: English metropolitan LAs – food hygiene samples and establishments (2012/13)

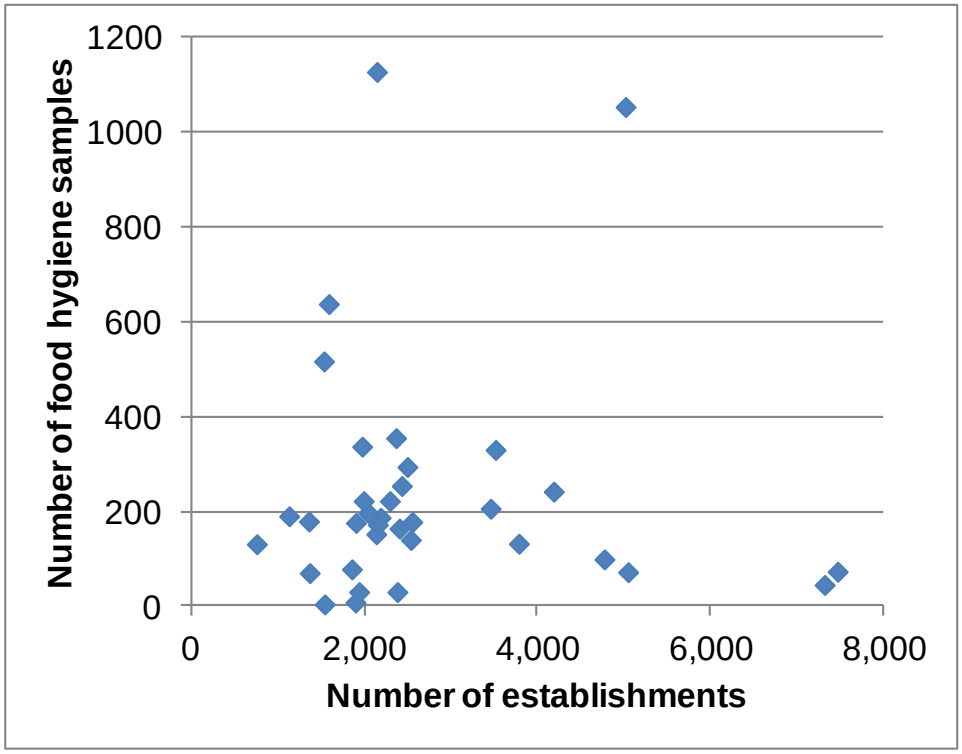


Figure 33: English metropolitan LAs – food standards samples and establishments (2012/13)

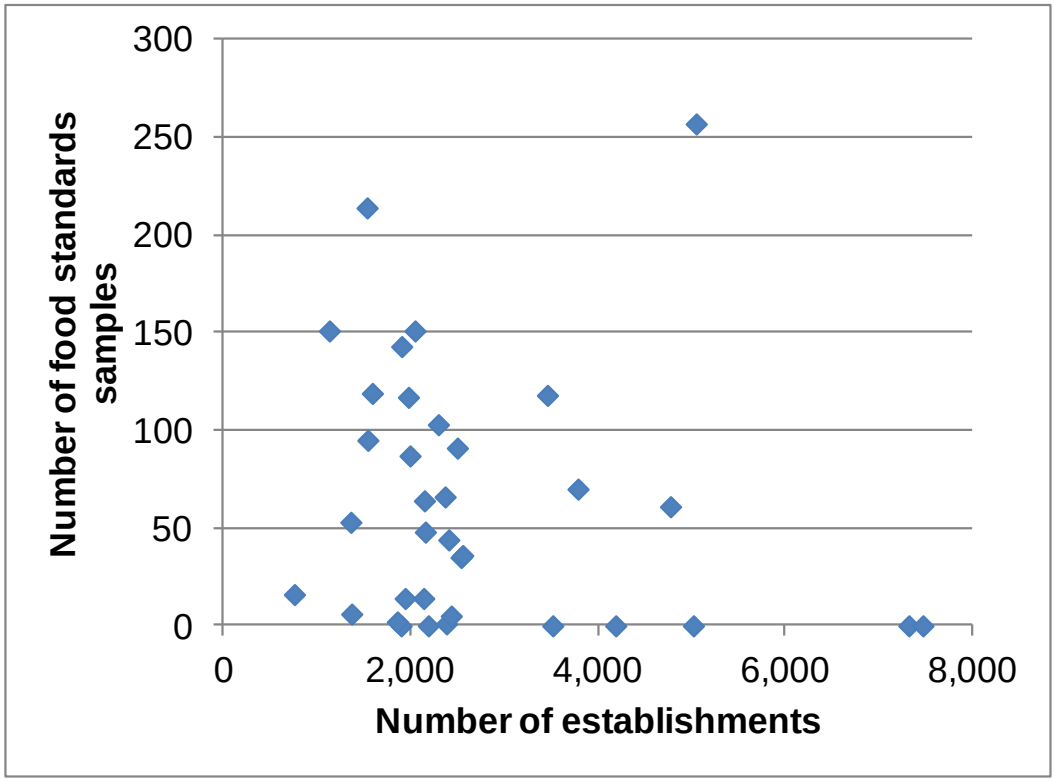


Figure 34: English unitary authorities – food hygiene samples and establishments (2012/13)

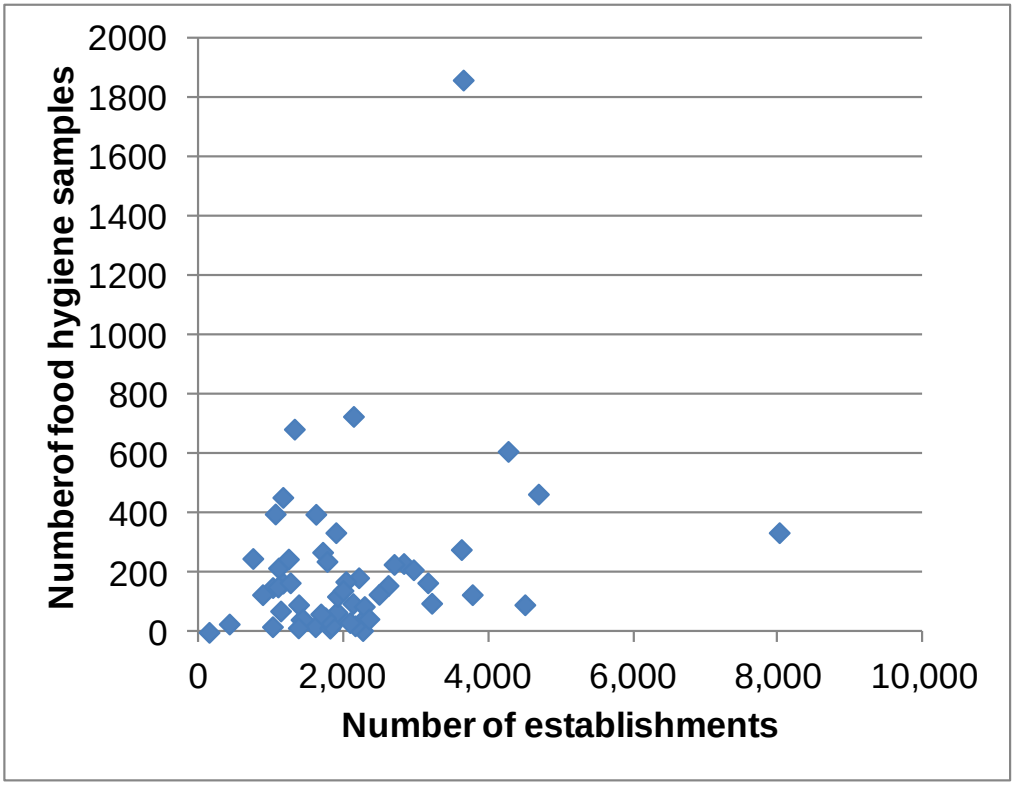


Figure 35: English unitary authorities – food standards samples and establishments (2012/13)

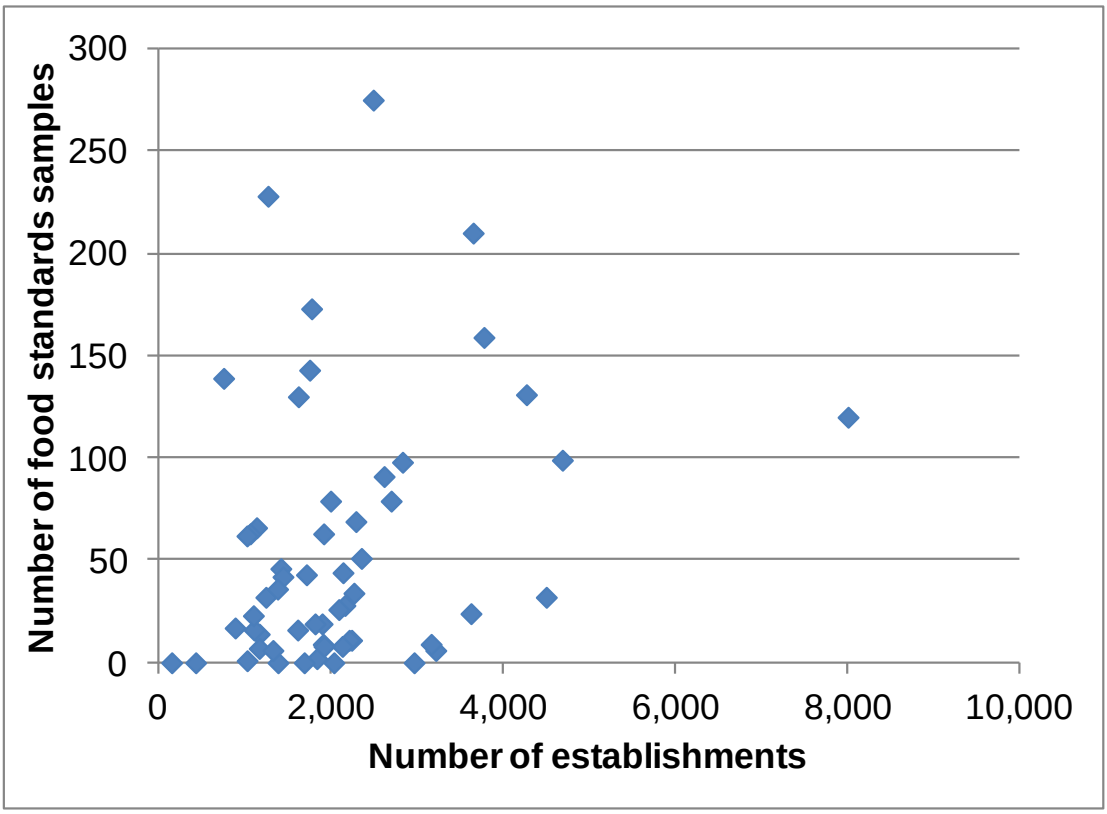


Figure 36: Northern Ireland – food hygiene samples and establishments (2012/13)

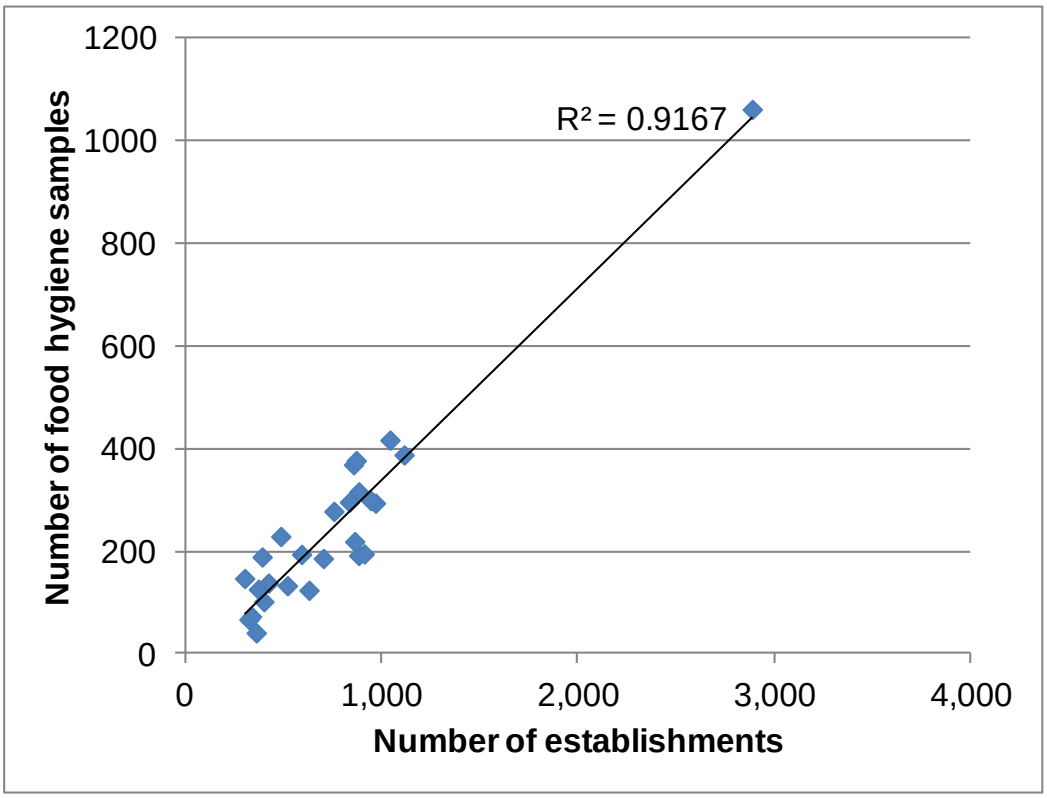


Figure 37: Northern Ireland – food standards samples and establishments (2012/13)

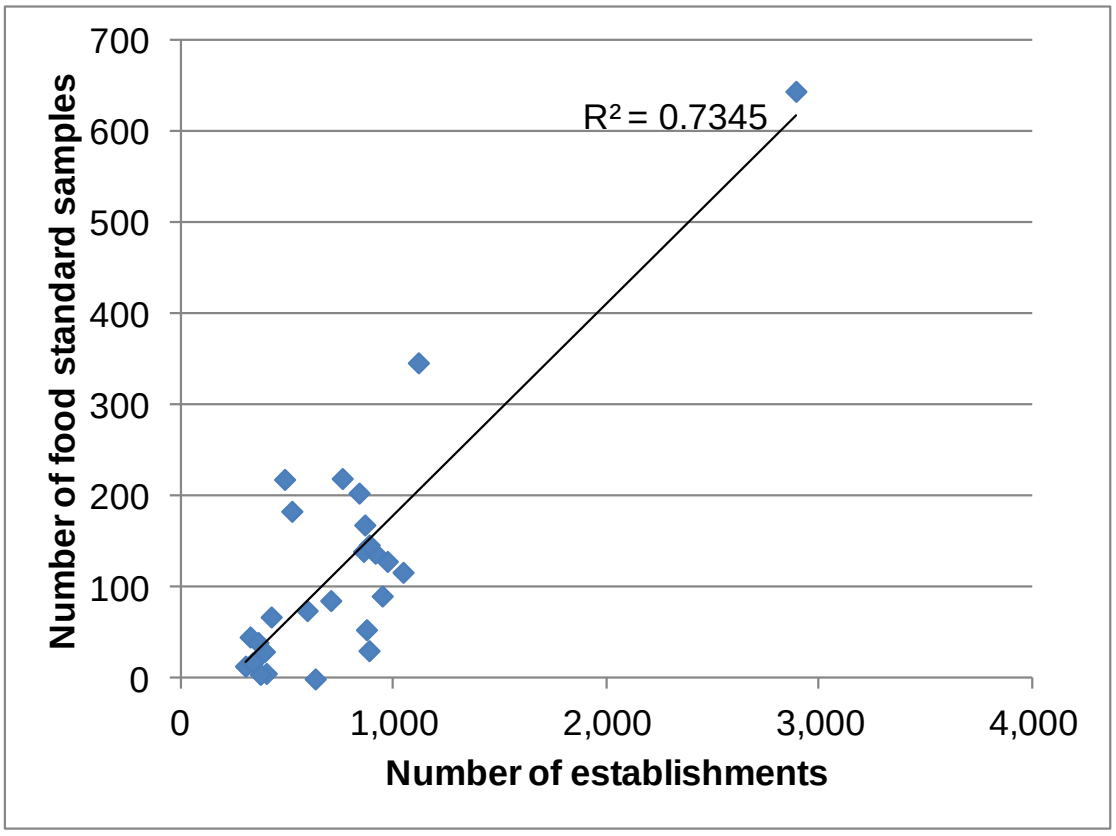


Figure 38: Scotland – food hygiene samples and establishments (2012/13)

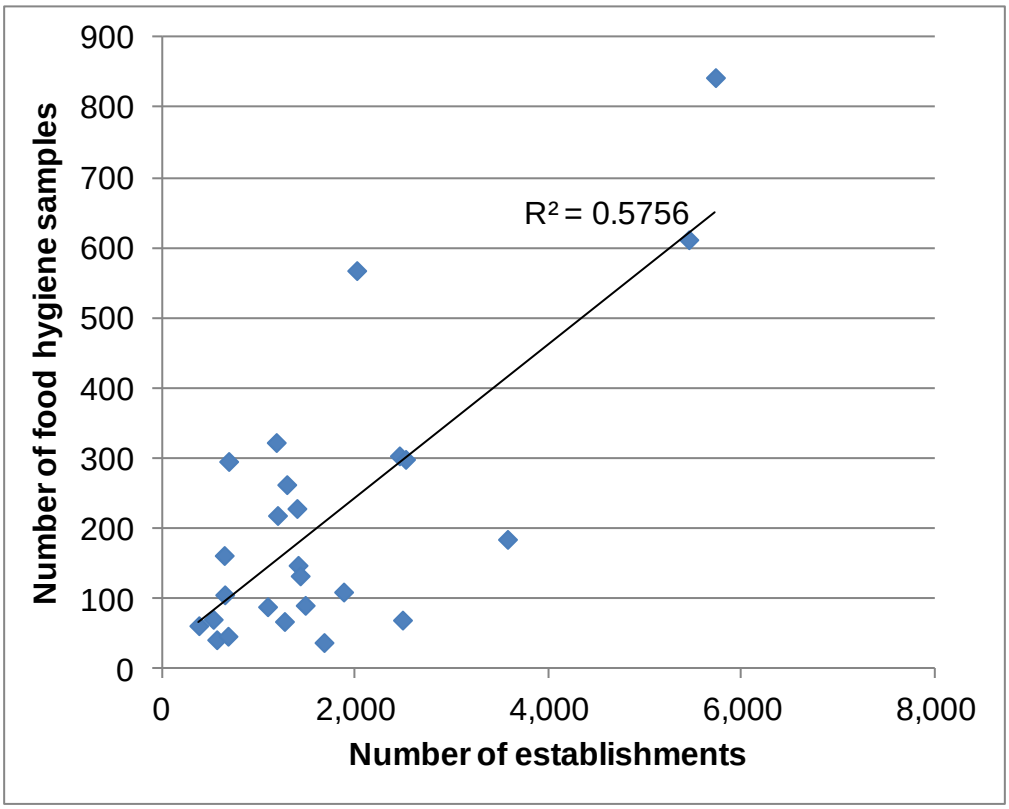


Figure 39: Scotland – food standards samples and establishments (2012/13)

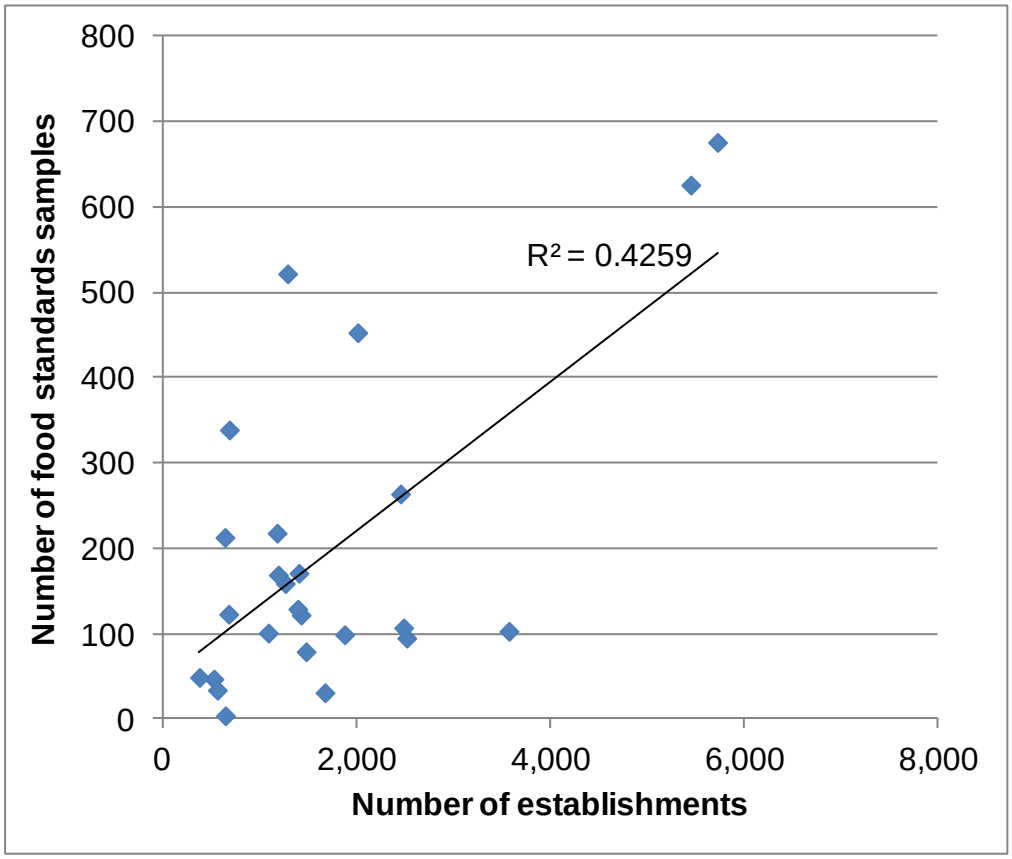


Figure 40: Wales – food hygiene samples and establishments (2012/13)

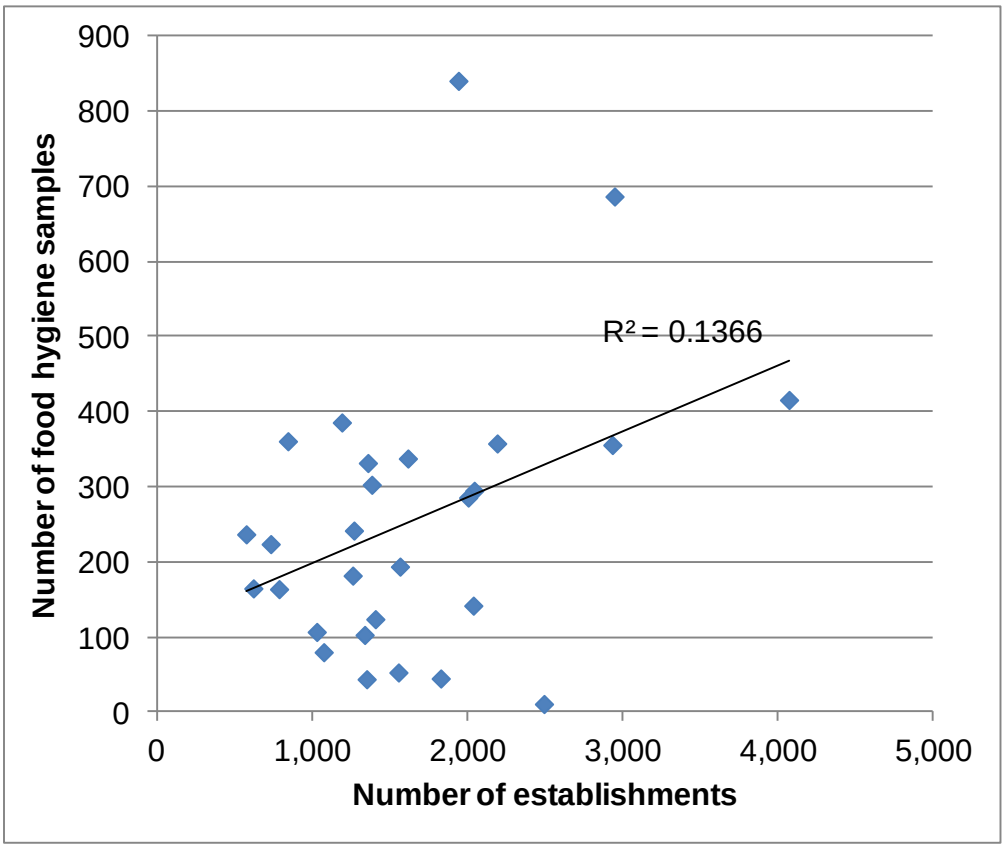
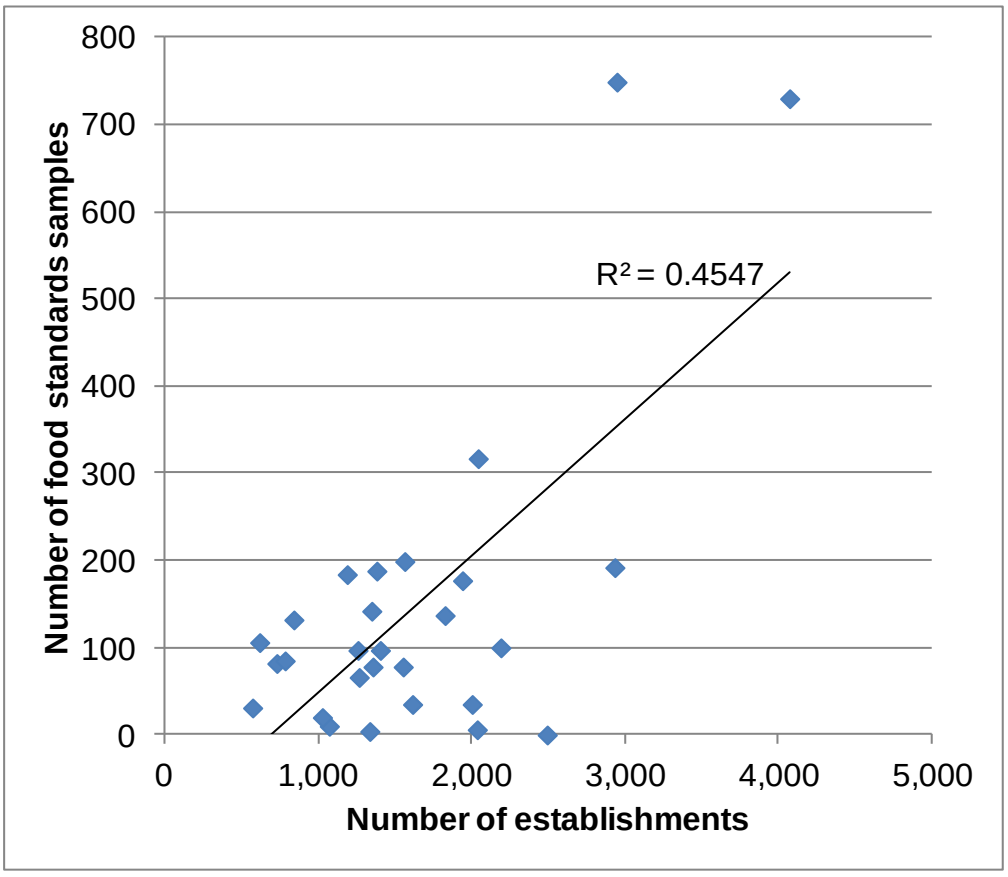


Figure 41: Wales – food standards samples and establishments (2012/13)



7.7 Number of inland LAs with zero or very few food samples

Figure 42 shows the number of LAs that reported zero food samples with Figure 43 showing the number of authorities reporting less than 10 samples per 1000 establishments[37]. It is apparent that:

- Six out of 33 London boroughs report zero food standards samples, with three reporting zero food hygiene samples;
- Three of the 37 metropolitan authorities report zero food standards samples;
- Eight of the 56 unitary authorities report zero food standard samples, with three reporting zero food hygiene samples; and
- Thirteen of the 201 district councils report zero food hygiene samples.

None of Scottish, Northern Irish or Welsh LAs report zero food samples.

6% of English LAs reported zero food hygiene samples in 2011/12 and 15% reported less than 1 sample per 100 establishments compared to an average of 1 sample per 6 establishments in Scotland, 1 in 5 in Wales and 1 per 2.4 establishments in Northern Ireland.

A rate of 10 samples per 1000 establishments was assumed by the researchers to represent a very low rate of food samples (1 sample per 100 establishments). The average UK rate of food hygiene samples in 2011/12 was one per 13 establishments and one per 48 establishments for food standards.

A similar pattern is apparent from Figure 43, namely that some English LAs have very low rates of food samples, specifically:

- For the 33 London boroughs – 9 have very low rates of food hygiene samples and 14 have very low rates of food standards samples;
- For the 37 metropolitan authorities - 2 have very low rates of food hygiene samples and 6 have very low rates of food standards samples;
- For the 56 unitary authorities - 3 have very low rates of food hygiene samples and 10 have very low rates of food standards samples;
- For the 201 district councils - 27 have very low rates of food hygiene samples; and
- For the 27 county councils – 5 have very low rates of food standards samples.

Only one Welsh LA had a very low rate of food samples.

As shown in Table 7 for the UK 9% of LAs had rates of food hygiene samples of less than 10 per 1000 establishments and 8% had rates of food standards samples of less than 10 per 1000 establishments, in 2011/12. It is clear that London LAs have low rates of food samples, with England as a whole more commonly having lower rates of food samples than the other countries.

[37] Local authorities that did not report data or merged food hygiene and food standards samples data were excluded from this analysis.

Table 7: Number of LAs with rates of food samples less than 10 per 1000 establishments (2011/12)

	Number of LAs	Food hygiene	Food standards
County councils	27		19%
District councils	201	13%	
London boroughs	33	27%	42%
Metropolitan councils	37	5%	16%
Unitary authorities	56	5%	18%
Northern Ireland	26	*	*
Scotland	32	*	*
Wales	22	0%	5%
UK	434	9%	8%

*Scotland and Northern Ireland report food hygiene and food standards sampling together. No Scottish or Northern Irish LAs reported zero food samples.

The number of LAs reporting less than 10 samples per 1000 establishments for food hygiene has increased from 10 to 41 between 2009/10 and 2011/12, and from 26 to 36 for food standards.

Figure 42: Number of LAs reporting zero food samples per 1000 establishments (2011/12)

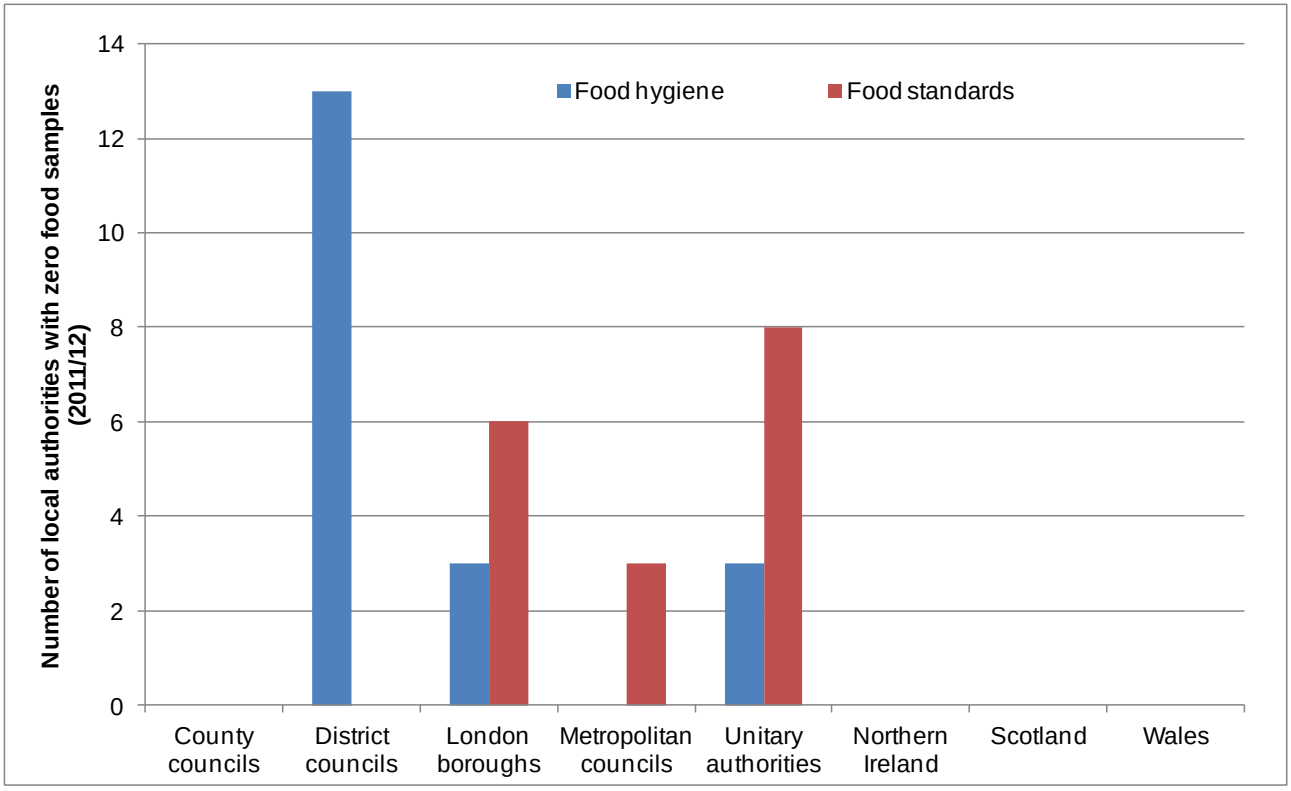
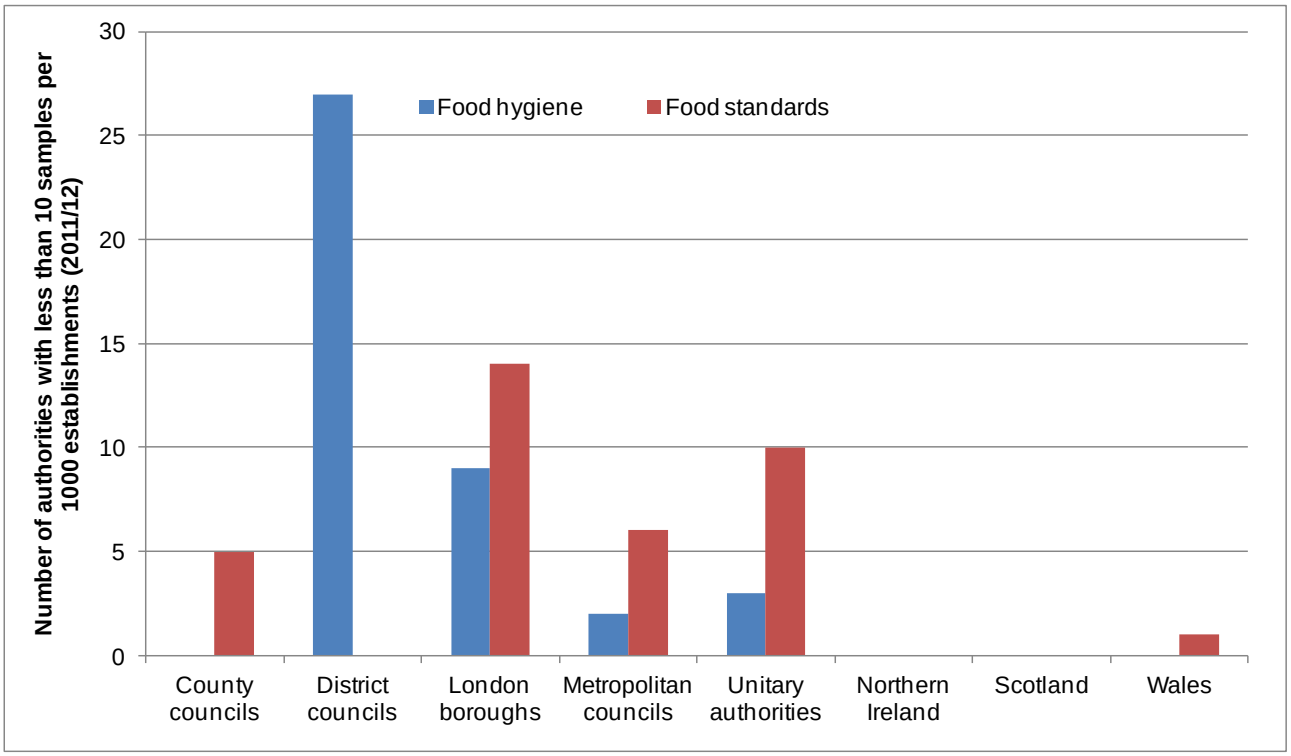


Figure 43: Number of LAs reporting less than 10 food samples per 1000 establishments (2011/12)



8 APPENDIX C: SAMPLING POLICY

8.1 Rapid survey results

The rapid survey asked respondents to indicate which statements represented their LA's policy towards sampling. Respondents' answers regarding current food sampling policy are shown in Table 8 and Figure 44/Figure 45. It can be noted that:

- No respondents said they had a policy of not carrying out any surveillance sampling. Very few (8%) only do surveillance sampling when funded by the FSA or where costs can be recovered (which is not possible for inland authorities);
- The responses are very similar for food hygiene and food standards;
- About 70% of respondents have a policy of sampling in support of prosecutions, enforcement and investigations as well as responding to intelligence;
- About 70% aim to participate in FSA national co-ordinated sampling;
- About half have a policy of locally funded sampling, with a third aiming to sample imported food, and somewhat more aiming to identify emerging risks;
- About two thirds aim to collaborate with other authorities to co-ordinate surveillance sampling;
- About one third aim to use UKFSS to plan surveillance, with about 20% using RASFF and 10% using TRACES/GRAIL.

Table 8: Current food sampling policy

	All	Food hygiene respondents	Food standards respondents
Not to carry out routine surveillance on food.	0%	0%	0%
To sample/test food in support of prosecutions, enforcement & investigations...	70%	69%	72%
To test food in response to intelligence...	72%	71%	72%
To carry out food routine surveillance sampling only when funded by FSA or others.	8%	8%	9%
To sample foods only where costs can be recovered.	0%	0%	0%
To participate in the FSA national co-ordinated sampling programme & ...projects.	72%	73%	72%
...use of Public Health England funding for...sampling.	33%	19%	43%
To carry out...locally funded surveillance...	48%	49%	48%
To carry out routine surveillance sampling on imported food, locally funded by your local/port authority.	31%	39%	29%

	All	Food hygiene respondents	Food standards respondents
To carry out some routine surveillance of food to identify new or emerging risks funded by your local/port authority.	37%	47%	34%
To...collaborate with other, neighbouring authorities...to co-ordinate routine surveillance sampling.	67%	61%	69%
To use...UKFSS database to help plan and co-ordinate... surveillance sampling.	36%	42%	35%
To use the RASFF...to help plan...surveillance sampling.	19%	23%	19%
Use other database e.g. TRACES/GRAIL to help plan local food surveillance sampling.	11%	16%	11%
Are any other factors influential...	0%	0%	0%

Figure 44: Food sampling policy

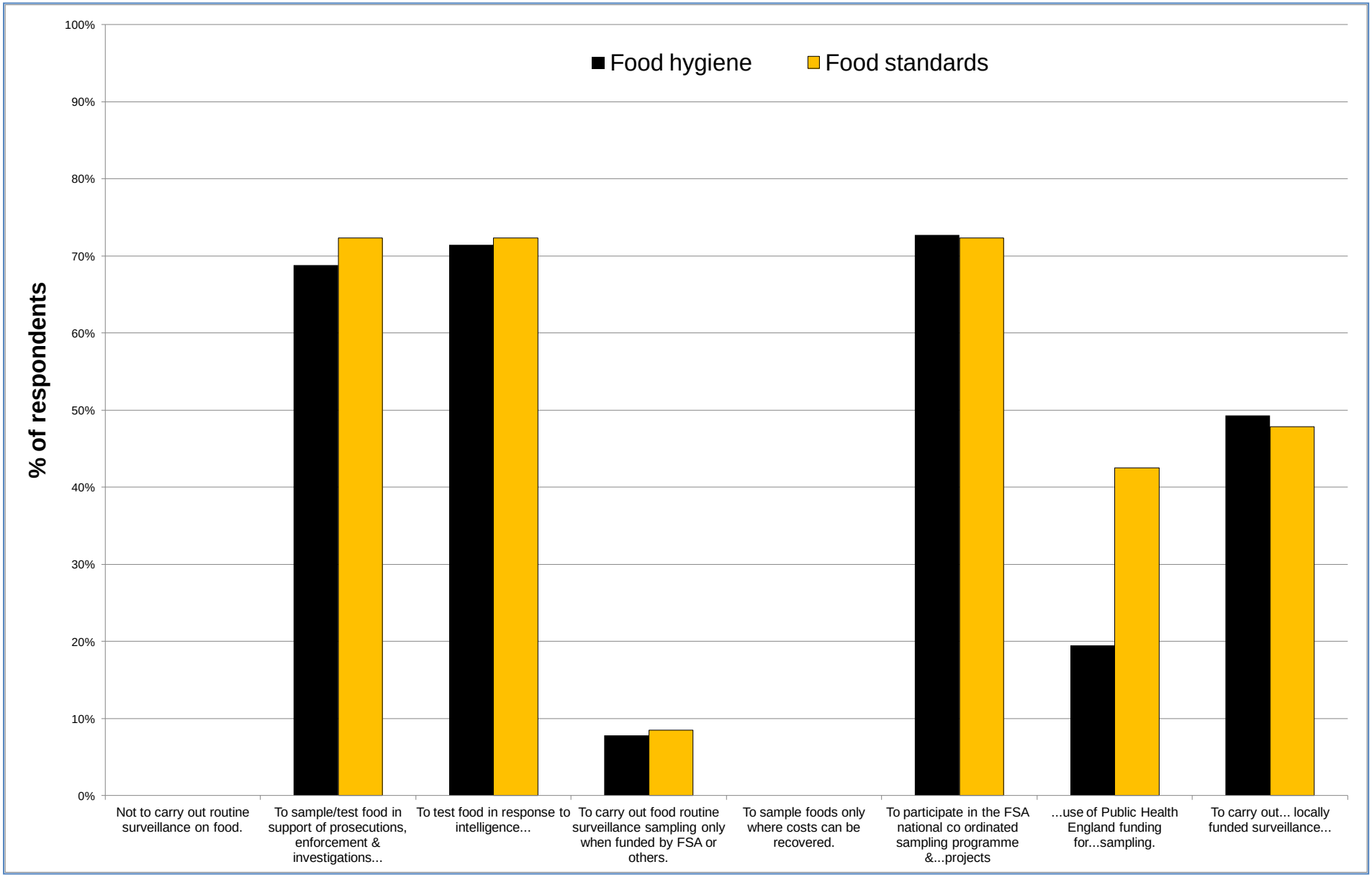
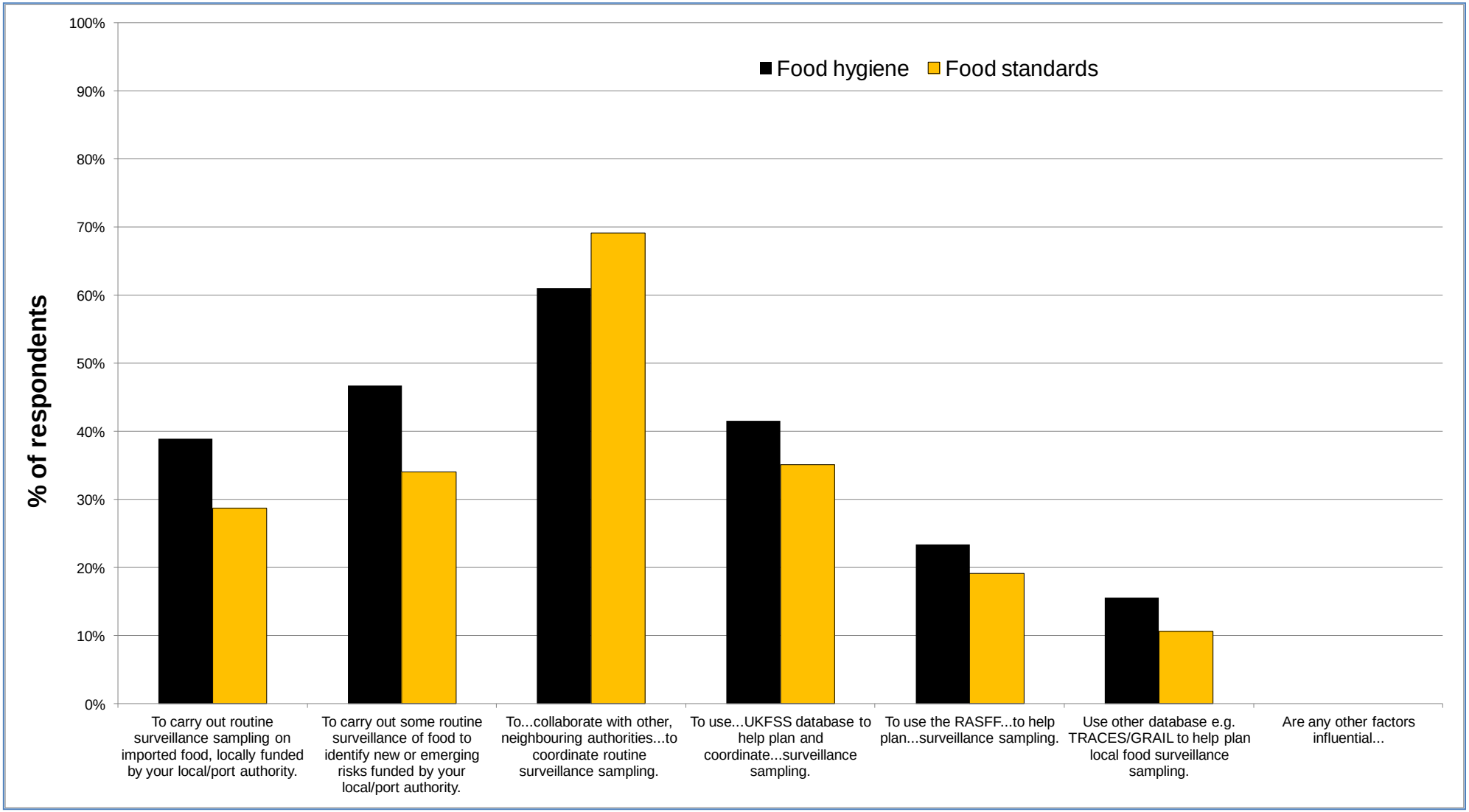


Figure 45: Food sampling policy



8.2 Stakeholder interview feedback

Stakeholders were asked to describe and explain selected aspects of their sampling practice, as noted below.

8.2.1 To what extent are test results shared?

There was mixed feedback regarding the extent of communication between authorities.

- Test results are communicated via the UKFSS and RASFF systems (see Table 9) by many but not all authorities (both PHAs and LAs). As all LAs are allowed to access UKFSS and RASFF databases this enables the sharing of results with all authorities;
- LAs rarely communicate results to PHAs;
- PHAs only communicate directly with inland LAs if there is an issue with a consignment that went to that LA;
- In some areas inland and PHAs also communicate amongst themselves via forums and regional groups;
- There is an element of direct communication between authorities of unsatisfactory results to specific authorities who may be directly affected by the results;
- Communication outside of UKFSS is usually limited to unsatisfactory results.

Table 9: Description of UKFSS, RASFF and TRACES

UKFSS[38]	RASFF[39]	TRACES[40]
UKFSS is a national database run by the UK FSA for central storage of analytical results from feed and food samples taken by enforcement authorities (LAs and PHAs) as part of their official controls.	RASFF is operated by the European Commission. It contains information about serious health risk deriving from food or feed, submitted by European Union member states and rejections of food or feed at a border post of the European Union on account of a health risk, and any actions taken in respect of this risk such as recalls. The Commission immediately transmits the notification to all members of the network.	Trade Control and Expert System (TRACES) is a trans-European network for veterinary health which notifies, certifies and monitors imports, exports and trade in animals and animal products.

Regional liaison groups

Some examples of "regional" liaison include:

> "*There is good communication between LAs through the Northern Ireland Food Liaison Group and working groups where chemical sampling results are discussed. Microbiological sample results are not communicated as they are only relevant in real time. Labelling issues are posted on a website for all LAs to read. Because Northern Ireland is a small group there is good telephone communication between LAs as well as with the FSA. PHAs of Northern Ireland have monthly meetings, often with a FSA representative, where issues are discussed. The Local Liaison Group would discuss serious issues or issues of regional interest."* (Northern Ireland LA)

[38] http://www.food.gov.uk/enforcement/monitoring/fss/#.Uo47TOK7QnE Accessed 20th November 2013
[39] http://ec.europa.eu/food/food/rapidalert/about_rasff_en.htm Accessed 20th November 2013
[40] http://ec.europa.eu/food/animal/diseases/traces/about/index_en.htm Accessed 20th November 2013

"*At the local level there is liaison within the South East (region) forums as well as through (the county) and the (national) Food Microbiological Forum."*

"Scotland has very clear communication structure – 4 regional liaison groups meet quarterly. UKFSS used. This communicates satisfactory and unsatisfactory results. Unusual issues discussed at liaison group level e.g. speciation work in lamb curries." (Scottish city council)

The examples came from the devolved administration.

PHA feedback

PHAs report that:

- There would be communication with an inland LA if a failed product had moved inland, e.g. labelling problems. This is done by telephone and email;
- They tend not to get information from inland LAs. With unsatisfactory imported food samples, the LA would not contact the PHA but would notify the importer or the importer's home authority. Communication is very infrequent and usually relates to a specific import or problem;
- The main communication between PHAs is via the RASFF alert system and, although there is no regional system for PHAs, port user groups would communicate PHA issues among the ports;
- PHAs do not tend to monitor test results from other authorities;
- For PHAs the EU's TRACES and the FSA's Guidance and Regulatory Advice on Import Legislation (GRAIL) database systems are meant to link the ports together;
- The RASFF and TRACES systems are co-ordinated at EU level. There is currently no central UK co-ordination;
- The Association of Port Health Authorities (APHA) has a technical panel to look at communication of port issues and mentoring support to smaller ports;
- There is currently no system which flags up emerging issues for PHA / LA interaction; and
- PHAs meet regularly with their PA who would give advice on sampling issues.

Between inland LAs

Inland LAs reported that:

- Results are shared mainly via UKFSS by some but not all;
- LAs check RASFF reports;
- They get a PA newsletter which contains a link to RASFF;
- Only non-compliant sample results are communicated among LAs;
- As the existence and activity of regional groups varies, the extent of liaison outside of sharing results via UKFSS is mixed in different areas; and
- There is no formal mechanism to communicate test results between LAs (at a local level) but they may be discussed at food liaison group meetings.

The variable extent of communication is illustrated below:

> "*The LA does not know enough about what other LAs are doing and vice versa. For example, the LA has set up its own formal sampling programme for meat labelling fraud but results from this programme have not been communicated to other LAs."* (Inland LA)

The variable use of UKFSS is illustrated by:

> "*UKFSS system is not used in the (this English region). The main focus of communication is the... Regional Forum and the... Food Liaison Group."* (Inland LA)

Also respondents noted that although the UKFSS is used, there is no real time data reporting, and so it has limited use in directing short term work.

8.2.2 What action is taken in response to tests?

Where unsatisfactory results are communicated, authorities will act on that product or consignment as befits the severity of the issue, such as enforcement or tracing of suppliers.

It was noted that:

> "*Turnaround time on samples makes it difficult to communicate unsatisfactory results in a timely fashion*." (Inland LA)

This may be inferred to reduce the motivation for LAs to share results quickly upon receipt from the laboratory.

8.2.3 Action taken in response to shared test results

On "routine" communications, it is reported that there is limited feedback on actions taken. Inland LAs reported receiving limited feedback on responses to test results. Respondents said, for example:

- There is limited feedback from other LAs, Primary Authorities or the FSA unless problems are identified and then cascaded up to them;
- You would expect email feedback but these cases are very rare; and
- Do not get much feedback from other LAs.

If there is a serious outbreak, for example, then this is more likely to be communicated with feedback received on actions taken.

The main communication system for ports is RASFF so if further samples are taken which fail as a result of contaminant levels these will also be posted on the RASFF system for other PHAs/LAs to view.

8.2.4 Rationale for the range of analyses completed

The range of analyses is specified by statutory and FSA grant requirements, with analysts directing appropriate tests.

FSA and national programmes will often specify details. If not, it is likely that the choice of tests will be based on local issues and consultation with regional sampling groups and/or public analysts and food examiners.

No other rationales were cited by respondents.

8.2.5 Local use of the results of the national sampling programme

It was noted that:

"*The former national co-ordinated sampling programme, LACORS, used to promote follow up. LACORs have now gone, so unless local Health Protection units promote follow up activities they may not happen*." (LA)

"*We study LAEMS reports e.g. number of voluntary closures and other Scotland based reports. National co-ordinated food sampling programme is discussed at senior level in Scotland and then information cascaded down e.g. Campylobacter surveys*." (Scottish City Council)

There was feedback that the results are used and reviewed annually and fed into local surveillance budgets and sampling plans.

8.2.6 What use is made locally of the UKFSS data?

It was noted that the latest UKFSS version is web-based. The FSA are looking at producing a quarterly analysis report. It will be up to the LA to extract what information they need from these reports.

Whilst the UKFSS was often cited as a means of communication, respondents reported many issues that limit the role of UKFSS, including:

- The FSA no longer has permanent staffing to generate sampling reports for LAs and PHAs;
- The use of UKFSS is said to be constrained by the limited extent of training;
- Not all authorities are on the UKFSS system. A number continue to struggle with compatibility issues. As illustrated below:
    - "*The LA does not generate reports off the UKFSS system. They do not have the latest FSS web-based version yet and the Trading Standards team do not have a stand-alone computer with the FSS software installed*." (Inland LA),
    - "*The LA's IT department will charge for any software installation, etc. which is an additional burden to the food safety budget. Linking the local APP database system to the FSS system remains a problem. For example if multiple samples are entered into the FSS, only one result would be passed back to the APP system. This causes problems with producing accurate performance reports."* (Inland LA),
    - "*Would like to use the UKFSS more but are restricted by technical issues. Ideally would like to formulate own sampling programme from the UKFSS data but a lack of staff resources to do this would be an issue."* (Inland LA).

Also some respondents noted that:

- They feel that they do not need the UKFSS data for deciding what to sample; and
- The PHA enters all samples on to the UKFSS system but does not regularly get reports off the UKFSS. The PHA tends to use the EU's TRACES more.

9 APPENDIX D: POSSIBILITY OF DETECTING NON COMPLIANCE

9.1 Aims of this analysis

The number of samples taken and analysed varies greatly between products. It is important to evaluate whether there is the possibility for unsatisfactory food or emerging risks to go undetected as a result of the level of surveillance sampling. The ability to detect non-compliance is related to the number of samples analysed and the rate of non-compliance. Therefore, the research briefly considered the statistical aspect of how the number of samples analysed relates to the probability of detecting non-compliance and then reviewed the actual number of samples analysed and reported in the 2012 UKFSS data.

9.2 Probability of detecting at least one non compliant item

The statistical probability of detecting non-compliance depends on the number of samples analysed and the rate of non-compliance. This is illustrated in Figure 46. For example, if the rate of non-compliance is 1%, the probability of detecting one or more non-compliant items is:

- For a sample of 10 a 10% probability of detection (i.e. there is a 10% chance that at least one sample will be non-compliant if you test 10 items that have a 1% rate of non-compliance);
- For a sample of 50 a 40% probability of detection; and
- For a sample of 200 items it is close to 90% probability of detection.

Analysis of 2012 UKFSS data indicated that the rates of unsatisfactory results (for all analyses of all products) ranged from 0% for Campylobacter, 0.1% for Salmonella, 0.32% for undesirable substances, 0.85 for E. Coli, 1.1% for Listeria, 1.9% for constituents, 3 % for additives, 4.2% for Enterobacteriaceae and 8.8% for substitution.

Referring to Figure 46, if an analyst wished to be 99% confident in detecting a non-compliant item for a product with these rates of unsatisfactory results, the approximate numbers of analyses required would be:

- For a 0.1% rate of unsatisfactory results, a sample of 4500 analyses has a 99% likelihood of detecting one or more non-compliant item;
- For a 1% rate of unsatisfactory results, a sample of 500 analyses has a 99% likelihood of detecting one or more non-compliant item; and
- For a 10% rate of unsatisfactory results, a sample of 50 analyses has a 99% likelihood of detecting one or more non-compliant item.

Statistical formula

The formula on which Figure 46 is based is given below.

The probability of detecting at least one non-compliant unit can be written as:

$$1-[1-p)]^n$$

Where

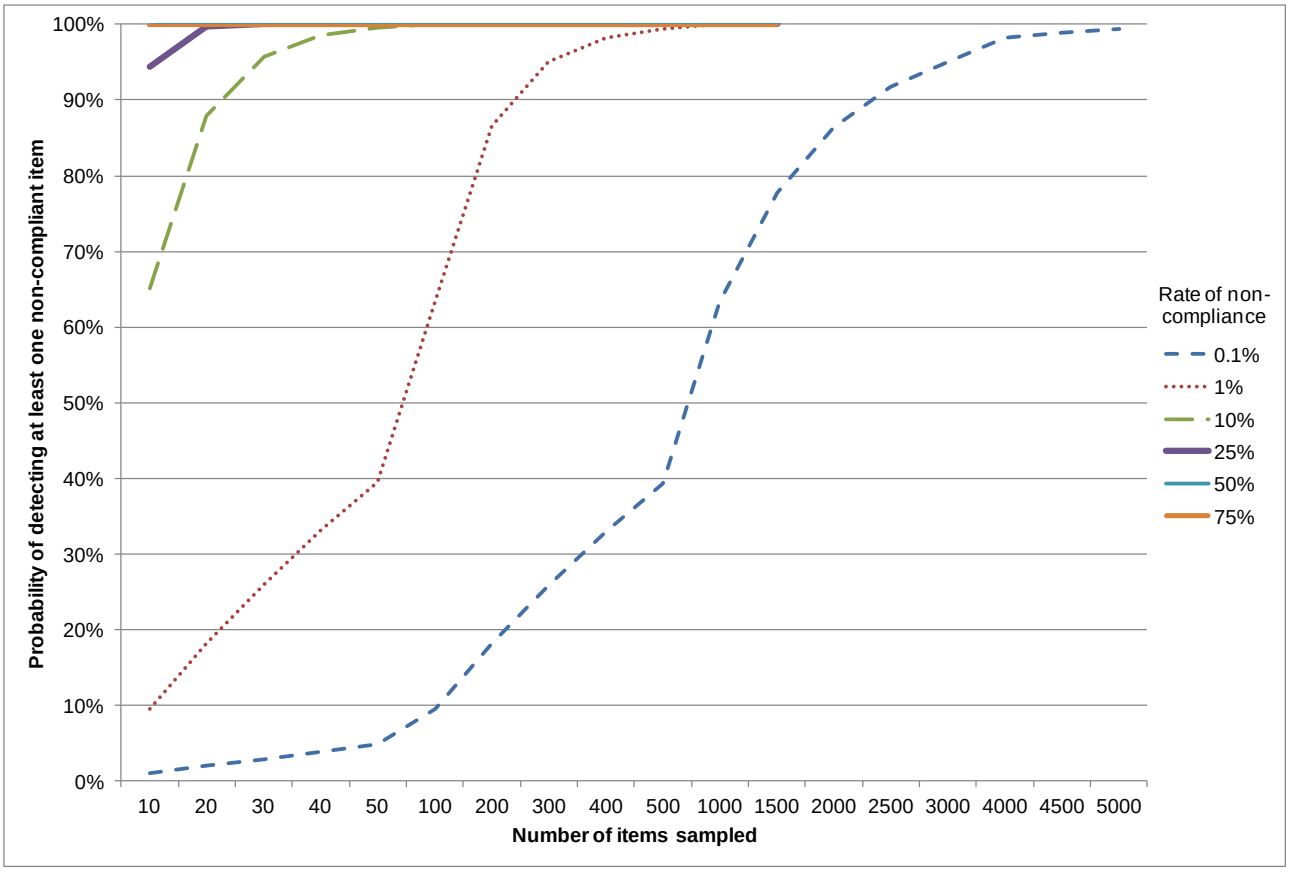
n is the sample size

p = proportion of non-compliance

If the non-compliance rate is 1% and we have a sample size of 10, 50 and 60 etc, then:

- For n=10, the probability of detecting at least one non-compliant unit = 1-[(1-0.01)]^{10} =0.0956;
- For n=50, the probability of detecting at least one non-compliant unit = 1-[(1-0.01)]^{50} =0.394;
- For n=60, the probability of detecting at least one non-compliant unit = 1-[(1-0.01)]^{60} =0.453.

Figure 46: Probability of detecting non-compliance for different numbers of samples and rates of non-compliance



9.3 Review of 2012 UKFSS data

9.3.1 Overview

Data for surveillance sample results from UKFSS for 2012 was analysed. The data was assessed with respect to:

- Were sufficient samples analyses completed to be able to detect one or more unsatisfactory item per category of food? and
- What was the 95% confidence intervals for the reported rates of unsatisfactory results per category of food?

The rate of “unsatisfactory” results and the number of samples analysed were compared with Figure 46 to indicate whether sufficient samples had been analysed to enable detection of unsatisfactory results. These data are for the UK as a whole.

The term “unsatisfactory” is used to refer to tests where:

- There is an unsatisfactory level of certain microbiological and chemical indicators in the food;
- The presence of certain bacteria used as an indicator of general hygiene practices have been detected (these are sometime referred to as hygiene indicators); and
- There is incorrect labelling of ingredients or the quantity of certain ingredients required to be declared on the label is wrong.

9.3.2 Detecting one or more unsatisfactory result

The number of sample analyses needed to have a 95% probability of detecting one or more unsatisfactory result was calculated using the formula cited in section 9.2 for each type of analyses. For example, 100 analyses are needed to detect one or more unsatisfactory result where the rate of unsatisfactory results is 3%, as in testing for additives.

Table 10 shows the number of analyses needed to detect one or more unsatisfactory result per type of test, reflecting the calculated rate of unsatisfactory results, such as 100 for additives and 30 for substitution. The proportion of the categories of products tested, such as herbs and spices, cheese and ice cream that had sample sizes that equalled or exceeded the indicated number is given. The total number of analyses is also indicated per type of test.

It was found that;

- The total number of analyses for all products, such as 9,899 for additives, are far above the indicated level, suggesting that testing would detect unsatisfactory results for products taken as a whole; and
- In most cases, the number of analyses for each category of product is less than the indicated number, suggesting that the ability to detect unsatisfactory results per product category is below 95%.

Review of the data indicates that:

- In many cases the number of analyses per type of product is far below the number needed to detect unsatisfactory results, such as four tests of cheese for substitution; and
- In some cases the number of analyses per product category is far above the number needed to detect unsatisfactory results, such as 1088 substitution tests for Restaurant and Take-Away Meals.

It should be noted that the number of analyses per product would be far less than the national total when examined per region or per LA. Also the rates of unsatisfactory results vary between categories of food, with restaurant and take-away meals reporting a 12% rate of unsatisfactory substitution results.

Thus, whilst the “high” number of analyses for some products may exceed the suggested number of samples at a national level, they may provide meaningful results at a local level. On the other hand, the very small number of analyses for some categories of products means that unsatisfactory results cannot be confidently detected in these cases at a national or local level.

Table 10: Summary of number of analyses

Substance	Number of product categories tested	Rate of unsatisfactory results	Sample analyses required to detect one or more unsatisfactory result with 95% probability	Proportion of product categories with indicated number of sample analyses	Total number of samples
Additives	40	3%	100	40%	9899
Substitution	19	9%	30	47%	2798
Constituent	48	2%	150	56%	34094
Undesirable substances	46	0.3%	1000	13%	34485
Enterobacteriaceae	39	4%	75	41%	8058
E coli	42	0.8%	3000	0%	11284
Salmonella	37	0.07%	3000	0%	7392
Listeria	36	1.1%	300	33%	17252
Campylobacter	17	0%	>3000	0%	993

9.3.3 Confidence intervals

A confidence interval is the range of results you would expect to find if you were to analyse a series of batches of products, for example, comparing results between the year 2009 and 2010. The results for each set of analyses will differ due to random variations in the selection of items analysed.

The extent to which random variations impact the overall results will depend, in part, on the number of samples taken and the inherent variability in product standards. The larger the number of samples analysed the more representative the results will be of the total population of the product and the narrower the confidence intervals in the results.

Table 11 shows the upper and lower confidence intervals per type of test for 2012 UKFSS data. It shows that the confidence intervals for each type of test are, in the researcher's view, narrow.

Table 11: Upper and lower confidence intervals for 2012 UKFSS test results

Substance	Lower confidence interval	Upper confidence interval
Additives	2.8%	3.5%
Substitution	7.1%	9.1%
Constituent	1.8%	2.1%
Undesirable substances	0.3%	0.4%
Enterobacteriaceae	3.6%	4.5%
E. Coli	0.6%	1.0%
Salmonella	0.01%	0.1%
Listeria	0.9%	1.2%
Campylobacter	N/A	N/A

Figure 47 and Figure 48 show the upper and lower confidence intervals for substitution and Enterobacteriaceae test per type of product. These two tests are used as examples of the width of confidence intervals. Results are only shown for products where the number of samples equalled or exceeded the number indicated in Table 10.

It was found that for substitution tests:

- The confidence intervals for some categories of products are very wide, such as 2% to 23% for 'Poultry - Fresh and Frozen'; and
- The confidence intervals are quite narrow for some categories of products, such as 9% to 15% for 'Meat - Products and Processed (incl. Sausages)'.

The width of the confidence intervals relate to the sample sizes, with far more 'Meat - Products and Processed (incl.. Sausages)' tests (404) than for 'Poultry - Fresh and Frozen' (40).

A similar position is noted for Enterobacteriaceae where, for example:

- The confidence intervals are 5% to 8.3% for Poultry - Products and Processed', with 900 analyses;
- The confidence intervals are 1.1% to 7% for Liquid milk, with 173 analyses.

In the case of products with fewer samples than indicated in Table 10 the upper and lower confidence intervals can be far wider, such as 0.1% to 6.8% for constituent tests of 'Vegetables - Products and Processed'.

This suggests that for those categories of products with fewer test results, the calculated rate of unsatisfactory results is uncertain.

Figure 47: Upper and lower 95% confidence intervals for substitution test results

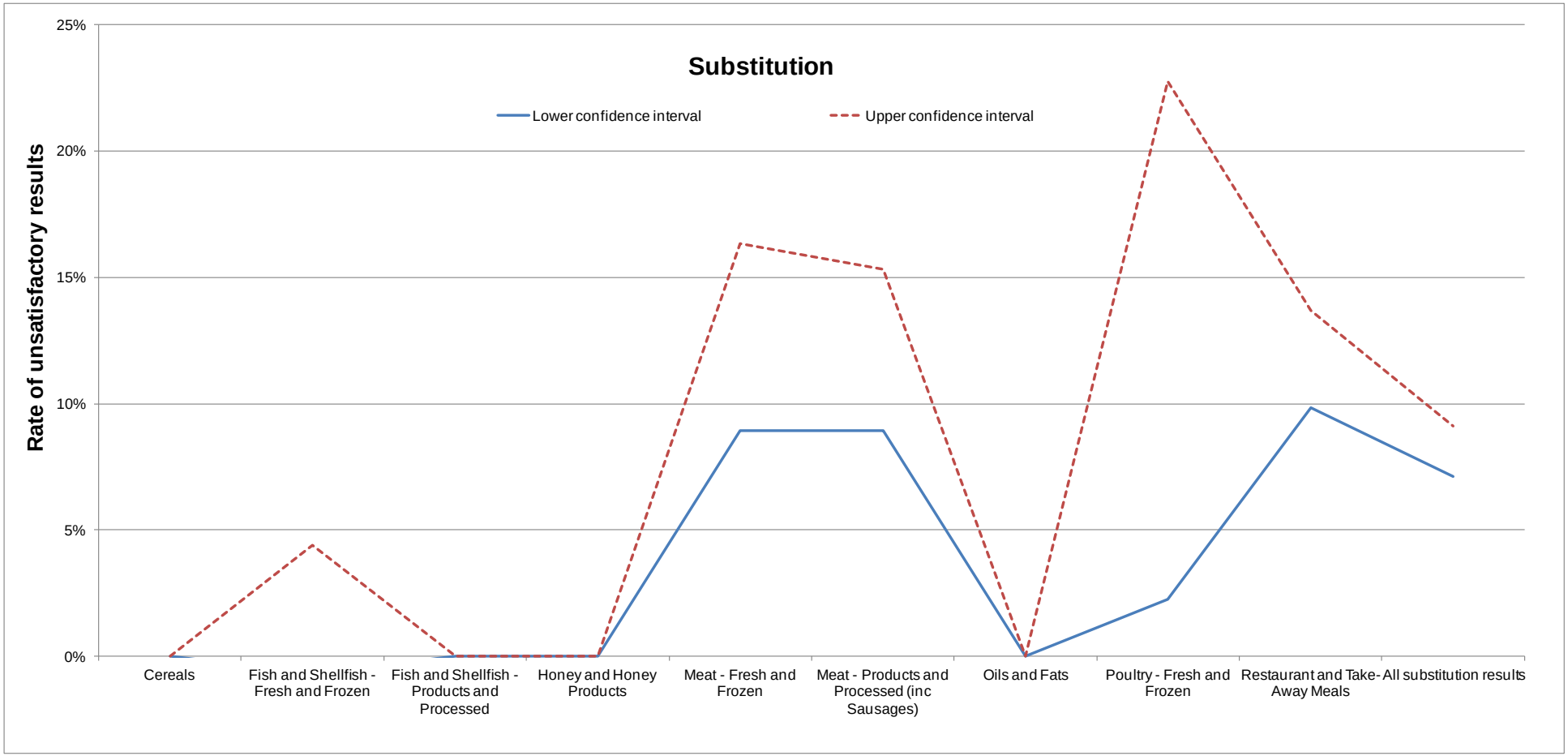
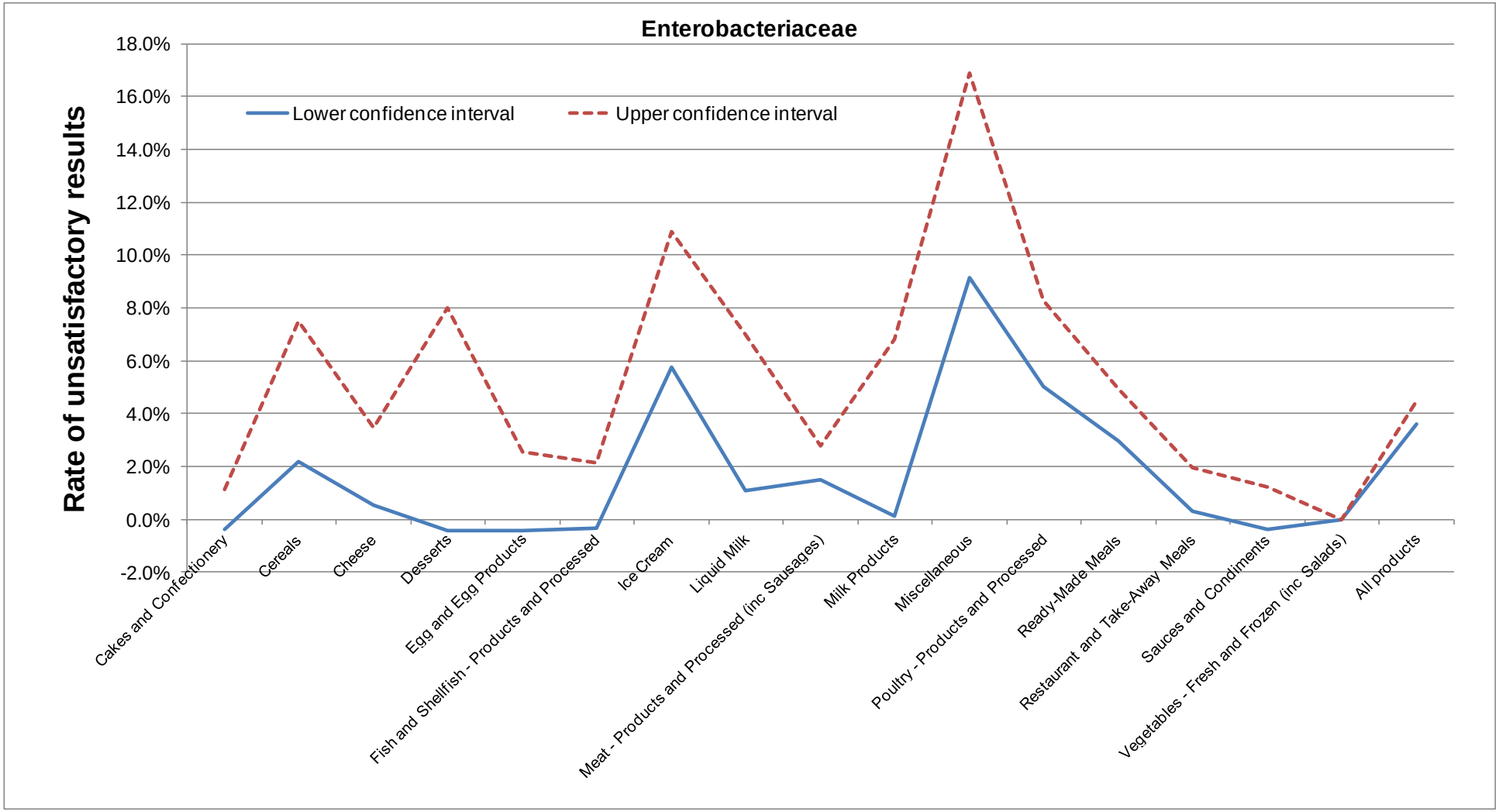


Figure 48: Upper and lower 95% confidence intervals for Enterobacteriaceae test results



10 APPENDIX E: STAKEHOLDER FEEDBACK ON POTENTIAL IMPROVEMENTS

10.1 Feedback from stakeholder interviews

10.1.1 Introduction

There was strong support for improvements to the approach to sampling in the UK although some respondents said the current system is adequate and works. The latter respondents were from Wales.

The main ideas are summarised below on how to support the level, effectiveness and cost effectiveness of sampling. The ideas cover:

- Changing funding for sampling to make it more sustained, flexible and assured;
- Better targeting of sampling;
- Better co-ordination at a local, regional and national level;
- Better sharing and use of results;
- Use of new technology to screen samples and reduce sampling costs;
- Improvements to UKFSS and RASFF;
- Further development of the FSA's national co-ordinated sampling programme and grants; and
- More sharing of results by and with industry.

10.1.2 Funding &/or cost recovery

A number of respondents offered ideas on changes to funding arrangements, as below.

Ring fenced funding

Three respondents said:

> "*The funding of sampling programmes needs to remain under central (FSA) control as PHAs/ LAs will not be able to raise the required income*." (LA)

> "*FSA ought to take central control of the delivery of food sampling official controls with a central budget rather than using LA budgets. In addition, a central body would have more control over risk-based surveillance sampling*." (Stakeholder)

> "*LA sampling budgets across the country need to be ring-fenced in order to maintain sampling levels*." (Stakeholder)

Credit system for regions

It was stated that the credit allocation system operated in some regions for microbiological sampling (with funding from PHE) worked well and could be implemented more widely.

Bidding for vs. receiving allocations

It was noted that:

> "*The (PHE) credit process is not subject to bidding. Bidding for FSA grants, do not always have time to complete bid documentation."* (Inland LA)

Cost recovery from companies

LAs to be able to recover the costs for food hygiene inspections from companies.

Funding non statutory sampling at PHAs

In the context of very limited locally funded non statutory sampling, one stakeholder stated that:

> "*The more FSA grant work that PHAs get the more sampling they will do up to a point where there are not enough PHA staff to actually do any more FSA sampling work, over and above their statutory and other non-food work*."

Thus, the suggestion is that the extent of non statutory sampling by PHAs would be directly related to the level of grant funding.

PHAs to be able to recover costs from importers for suspect sampling.

10.1.3 Agency promotion of sampling

Respondents stated:

> "*There needs to be a greater push by the FSA to promote sampling in a similar way to how the Food Hygiene Rating Scheme has been promoted. All LAs need to be made better aware of the importance of food sampling as this is perhaps not recognised as much as it should be.*" (Inland LA)

> "*Useful if FSA provide more guidance, especially on emerging risks, and somehow generate more enthusiasm for sampling."* (Stakeholder)

> "*The FSA needs to make it clear to LAs that sampling is an important part of the official food control system. The FSA can compile intelligence to determine a risk-based sampling programme and then stipulate to LAs that they are to meet the FSA's expectations. LAs could develop a risk template to demonstrate how the LA has assessed food safety risks among their food businesses*." (Stakeholder)

Another stakeholder said:

> "*City and District Councillors' priorities are very different to that of PHAs and the FSA and DEFRA could give more political weight to promoting the work of PHAs*."

10.1.4 Targeting sampling

Some respondents advocated more risk based targeting with the proviso that sampling must not be too targeted as wider surveillance sampling is necessary for building up intelligence and to assess emerging risks.

Better targeting & risk based targeting

- Better targeting at the point of production level rather than at the retail level;
- More intelligence throughout the food chain and better linkages with PHA sampling and LA sampling;
- Smarter sampling for validating systems;
- For imported food there needs to be an analysis of RASFF alerts across Europe to provide direction to PHAs;
- *"In Italy food fraud sampling is focused on premium products and seasonal sampling. With expensive products, e.g. virgin olive oil, the chance of food fraud is pretty high and these high-value products are regularly checked. For food products that are eaten on only one occasion of the year, e.g. panettone, and where there is a high demand and high process, targeted seasonal sampling would be prioritised."* (Stakeholder)

- *"Initiative-based sampling rather than all risk-based sampling, e.g. examining increasing commodity prices and determining at what point will high prices affect the market and thus increase the risk of food fraud."* (Stakeholder)

Horizon scanning

One respondent advocated improvements to horizon scanning:

- Horizon scanning is needed to direct sampling programmes;
- EU food agencies need to work together on horizon scanning;
- The European Anti-Fraud Office (OLAF) obtains intelligence across the EU agricultural sectors. By looking at where the EU spends its subsidies and calculating volumes of food produced to what is imported, commodities can be tracked and any discrepancies are flagged up;
- *"There needs to be better use of international intelligence reports for issues relevant to the UK and this ought to be a part of global horizon scanning. e.g. outbreak of E. coli in Canadian salad bars."* (Stakeholder)
- *"Emerging hazards need to be identified better by having a small percentage of the routine surveillance sampling programme allocated for non-directed, random sampling"*. (Stakeholder)

Random sampling to identify emerging risks

One respondent said they would like to see a FSA grant made available for totally random sampling to identify emerging risks. Random sampling can be a small proportion of the sampling programme and can be focused on the problem rather than the food product or country of origin.

10.1.5 Regional and national liaison

Whilst some respondents reported effective regional liaison, others advocated development of regional and national co-ordination of sampling.

Better co-ordination

There should be improved co-ordination of sampling programmes (between authorities) to best direct resources.

The Sampling Forum should meet regularly to pass ideas from regions to all LAs.

Regional liaison

There was support for regional liaison and communication, such as:

- "*Sharing of local intelligence would also be beneficial if it was across a wider region."* (Inland LA)
- "*Would like to see a nationally co-ordinated body for all the regional Food Liaison Groups*." (Inland LA)
- "*With staff resources for sampling being under pressure in most authorities, LAs ought to work more closely together pooling their staff resources and do more sharing of qualified staff in their region*." (Stakeholder)
- "*There should be more cross-border investigations, such as food fraud investigations of caged eggs sold as free range.*" (Stakeholder)

- *"There are many small unitary bodies that struggle with specialised resourcing to take samples. There is a need for a mentoring scheme for food sampling officers from smaller LAs. Some smaller LAs do not have the staff resources to take up FSA sampling grant work."* (Stakeholder)

One stakeholder noted that there has been a move to submit regional bids rather than individual authorities applying for FSA funding. This has resulted in more focused sampling than what was done previously.

National

It was said:

- "*PHAs should be the driver for local sampling but the FSA needs to tell PHAs of the risks as they have the bigger picture*." (Stakeholder)
- "*There needs to be better sharing of follow-up work as LAs have limited resources to do all this work. Would rather have FSA spoon-feed information to LAs as important information can be easily overlooked if embedded in lengthy FSA reports and publications."* (Inland LA)
- *"There could be more co-ordination between the relevant subgroups across the country. A representative from each area could feedback to the other subgroups."* (Inland LA)
- *"In favour of a centrally co-ordinated national sampling programme, which includes the FSA national surveillance sampling programme, but also directs all other types of sampling undertaken in LAs."* (Stakeholder)
- "*Would like to see more targeted sampling...focuses more on regional sampling because of poor national communication."* (Inland LA)
- *"Communication across the UK regarding Trading Standards chemical sampling could be improved."* (Stakeholder)
- *"Apart from specific FSA funded surveys, there is no real UK-wide approach to routine sampling work."* (Inland LA)
- "*English LAs could benefit from better communication with LA bodies in Wales, Northern Ireland and Scotland."* (Inland LA)

10.1.6 Sharing results amongst authorities

A number of respondents cited the successful role of regional food liaison groups in sharing information and results, where these groups operated effectively. The implication being that these groups should be encouraged to operate effectively across the UK.

Respondents cited strong support for making improvements to how test results are shared and offered many ideas. For example:

- "*Yes, should be intelligence led and targeted – would be better to have more feedback and information sharing."* (LA)
- "*Sharing of local intelligence would also be beneficial if it was across a wider region*." (LA)
- "*Would like to see more national sharing of information and more real-time result reporting." (*LA)
- *"Need better communication of intelligence between PHAs and with the FSA.*

Communication is difficult through the UKFSS as there are a number of open ended categories. There are regular emails on food fraud which is useful. Be good to be able to communicate local knowledge more to a wider audience." (LA)

- "*There is a great need for better sharing of information. PHAs should need to interrogate UKFSS data and also data from other government databases such as DEFRA's authenticity and fraud database."* (Stakeholder)

The ideas are summarised below.

Information sharing protocol

- A protocol on sharing information might improve interaction.

RASFF

- A central body co-ordinating RASFF intelligence and distributing that intelligence in real time.

Improvements to UKFSS

It was said that there is no need for a new system but the current system needs to be improved. Some specific ideas included:

- The UKFSS search engine needs to be more robust, e.g. picking up misspellings, etc;
- UKFSS Net could have more specific drop-down fields to make sample reports more accurate;
- More time is needed to develop reporting strategy and data reports.

Periodic reports

It was said that:

- "*Frequent periodic communication of emerging issues/contaminants and identification of trends would be useful and help to target potential problem imports and devote resources in the best way to protect public health."* (LA)

Early warning system

It was said:

- *"There needs to be an early warning system much like the PA bulletin that is emailed out on a monthly basis. In the PA bulletin, useful information such as legislative changes and a summary of RASFF alerts is included."* (LA)

5x5x5 system

A stakeholder said:

- "*There is a great need for more sharing of intelligence. One way of better communicating would be using the food fraud's 5x5x5 intelligence-sharing protocols. The 5x5x5 method is based on the 5x5x5 police protocol where sources of information are rated to determine its actual value and is a good tool for showing linkages between people. An example of food fraud usage would be monitoring high level of business ownership changes to detect a rogue food trader registering new businesses in different names."*

Knowledge hub

One LA said:

> "*More could be done with this as a communication tool also with EHCnet enquiries."*

10.1.7 International intelligence

One stakeholder highlighted the need for greater "intelligence" from overseas ports as follows:

> "*There needs to be a stronger intelligence-gathering effort using data from universities, DEFRA, international agencies, etc. For example, Dominican Republic melons were sampled by the Southampton PHA and the presence of Salmonella and pesticide residues were found on the skins. Further investigation revealed that this shipment had been rejected by the USA and had been re-routed to be sold in the UK. Another example was damaged cans of Russian salmon that were sampled at the PHA and found to contain Clostridium botulinum. Again this consignment had been rejected by the USA authorities and then shipped to the UK."*

10.1.8 New technology

A number of respondents suggested that new technology enables more targeted and cost effective sampling, particularly ATP meters.

Respondents mentioned the following:

- Screening tests, e.g. for aflatoxins and bacteria, could also play an important role;
    - Having better screening kits would help solve issues at point of production. E.g. some alcohol manufacturers have developed a quick dip test (using sugar trace markers) for detecting adulteration of their products. If Trading Standards officers could use these kits then formal samples would only need to be taken if a dip-test failed,
    - Adenosine triphosphate (ATP) meters. It was stated that:
        - ATP meters were successfully used at the 2012 Olympic Games as an indicator for focusing on areas where formal microbiological samples could be taken,
        - Instant results from ATP meters are very effective for educating business owners to how good or bad their hygiene regimes are,
    - Acidity pH meters for on-site testing;
- Dipstick tests for determining the ionic levels of cleaning chemicals could be made more use of;
- Using allergen kits;
- Digital recording and communication of results;
    - Record results of food tests and communicate by email to accelerate response times,
    - The use of Personal Digital Assistants (PDAs) in the field to cut down on time spent filling in forms;
- DNA analysis e.g. with caviar;
- Online information:

- A web-based application that would enable an officer on a premise visit to look up information on a particular food product for what bacteriological and chemical risks that product might have,
- An Imported Food database, having photographs, common names, detailed descriptions etc. would be very useful for officers. At the moment officers tend to do a Google search to try and find out more information on a particular imported food,
- Scanning barcodes and Quick Response codes (QR-codes) could be useful for obtaining instant information off a food products database,
- Receive a newsletter from Eurofins which provides updates on new tests the PA perform.

However, it was also noted that:

- There is often a high initial cost for new technologies which could be prohibitive for LAs and laboratories;
- New technologies need to be validated and meet legal and EU requirements before they can replace existing tests. For example:
  - One LA respondent said they had trialled PDAs but they did not work properly and so the LA is not using them anymore,
  - Another LA respondent stated that the use of ATP meters has not affected formal microbiological sampling, (they are used more for awareness), and is not a substitute for microbiological sampling.

This led on to the suggestion that the FSA could put resources into developing more such screening technology to help alleviate resource pressures.

10.1.9 Role of FSA's national programme and grants

A number of respondents stated that the programme is effective and useful as it stands. For example:

"*The FSA's National Co-ordinated food sampling programme is very important and they are doing a good job with what they are currently doing."*

"The programme generally achieves what it sets out to achieve..."

"It is a good mechanism for identifying new and emerging risks."

Some respondents expressed satisfaction with the current arrangements, such as:

"*The FSA grant funding is good to have and good to use to support surveillance sampling."* (Inland LA)

"Happy with the current situation". (Inland LA)

Respondents did also offer ideas for the further development of the programme and grants, including:

Programme planning

- There needs to be more intelligence-led and robust criteria for developing FSA grant funded sampling programmes;
- Invite Heads of Ports to an annual meeting to agree the priorities that could be put forward when deciding on the annual sampling programme;

- Communication on how and why the FSA develop sampling projects. This would give LAs a better understanding how they could contribute and feed into the FSA grant sampling work; and
- Thought needs to be given to whether FSA grant bids are coming from the right LAs as some LAs may have issues with certain food products but have not requested a FSA grant for whatever reason.

Co-ordination and information sharing

- More information sharing and early warning of potential contaminants issues;
- Better co-ordination regarding sampling and analyses protocols to ensure consistent sampling across the country;
- Compliant results need to be communicated to prevent unnecessary sampling; and
- It should be developed for local implementation at the Regional Liaison group level.

Flexibility and local risks

- Greater flexibility to include unforeseen food safety issues;
- The projects need to meet local demographic issues more;
- The FSA to identify local risks; and
- Simplify the process of applying for FSA grants, such as using website tools.

Scope and level of funding

- Trading Standards need FSA grant funding for analysis costs;
- Help with staff resourcing e.g. overtime costs;
- A training budget to increase staff competencies;
- Cover analyses and staff time costs;
- Need specific money in FSA grants for staffing/administrative costs; and
- Grant funding to be more related to local risks.

For example:

> "*Would like to see more money being made available for follow-up work and staff time. For example, the £15/sample allocated by FSA grants to cover sampling costs is not a realistic figure as staffing resources are not adequately covered. Grant money will not cover the follow up paperwork with a business on a non-compliant sample result and these staff costs are taken from the LA budget."* (Inland LA)

10.1.10 Industry sharing results with primary authorities and FSA

A stakeholder noted that:

> *"There needs to be better sharing of intelligence within the food industry. If a business has a Primary Authority then that business should share their sampling information with their LA. This issue has been highlighted by the recent horsemeat scandal where there is more of a recognition that industry needs to work with government to stop food fraud. There also needs to be more sample sharing with the FSA itself and this agenda needs to drive this forward quickly."*

Another stakeholder noted that:

"The FSA needs to be more open with what they share with industry and increase communication. The National Food Standards and Labelling Group has been talking with the Business Expert Group (representatives from different trade bodies) and this could be the type of forum to discuss food safety and food sampling issues."

10.1.11 Earned recognition

A stakeholder noted:

"On the animal feed sampling side there is a lot of discussion on earned recognition where businesses that demonstrate a high level of compliance could have their sampling frequency reduced and this could be considered for food sampling as well.

Accreditation/Assurance schemes, similar to what are available in primary production, could also be considered but would need to consider the legal requirements that Trading Standards would need to enforce. Robust monitoring and open sharing of sampling data would be necessary."

10.1.12 Public Analyst

Respondents suggested that:

"PAs need to be supported so as to reduce sample analysis costs.

It would be good to standardise analyses costs across all LAs. For example, one sample test costs £450 (ELISA test) in one PA laboratory and the same test (DNA test) costs only £255 at another PA laboratory." (Stakeholder)

"There is no service level agreement with the laboratory. A service level agreement that includes turnaround times would improve efficiency – one project had six month turnaround time for analytical results." (Inland LA)

"More timely turnaround of samples. The lab is less approachable now for general advice due to lack of people resource and time to answer enquiries. Limited time too for officer research but there is a lot of definitive advice/data. This however differs from access to expert knowledge where it can be adjusted to particular situations." (Inland LA)

"Improved automation at laboratory level would improve turnaround of results." (Inland LA)

"Shortening approval time for results at the laboratory; seems to be a bottleneck." (Inland LA)

Some respondents expressed concern about the length of time it takes for some analyses results to be delivered and how this impacts the values of samples.

10.2 Feedback from rapid survey

10.2.1 Introduction

Respondents were invited to cite potential improvements. These were categorised as per Table 12. It can be noted that the top four categories were co-ordination, funding, risk based sampling and ring fencing sampling/sampling level guidance.

Some quotes are provided below to illustrate these ideas. The ideas revolve around making better use of current resources through co-ordination and risk based sampling, as well as improved funding and guidance on the level of sampling.

10.2.2 Co-ordination

Improved co-ordination is advocated between LAs, regionally and nationally.

"*LAs need to be more co-ordinated in their approach, but retaining the ability to undertake very local needs based sampling. LAs need to use more data sources to determine their local sampling plans. At a national level, the results of analysis of sampling data held in the FSA's UKFSS database, RASFF portal and TRACES/GRAIL should be more widely known to inform LA sampling plans / programmes."*

"Better co-ordination of sampling in relation to large companies especially those with a Primary Authority relationship to avoid double sampling."

"On a wider basis, improvements could be made by increased co-ordination of targeted sampling surveys to assist in obtaining suitable data sets to provide more meaningful results. This is currently being looked at on a regional level."

"A more co-ordinated approach to food sampling is required at national level as it seems quite disjointed and all info and surveys should be organised by one body."

"At national level I think the division of responsibilities between FSA and DEFRA has led to some confusion which has fed through into sampling priorities. I would like to see better collaboration between the two bodies particularly in the area of intelligence sharing where food fraud is suspected. The recent horse meat incident is an example of where clearer lines of responsibility could have improved the speed of the response."

Funding

"More funding should be made available and the bidding process needs to be simplified. It would also be of great benefit to have the outcome of the bid early in the year - i.e. ready for 1st April, rather than almost halfway through the year. We are unable to include food work within our service plan as we do not know what funding we will obtain. Also, when funding is only confirmed late (end of August last year) the work has to be squeezed in, as we will be involved in non food project work which has been started early in the year."

"Additional funding for food standards samples."

"FSA funded sampling could be expanded. Many small LAs have no or very little sampling budget so FSA could provide ad hoc funding for specific products found by enforcement officers - which does not require the submission of a funding bid."

10.2.3 Risk based sampling

"Better information to enable targeting of resources at the highest risk foods and premises and taking account of emerging issues."

"To target specific food products where an issue has arisen at a local or National level. Not to sample some foodstuffs where there is little or no risks."

"The risk based sampling could be better co-ordinated. It should be driven by intelligence and focus on localised problems."

"Intelligence models could be made more sophisticated to help target sampling activities particularly in the area of food fraud."

10.2.4 Ring fenced funding/sampling level guidance

"Incorporate specific sampling targets within the FSA code of practice / Food Law Enforcement Framework Agreement."
"Improvements could be made by providing direct funding for sampling."

"Without firm national guidance on the amount of food sampling there is massive pressure

to reduce budgets, the food sampling budget is an easy and seemingly painless target."

"I believe sampling levels have continued to fall because unlike other official control interventions there is no clear guidance to establish what level of sampling is appropriate in a particular geographic area and therefore there has been virtually no accountability or efforts to remedy where LAs reduce below what is acceptable."

"The importance of routine sampling does not appear to be fully understood by some of our neighbours and they take very few samples."

"At a national level we do not get much support in terms of the information we can give to Directors and elected members about the importance of routine sampling."

10.2.5 Other points

Other suggestions were offered regarding UKFSS, Laboratories and some other points such as:

- *"Improved recognition of the importance of sampling."*
- *"The use of FSSNet will hopefully be able to target sampling resources in areas of potential concern and assist the ... in developing their surveys."*
- *"Use UKFSS to its full potential."*
- *"More flexible lab collections of samples from LA offices - rather than being limited to certain days and have to pre-book pickups from the lab - would allow for more officer autonomy in prioritising workloads / inspections and to take impromptu samples when inspecting more problematic premises."*

Table 12: Categories of suggested improvements

Category of improvement	Number of respondents citing it	% of responses
Co-ordination	26	29%
Co-ordination	3	
Regional co-ordination	5	
National co-ordination	10	
Local co-ordination	4	
Primary Authority co-ordination	2	
Standardise county/regional plans	1	
Long term plans	1	
Funding	20	22%
Funding	14	
More staff	3	
More flexible use of FSA funds to match local risks	1	
More timely advice of FSA funding	2	
Risk based sampling	18	20%
Local intelligence led sampling	8	
More risk based national programme	3	
Risk based sampling	1	
Risk based sampling using UKFSS	2	
Support to target high risk	4	
Ring fencing/sampling level guidance	10	11%
Ring fence sampling budgets	3	
Guidance on level of sampling	6	
Make sampling statutory	1	
UKFSS	5	6%
Improve UKFSS	3	
Train staff in UKFSS	1	
Help with UKFSS	1	
Promotion of sampling	5	6%
Promote sampling to EHOs	2	
Promote sampling to local politicians	2	
Advice & training	1	
Other	5	6%
More support from other enforcers	1	
Flexible laboratory collections	3	
More use of ATB	1	
Total	89	100%

10.3 Feedback from final stakeholder interviews

10.3.1 Overview

Seven interviews were undertaken to ascertain opinions on the improvement options put forward in section 4 of this report. There were three responses from stakeholders (APA, CIEH and PHE), one LA and three PHAs. Respondents rated each potential option in respect of impact, effectiveness and feasibility. Their ratings are summarised in Table 13, Table 14 and Table 15.

There were a range of comments expressed as to how the effectiveness of food sampling could be improved. Overall the responses indicated:

Increasing effectiveness of sampling

- The measures that received the most clear positive response that they would lead to more effective sampling and be practical to implement were:
    - Better coordination;
    - Introducing more intelligence led and risk-based sampling, and
    - Better sharing of results, with improved reporting functions on UKFSS key to improvement. It was a challenge that UKFSS could not be interrogated in real time.
- Making sampling more effective could lead to less sampling.
- Another issue that was affecting effectiveness was that of laboratories being able to undertake more specific testing. Coordination of samples for such tests at a national level might overcome this. National co ordination would also take away any local bias and make it is easier to see trends.
- There was some concern over the practicality of implementation especially where there are either interdepartmental barriers for communication or where there is a more generalised skill base at local authority level.

Funding

- Increasing funding for sampling as a stand-alone measure was said to increase the level of sampling.
- However, increased funding needed to address both the cost of analytical samples and the cost of time and resources for the actual sampling activity by designated personnel.
- How money is channelled to LAs is important. Regional groupings of LA food control might be an option. An option raised was for local authorities or regional groups to bid for grants to cover regional sampling officers. This would mean that the funding could be ring fenced and not spent by local authorities on other areas of environmental health jurisdiction.

Cost recovery

- It would be difficult to recover the cost of sampling from food business operators as in some areas the administration charge to recover costs was higher than the cost that could be charged.

Sharing expertise

- The local authority respondents felt that sharing expertise could be extended even further with the sharing of sampling officers across a number of local authorities.

Third party accreditation sampling

- Concern was also raised as to the quality of third-party certification standards and audits and their compliance with regulatory sampling requirements. Small businesses would find it difficult to be in such certification schemes and the risk assessment undertaken in these kinds of audits would need to comply with national priorities.

Use of new technology

- Use of monitoring equipment such as ATP swabbing was felt to be a benefit and that this mechanism would reduce the number of samples collected overall.

Port Health Authorities

PHA respondents noted that the position with PHAs differs from LAs. Key feedback included:

- The current system of sampling and surveillance was not broken but there is room for improvement.
- There appears little value in regionalising funding when the majority of the major ports and airports facilitating imports are in the south and south east with the exception of Liverpool.
- Port health services have national and European considerations rather than regional ones which suggest more central co-ordination and distribution of funds.
- Ring fencing of funds is pretty much in place at present for FSA sampling programme initiatives. The remainder is recovered via import charges for specified products.
- The suggestions of national sampling programmes conducted by outside agencies will be unfeasible and impractical in a port environment and could be seriously detrimental to imported food and feed trade.

It was suggested that the improvement options be tailored to port health authorities and airports rather than combined with in-land authorities.

The responses per option are elaborated below.

10.3.2 Responses per option

Better use of current resources

The first set of options reviewed was to make better use of current sampling resources. The feedback is summarised below.

1. Better coordination between FSA, Defra PHE and other agencies regarding sampling plans.

With regard to an impact on level of food sampling - four respondents indicated that they felt there would be somewhat of an increase in the level of sampling with one respondent saying sampling might reduce slightly. In terms of effectiveness of the option all respondents felt the measure would have an impact. Five respondents felt that the option was practical.

It was said that:

- Co-ordination would make it easier to see trends.

- If there was a co-ordinated sampling contract, either by people sampling or one laboratory, samples would be taken in the same way.
- A central agency would take away any local bias.
- There should be more co-ordination at PHA group level in terms of data and expertise.

2. Better coordination between local authorities regarding the sampling plans.

There was overall an uncertainty expressed about the impact on the level of the sampling. However all those who responded felt there would be either somewhat or more effective sampling and again most felt that it would be practical to implement.

3. Sharing feed standards and food hygiene sampling expertise between local authorities.

Three respondents felt there would be something of an increase in the level of food sampling and these people also felt there would be slight improvement on the effectiveness of sampling. Only two respondents felt this would be a practical measure to implement.

It was noted:

- Specialists covering more than one LA would be of value but this would require agreement between LAs.

4. More risk-based sampling.

Two respondents felt it would slightly reduce the level of food sampling whilst five out of seven felt that it would increase. Again five out of seven said that this measure would increase the effectiveness of sampling. Four people said that this measure would be practical to implement. There was concern that if this measure was implemented there would be less focus on horizon scanning and taking samples when non-compliance has not been identified in the past. This approach could mean that emerging hazards and risks were not identified.

One PHA noted that they already carried out a lot of statutory sampling which was risk based. Therefore, they felt that much of the value of risk based sampling was already being achieved.

There was concern raised by a number of respondents that if the process of sampling went purely down the route of being risk-based and intelligence led then problems that were “outside the box” would be missed and the ability to horizon scan would be seriously reduced.

5. More intelligence based sampling.

There was a range of views with regards to this option with three out of seven suggesting that it would increase the level of the sampling and one person suggesting that food sampling levels would be reduced. The overall opinion was that this measure would increase the effectiveness of the sampling and four out of seven said it was practical to implement.

6. More use of screening techniques such as ATP.

Whilst there was divided opinion on the impact on the level of the sampling three out of five respondents said it would increase the effectiveness of sampling. There was no clear conclusion on whether this measure was practical to implement.

It was noted that:

- ATP monitoring and other monitoring tools such as infra-red temperature probes allows for more informed premises auditing. In (a city) there are a range of food teams – many do very little official sampling but they can use these tools to give on the spot feedback to food business operators and inform areas where they need to sample.

7. Better sharing of results.

There was even opinion on whether this option would somewhat increase or somewhat decrease the level of the sampling. However all respondents felt that this measure would lead to more effective sampling. Five out of seven respondents said that the measure would be practical to implement.

It was noted that:

- As not all the LAs are inputting into UKFSS this limits the ability to use data and share to inform decision making.

Changing funding arrangements

Options in the B category reflected changing funding arrangements.

1. Increased funding

Increasing funding for the sampling as a stand-alone measure was said to increase the level of sampling.

- Five out of seven respondents felt this would be somewhat more effective however there were concerns that just increasing funding in isolation would not lead to more effective use of resources.
- Four out of seven people were unsure whether this measure could be implemented.

However, it was also noted that even with more funding the effectiveness of sampling was constrained by laboratories getting more specific leading to samples are being sent to Europe. This was said to lead to longer response times, such as 3.5 months for dioxin results to be released after samples sent. This limits the value of the results. It was noted that the impact of funding would be enhanced by:

- Increased funding officers as well as testing fees.
- Grants to support Regional Liaison Groups to support regional sampling officers.

2. Advice on level of sampling

Giving advice on the level of the sampling e.g. weighting the number of feed businesses or consignments was discussed. All respondents that answered this question said it would increase the level of sampling. There was no clear opinion on whether it would be effective

or practical to implement.

It was noted:

- This would prevent budget cuts.
- Need to safeguard sampling frequency in order to be able to identify ongoing level of legal compliance and trends.

3. Ring fencing funding

Ring fencing funding for food standard sampling was discussed. It was suggested that it may increase the level of the sampling (five out of seven) but again there was no clear opinion on the effectiveness or practicality of implementing this measure.

4. Greater cost recovery

It was felt that greater cost recovery from the businesses for sampling completed as part of an investigation or in support of formal enforcement would increase the level of the sampling. There was uncertainty as to its effectiveness or practicability.

There was concern expressed that this option may be difficult to implement in practice and not cost effective if the administration charge to recover costs is higher than the costs that can be charged.

Increasing level and scope of national sampling

For question three increasing level and scope of national sampling programmes directed or conducted by national agencies with less local authority sampling there was a mixed response as to whether this will increase or decrease the level of the sampling. There was uncertainty over its practicality, effectiveness and feasibility.

Increasing extent of sampling by businesses

With regard to option d) increasing the extent/use of food sampling for all options there was a mixed response and no clear collective view on whether it would increase or decrease the sampling except perhaps where there was a duty of care placed on food businesses to sample (four out of seven felt somewhat of an increase in level of food sampling).

It was noted that:

- To implement this option and for it to be feasible and practical requires trust. At the moment trust is limited.
- There is a structural limit to implementation for this option – the time available to LA staff to assess the results and data provided. This would have to be covered and the skill set would need to exist to interpret the results.
- There is a question as to whether you could take action on results from this source.

A PHA noted that:

- “Non EU assurance schemes in our experience are not as robust and reliable as controls and schemes within the UK/EU. Frequently imports certified by officials for products originating outside the EU have assurances concerning food safety such as lab reports for contaminants however when tested on import the product is found to be unsatisfactory (aflatoxin analytical reports for example).There are also additional concerns regarding laboratories used by some food business operators

to give assurance of food/feed safety as these vary in standard. A formally sampled product at the border will be tested by a Public Analyst or in the case of microbiological analysis a Food Examiner in a lab which has all necessary accreditations and standards.... More due diligence sampling by food business operators is supported but there is no substitute for independent sampling conducted by fully qualified officials at the borders."

Please note, some respondents did not rate all options.

Table 13: Respondents ratings of impact on level of sampling

Options	Impact on level of food sampling				
	Greatly reduce	Somewhat reduce	No impact	Somewhat increase	Greatly increase
a) To make **better use of current food sampling resources** through ...					
i. Better co-ordination between Food Standards Agency (FSA), Defra, Public Health England (PHE) & other agencies regarding sampling plans		1	2	4	
ii. Better co-ordination between local authorities (LAs) regarding sampling plans		1	3	1	
iii. Sharing food standards and food hygiene sampling expertise between local authorities			2	3	
iv. More risk based sampling		2		5	
v. More intelligence based sampling		1	2	1	2
vi. More use of screening such as ATP monitoring		2	2	1	
vii. Better sharing of results		3	1	3	
b) **Changing funding arrangements**, such as...					
i. Increased funding for food sampling				2	5
ii. Indicating levels of sampling to be conducted by LAs, such				2	2

Options	Impact on level of food sampling				
	Greatly reduce	Somewhat reduce	No impact	Somewhat increase	Greatly increase
as a rate per risk weighted 1000 food businesses					
iii. “Ring fencing” funding for food standards sampling, such as the FSA specifying credits per LA as is done with the existing PHE credits		1	1	2	3
iv. Greater cost recovery from food businesses for sampling completed as part of investigation, suspect sampling & in support of improvement notices & other forms of formal enforcement			1	3	2
c) **Increasing level and scope of national sampling programmes** directed or conducted by national agencies FSA and PHE, with less LA sampling		2		2	1
d) **Increasing the extent/use of food sampling undertaken by businesses, such as...**					
i. Requiring third party certification schemes to conduct food sampling using official methods & accredited laboratories & sharing all results with FSA, Defra and LAs		1	3		2
ii. Requiring large food businesses to conduct food sampling tests using official methods & accredited laboratories & sharing all results with FSA, Defra and LAs		1	3	2	1

Options	Impact on level of food sampling				
	Greatly reduce	Somewhat reduce	No impact	Somewhat increase	Greatly increase
iii. Placing a duty of care on food businesses that produce or supply food to carry out food sampling as part of their food safety and food standards management process & sharing all results on request		1	2	4	

Table 14: Respondents ratings of impact on effectiveness of sampling

Options	Impact of effectiveness of sampling				
	Far less effective	Somewhat less effective	No impact on effectiveness	Somewhat more effective	Far more effective
a) To make **better use of current food sampling resources** through ...					
i. Better co-ordination between Food Standards Agency (FSA), Defra, Public Health England (PHE) & other agencies regarding sampling plans				6	1
ii. Better co-ordination between local authorities (LAs) regarding sampling plans				4	1
iii. Sharing food standards and food hygiene sampling expertise between local authorities			2	3	
iv. More risk based sampling		1	1	4	1
v. More intelligence based sampling		1		2	3
vi. More use of screening such as ATP monitoring			2	3	
vii. Better sharing of results				5	2
b) **Changing funding arrangements**, such as...					
i. Increased funding for food sampling			2	5	
ii. Indicating levels of sampling to be conducted by LAs, such as a rate		1	2	1	

Options	Impact of effectiveness of sampling				
	Far less effective	Somewhat less effective	No impact on effectiveness	Somewhat more effective	Far more effective
per risk weighted 1000 food businesses					
iii. “Ring fencing” funding for food standards sampling, such as the FSA specifying credits per LA as is done with the existing PHE credits		2	4	1	
iv. Greater cost recovery from food businesses for sampling completed as part of investigation, suspect sampling & in support of improvement notices & other forms of formal enforcement		1	4		1
c) **Increasing level and scope of national sampling programmes** directed or conducted by national agencies FSA and PHE, with less LA sampling		1	2	2	
d) **Increasing the extent/use of food sampling undertaken by businesses, such as...**					
i. Requiring third party certification schemes to conduct food sampling using official methods & accredited laboratories & sharing all results with FSA, Defra and LAs	1		4	1	1

Options	Impact of effectiveness of sampling				
	Far less effective	Somewhat less effective	No impact on effectiveness	Somewhat more effective	Far more effective
ii. Requiring large food businesses to conduct food sampling tests using official methods & accredited laboratories & sharing all results with FSA, Defra and LAs	1		3	2	1
iii. Placing a duty of care on food businesses that produce or supply food to carry out food sampling as part of their food safety and food standards management process & sharing all results on request	1	1	3	2	

Table 15: Respondents ratings of impact on feasibility/practicality of sampling

Options	Practicality/feasibility				
	Not at all practical	Somewhat impractical	Unsure	Practical	Very practical
a) To make **better use of current food sampling resources** through ...					
i. Better co-ordination between Food Standards Agency (FSA), Defra, Public Health England (PHE) & other agencies regarding sampling plans			2	5	
ii. Better co-ordination between local authorities (LAs) regarding sampling plans			1	5	
iii. Sharing food standards and food hygiene sampling expertise between local authorities			3	2	
iv. More risk based sampling			3	4	
v. More intelligence based sampling			2	4	
vi. More use of screening such as ATP monitoring			3	2	
vii. Better sharing of results			2	4	1
b) **Changing funding arrangements**, such as...					
i. Increased funding for food sampling			4	3	
ii. Indicating levels of sampling to be conducted by LAs, such as a rate per risk weighted 1000 food businesses	1		2	1	
iii. “Ring fencing” funding for food standards sampling, such as the FSA specifying credits per LA as is done with the existing PHE credits		2	2	3	

Options	Practicality/feasibility				
	Not at all practical	Somewhat impractical	Unsure	Practical	Very practical
iv. Greater cost recovery from food businesses for sampling completed as part of investigation, suspect sampling & in support of improvement notices & other forms of formal enforcement	1	1	4		
c) **Increasing level and scope of national sampling programmes** directed or conducted by national agencies FSA and PHE, with less LA sampling		2	1	2	
d) **Increasing the extent/use of food sampling undertaken by businesses, such as...**					
i. Requiring third party certification schemes to conduct food sampling using official methods & accredited laboratories & sharing all results with FSA, Defra and LAs		2	3	1	1
ii. Requiring large food businesses to conduct food sampling tests using official methods & accredited laboratories & sharing all results with FSA, Defra and LAs		3	3	1	
iii. Placing a duty of care on food businesses that produce or supply food to carry out food sampling as part of their food safety and food standards management process & sharing all results on request		3	2	1	1

11 APPENDIX F: FOOD SAMPLING PRACTICES OVERSEAS

11.1 Introduction

A rapid internet search was completed to identify publicly available information on food sampling practices in other countries, with the aim of identifying potential improvements for the UK. Searches were completed for Spain, Italy, France, Norway, Sweden, Holland, Denmark, Germany, Finland, Ireland and Belgium as well as Australia, New Zealand, America and Canada. Limited information was available on official control sampling completed by competent authorities. Selected information is reported here by exception. The approach adopted by Belgium was judged to be of most relevance to the issues identified in this research and so are summarised in more detail.

11.2 World Health Organisation

The World Health Organisation (FAO/WHO, 2001) suggests that for countries where food control responsibilities are spread across many government agencies it may be necessary to negotiate a revised funding structure and establish transition arrangements to ensure continuity of funds and resources. Securing sufficient resources may be a problem, as the trend towards reduced public sector spending is influencing governments to review their priorities and funding arrangements. It is important that any cost recovery is managed carefully as any costs passed directly onto the food industry will ultimately be passed onto consumers as an indirect tax on food. Cost recovery options include fees for licensing, inspection activity, and food analysis.

11.3 New Zealand

New Zealand (NZ) has had similar issues to the UK regarding food safety resourcing in their Local Authority equivalent. Contracting was a popular solution for those Territorial Authorities (TAs) that either do not have enough work or resources for a full time Environmental Health Officer (EHO), or had too much work for the EHO they had (NZFSA 2004). Contractors come from the private sector and from other TAs. Food safety cost recovery has been varied among NZ TAs. Twenty-three TAs recover less than 50% of their costs through user charges, however 12 recover 100%. Fees are calculated and charged one of four ways: a flat fee; risk grouping or risk factor; by activity type or based on ground area or seating numbers.

One of the NZ Ministry of Health's food safety monitoring programmes is in the form of Total Diet Surveys (TDSs) which are conducted in the country every five to six years (MAF, 2009). The TDSs are undertaken to determine the safety of commonly eaten foods with respect to chemical residues (pesticides and heavy metals) and selected nutrient elements (Ministry of Health, 2003). The survey is based on a series of simulated fortnightly diets for different population subgroups including adult males, adult females, young men and children. The simulated diets are based on a food list of over 100 commonly eaten foods, as well as some foods with potentially high levels of contaminants or nutrients of interest. The food list is constructed using food consumption data from national nutrition surveys and supermarket scan data. Foods from the food list are collected over a 12-month period to account for seasonal variation (MAF 2009). TDSs are promulgated by the WHO as the most cost effective means of assessing robust dietary exposures.

All food in NZ is categorised by the New Zealand Food Safety Authority (NZFSA) into one of three levels of 'regulatory interest' — low, medium or high (AGPC, 2009). This grouping

determines the level of regulatory intervention by NZFSA with a particular food and enables differing import requirements that relate to the potential health risk of products in each group. Importers of foods of medium regulatory interest operate under a Food Control Plan, which involves recording the steps taken to manage the food safety and suitability of their products. Importers of foods of high regulatory interest also operate under a Food Control Plan, but are only able to import from countries/regions that have established pre-clearance arrangements with NZFSA.

For food imported into NZ, a compliance history is developed for every prescribed food for each importer (MPI, 2013). From the sampling and testing history, the frequency of sampling is gradually reduced with acceptable test results. This “Switching Rule” works with a 100% sampling of a new prescribed food line and once five consecutive compliant imports have been cleared then the sampling frequency is reduced to 20%. The final reduced level would be 10% after another five consecutive imports. If there is a failed result, the sampling frequency returns to the 100% tightened level.

Food Standards Australia New Zealand (FSANZ) acts as the central point for collection of food surveillance data from public health units in Australia and NZ. This data includes the results of general compliance testing, and specially targeted Co-ordinated Survey Plans conducted in the various jurisdictions (FSANZ 2014a). One of the priorities for the Co-ordinated Survey Plan is to promote greater co-ordination and consistency in the testing of both imported and domestically produced food (FSANZ, 2014b).

11.4 Australia

The Australian risk-based border inspection programme is very similar to that of New Zealand (AGPC, 2009). Initially, all risk food from a given producer is inspected and tested at a rate of 100 per cent against a published list of potential hazards - including micro-organisms and contaminants. Once five consecutive consignments from that producer have passed inspection, the inspection rate is reduced to 25%; after a further 20 consecutive passes, the inspection rate is reduced to 5%. The highest risk imported foods are seafood (15% of tests applied - fresh, chilled, frozen and processed seafood products) and horticulture, including fresh and processed fruit and vegetables, which accounted for 14% of all tests applied to imported food. Random surveillance foods are considered to pose a low risk to human health and safety and are inspected at a rate of 5% of consignments of that food type. Producers who regularly import consignments of random surveillance foods will, just by the frequency of their imports, have an increased likelihood of having a consignment inspected.

11.5 United States (US)

In 2000, the US Food Safety and Inspection Service (FSIS) completed implementation of its landmark rule, Pathogen Reduction/Hazard Analysis and Critical Control Point (HACCP) Systems (USDA, 2001). The rule addresses the serious problem of foodborne illness in the US associated with meat and poultry products by focusing more attention on the prevention and reduction of microbial pathogens on raw products that can cause illness. It also clarifies the respective roles of government and industry in food safety. Industry is accountable for producing safe food. Government is responsible for setting appropriate food safety standards, maintaining vigorous oversight to ensure that these standards are met, and for operating a strong enforcement program to, among other things, deal with plants that do not meet regulatory standards. The Pathogen Reduction/HACCP rule applies also to countries that export meat and poultry products to

the US.

The US Food Safety Modernization Act of 2011 (FSMA) aims to ensure the US food supply is safe by shifting the focus from responding to contamination to preventing it (FDA 2014). The primary aim of the FSMA is to require food companies to implement preventive controls (Eurofins, 2012). All food manufacturers, whether inside or outside the US, are required to have documented preventive control programmes in place. The preventive control requirements will go above and beyond a typical HACCP plan, and will include requirements related to recall plans, sanitation, employee hygiene training, environmental monitoring, allergen control programme, supplier approval and verification activities, etc. The FSMA is moving the burden of imported food safety onto importers. Importers will need to perform risk-based foreign supplier verification activities to ensure that food entering the USA has been produced by firms employing preventive controls.

11.6 Canada

The Canadian Food Inspection Agency (CFIA) are introducing similar rules whereby food importers are required to be licensed and have food safety plans in place to identify, report and recall potentially hazardous products from the marketplace as quickly as possible (CFIA, 2014a).

The CFIA uses a risk-based approach for its inspection activities (CFIA, 2013). The criteria are defined in Figure 49. The CFIA chemical residue surveillance programme consists of three components: sample monitoring, directed sampling and compliance sampling (CFIA 2014b). The last published report was in 2011/2012 for melamine. The last reported microbiological surveillance programmes were for contamination of tomatoes and cantaloupes in 2009-2010.

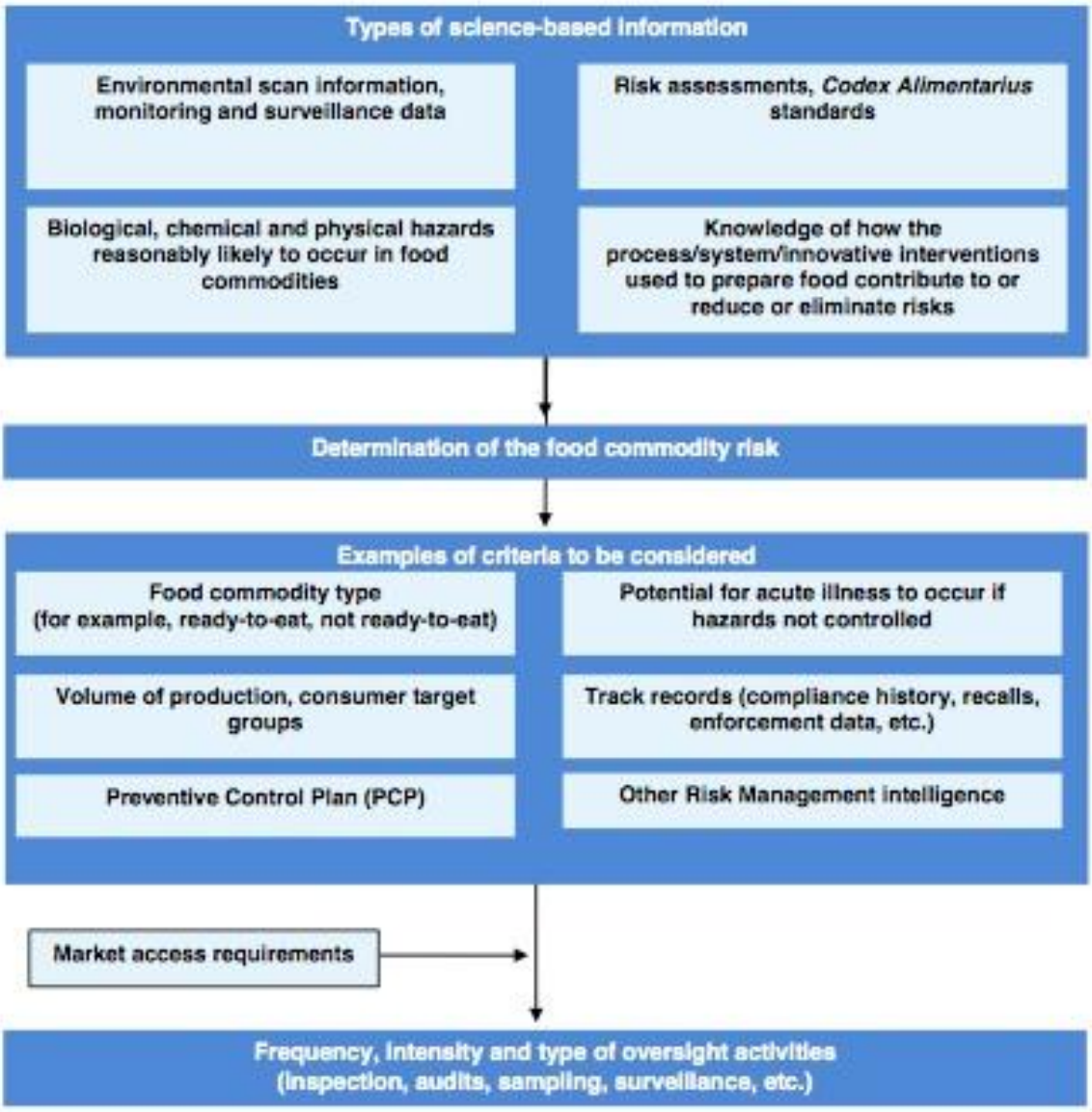


Figure 49: Factors in determining frequency, intensity and type of oversight activities used by the CFIA (CFIA, 2013)

The CFIA is responsible for monitoring the food supply for chemical residues and contaminants, and determination of compliance with maximum residue limits (MRLs) and maximum levels established by Health Canada (CFIA, 2014c). In the 2009-2010 National Chemical Residue Monitoring Program (NCRMP), over 160 000 tests for residues of agricultural chemicals and veterinary drugs, mycotoxins, and metals were performed on monitoring samples of domestic and imported dairy, eggs, honey, meat and poultry products, fresh fruit and vegetables, processed products, and maple products. The primary aim of the monitoring programme is to provide information about the compliance status of the food supply. These tests produced over 3 million results. Compliance rates were high for domestic and imported products, and there was no clear relationship between compliance rate and country of origin. With a small sample size, data had to be collected over a longer period of time before significant inferences could be drawn. With a sample size of 300, seasonal trends may be evident, especially if there is a large seasonal variation. By comparison, seasonal variations would not be as evident with smaller sample sizes.

The CFIA employs the Compliance Verification System (CVS) approach when verifying

compliance associated with feeds and feed ingredients. Verification tasks are designed to assess compliance of regulated parties (commercial feed manufacturing and rendering facilities, on-farm feed manufacturing facilities, and other locations such as feed retailers and ingredient manufacturers) with Canada's regulatory requirements (CFIA 2014d). The tasks include reviewing information which identifies the specific feed sampled, reviewing any directions for use/inclusion rates, on-site observations and reviewing the associated sample analyses to determine whether the regulatory requirements are being met.

11.7 Belgium

In Belgium the safety of the food chain is the responsibility of the Ministry of Public Health. Within this ministry is the Federal Agency for the Safety of the Food Chain (FASFC). The FASFC is an autonomous entity responsible for risk evaluation, risk management and risk communication (Maudoux et al, 2006). The FASFC has adopted an approach that allows objective risk-based planning of official controls.

The required number of analyses is estimated as part of the planning process.

The number of analyses is planned by two routes:

- Imposed by regulation i.e. statutory;

  If a regulation prescribes a certain frequency of sampling, sampling plans will include these as per the prescribed frequencies; and

- Risk analysis and statistical requirements.

A statistical approach is adopted. A key criteria guiding plans is the level of confidence sought in the process of detecting contaminants.

The level of confidence sought by sampling is higher for hazards that pose a greater risk. The risk level is considered alongside statistical considerations to indicate a required number of analyses per hazard.

Determining the number of samples needed to detect non conformance

The steps in their approach include:

1. List all food hazards (undesirable substances, diseases etc) based on previous sample results, scientific findings and legal recommendations.
2. For each hazard identify the groups of products, animals or plants that may be affected. These groups may be sub divided.
3. Assess the importance of each group of products, such as by considering the volume or number of batches each year.
4. Set the confidence level to be achieved by sampling and the "acceptable level" (termed prevalence level) of contamination.
5. Calculate the number of analyses to be carried out.

The confidence level to be attained is based on three criteria:

a) The degree of harmful effect. This is scored on a four point scale:
   1) Not harmful,
   2) Probably Harmful,
   3) Seriously harmful,
   4) Very harmful.

b) The prevalence of contamination. This is scored on a four point scale:
   1) Very low prevalence,
   2) Low probability of prevalence,
   3) Average probability of prevalence,
   4) High probability of prevalence.

   They advise that prevalence is based on a three year reference period.

c) The contribution of the product to the overall level of contamination or disease in the food chain. This is scored on a four point scale:
   1) Limited,
   2) Average,
   3) Substantial,
   4) Very substantial.

They provide guidance on these scoring scales and sources of information.

The risk is estimated as:

Harmful effect + (prevalence x Contribution)

This gives a required confidence level as per Table 16.

Table 16: Risk based confidence levels required of surveillance

Score	Required confidence level
13 to 20	99%
7 to 12	95%
2 to 6	90%

Next the prevalence to be controlled is determined as per Table 17.

Table 17: Risk based level of control (unsatisfactory results)

Hazard class	Prevalence to control
Very serious	1%
Serious	2.5%
Probably serious	5%
Not serious	10%

The estimated number of batches, per sub-group of products, to test is given by a

statistical formula. The formula is:

$$N = [1-(1-\alpha)^{1/D}]*[N-(D-1)/2]$$

Where:

- n is the sample size required;
- α is the confidence level;
- N is the size of the population being sampled from;
- D is the expected number of results that will not conform.

Any product with more than 10,000 items (e.g. 10,000 carcases) per year is treated as an infinite population.

This gives a number of samples needed per hazard per, for example, animal species, e.g. 120 Dioxin tests for cattle.

Number of samples needed to determine level of contamination

A similar approach is applied to determining the number of samples needed to estimate the true level of contamination. They calculate the number of samples needed to estimate the level of contamination within a 95% confidence interval.

11.8 Germany

Competence for official food surveillance in Germany lies with the federal states (Bundesländer). Official surveillance covers all levels of food production, including producer and processing establishments as well as storage, transport and sale of food products, or gastronomic businesses (BVL, 2014b). Businesses are inspected periodically without prior notice and establishments with an incident record are inspected more often. The Federal Office of Consumer Protection and Food Safety (BVL) in Germany develops effective emerging risk identification systems through the evaluation of numerous sources (BVL 2014a). In this respect, the BVL has established an internet-based information system, in which relevant data from the Federal Government, Federal States and other stakeholders are gathered and evaluated. Through this system, the BVL is in the position of being able to identify risks at an early stage and to forestall the occurrence of crises.

The overall number of samples to be taken during the official controls by the Federal states is specified to 5 samples per 1,000 inhabitants for foodstuff per year (BVL 2014c). A certain proportion of the total number of samples (0.15 – 0.45 samples per 1,000 habitants per year) is to be drawn in co-ordinated programmes.

Most of these co-ordinated drawn samples are analysed as part of the Federal control plan in about 30 programs each year. Further co-ordinated samples are drawn within the food monitoring and co-ordinated programs of the European Union.

Due to the regional differences between the Federal states each state decides on its own in which programme it will participate with how many samples. The Federal control plan is, unlike food monitoring, a risk based control programme where the choice of products and establishments is based on a risk assessment.

11.9 Ireland

The information for this section of the report was sourced from the Food Standards Authority of Ireland (FSAI) website (FSAI, 2014a). The FSAI and its agencies carry out

monitoring of food on the Irish market to verify that relevant requirements of food law are fulfilled by food businesses (FSAI, 2014b). Areas of monitoring and surveillance include microbiological, chemical, genetically modified food, irradiated food, labelling and nutrition. The FSAI routinely conducts microbiological surveillance programmes to monitor microbiological trends, by designing new surveys to build on existing data, and determine the true microbiological quality of a foodstuff by utilising the randomness of survey sampling (FSAI, 2014c). Chemical food surveillance activities in Ireland are carried out in the following areas: contamination, additives and pesticides (FSAI, 2014d).

A) Microbiological Monitoring: National Microbiological Monitoring and Surveillance Programme

The national microbiological monitoring and surveillance programme is developed collaboratively by the FSAI, the Environmental Health Service and the Food Microbiology Laboratories of the HSE. Occasionally, other official agencies of the FSAI are also involved. Each year's programme is finalised in the latter half of the preceding year.

In 2011 a survey was undertaken to determine the microbiological safety of raw minced beef and beef burgers on retail sale in Ireland. 983 samples were taken as part of the national survey to collate baseline data on the incidence of *Campylobacter* spp. and *Salmonella* spp. on raw chicken on retail sale in Ireland. In 2012 the survey was to verify compliance with Commission Regulation (EC) No 2073/2005. In 2013 a survey of the microbiological safety of ready-to-eat, pre-cut and pre-packaged fresh herbs and salad leaves from retail establishments in Ireland was undertaken.

Health Service Executive (HSE) Local Monitoring and Surveillance Programme

Under the official food control programme, food samples are taken for microbiological analysis at HSE supervised premises and are submitted for analyses to one of seven official food microbiology laboratories (OFMLs). Food samples are analysed for a wide range of foodborne bacteria. Remedial action for any samples with an unsatisfactory outcome is taken by environmental health officers. These actions can range from follow-up investigations to taking of further samples, or an inspection of the premises to identify possible hygiene deficiencies. Last reported results from 2005.

Targeted Monitoring of the Irish Food Supply

Occasionally the FSAI will commission specific microbiological monitoring projects, for example, in response to recommendations of the Scientific Committee. The last report was in 2005.

B) Chemical Monitoring and Surveillance

Chemical food surveillance activities are carried out in the areas of contaminants, additives and pesticides. An investigation into the levels of dioxins, furans, polychlorinated biphenyls and brominated flame retardants in fishery products in was reported for Ireland in April 2013. The previous report was in 2008. The last additives report was in 2008 and the pesticides report in 2006.

C) Genetically Modified Food Surveillance

The FSAI carries out routine monitoring of the food supply in Ireland to ensure only authorised GM ingredients are on the market and that they are labelled appropriately, 46 samples were taken in 2012.

D) Irradiated Food Surveillance

The FSAI is responsible for the enforcement of legislation governing irradiated food and monitors food supply to ensure that only foods authorised for irradiation within the EU are

on sale and that they are labelled correctly. Surveys are undertaken by the HSE on behalf of the FSAI. 78 samples were taken in 2012 (8 products – 3 product types only one sample taken).

E) Labelling Monitoring and Surveillance

Monitoring of food labelling in Ireland is carried out to assess compliance with the labelling legislation and to check for authenticity of stated ingredients. For fish authenticity in 2013 35 samples were taken, in 2012 16 samples were assessed. In an allergen survey reported in 2011 229 samples were assessed.

F) Nutrition Monitoring

The last survey was in 2008.

11.10 France

A Food and Veterinary Office (FVO) 2012 audit of French official controls of food safety and process hygiene criteria stated that France has a total of 92 microbiological laboratories are involved in the analysis of official food samples (approved laboratories) of which 29 are NRLs. The reports states that:

- Plans are under way to establish a database comprising results of both official and of FBOs' own microbiological sampling.
- Official sampling is not a primary tool for validation and verification of the FBOs HACCP-based programme.
- Official sampling is carried out in connection with:
    - Food alerts and food-borne disease outbreaks;
    - Monitoring results across the years;
    - As part of the official controls in establishments before the first placing on the market of their products if the inspector carrying out the control deems it necessary; and
    - As part of the controls of imported food and of food destined for export.

An annual national surveillance and monitoring plan is established and co-ordinated by the two competent authorities in France (Directorate-General for Food and the Directorate General of Competition, Consumer Affairs and Fraud Repression). The report cites 20,168 microbiological samples in the 2010 national plan.

The rationale for selection of products and the number of samples taken could not be determined in this brief review.

11.11 Sweden

The Swedish Municipal Environment and Health Protection Committees carry out food control at most food handling establishments (FAO/WHO, 2000). Although approximately 1000 inspectors are involved in food control at the municipal level only a third of this number are full-time food control inspectors. The work of the National Food Administration (NFA) is financed partly by an annual appropriation from the Government and partly by fees paid by the food industry and trade. Municipal food control is financed partly by local taxes and partly by fees collected from the food industry and trade for sampling and analysis. All establishments producing or handling foods (except very small operations) are required to pay an annual food control fee to the supervisory authority, i.e. the NFA or

the municipal food control authority. Fees are based on control needs, assessed risk and compliance history (Slorach, 2009). A weakness of the current Swedish system is that some of the 290 local authorities have very small resources and co-ordinating such a large number of independent organisations is difficult. It has been suggested that it would be better to have a central authority with regional/local offices. The Swedish food law requires food business operators to have an in-house control system in place, including full HACCP (EC 1998).

11.12 References

AGPC (2009) Australian Government Productivity Commission Performance Benchmarking of Australian and New Zealand Business Regulation: Food Safety. Productivity Commission Research Report – Appendix C: Regulation of food imports and exports. [online] Available from: http://www.pc.gov.au/__data/assets/pdf_file/0020/93503/food-safety-report.pdf [Date accessed 13/02/2014]

BVL (2014a) Many paths – one goal: Safe food. [online] Available from: http://www.bvl.bund.de/EN/01_Food/lm_food_node.html;jsessionid=AB2068388115D46F1E154782B2BAAF12.1_cid350 [Date accessed 18/02/2014]

BVL (2014b) Food Safety – Who Does What? [online] Available from: http://www.bvl.bund.de/EN/01_Food/01_who_does_what/lm_who_does_what_node.html [Date accessed 18/02/2014]

BVL (2014c) Federal control plan. [online] Available from: http://www.bvl.bund.de/EN/01_Food/031_BUEp_en/lm_BUEp_en_node.html [Date accessed 18/02/2014]

CFIA (2013) Inspection Modernization: Optimising Confidence in Food Safety: Improved Food Inspection Model: Final Model. Available from: http://www.inspection.gc.ca/DAM/DAM-aboutcfia-sujetacia/STAGING/text-texte/acco_modernization_modeldraft_final_1371833418843_eng.pdf [Date accessed 13/02/2014]

CFIA (2014a) Government of Canada to Strengthen Safety of Imported Food. [online] Available from: http://www.inspection.gc.ca/food/non-federally-registered/imports/regulatory-proposal/imported-food/eng/1334853031120/1334853177781 [Date accessed 13/02/2014]

CFIA (2014b) CFIA website: Chemical Residues in Food. Available from: http://www.inspection.gc.ca/food/chemical-residues-microbiology/chemical-residues/eng/1324258929171/1324264923941 [Date accessed 13/02/2014]

CFIA (2014c) 2009-2010 Annual Report - National Chemical Residue Monitoring Program, [online] Available from: http://www.inspection.gc.ca/food/chemical-residues-microbiology/chemical-residues/national-chemical-residue-monitoring-program/eng/1349814013684/1349814138195 [Date accessed 17/02/2014]

CFIA (2014d) Feed Sampling Verification Task Procedures. [online] Available from: http://www.inspection.gc.ca/animals/feeds/inspection-program/feed-sampling/eng/1378172340160/1378172979834?chap=2 [Date accessed 17/02/2014]

EC (1998) Results of the second visit of evaluation of the official foodstuffs control system in Sweden. [online] Available from: http://ec.europa.eu/food/food/controls/foodfeed/oc03swe_en.pdf [Date accessed 18/02/2014]

Eurofins (2012) http://www.afsca.be/publications-en/_documents/2006_article_methodology.pdf [Date accessed 13/02/2014]

US Food Safety Modernization Act: Overview and Impact for Importers and Exporters. [online] Available from: http://www.eurofinsus.com/downloads/FSMA_Overview_Leavitt_Eurofins.pdf [Date accessed: 13/02/2014]

FAO/WHO (2001) Assuring Food Safety and Quality: Guidelines for Strengthening National Food Control Systems. [online] Available from: http://www.wpro.who.int/foodsafety/documents/docs/English_Guidelines_Food_control.pdf [Date accessed 06/02/2014]

FAO/WHO (2000) Harmonization and Co-operation in Food Legislation and Food Control. Activities in the Region (Sweden, Finland, France). [online] Available from: ftp://ftp.fao.org/codex/meetings/CCEURO/cceuro22/eu0012ae.pdf [Date accessed 18/02/2014]

FDA (2014) FDA Food Safety Modernization Act (FSMA). [online] Available from: http://www.fda.gov/Food/GuidanceRegulation/FSMA/default.htm [Date accessed 13/02/2014]

FSAI (2014a) Food Safety Authority of Ireland. Available at: http://www.fsai.ie [Date accessed 13/02/2014]

FSAI (2014b) Food Monitoring and Surveillance. [online] Available from: http://www.fsai.ie/enforcement_audit/monitoring/food_monitoring_surveillance.html [Date accessed 18/02/2014]

FSAI (2014c) National Microbiological Monitoring and Surveillance Programme. [online] Available from: http://www.fsai.ie//enforcement_audit/monitoring/micro_monitor_surveillance/national_programme.html [Date accessed 18/02/2014]

FSAI (2014d) Chemical Monitoring and Surveillance. [online] Available from: http://www.fsai.ie/enforcement_audit/monitoring/surveillance/chemical_surveillance.html#chemical_contaminants [Date accessed 18/02/2014]

FSANZ (2014a) Food Surveillance. [online] Available from: http://www.foodstandards.gov.au/science/monitoring/surveillance/pages/default.aspx [Date accessed 17/02/2014]

FSANZ (2014b) Implementation Sub Committee Co-ordinated Food Survey Plan 1 July 2012 – 30 June 2015. [online] Available from: http://www.foodstandards.gov.au/science/monitoring/surveillance/documents/coordinated%20food%20survey%20plan%202012-15.pdf [Date accessed 17/02/2014]

Directorate F - Food and Veterinary Office European Commission, Health and Consumers Directorate General. Final report of audit carried out in France from 23 January to 03 February 2012 in order to evaluate the official controls on food safety and process hygiene criteria (Commission Regulation (EC) NO 2073/2005), 2012. *ec.europa.eu/**food**/fvo/act_getPDF.cfm?PDF_ID=9867 accessed may 2014*

MAF (2009) 2009 New Zealand Total Diet Study. Agricultural compound residues, selected contaminant and nutrient elements. [online] Available from: http://www.foodsafety.govt.nz/elibrary/industry/total-diet-study.pdf [Date accessed 06/02/2014]

Maudoux, J.P., Saegerman, C., Rettigner, C. Houins, G. Van Huffel, X., and Berkvens, D.

(2006) Food safety surveillance through a risk based control programme: Approach employed by the Belgian Federal Agency for the Safety of the Food Chain *Veterinary Quarterly* 28(4) 140-154

Ministry of Health (2003) Food and Nutrition Monitoring in New Zealand. Public Health Intelligence Occasional Bulletin No 19. [online] Available from: http://www.moh.govt.nz/notebook/nbbooks.nsf/0/D534DDBDD158BE99CC256DE100029D14/$file/FoodandNutritionMonitoring.pdf [Date accessed 07/02/2014]

MPI (2013) Ministry for Primary Industries Sampling and testing protocol for imported prescribed foods. [online] Available from: http://www.foodsafety.govt.nz/elibrary/industry/Nzfsa_Sampling-.pdf [Date accessed 12/02/2014]

NZFSA (2004) New Zealand Food Safety Authority Domestic Food Review. Survey of Territorial Authorities. [online] Available from: http://www.foodsafety.govt.nz/elibrary/industry/Domestic_Food-Baseline_Information.pdf [Date accessed 12/02/2014]

Slorach, S.A. (2009) EU Food Safety Systems and its Application in Sweden. [online] Available from: http://www.ifc.org/wps/wcm/connect/e38cb9004b5f7a289cb6bd6eac26e1c2/Slorach_Eng.pdf?MOD=AJPERES&CACHEID=e38cb9004b5f7a289cb6bd6eac26e1c2 [Date accessed 18/02/2014]

USDA (2001) Agriculture Fact Book 2001 – 2002. Chapter 9 – Food Safety. [online] Available from: http://www.usda.gov/factbook/chapter9.htm [Date accessed 13/02/2014]

12 APPENDIX G: GENERIC STATISTICAL ADVICE ON NUMBER OF SAMPLES

12.1 The purpose of sampling

The statistical approach adopted for determining the number of samples to be taken depends in part on the purpose of the surveillance, as follows:

a) If the aim is to try to detect non-compliance, then the number of samples may be guided by the minimum samples needed to detect one or more non-compliances.

b) If the aim is to measure the rate of non-compliance, then the confidence intervals achieved by alternative numbers of samples need to be considered.

Some generic statistical advice is noted below on these two points.

The advice starts from the point of having identified a product to be tested, possibly having determined what test to carry out. The products and hazards may be produced by, for example, considering intelligence on potential or emerging risks, wishing to survey a representative “basket” of products, tracking known risks over time, evaluating impact of interventions on compliance in specific products or other considerations.

This advice focuses on statistical considerations and does not cross reference to any sampling frequencies defined by the EU.

12.2 Probability of detecting unsatisfactory results

The statistical probability of detecting non-compliance depends on the number of samples analysed and the rate of non-compliance. Fewer samples need to be tested to detect a high rate of non-compliance.

The probability of detecting at least one non-compliant unit can be written as:

$$1-[1-p)]^n$$

Where

n is the sample size

p = proportion of non-compliance

An example of the calculation is given below for a sample of 50 with a 0.1 (10%) probability of non-compliance:

$1 – (1-0.1)^{50} = 1-(0.9)^{50} = 0.995$ (99.5% probability of detection non-compliance)

Table 20 shows the probability of detecting one or more non-compliant item for combinations of different rates of non-compliance and numbers of samples taken. For example, if the rate of non-compliance is 1%, the probability of detecting one or more non-compliant item is:

- For 10 analyses a 10% probability of detecting one or more unsatisfactory item; and
- For 200 analyses a 90% probability of detecting one or more unsatisfactory item.

An option is to consider the risk posed by the product/hazard when determining what level of probability of detecting non compliance should be sought. Table 18 provides risk levels and targeted probability of detection, based on the Belgium system discussed in section 11.7 of this report. If the product or hazard is assessed as being high risk, then a very high probability of detection may be sought, such 99%. However, if the product or hazard is assessed as lower risk, than a lower probability of detection might be sought, such as

90%.

In order to apply Table 20 it is necessary to have either:

- Results from previous tests (to give an expected rate of non-compliance), or
- Expert judgement on the possible rate of non-compliance or
- A target level of non-compliance against which test.

Table 19 provides some example criteria for the maximum acceptable rate of non-compliance, again drawing on the Belgium approach. The Agency and PHE would need to determine what criteria to apply for the UK. Two examples are:

- If the product was assessed as high risk with a maximum “acceptable” rate of non-compliance of 1%, then the number of samples tested could be based on achieving a 99% probability of detection for a 1% rate of non-compliance, i.e. 500 samples.
- A medium risk product with a target of 95% probability of detection and a maximum “acceptable” non-compliance rate of 5% would require 60 samples.

When applying this advice, the population from which samples are being taken and assessed needs to be defined. If a set of results are sub-divided, such as splitting test results between regions, the statistical guidelines would apply to each region.

Table 18: Optional risk based required probability of detection

Product/hazard risk	Required probability of detection
High or very high	99%
Medium	95%
Low	90%

Table 19: Risk based maximum non-compliance rates

Product/hazard risk	Maximum acceptable rate of non-compliance
Very high	0.1%
High	1%
Medium	5%
Low or very low	10%

The examples provided in Table 20 have been selected to generate the numbers of samples needed to detect one or more non compliance item at the three levels of 99%, 95% and 90% (as highlighted in the table) and five rates of non-compliance. Once a 100% probability of detection is achieved there is no statistical benefit in further increasing the number of samples taken.

Table 20: Probability of detecting non compliance for combinations of number of samples tested and rates of non-compliance

		Rate of non compliance				
		0.1%	1%	5%	10%	20%
Number of samples tested	4500	**99%**	100%	100%	100%	100%
	3000	**95%**	100%	100%	100%	100%
	2300	**90%**	100%	100%	100%	100%
	2000	86%	100%	100%	100%	100%
	1000	63%	100%	100%	100%	100%
	600	45%	99.8%	100%	100%	100%
	500	39%	**99%**	100%	100%	100%
	400	33%	98%	100%	100%	100%
	300	26%	**95%**	100%	100%	100%
	200	18%	**90%**	100%	100%	100%
	100	10%	63%	**99%**	100%	100%
	60	6%	45%	**95%**	99.8%	100%
	50	5%	40%	92	99.5%	100%
	45	4%	36%	**90%**	**99%**	100%
	28	3%	25%	76%	**95%**	99.8%
	20	2%	18%	64%	**88%**	**99%**
	10	1%	10%	40%	65%	**89%**

12.3 Confidence intervals

As previously noted, a confidence interval is the range of results you would expect to find if you were to analyse a series of batches of products, for example, comparing results between the year 2009 and 2010.

The confidence interval is influenced by:

- The number of samples taken;
- The reported rate of non-compliance;
- The required level of confidence in the result, such as 90%, 95% and 99%; and

- The total size of population from which samples are taken (up to a certain level of about 10,000 beyond which the size of the population is less important).

As before, an option is to seek a higher level of confidence (and hence narrower margins of error) for higher risk products and less confidence in results for medium and low risk products. This leads to three tables, Table 21, Table 22 and Table 23, one for each confidence level - 90%, 95% and 99%.

Table 22 provides a set of values for 95% confidence intervals, as suggested for medium risk products. The examples have been chosen to:

- Match the range of non-compliances in Table 20 and 20%.
- An assumed wish to have the cited confidence intervals.

The cited confidence intervals, such as 0.1% for a rate of non-compliance of 0.1% is based on the presumption that it would be acceptable to have a conclusion that the observed rate of non-compliance is in the region of 0% to 0.2%.

Similarly, it was assumed that the following results would be reasonable:

- Non-compliance between 0.5% to 1.5% (in case of a 1% rate of non-compliance)
- 4% to 6% (in case of a 5% rate of non-compliance)
- 7.5% to 12.5% (in case of a 10% rate of non-compliance)
- 15% to 25% (in case of a 20% rate of non-compliance).

The rationale is that as the reported rate of non-compliance increases, so the “acceptable” margin of error increases because once the rate exceeds a certain level it can be defined as very high. Two examples are:

> A medium risk product with a 1% reported rate of non-compliance, would indicate (from Table 22) 1,320 samples needed from a population of items exceeding 10,000 to achieve a confidence interval of +/- 0.5%.
>
> A high risk product with a 0.1% rate of non-compliance would indicate (from Table 23) 3,986 samples needed from a population of items exceeding 10,000 to achieve a confidence interval of +/- 0.1%.

If alternative confidence intervals are sought, the tabulated values would require re-calculation.

Table 21: Samples needed to achieve indicated 90% confidence intervals

Rate of non-compliance	90% confidence interval of (+ or -)	Total population					
		100	250	500	1000	5000	10000
0.1%	0.10%	96	229	422	730	1,755	2,128
1%	0.5%	91	203	341	517	882	968
5%	1%	93	209	360	562	1,023	1,139
10%	2.5%	80	152	219	280	361	375
20%	5%	63	102	129	148	167	170

Table 22: Samples needed to achieve indicated 95% confidence intervals

Rate of non-compliance	95% confidence interval of (+ or -)	Total population of products					
		100	250	500	1000	5000	10000
0.1%	0.10%	97	235	442	793	2,171	2,773
1%	0.5%	94	215	376	603	1166	1320
5%	1%	95	220	392	646	1,337	1,543
10%	2.5%	85	172	263	356	498	524
20%	5%	71	124	165	197	234	240

Table 23: Samples needed to achieve indicated 99% confidence intervals

Rate of non-compliance	99% confidence interval of (+ or -)	Total population					
		100	250	500	1000	5000	10000
0.1%	0.10%	99	241	465	869	2,850	3,986
1%	0.5%	96	228	420	724	1723	2081
5%	1%	97	232	432	759	1,933	2,397
10%	2.5%	91	198	328	489	802	872
20%	5%	81	157	230	298	391	407