Food Safety
AUTHORITY OF IRELAND

Report of the Scientific Committee
of the Food Safety Authority of Ireland

2011

Review of the Sampling and Microbiological Examinations undertaken by the Health Service Executive, 2007 and 2008

Report of the Scientific Committee
of the Food Safety Authority of Ireland

Review of the Sampling and Microbiological Examinations undertaken by the Health Service Executive, 2007 and 2008

Published by:
Food Safety Authority of Ireland
Abbey Court, Lower Abbey St
Dublin 1

Advice Line: 1890 336677
Tel: +353 1 8171300
Fax: +353 1 8171301
info@fsai.ie
www.fsai.ie

ISBN 1-904465-79-X

Review of the Sampling and Microbiological Examinations undertaken by the Health Service Executive, 2007 and 2008

CONTENTS

FOREWORD

This report was prepared by a working group on behalf of the Microbiology Sub-committee of the Food Safety Authority of Ireland (FSAI) and was adopted by the Scientific Committee for presentation to the FSAI.

A meeting was held in April 2011 between the FSAI, Official Food Microbiology Laboratories and the Environmental Health Service National Sampling Review Group to discuss the implementation of the recommendations made in this report. A summary of the progress to date is provided in Appendix 6 of this report.

EXECUTIVE SUMMARY

Food sampling and examinations for official control purposes are carried out by official agencies under contract to the Food Safety Authority of Ireland (FSAI). Data relating to these activities are submitted to and analysed by the FSAI.

Regarding microbiology, most data are generated by the Health Service Executive (HSE). Sampling is undertaken by the environmental health service (EHS), while microbiological examinations are undertaken by the official food microbiology laboratories (OFMLs) of the HSE. The samples obtained by the EHS for microbiological examinations account for approximately 44% of samples obtained from all official agencies for microbiological examinations every year.

Given the significance of the microbiological data generated by the HSE, the FSAI requested its Scientific Committee to: i) assist in the analysis of these data and ii) advise the FSAI on the strengths and weaknesses of the current approach to sampling and microbiological examinations. The Scientific Committee delegated the task to the Microbiology Sub-committee and in March 2009 a working group was convened to draft this report.

The working group focused on data relating to samples of ready-to-eat (RTE) food obtained for routine investigations, i.e. samples obtained to support inspection activities. These data, which are presented in section 2 of this report, highlight the range of samples submitted for microbiological examination and the range of microbiological examinations (indicator and pathogenic microorganisms) conducted on each sample. Regarding microbiological results, more samples were unsatisfactory/unacceptable potentially hazardous for indicator rather than pathogenic microorganisms. In fact, pathogenic microorganisms were rarely detected. Analysis of these data enabled the working group to identify strengths and weaknesses with the approach to sampling and microbiological examinations.

These data were compared with published data on food sampling and microbiological examinations conducted in other countries/regions (section 3 of this report). Many difficulties were encountered with the data comparison; however, subject to the caveats presented in section 3.1, it was concluded that the number of samples per capita and the number of microbiological examinations per sample is higher in Ireland than some of the other countries/regions reviewed.

All data presented are discussed in section 4 of this report and form the basis for the recommendations presented in section 6. The aim of these recommendations is to enhance the efficiency and efficacy of food sampling and microbiological examinations undertaken by the HSE for official control purposes and to ensure the continuous improvement of data submitted to the FSAI. Recommendations (one overall recommendation and a number of sub-recommendations) are made for the following areas: i) sampling, ii) microbiological examinations, iii) designation of results and iv) data submitted to the FSAI. Following are the overall recommendations:

i) Sampling

Sampling should be undertaken only where it is likely to inform action. When sampling is undertaken, consideration should be given to the following: sampling reason, sample type, sample source and sample numbers, i.e. single versus batch samples. Data collated by sampling officers should be relevant, accurate and complete. Furthermore, to ensure consistency at national level, the HSE should ensure that data are collected and formatted in the same way in all regions.

ii) Microbiological Examinations

Microbiological examinations should be restricted to those parameters relevant for the foodstuff under examination. To ensure comparability of results at national level and to facilitate analysis of the data, all OFMLs must adopt an agreed laboratory method for each parameter, maintain their database in a uniform structure and report the laboratory results to the FSAI in a standard electronic format.

iii) Designation of Results

Results should be designated against the appropriate standards or guidelines. These designations should be undertaken by the OFML and reported to the EHS and the FSAI.

iv) Data submitted to the FSAI

The quality of data submitted to the FSAI should be continuously improved in terms of accuracy, completeness, standardisation, timeliness and accessibility.

A meeting was held in April 2011 between the FSAI, Official Food Microbiology Laboratories and the Environmental Health Service National Sampling Review Group to discuss the implementation of the recommendations made in this report. A summary of the progress to date is provided in Appendix 6 of this report.

ABBREVIATIONS

cfu/g	Colony forming units per gram
DAFF	Department of Agriculture, Fisheries and Food
EC	European Commission
ECDC	European Centre for Disease Control
EFSA	European Food Safety Authority
EHO	Environmental Health Officer
EHS	Environmental Health Services of the HSE
EU	European Union
FSAI	Food Safety Authority of Ireland
FSLS	Food Safety Laboratory Services
HACCP	Hazard Analysis and Critical Control Point
HPSC	Health Protection Surveillance Centre
HSE	Health Service Executive
LIMS	Laboratory Information Management System
MI	Marine Institute
MOUs	Memoranda of Understanding
NSAI	National Standards Authority of Ireland
OFML	Official Food Microbiology Laboratory of the HSE
PAL	Public Analyst Laboratory
QMRA	Quantitative Microbial Risk Assessment
RASFF	Rapid Alert System for Food and Feed
RTE	Ready-to-Eat
SFPA	Sea Fisheries Protection Authority
spp.	species

1. INTRODUCTION AND BACKGROUND

Food sampling and examinations for official control purposes are carried out by the official agencies under contract to the FSAI. Data relating to these examinations are submitted to the FSAI where they are: i) collated, ii) subjected to validation and quality assurance procedures and iii) analysed.

Regarding microbiology, most data are generated by the HSE. Sampling is undertaken by the EHS, while microbiological examinations are undertaken by the OFMLs. The samples obtained by the EHS for microbiological examinations account for approximately 44% of samples obtained from all official agencies for microbiological examinations every year. Further information on food sampling by the EHS, microbiological examinations by the OFMLs and data transfer to the FSAI is provided in Appendix 1.

Section 16 of the FSAI Act requires the FSAI to collect information concerning the hygiene and safety of food that will facilitate the performance by it of its functions. The same section charges the FSAI with responsibility to collect in such form, if any, as it may decide and assess statistical data on the official control of food. Section 34 6(b) charges the Scientific Committee to advise the Board where requested on the implementation and administration of food inspection services.

The FSAI therefore requested the Scientific Committee via its Microbiology Sub-committee to assist in the analysis of data on official microbiological controls and advise the FSAI on the strengths and weaknesses of both the data and the current sampling and analysis approach.

A working group (Microbiological Data Working Group) was convened in April, 2009.

The terms of reference of this group were as follows:

1.1 Terms of Reference

1. Examine the strengths and weaknesses of the current sampling approach through interrogation of the OFML data in the FSAI database.
2. Examine the strengths and weaknesses of the current analysis approach through interrogation of the OFML data in the FSAI database.
3. Identify the strengths and weaknesses of the OFML data, e.g. sample data, premises data and microbiological data, currently available to the FSAI.
4. Identify how the OFML data can be used to inform microbiological risk management decisions.

1.2 Scope of the Report

The findings of the working group are presented in this report.

This report focuses on RTE samples obtained for routine investigations, i.e. samples obtained to support inspection activities. These samples were obtained by EHOs and examined microbiologically in the OFMLs of the HSE over the two year period, 2007 and 2008.

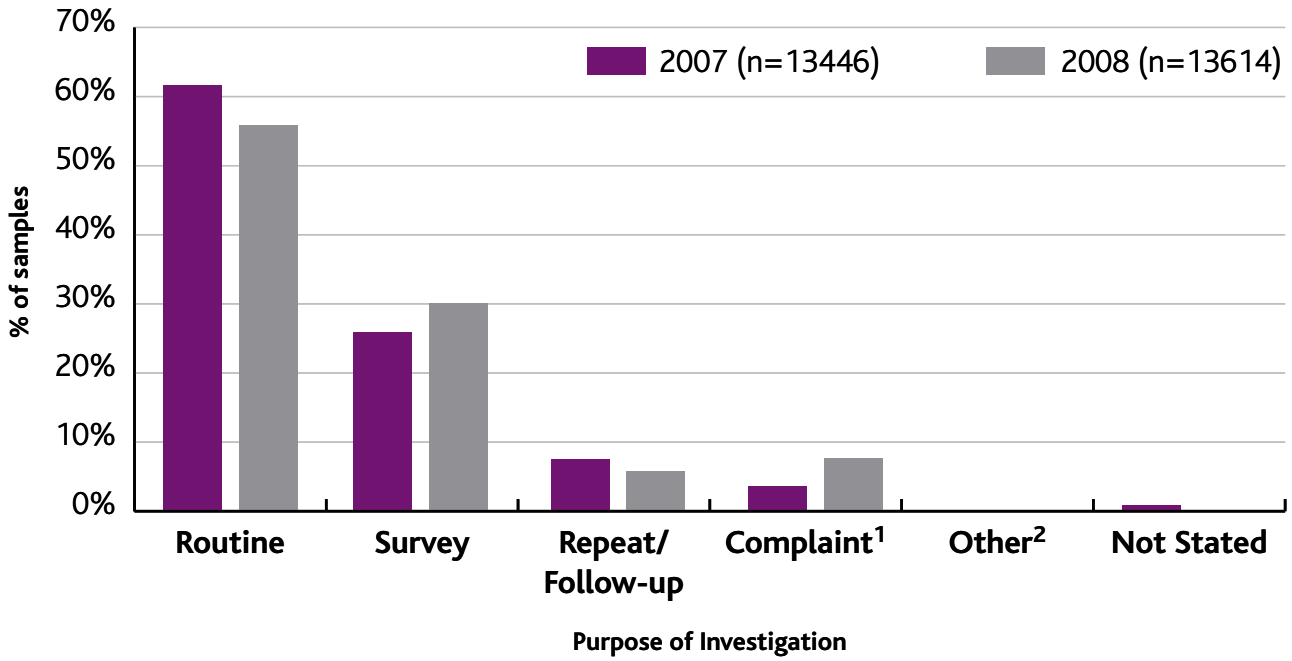
Chemical examination which is carried out in the public analyst laboratories (PALs) is not considered in this report nor is microbiological examination carried out by official agencies other than the HSE.

2. REVIEW OF THE SAMPLING AND MICROBIOLOGICAL EXAMINATIONS UNDERTAKEN BY THE HSE

2.1 Sample Information

2.1.1 Reason for sampling

In both 2007 and 2008, over 85% of food samples were obtained for routine investigations and surveys (Figure 2.1).



1 Samples classified as 'complaint' include those obtained to investigate foodborne outbreaks, suspected foodborne illness and alerts issued through EU rapid alert system for food and feed (RASFF).

2 Samples classified as 'other' include control, formal and import samples (the latter are samples from third countries which are obtained at ports).

Routine investigations are undertaken to support inspection activities and a range of foodstuffs are sampled for this purpose. Routine investigations accounted for 61.5% (8,263/13,446) and 55.7% (7,580/13,614) of samples examined in 2007 and 2008, respectively.

Surveys, on the other hand, are targeted to assess i) the microbiological status of a specific foodstuff/category of foodstuff and/or ii) specific food handling/food hygiene practices. Surveys accounted for 26.3% (3,538/13,446) and 30.1% (4,096/13,614) of samples examined in 2007 and 2008, respectively. Surveys are undertaken at both local level (surveys agreed locally between the EHS and OFMLs) and national level (surveys agreed nationally between EHS, OFMLs and the FSAI). The national microbiological surveys conducted in 2007 and 2008 are outlined in Tables 2.1a and 2.1b (A complete list of surveys conducted since 2001 is provided in Appendix 2). Occasionally, surveys are organised at European level and each Member State is obliged to participate. European surveys requiring the participation of EHOs and OFMLs were not conducted in 2007 or 2008.

The sampling program also has in-built flexibility to allow for unplanned sampling activities, e.g. to support enforcement activities or during the investigation of complaints, suspected foodborne illness and alerts received through the EU RASFF. Less than 15% of all samples were obtained for these purposes in both 2007 and 2008.

The remainder of this chapter focuses on samples obtained for routine investigation as these account for most samples submitted for microbiological examination every year.

Table 2.1a Overview of the National Microbiological Surveillance Programme, 2007

Topic	Period	Microbiological Parameters
Microbiological quality of ice for cooling drinks	January – April 2007	*Escherichia coli* Enterococci Coliforms
Microbiological safety of unpasteurised fruit and vegetable juices (including smoothies)	May – August 2007	*Salmonella* spp. *Listeria monocytogenes* *Escherichia coli* O157
Microbiological safety and quality of bottled water	September – December 2007	*Escherichia coli* Coliforms Faecal streptococci *Pseudomonas aeruginosa* Sulphite reducing anaerobes Enterococci Colony count (22 & 37˚C)

Table 2.1b Overview of the National Microbiological Surveillance Programme, 2008

Topic	Period	Microbiological Parameters
Prevalence of *Salmonella* spp. in pork sausages	January – April 2008	*Salmonella* spp.
Microbiological quality of whipped and scoop ice-cream	May – August 2008	Aerobic Colony Count (ACC) *Enterobacteriaceae*
Sampling of surface of poultry packaging and examination of handling and cleaning practices in poultry meat display cabinets	September – December 2008	*Campylobacter* spp. *Salmonella* spp.

Reports from these surveys are published on the FSAI website:
http://www.fsai.ie/monitoring_and_enforcement/monitoring/surveillance/microbiological_surveillance.html

2.1.2 Type of samples (RTE and non-RTE) obtained for routine investigation

European Communities classification system: EU category and code

The EC classification system segregates food into 21 discrete categories based on sample description. Each category is assigned an EU code (1-21). The EU categories and their associated codes are listed in Appendix 3.

The EU code of the food sample is recorded by the EHO on the sample submission form which is submitted with the sample to the OFML. This information is transmitted to the FSAI by the OFML and is collated in the FSAI national database. Analysis of the EU code provides a general overview of sample type.

The EU code and EU category of samples obtained for routine investigation in 2007 and 2008 are presented in Table 2.2. Following are the main findings:

- In both 2007 and 2008, EU code 3 (Meat and meat products, game and poultry) and EU code 17 (Prepared dishes) accounted for over 60% of all samples obtained for routine investigation
- In both 2007 and 2008, only a small number of samples were obtained from 8 food categories for microbiological examination, i.e. the number of samples submitted from each category accounted for less than 1% of the total number of samples submitted for that year. The 8 food categories are as follows: EU codes 5 (Fats and oils), 9 (Herbs and spices), 14 (Cocoa and cocoa preparations, coffee and tea), 15 (Confectionery), 16 (Nuts and nut products, snacks), 18 (Foodstuffs intended for special nutritional uses), 20 (Materials and Articles Intended to come into Contact with Foodstuffs) and 21 (Others). Extensive sampling of many of these food categories for microbiological examinations is not warranted

- In both 2007 and 2008, the following 3 food categories, as expected, were not sampled for microbiological examination: EU code 11 (Wine), 12 (Alcoholic beverages other than wine) and 19 (Additives)
- A statistical analysis was undertaken to determine if the proportion of samples obtained from each food category differed significantly (at the alpha = 0.01 significance level) between 2007 and 2008. For most food categories there was no significant difference in the proportion of samples obtained in 2007 and 2008

Table 2.2 Number of samples (RTE and non-RTE) obtained for routine investigation and classified by EU code and EU category

EU Code	EU Category	No. of Samples (% of samples)		P-Value*
		2007	2008	
1	Dairy products	690 (8.4%)	374 (4.9%)	<0.001
2	Eggs and egg products	472 (5.7%)	407 (5.4%)	0.346
3	Meat and meat products, game and poultry	**2,808 (34.0%)**	**2,695 (35.6%)**	0.038
4	Fish, shellfish and molluscs	500 (6.1%)	405 (5.3%)	0.055
5	Fats and oils	9 (0.1%)	0 (0%)	**0.004**
6	Soups, broths and sauces	317 (3.8%)	380 (5.0%)	**<0.001**
7	Cereals and bakery products	367 (4.4%)	370 (4.9%)	0.189
8	Fruit and vegetables	268 (3.2%)	207 (2.7%)	0.059
9	Herbs and spices	17 (0.2%)	15 (0.2%)	0.912
10	Non-alcoholic beverages	88 (1.1%)	99 (1.3%)	0.160
11	Wine	0 (0%)	0 (0%)	
12	Alcoholic beverages (other than wine)	0 (0%)	0 (0%)	
13	Ices and desserts	143 (1.7%)	164 (2.2%)	0.048
14	Cocoa and cocoa preparations, coffee and tea	1 (<0.001%)	16 (0.2%)	**<0.001**
15	Confectionery	11 (0.1%)	18 (0.2%)	0.125
16	Nuts and nut products, snacks	3 (<0.001%)	15 (0.2%)	**0.003**
17	Prepared dishes	**2,497 (30.2%)**	**2,349 (31.0%)**	0.293
18	Foodstuffs intended for special nutritional uses	51 (0.6%)	57 (0.8%)	0.303
19	Additives	0 (0%)	0 (0%)	
20	Materials and articles intended to come into contact with foodstuffs	3 (<0.001%)	0 (0%)	0.097
21	Others **	18 (0.2%)	9 (0.1%)	0.131
Total		**8,263 (100%)**	**7,580 (100%)**	

* Chi square (x^2) analysis or Fishers Exact Test was performed using SPSS version 14.0, with significance defined at the alpha = 0.01 significance level. If the P-value is less than the alpha value of 0.01, there is a significant difference between the proportion of samples taken in 2007 and 2008. These P-values are highlighted in bold.

** Samples belonging to this category are predominantly tap water and ice-cubes.

Sample description

A more in-depth analysis of sample type requires investigation of the sample description. This information is recorded in a 'free text field' on the sample submission form by the EHO. The information is transmitted to the FSAI via the OFML and is collated in the FSAI national database. Different terminologies are often used by EHOs to describe the same sample; therefore, these sample descriptions must be 'grouped/ reclassified' before any analysis is possible. This can lead to errors and/or lack of specificity when conducting analysis at national level.

This in-depth analysis was undertaken for a subset of samples, i.e. samples obtained for routine investigation in 2008 and classified by the EHO as EU code 3 (Meat and meat products, game and poultry) or EU code 17 (Prepared dishes). These data which are presented in Table 2.3a (EU code 3) and 2.3b (EU code 17) highlight the following:

- Although a wide variety of foods were sampled within each food category, there was a strong dominance towards specific foods, e.g. almost 60% of samples classified as EU code 3 were described as either '*Chicken and Turkey - Slices, Roast, Pieces etc*' (34.1%) or '*Ham and Bacon - Slices, Joints, Rashers*' (23.7%). Almost 60% of samples classified as EU code 17 were described as either coleslaw (38.4%) or sandwiches (20.1%)

Table 2.3a Description of samples (RTE and non-RTE) obtained in 2008 for routine investigations and classified by the EHO as EU code 3 (Meat and meat products, game and poultry)

Sample Description*	No. (%) of Samples
Chicken and turkey (slices, roast, pieces etc)	919 (34.1%)
Ham and bacon (slices, joints, rashers)	640 (23.7%)
Minced meat dishes, e.g. lasagne, shepherd's pie	201 (7.5%)
Beef (sliced, roast, pieces)	170 (6.3%)
Chicken and turkey dishes, e.g. curry, casserole	161 (6.0%)
Meat and pastry products	95 (3.5%)
Sausages	79 (2.6%)
Corned beef	65 (2.4%)
Beef/lamb stews, curries, casseroles	57 (2.1%)
Pork (roast, chops, pieces)	53 (2.0%)
Sandwich fillings containing meat/mayonnaise	41 (1.5%)
Lamb (slices, steaks, skewers)	40 (1.5%)
Pork dishes (ribs, loaf, other)	34 (1.3%)
Breaded/battered poultry products	34 (1.3%)
Pâté	29 (1.1%)
Meat burgers (including chicken)	26 (1.0%)
Other meat and game products	23 (0.9%)
Duck dishes	20 (0.7%)
Pasta, rice and couscous dishes	5 (0.2%)
Others (miscellaneous)	2 (0.1%)
Sandwiches (includes paninis, bagels and wraps) **	1 (<0.001%)
Grand Total	**2,695 (100%)**

* Sample descriptions presented are those reported by EHOs.

** This sample should have been categorised as EU code 17 (all sandwiches irrespective of content should be categorised as EU Code 17)

Table 2.3b Description of samples (RTE and Non-RTE) obtained in 2008 for routine investigations and classified by the EHO as EU code 17 (Prepared dishes)

Sample Description*	No. (%) of Samples
Coleslaw	901 (38.4%)
Sandwiches (includes panini, bagels and wraps)	473 (20.1%)
Salad	327 (13.9%)
Potato salad/egg or tuna mayo and other mayo salad fillings/dressings	279 (11.9%)
Pasta, rice and couscous dishes **	163 (6.9%)
Quiche, tarts and vol-au-vents	57 (2.4%)
Vegetable dishes	33 (1.4%)
Stuffing	28 (1.2%)
Mashed potato	24 (1.0%)
Houmous	19 (0.8%)
Others (miscellaneous)	16 (0.7%)
Noodles	8 (0.3%)
Pizza	7 (0.3%)
Meat burgers (including chicken)	5 (0.2%)
Chips	3 (0.1%)
Pâté	2 (0.1%)
Fruit salad	2 (0.1%)
Sauces and dressings	2 (0.1%)
Grand Total	**2,349 (100%)**

* Sample descriptions presented are those reported by EHOs.

** Pasta, rice and couscous dishes are classified under both EU Code 3 (Table 3a) and EU Code 17 (Table 3b). If the dish contains meat it should be classified as EU Code 3; otherwise, it should be classified as EU Code 17.

Strengths, Weaknesses and General Comments Arising from Section 2.1.2 (type of sample obtained for routine investigation)

1) EHOs classify samples by EU code/category as defined by the European Communities. This classification is beneficial for data analysis purposes. However, the working group acknowledged that although guidance is provided by the FSAI (FSAI, 2001), classification can be problematic for certain products, e.g. ambiguities may arise in the case of multi-component products.

The working group noted that the European Food Safety Authority (EFSA) is in the process of developing a more comprehensive and detailed food classification system. This is intended to facilitate the recording of more detailed food classifications in a standard way throughout the EU and to facilitate the linking of contaminant occurrence data (including this OFML data) with food consumption data for risk assessment. This new classification system is expected to become available within the next 2 to 3 years and should alleviate some of the current problems. FSAI staff are involved in its development.

2) Sample descriptions are recorded by EHOs in a 'free- text' box on the sample submission form (furthermore, at least one laboratory provides a detailed sample description in a memo on the laboratory report). The very nature of 'free-text' means that variation exits in the terminology used by EHOs to describe the sample and in the level of detail provided. This reporting mechanism hinders the analysis on sample description conducted at national level.

3) EHOs predominantly sample foods categorised as EU code 3 (Meat and meat products, game and poultry) and EU code 17 (Prepared dishes). In both 2007 and 2008, these accounted for over 60% of all food types sampled. Furthermore, certain foods within these categories were sampled more frequently than others. This dominance towards certain samples is appropriate if risk based, i.e. it must be based on assessment of risk rather than ease of sampling. Although it was not possible for the working group to determine if sampling was risk based, it was noted that the service contract between the FSAI and the HSE requires official controls to be carried out regularly, on a risk basis and with appropriate frequency.

4) When determining appropriate sample types, consideration should be given to food sampling undertaken by other official agencies, e.g. Department of Agriculture Fisheries and Food (DAFF), Sea Fisheries Protection Authority (SFPA) and local authorities. This sampling is generally undertaken earlier in the food chain. Consideration should also be given to i) data on infectious diseases (some of which may be transmitted via the consumption of contaminated food), ii) data from foodborne outbreaks and iii) food consumption data, if available. These data sources are addressed in the discussion (section 4).

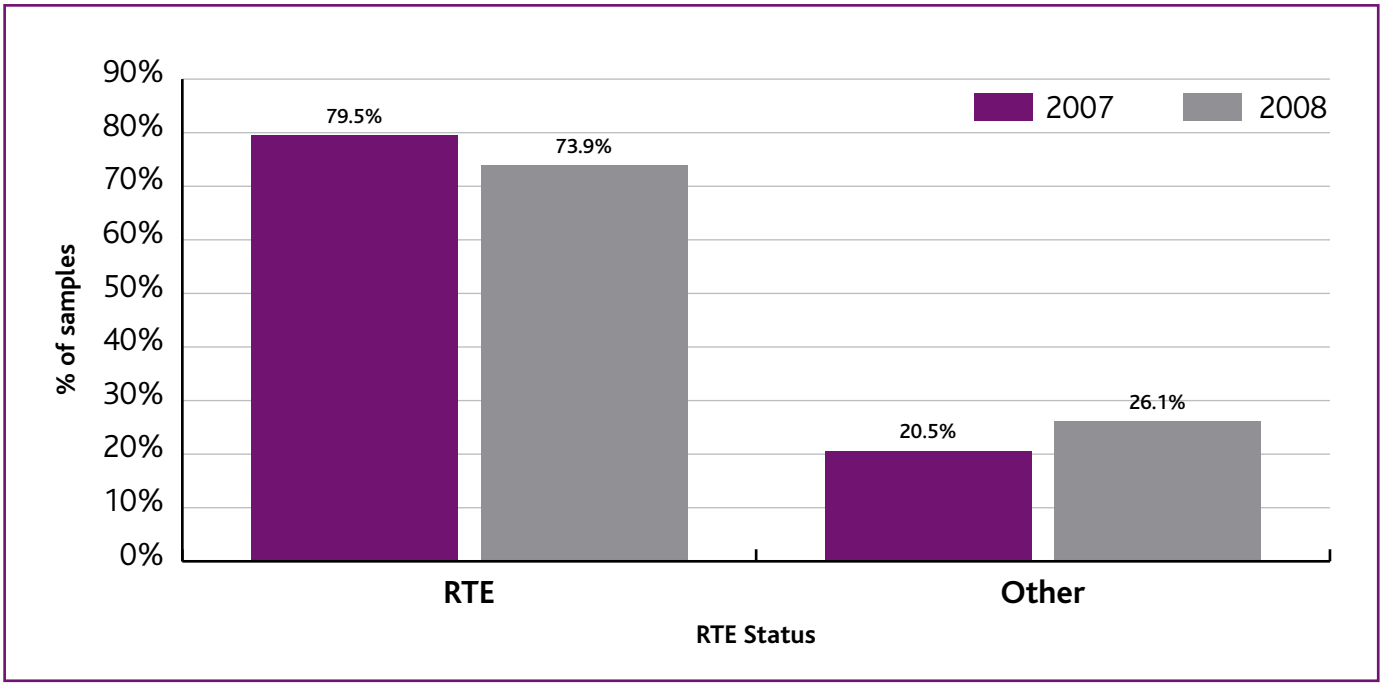
2.1.3 Ready-to-eat status of samples obtained for routine investigation

A RTE food means a food intended by the producer or the manufacturer for direct human consumption without the need for cooking or other processing effective to eliminate or reduce to an acceptable level microorganisms of concern (Article 2(g), Commission Regulation (EC) No. 2073/2005).

The RTE status of the food sample, i.e. RTE or non-RTE, is recorded by the EHO on the sample submission form which is submitted with the sample to the OFML. This information is transmitted to the FSAI via the OFML and is collated in the FSAI national database. A breakdown of routine samples by RTE status is provided in Figure 2.2. In both years, the majority of samples were classified as RTE (79.5%, 6,565/8,263 in 2007 and 73.9%, 5,598/7,580 in 2008).

Before 2010, information on the RTE status was collated in the national database as either 'RTE' or 'Non-RTE'. Where the RTE status of the sample was 'not stated' by the EHO, these samples were captured in the national database as 'Not RTE' and in many cases, this default classification could have been incorrect. Thus, no differentiation can be made between samples classified as 'Not RTE' and samples where the RTE status was not stated. These samples are categorised as 'Other' in Figure 2.2.

Figure 2.2: Ready-to-eat (RTE) status of samples obtained for routine investigations



Data collected since 2010 are differentiated into 3 categories with respect to RTE status: i) RTE ii) Non-RTE and iii) RTE status not stated. A preliminary review of these data has shown variability between HSE regions in the reporting of the RTE status.

It should be noted that the cooked status of the sample, e.g. raw, cooked, cook-chilled, reheated, etc, is also recorded by the EHO at the time of sampling. This information is transmitted to the OFML via the sample submission form and onwards to the FSAI where it is collated in the FSAI national database. It is important to note that this information cannot be relied on as an indicator of the RTE status, e.g. raw foods may be either RTE or not RTE.

All further analyses in this report focus on samples of RTE food obtained for routine investigation (2007: n=6,565; 2008: n=5,598)

Strengths, Weaknesses and General Comments Arising from Section 2.1.3 (RTE status of samples obtained for routine investigation)

1) EHOs classify samples by RTE status. This is necessary to assess the public health significance of the microbiological results, e.g. the public health significance is different if a pathogen is detected in a RTE food compared to a non-RTE food. Furthermore, it is necessary to ensure results are assessed against the appropriate criteria or guidelines (see section 2.3).
2) This review could not determine the RTE status of 20.5% of foods sampled for routine investigation in 2007 and 26.1% of foods sampled for routine investigation in 2008, due to problems with the national database. This is a large data gap; however, the working group acknowledged that this issue has been resolved since January, 2010. It is worth noting that a preliminary review of these data has shown variability between HSE regions in the reporting of the RTE status.
3) This review has shown that most of the samples (over 70%) obtained by EHOs for routine investigation in 2007 and 2008 were classified as RTE. Sampling of RTE foods for microbiological examination is one means of verifying the efficacy of the control measures adopted by the food business, i.e. good hygiene practices, good manufacturing practices and the food safety management system (under EU law all food businesses with the exception of primary producers are required to put in place, implement and maintain, a permanent procedure or procedures based on the principles of HACCP). The discussion (section 4 of this report) focuses on whether sampling and microbiological examination is the most appropriate means for verifying the efficacy of these control measures.

2.2 Microbiological Examinations

This section focuses on the microbiological examinations conducted on samples of RTE foods obtained for routine investigations.

RTE foods sampled by EHOs are examined in the OFMLs for both indicator, e.g. *Enterobacteriaceae*, *E. coli*, and pathogenic microorganisms, e.g. *L. monocytogenes*, *Salmonella* spp. The type of examination can be further differentiated based on the type of data they provide, i.e. qualitative or quantitative. Qualitative examinations determine whether the organism of interest is detected/not detected in a specified quantity of the foodstuff. The acceptance criterion is usually 'not detected in 25g' (Note: the terminology used in legislation is 'absence in 25g'). Quantitative examinations determine the number of specific microorganisms present in the foodstuff. The acceptance criterion is always based on the number of specific microorganisms, e.g. <20, <100 cfu/g.

The numbers of quantitative and qualitative examinations undertaken on samples of RTE food obtained for routine investigation in 2007 and 2008 are presented in Table 2.4. The total number of microbiological examinations was 47,443 in 2007 (mean of 7.2 examinations per sample) and 39,773 (mean of 7.1 examinations per sample).

Table 2.4 Quantitative and qualitative examinations undertaken on samples of RTE foods obtained for routine investigation

No. of Examinations and Samples		2007		2008	
		No.	%	No.	%
Examinations	**Quantitative**	36,605	77.2%	32,910	82.8%
	Qualitative	10,838	22.8%	6,863	17.2%
	Total	**47,443**	**100%**	**39,773**	**100%**
Samples	**Total**	**6,565**		**5,598**	
Mean number of examinations per sample		**7.2**		**7.1**	

2.2.1 Quantitative examinations

2.2.1.1 Quantitative examinations by microbiological parameter

The number of quantitative examinations undertaken for each microbiological parameter is presented in Table 2.5.

Following are the main findings:

- In both 2007 and 2008, quantitative examinations were undertaken on samples of RTE food for 10 microbiological parameters (6 indicator and 4 pathogenic microorgansims)
- In both 2007 and 2008, seven microbiological parameters, i.e. *E. coli*, ACC, *Enterobacteriaceae*, coagulase positive staphylococci, *Listeria* spp., *C. perfringens*, and presumptive *B. cereus*, accounted for 99% of all quantitative examinations undertaken

Table 2.5 Quantitative examinations by microbiological parameter (examinations undertaken on samples of RTE foods obtained for routine investigation)

Indicator/ Pathogenic Microorganism	Microbiological Parameter	2007		2008	
		No. of Examinations	% of Examinations	No. of Examinations	% of Examinations
Indicator	***E. coli***	6,415	17.52	5,504	16.72
	Aerobic Colony Count (ACC)	5,170	14.12	5,496	16.70
	Enterobacteriaceae	4,111	11.23	3,441	10.46
	Coliforms	68	0.19	72	0.22
	Enterococci	51	0.14	60	0.18
	P. aeruginosa	49	0.13	63	0.19
Pathogen	**Coagulase positive *staphtylococci*** **	6,355	17.36	5,450	16.56
	Listeria spp. *	6,072	16.59	5,411	16.44
	C. perfringens	5,351	14.62	4,878	14.82
	Presumptive *B. cereus*	2,963	8.09	2,535	7.70
Total		**36,605**	**100.00**	**32,910**	**100.00**

** Most coagulase positive staphylococci are *Staphylococcus aureus*

* This includes *L. monocytogenes*. There are inconsistencies between OFMLs in the reporting of these results. For further information see Appendix 4.

2.2.1.2 Quantitative examinations by microbiological parameter and sample type (EU code)

Quantitative examinations by microbiological parameter and sample type (EU Code) are presented in Tables 2.6a (2007) and 2.6b (2008). These data are represented graphically in Figures 2.3a (2007) and 2.3b (2008). The following are the main findings:

- Samples categorised as EU Codes 1 to 9 and EU Codes 13 to 18, were examined for a range of 7 quantitative microbiological parameters, i.e. ACC, presumptive *B. cereus*, *E. coli*, *Enterobacteriaceae*, *Listeria spp*., coagulase positive staphylococci and *C. perfringens*

  Looking closely at each sample type (EU code), it is clear that every sample was not examined for every parameter (Table 2.6a and 2.6b). This is reflected in the mean number of examinations per sample (presented in the last column of each table), e.g. in 2008, the mean number of examinations conducted on samples categorised as EU Code 3 was 6.1. Thus, most samples were examined for 6 out of 7 quantitative microbiological parameters

- Samples categorised as EU Code 10 (non alcoholic beverages), were examined for a range of 10 quantitative microbiological parameters. In addition to the 7 parameters listed in the previous bullet point, examinations were also undertaken for coliforms, *P. aeruginosa* and enterococci. Microbiological criteria are specified in legislation for some of these parameters in bottled water

  As before, all samples were not examined for all parameters. The mean number of quantitative examinations undertaken on samples classified EU code 10 was 6.1 in 2007 and 6.4 in 2008. Thus, most samples were examined for 6 out of 10 quantitative microbiological parameters

- Samples categorised as EU Code 21 (Others), were examined for a range of 4 quantitative microbiological parameters, i.e. ACC, *E. coli*, coliforms and enterococci. Samples belonging to this EU category were predominantly ice samples

  The mean number of quantitative examinations undertaken on samples classified as EU code 21 was 3.9 in 2007 and 4.0 in 2008.

- Overall, the mean number of quantitative examinations per sample was 5.6 in 2007 and 5.9 in 2008

- *Enterobacteriaceae* are indicators of hygiene and post process contamination of heat processed foods. They are not appropriate indicators for fresh fruit, vegetables and salad vegetables. In 2007, 5.2% (58/1,126) and in 2008, 4.9% (41/841) of all tests carried out on EU code 8 (Fruit and vegetables) were for *Enterobacteriaceae*

Table 2.6a Quantitative examinations by microbiological parameter and sample type (EU Code*) conducted in 2007

EU Code*	No. of samples	Number (%) of Examinations											Mean no. of examinations per sample
		ACC	Presumptive *B. cereus*	Coliforms	*E. coli*	*Enterobacteriaceae*	*Listeria* spp.	*P. aeruginosa*	Coagulase positive *staphylococci*	Enterococci	*C. perfingens*	Overall total	
1	**547**	455 (16.1%)	150 (5.3%)	3 (0.1%)	465 (16.4%)	520 (18.4%)	425 (15.0%)	0	539 (19.0%)	0	275 (9.7%)	**2,832 (100%)**	**5.2**
2	**369**	297 (15.0%)	183 (9.2%)	0	358 (18.0%)	241 (12.1%)	350 (17.6%)	0	356 (17.9%)	0	201 (10.1%)	**1,986 (100%)**	**5.4**
3	**2,268**	1,824 (13.6%)	1,046 (7.8%)	0	2,258 (16.8%)	1,706 (12.7%)	2,162 (16.1%)	0	2,236 (16.6%)	0	2,220 (16.5%)	**13,452 (100%)**	**5.9**
4	**344**	254 (13.5%)	139 (7.4%)	0	341 (18.2%)	197 (10.5%)	310 (16.5%)	0	322 (17.1%)	0	315 (16.8%)	**1,878 (100%)**	**5.5**
5	**9***	9 (14.3%)	9 (14.3%)	0	9 (14.3%)	9 (14.3%)	9 (14.3%)	0	9 (14.3%)	0	9 (14.3)	**63 (100%)**	**7.0**
6	**270**	195 (12.9%)	100 (6.6%)	0	269 (17.8%)	201 (13.3%)	251 (16.6%)	0	264 (17.5%)	0	230 (15.2%)	**1,510 (100%)**	**5.6**
7	**328**	246 (12.6%)	270 (13.8%)	0	312 (15.9%)	248 (12.7%)	309 (15.8%)	0	307 (15.7%)	0	267 (13.6%)	**1,959 (100%)**	**6.0**
8	**235**	148 (13.1%)	49 (4.4%)	0	233 (20.7%)	58 (5.2%)	219 (19.4%)	0	231 (20.5%)	0	188 (16.7%)	**1,126 (100%)**	**4.8**
9	**17**	7 (10.1%)	7 (10.1%)	0	12 (17.4%)	12 (17.4%)	7 (10.1%)	0	12 (17.4%)	0	12 (17.4%)	**69 (100%)**	**4.1**
10	**74**	113 (24.8%)	1 (0.2%)	50 (11.0%)	74 (16.3%)	18 (4.0%)	23 (5.1%)	49 (10.8%)	22 (4.8%)	49 (10.8%)	56 (12.3%)	**455 (100%)**	**6.1**
13	**135**	98 (12.7%)	83 (10.7%)	0	129 (16.7%)	101 (13.0%)	125 (16.1%)	0	131 (16.9%)	0	107 (13.8%)	**774 (100%)**	**5.7**
14	**1**	1 (14.3%)	1 (14.3%)	0	1 (14.3%)	1 (14.3%)	1 (14.3%)	0	1 (14.3%)	0	1 (14.3%)	**7 (100%)**	**7.0**
15	**10**	8 (12.9%)	7 (11.3%)	0	10 (16.1%)	10 (16.1%)	9 (14.5%)	0	10 (16.1%)	0	8 (12.9%)	**62 (100%)**	**6.2**
16	**3**	2 (10.5%)	2 (10.5%)	0	3 (15.8%)	3 (15.8%)	3 (15.8%)	0	3 (15.8%)	0	3 (15.8%)	**19 (100%)**	**6.3**
17	**1,931**	1,483 (14.4%)	913 (8.8%)	0	1,922 (18.6%)	782 (7.6%)	1,865 (18.1%)	0	1,908 (18.5%)	0	1,456 (14.1%)	**10,329 (100%)**	**5.3**
18	**6**	4 (15.4%)	3 (11.5%)	0	4 (15.4%)	4 (15.4%)	4 (15.4%)	0	4 (15.4%)	0	3 (11.5%)	**26 (100%)**	**4.3**
21	**15**	26 (44.8%)	0 (0.0%)	15 (25.9%)	15 (25.9%)	0 (0.0%)	0 (0.0%)	0	0	2 (3.4%)	0	**58 (100%)**	**3.9**
2007	**6565**	5,170 (14.1%)	2,963 (8.1%)	68 (0.2%)	6,415 (17.5%)	4,111 (11.2%)	6,072 (16.6%)	49 (0.1%)	6,355 (17.4%)	51 (0.1%)	5,351 (14.6%)	**36,605 (100%)**	**5.6**

* Full details of EU codes and EU categories are provided in Appendix 3. EU codes 11, 12 and 19: No samples were submitted for microbiological examination. EU code 20: Three samples were submitted for analysis but no microbiological examination results were reported.

Table 2.6b Quantitative examinations by microbiological parameter and sample type (EU Code*) conducted in 2008

EU Code*	No. of samples	Number (%) of Examinations											Mean no. of quantitative examinations per sample
		ACC	Presumptive *B. cereus*	Coliforms	*E. coli*	*Enterobacteriaceae*	*Listeria* spp.	*P. aeruginosa*	Coagulase positive *staphylococci*	Enterococci	*C. perfingens*	Overall total	
1	**311**	280 (15.8%)	116 (6.6%)	0	273 (15.4%)	297 (16.8%)	287 (16.2%)	0	289 (16.4%)	0	225 (12.7%)	**1,767 (100%)**	**5.7**
2	**284**	280 (17.0%)	152 (9.2%)	0	283 (17.2%)	188 (11.4%)	281 (17.1%)	0	283 (17.2%)	0	179 (10.9%)	**1,646 (100%)**	**5.8**
3	**2,116**	2,088 (16.3%)	907 (7.1%)	0	2,090 (16.3%)	1,492 (11.6%)	2,080 (16.2%)	0	2,096 (16.3%)	0	2,093 (16.3%)	**12,846 (100%)**	**6.1**
4	**286**	279 (16.2%)	119 (6.9%)	0	284 (16.5%)	204 (11.8%)	276 (16.0%)	0	281 (16.3%)	0	280 (16.3%)	**1,723 (100%)**	**6.0**
6	**293**	287 (17.2%)	75 (4.5%)	0	290 (17.4%)	171 (10.3%)	289 (17.4%)	0	291 (17.5%)	0	261 (15.7%)	**1,664 (100%)**	**5.7**
7	**326**	324 (15.7%)	258 (12.5%)	0	324 (15.7%)	218 (10.5%)	323 (15.6%)	0	326 (15.8%)	0	294 (14.2%)	**2,067 (100%)**	**6.3**
8	**158**	153 (18.2%)	38 (4.5%)	0	157 (18.7%)	41 (4.9%)	154 (18.3%)	0	157 (18.7%)	0	141 (16.8%)	**841 (100%)**	**5.3**
9	**12**	8 (15.1%)	6 (11.3%)	0	8 (15.1%)	7 (13.2%)	8 (15.1%)	0	8 (15.1%)	0	8 (15.1%)	**53 (100%)**	**4.4**
10	**86**	144 (26.3%)	5 (0.9%)	64 (11.7%)	83 (15.1%)	10 (1.8%)	19 (3.5%)	63 (11.5%)	19 (3.5%)	60 (10.9%)	81 (14.8%)	**548 (100%)**	**6.4**
13	**149**	148 (15.6%)	117 (12.3%)	0	149 (15.7%)	117 (12.3%)	148 (15.6%)	0	149 (15.7%)	0	123 (12.9%)	**951 (100%)**	**6.4**
14	**1**	1 (14.3%)	1 (14.3%)	0	1 (14.3%)	1 (14.3%)	1 (14.3%)	0	1 (14.3%)	0	1 (14.3%)	**7 (100%)**	**7.0**
15	**17**	17 (15.7%)	9 (8.3%)	0	17 (15.7%)	16 (14.8%)	17 (15.7%)	0	17 (15.7%)	0	15 (13.9%)	**108 (100%)**	**6.4**
16	**15**	14 (22.6%)	4 (6.5%)	0	14 (22.6%)	13 (21.0%)	6 (9.7%)	0	6 (9.7%)	0	5 (8.1%)	**62 (100%)**	**4.1**
17	**1,519**	1,445 (17.0%)	727 (8.5%)	0	1,511 (17.7%)	654 (7.7%)	1,510 (17.7%)	0	1,515 (17.8%)	0	1,160 (13.6%)	**8,522 (100%)**	**5.6**
18	**17**	12 (16.4%)	1 (1.4%)	0	12 (16.4%)	12 (16.4%)	12 (16.4%)	0	12 (16.4%)	0	12 (16.4%)	**73 (100%)**	**4.3**
21	**8**	16 (50.0%)	0	8 (25.0%)	8 (25.0%)	0	0	0	0	0	0	**32 (100%)**	**4.0**
2008 Total	**5,598**	5,496 (16.7%)	2,535 (7.7%)	72 (0.2%)	5,504 (16.7%)	3,441 (10.5%)	5,411 (16.4%)	63 (0.2%)	5,450 (16.6%)	60 (0.2%)	4,878 (14.8%)	**32,910 (100%)**	**5.9**

* Full details of EU codes and EU categories are provided in Appendix 3.
EU codes 5, 11, 12, 19, 20: No samples were submitted for microbiological examination.

Figure 2.3a Quantitative examinations by microbiological parameter and sample type (EU code*) conducted in 2007

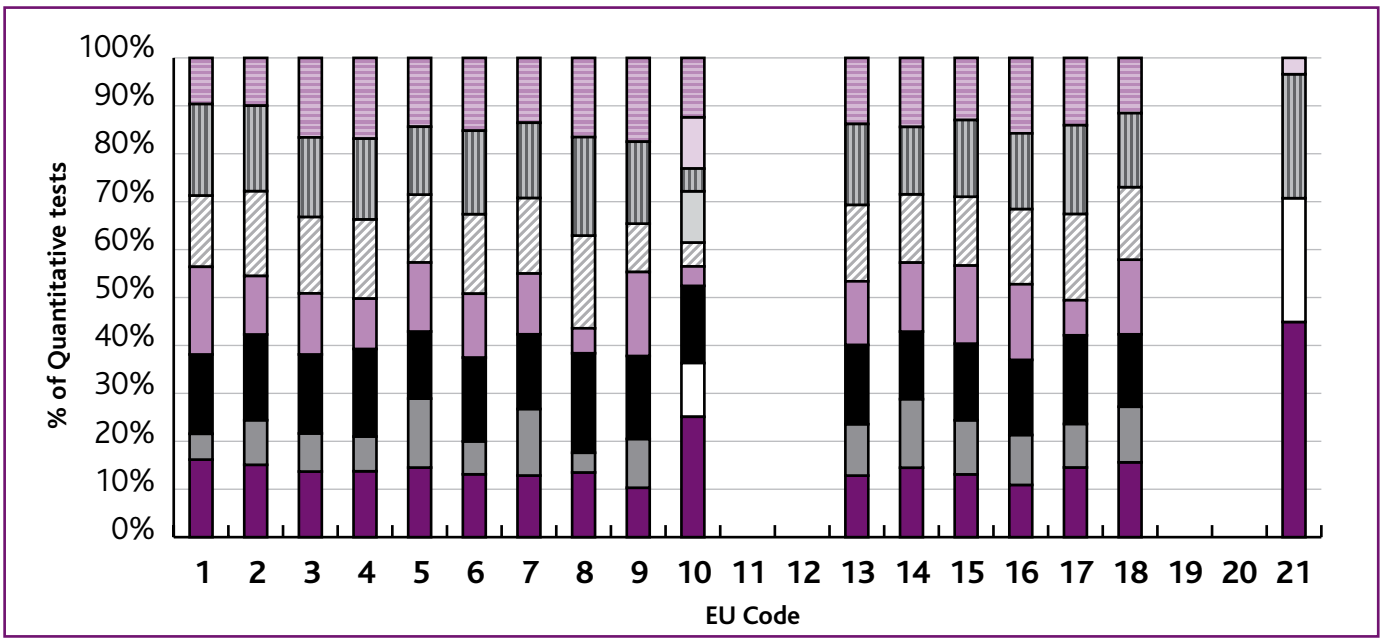
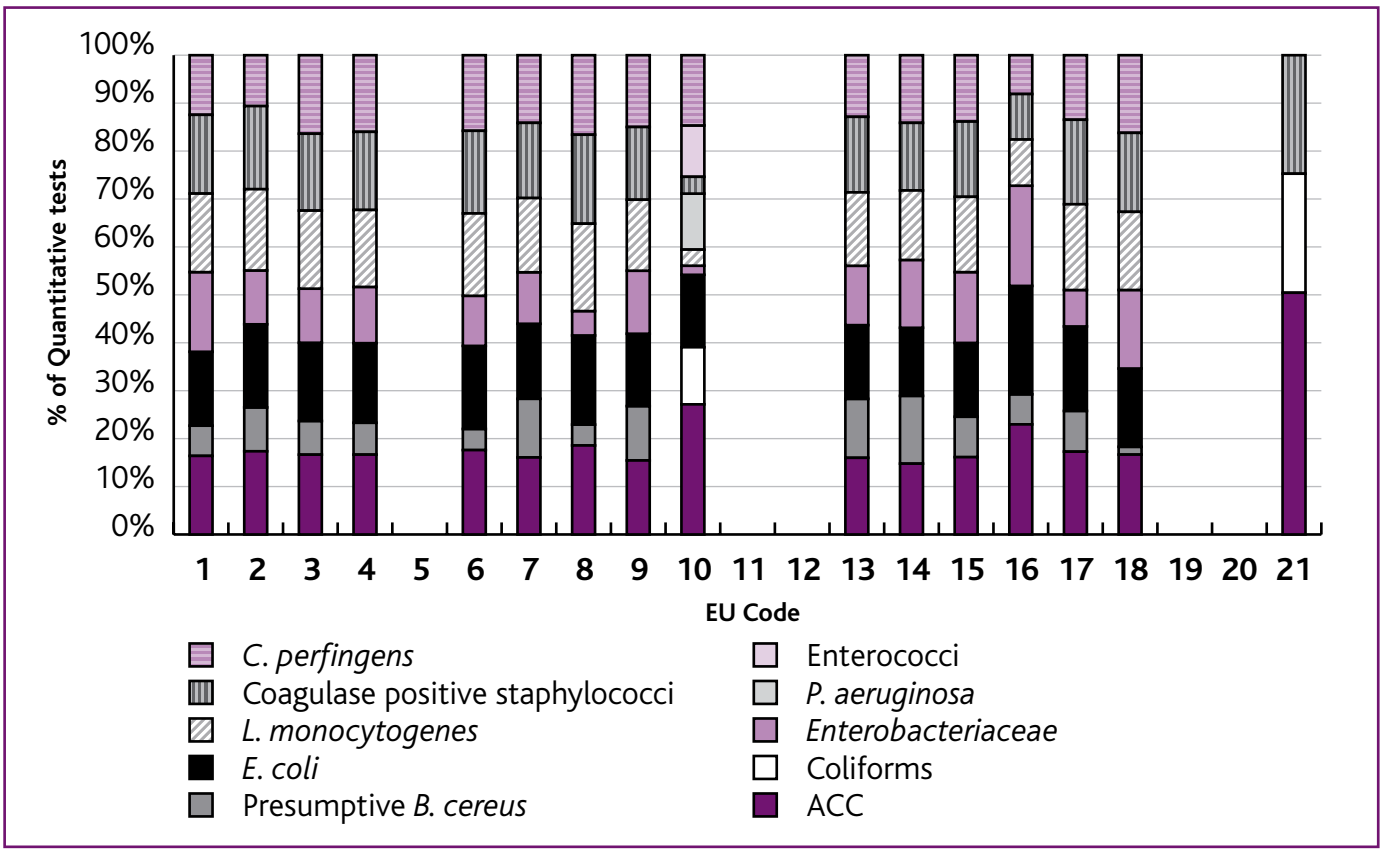


Figure 2.3b Quantitative examinations by microbiological parameter and sample type (EU code*) conducted in 2008



* Full details of EU codes and EU categories are provided in Appendix 3
Examinations undertaken on samples of RTE foods obtained for routine investigation.

2.2.2 Qualitative examinations

2.2.2.1 Qualitative examinations by microbiological parameter

The number of qualitative examinations undertaken for each microbiological parameter in 2007 and 2008 is presented in Table 2.7.

The following are the main findings:

- In both 2007 and 2008, qualitative examinations were primarily undertaken for four microbiological parameters, i.e. *Salmonella* spp., *Listeria* spp., *Campylobacter* spp. and *E. coli* O157. Two of these parameters, i.e. *Salmonella* spp. and *Listeria* spp., accounted for over 90% of all qualitative examinations undertaken
- There was a 26.6% decrease in the proportion of qualitative tests undertaken for *Listeria* spp. between 2007 and 2008. This can be explained as follows:

  Before 2008, all samples were examined both qualitatively and quantitatively for *Listeria* spp. In 2008, a change in approach was adopted (by the FSAI and the OFMLs). Since then, the type of examination, i.e. qualitative and/or quantitative, is determined by i) the sample description and ii) the period of time remaining on the shelf-life of the product, i.e.:

  – 'Ready-to-eat foods intended for infants and ready-to-eat foods for special medical purposes' are examined qualitatively for *L. monocytogenes* (this is a requirement of Commission Regulation (EC) No 2073/2005)

  – For all other RTE foods, the type of examination depends on the period of time remaining on the shelf-life of the sample at the time of receipt in the laboratory:

  A quantitative examination for *L. monocytogenes* is carried out on samples with less than 5 days remaining on their shelf-life (a quantitative limit is specified in Commission Regulation (EC) No 2073/2005 for *L. monocytogenes* in RTE foods placed on the market during their shelf-life); while, both qualitative and quantitative examinations for *L. monocytogenes* are carried out on samples with longer periods remaining on their shelf life (the limit of detection is lower for the qualitative test; thus *L. monocytogenes* may be detected by the qualitative but not the quantitative test. This approach is useful for long shelf-life products). Further details are provided in Appendix 5.
- Examinations for *Campylobacter* spp. accounted for 6.5% and 8.9% of all qualitative examinations undertaken in 2007 and 2008, respectively
- Examinations for *E. coli* O157 accounted for 0.2% and 0.1% of all qualitative examinations undertaken in 2007 and 2008, respectively.

Table 2.7 Qualitative examinations by microbiological parameter (examinations undertaken on samples of RTE foods obtained for routine investigation)

Indicator/ Pathogenic Microorganism	Microbiological Parameter	2007		2008	
		No.	%	No.	%
Indicator	***Enterobacteriaceae***	1	0.01	0	0.0
Pathogen	***Salmonella* spp.**	5,993	55.3	5,455	79.5
	***Listeria* spp. ***	4,125	38.1	792	11.5
	***Campylobacter* spp.**	701	6.5	610	8.9
	***E. coli* O157**	17	0.2	6	0.1
	Coagulase positive staphylococci	1	0.01	0	0.0
Total		**10,838**	**100.0**	**6,863**	**100.0**

- This includes *L. monocytogenes*. There are inconsistencies between OFMLs in the reporting of these results. For further information see Appendix 4.

2.2.2.2 Qualitative examinations by microbiological parameter and sample type (EU code)

Qualitative examinations by microbiological parameter and sample type (EU Code) are presented in Tables 2.8a (2007) and 2.8b (2008). These data are represented graphically in Figures 2.4a (2007) and 2.4b (2008). The following are the main findings:

- All sample types examined qualitatively in 2007, i.e. all EU codes except 11, 12, 19 and 21, and 2008, i.e. all EU codes except 5, 11,12,19,20 and 21, were examined for *Salmonella* spp. and/or *Listeria* spp.
- Qualitative examinations for *Campylobacter* spp. was predominantly undertaken on samples categorised as EU code 3 (Meat and meat products, game and poultry)
- In 2007, qualitative examinations for *E. coli* O157 were predominantly undertaken on samples categorised as EU Code 3 (Meat and meat products, game and poultry). In 2008, qualitative examinations for *E. coli* O157 were predominantly undertaken on samples categorised as EU code 2 (Eggs and egg products), 10 (Non-alcoholic beverages) and 17 (Prepared dishes)
- The mean number of qualitative examinations per sample was 1.7 in 2007 and 1.2 in 2008

Table 2.8a Qualitative examinations by microbiological parameter and sample type (EU Code*) conducted in 2007

EU Code*	No. of Samples	Number (%) of Examinations							Mean No. of qualitative examinations per sample
		Salmonella spp.	*Listeria* spp.	*Campylobacter* spp.	*E. coli* O157	Coagulase positive staphylococci	*Enterobacteriaceae*	Overall total	
1	**547**	421 (57.3%)	313 (42.6%)	1 (0.1%)	0	0	0	**735 (100%)**	**1.3**
2	**369**	355 (59.0%)	247 (41.0%)	0	0	0	0	**602 (100%)**	**1.6**
3	**2,268**	2,109 (50.1%)	1491 (35.4%)	596 (14.2%)	16 (0.4%)	0	0	**4,212 (100%)**	**1.9**
4	**344**	322 (56.6%)	237 (41.7%)	9 (1.6%)	1 (0.2%)	0	0	**569 (100%)**	**1.7**
5	**9**	9 (100%)	0	0	0	0	0	**9 (100%)**	**1.0**
6	**270**	246 (58.7%)	164 (39.1%)	9 (2.1%)	0	0	0	**419 (100%)**	**1.6**
7	**328**	320 (65.8%)	165 (34.0%)	1 (0.2%)	0	0	0	**486 (100%)**	**1.5**
8	**235**	213 (60.2%)	140 (39.5%)	1 (0.3%)	0	0	0	**354 (100%)**	**1.5**
9	**17**	12 (100%)	0	0	0	0	0	**12 (100%)**	**0.7**
10	**74**	22 (55.0%)	17 (42.5%)	1 (2.5%)	0	0	0	**40 (100%)**	**0.5**
13	**135**	125 (59.0%)	87 (41.0%)	0	0	0	0	**212 (100%)**	**1.6**
14	**1**	1 (100.0%)	0	0	0	0	0	**1 (100%)**	**1.0**
15	**10**	9 (81.8%)	2 (18.2%)	0	0	0	0	**11 (100%)**	**1.1**
16	**3**	3 (100.0%)	0	0	0	0	0	**3 (100%)**	**1.0**
17	**1,931**	1,817 (57.5%)	1,259 (39.9%)	83 (2.6%)	0	0	0	**3,159 (100%)**	**1.6**
18	**6**	6 (54.5%)	3 (27.3%)	0	0	1 (9.1%)	1 (9.1%)	**11 (100%)**	**1.8**
20	**3**	3 (100%)	0	0	0	0	0	**3 (100%)**	**1.0**
Grand Total	**6,565**	**5,993 (55.3%)**	**4,125 (38.1%)**	**701 (6.5%)**	**17 (0.2%)**	**1 (0%)**	**1 (0%)**	**10,838 (100%)**	**1.7**

* Full details of EU codes and EU categories are provided in Appendix 3
EU Codes 11, 12 and 19: No samples were submitted for microbiological examination.
EU Code 21: 15 samples were submitted for microbiological examination but no results returned.

Table 2.8b Qualitative examinations by microbiological parameter and sample type (EU Code*) conducted in 2008

EU Code*	No. of Samples	Number (%) of Examinations							Mean No. of Qualitative Examinations per Sample
		Salmonella spp.	*Listeria* spp.	*Campylobacter* spp.	*E. coli* O157	Coagulase positive staphylococci	*Enterobacteriaceae*	Overall total	
1	**311**	285 (84.1%)	53 (15.6%)	1 (0.3%)	0	0	0	**339 (100%)**	**1.1**
2	**284**	283 (90.4%)	26 (8.3%)	3 (1.0%)	1 (0.3%)	0	0	**313 (100%)**	**1.1**
3	**2,116**	2,096 (73.0%)	260 (9.0%)	517 (18.0%)	0	0	0	**2,873 (100%)**	**1.4**
4	**286**	284 (84.0%)	54 (16.0%)	0	0	0	0	**338 (100%)**	**1.2**
6	**293**	290 (90.6%)	25 (7.8%)	5 (1.6%)	0	0	0	**320 (100%)**	**1.1**
7	**326**	324 (82.0%)	70 (17.7%)	1 (0.3%)	0	0	0	**395 (100%)**	**1.2**
8	**158**	154 (93.9%)	10 (6.1%)	0	0	0	0	**164 (100%)**	**1.0**
9	**12**	12 (70.6%)	5 (29.4%)	0	0	0	0	**17 (100%)**	**1.4**
10	**86**	19 (54.3%)	13 (37.1%)	0	3 (8.6%)	0	0	**35 (100%)**	**0.4**
13	**149**	149 (85.1%)	26 (14.9%)	0	0	0	0	**175 (100%)**	**1.2**
14	**1**	1 (100.0%)	0	0	0	0	0	**1 (100%)**	**1.0**
15	**17**	17 (73.9%)	6 (26.1%)	0	0	0	0	**23 (100%)**	**1.4**
16	**15**	14 (87.5%)	2 (12.5%)	0	0	0	0	**16 (100%)**	**1.1**
17	**1,519**	1,510 (82.6%)	233 (12.7%)	83 (4.5%)	2 (0.1%)	0	0	**1,828 (100%)**	**1.2**
18	**17**	17 (65.4%)	9 (34.6%)	0	0	0	0	**26 (100%)**	**1.5**
Grand Total	**5,598**	**5,455 (79.5%)**	**792 (11.5%)**	**610 (8.9%)**	**6 (0.1%)**	**0**	**0**	6,863 (100%)	**1.2**

* Full details of EU codes and EU categories are provided in Appendix 3
EU Codes 5, 11, 12, 19 and 20: No samples were submitted for microbiological examination
EU Code 21: 8 samples were submitted for microbiological examination but no results returned

Figure 2.4a Qualitative examinations by microbiological parameter and sample type (EU Code*) conducted in 2007

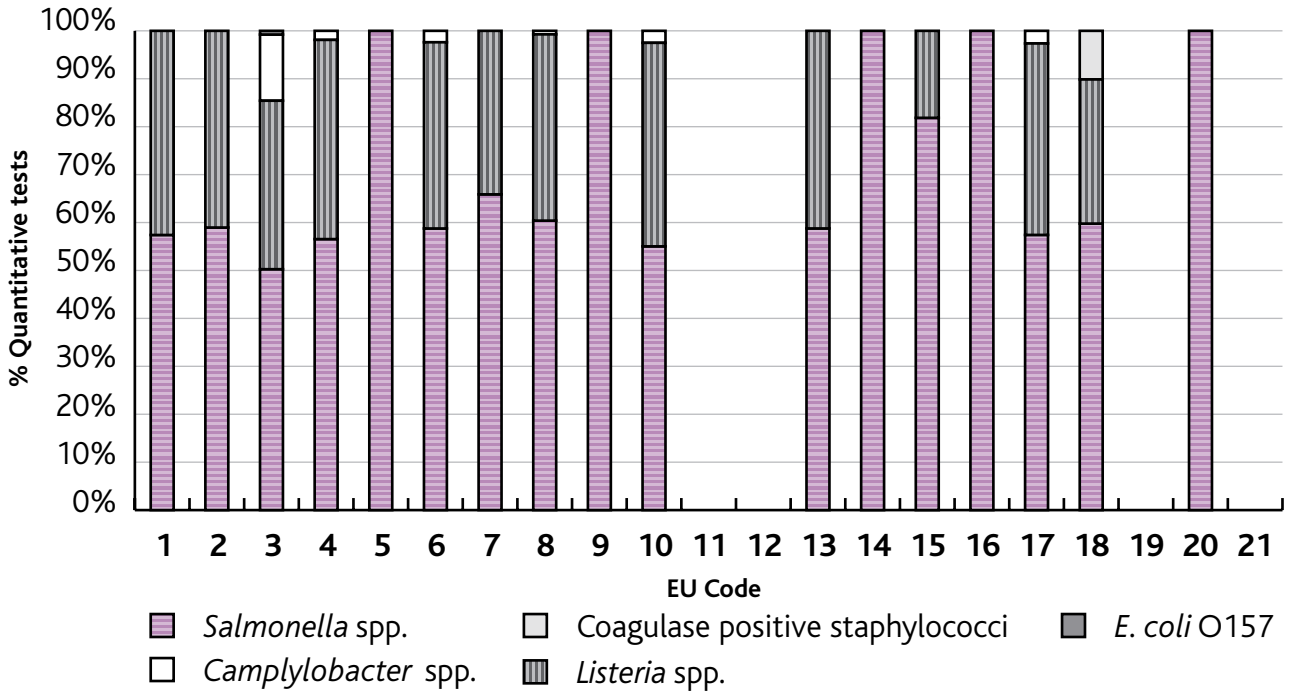
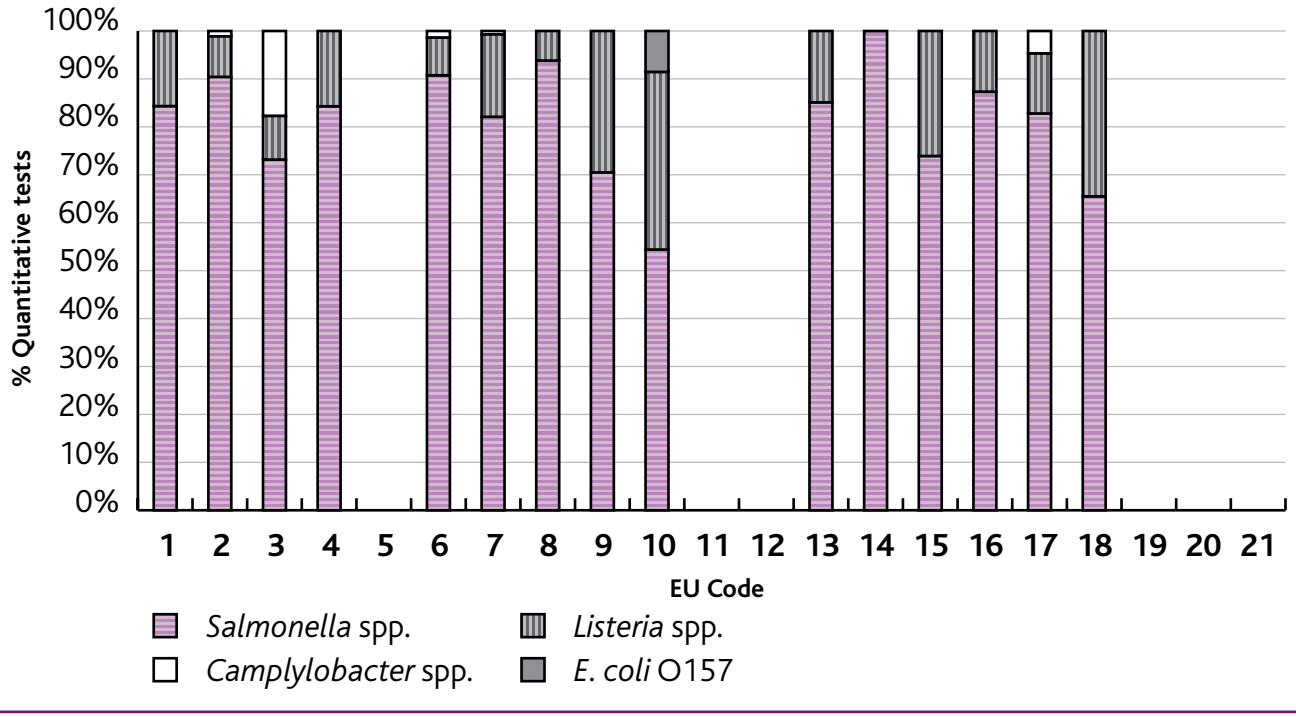


Figure 2.4b Qualitative examinations by microbiological parameter and sample type (EU Code*) conducted in 2008



* Full details of EU codes and EU categories are provided in Appendix 3
Examinations undertaken on samples of RTE foods obtained for routine investigation.

Strengths, Weaknesses and General Comments Arising from Section 2.2 (microbiological examinations)

1) This review clearly shows the large number of microbiological examinations which were conducted on routine RTE foodstuffs in the 7 OFMLs over the period 2007 and 2008. The total number of microbiological examinations undertaken on routine RTE foods was 47,443 in 2007 and 39,773 in 2008. On average, every sample was examined for 7 microbiological parameters, i.e. quantitative and qualitative parameters.

2) There is no national policy regarding the microbiological parameters to be examined. This is determined by each OFML and is influenced not only by sample type (EU Code) but also by i) the existence of legislative criteria and/or microbiological guidelines for specific combinations of food and microorganism and ii) historical practice. This leads to lack of standardisation at national level with regards to the microbiological parameters examined; therefore, the range of microbiological parameters appropriate for each food category needs to be considered.

3) Occasionally, the microbiological examinations conducted were not appropriate for the foodstuff examined, e.g. examination for *Enterobacteriaceae* is not appropriate for fresh fruit, vegetables and salad vegetables or foods containing these commodities.

4) This review did not examine in detail the analytical methods used to conduct the microbiological examinations; however, it was noted that variations exist in the methodologies used by the 7 OFMLs. In some instances, the variations were minor, e.g. differences in reporting format. Differences in reporting format were noted for methods capable of producing more than one result on a single sample, e.g. Listeria (for further information see Appendix 4) and Bacillus methods; however, it was noted that the OFMLs are working to standardise these reporting formats. Other variations reflect ways of working within laboratories.

   Although these variations exist it was noted that methods were accredited and all OFMLs participate in External Proficiency Schemes. Successful participation in these schemes is essential for achieving and maintaining accreditation. While this provides an assurance that the results from the OFMLs are valid in their own right, the diversity of analysis performed, methodology, information management and reporting creates considerable difficulty in automated collation of data from 7 sources. Standardisation of practice is essential to facilitate a coherent national database.

5) Data gaps were noted in relation to molecular typing, antimicrobial susceptibility testing and testing for viruses. These are addressed in the discussion (section 4 of this report).

2.3 Microbiological Results

Microbiological results are assessed against the relevant microbiological criteria specified in legislation. In the absence of appropriate criteria (microbiological criteria are not established in legislation for every combination of food and microorganism), results are assessed against microbiological guidelines.

National microbiological guidelines are established for a wide range of indicator and pathogenic microorganisms in RTE foods sampled at the point-of-sale. Although these guidelines are not legally enforceable they provide a benchmark against which unacceptable microbial contamination of RTE food can be identified. These guidelines were originally published by the FSAI in 2001 (FSAI, 2003). They are currently being revised to reflect the criteria introduced in Commission Regulation (EC) No 2073/2005 (since a microbiological criterion laid down in legislation takes precedence over a microbiological guideline). In the meantime, interim guidelines are available on the FSAI SafetyNet (FSAI, 2007c).

Assessment of results against the appropriate criteria or guidelines is undertaken by the EHO upon receipt of the laboratory report (in some cases the OFML may undertake these assessments). Based on these assessments, the results are designated as satisfactory, acceptable, unsatisfactory or unacceptable/potentially hazardous. The designations are transmitted by the EHO to the relevant food business operator. These designations are not transmitted to the FSAI (currently no sample information is transmitted directly from the EHO to the FSAI); therefore, assessment of results against the relevant criteria or guidelines is also undertaken at national level by the FSAI.

Further information on the assessment of results against the appropriate criteria or guidelines is provided in sections 2.3.1 and 2.3.2 respectively.

2.3.1 Microbiological criteria

Microbiological criteria for foodstuffs are laid down in two pieces of legislation:

- Commission Regulation (EC) No 2073/2005 on Microbiological Criteria for Foodstuffs as amended
- S.I. No. 225/2007 European Communities (natural mineral waters, spring waters and other waters in bottles or containers) Regulations, 2007

i) Commission Regulation (EC) No. 2073/2005 on Microbiological Criteria for Foodstuffs as amended.

Commission Regulation (EC) No 2073/2005 on Microbiological Criteria for Foodstuffs entered into force on the 1st January, 2006. It lays down microbiological criteria for the following food commodities:

- Ready-to-eat products
- Meat and meat products
- Milk and dairy products
- Egg products
- Live bivalve molluscs
- Fishery products
- Vegetables, fruits and their products

Food business operators involved in the processing, manufacturing, handling and distribution of food, including retailers and caterers, are responsible for ensuring that their products fulfill the criteria set down in this Regulation.

Commission Regulation (EC) No 2073/2005 specifies two types of microbiological criteria, i.e. process hygiene and food safety criteria.

Process hygiene criteria: These are used to assess the acceptable functioning of the production process. They are applicable to products at various stages during production/processing, e.g. *E. coli* in meat preparations, *Enterobactericeae* in ice-cream and frozen dairy desserts. Failure to comply with a process hygiene criterion requires the food business operator to focus actions on the improvement of production hygiene and/or the selection of the raw material.

Food safety criteria: Food safety criteria are laid down in Commission Regulation (EC) No 2073/2005 for *L. monocytogenes* in all RTE foods and *Salmonella* spp., *Cronobacter* spp., *E. coli*, staphylococcal enterotoxins and histamine in a variety of other foodstuffs. These criteria are used to assess the safety of a product or batch of foodstuffs and are applicable to products placed on the market. They are applicable both to food placed on the Community market and to food imported into the Community. Failure to comply with a food safety criterion requires the food business operator to withdraw or recall the batch of foodstuff in accordance with Article 19 of Regulation (EC) No 178/2002.

EHOs predominantly sample foodstuffs placed on the market; therefore, results from the microbiological examinations of these foodstuffs are assessed against the relevant food safety criteria. Results are designated as satisfactory or unsatisfactory. The designations relating to samples of RTE foods obtained for routine investigation in 2007 and 2008 are presented in Tables 2.9a and 2.9b.

Note: Commission Regulation (EC) No 2073/2005 lays down a sampling plan for each microbiological criterion. This includes a value for 'n' which is the total no. of samples which must be obtained from the production batch being examined. For food safety criteria, the value for 'n' is usually 5. However, during official sampling at retail level, single samples are generally obtained. This is permitted by the EC if the samples are taken in the context of a monitoring or surveillance program (European Commission, 2006).

Table 2.9a Designation of *L. monocytogenes* and *Cronobacter* spp. (*E. sakazakii*) results* according to Commission Regulation (EC) No 2073/2005

Quantitative/ Qualitative Test	Indicator/ Pathogen	Organism	Food Description	Year	Designation according to Commission Regulation (EC) No 273/2005 No. of designated test results (% of total designated test results)			No. of test results which could not be designated (% of overall total)	Overall total
					Satisfactory	Unsatisfactory	Total designated test results		
Quantitative	**Pathogen**	***L. monocytogenes***	All RTE foods with the exception of RTE foods for infants and special medical purposes	2007	6,071 (99.98%)	1 (0.02%)	6,072 (100%)	0	**6,072 (100%)**
				2008	5,407 (99.92%)	4 (0.07%)	5,411 (100%)	0	**5,411 (100%)**
Qualitative	**Pathogen**	***L. monocytogenes***	RTE foods for infants and special medical purposes **(Note 1)**	2007	36 (100%)	0	36 (100%)	1 (2.7%)	**37 (100%)**
				2008	0	0	0	0	**0**
		Cronobacter* spp. *(E. sakazakii)	Dried infant formula **(Note 2)**	2007	29 (100%)	0	29 (100%)	0	**29 (100%)**
				2008	40 (100%)	0	40 (100%)	0	**40 (100%)**

* Testing undertaken on samples of RTE food obtained during routine investigation

Note 1. The RTE status of these 36 samples were misclassified as 'non-RTE' and were therefore not included in section 2.2 of this report. As these samples belong to a high-risk food category for which a criterion is established in legislation, it was deemed prudent to assess the results against the limits specified in the criterion even though an error was made in the classification of the RTE status. One test result could not be designated because a quantitative test was undertaken and the limit specified in legislation is based on the results from the more sensitive qualitative test.

Note 2. The RTE status of these 69 samples were misclassified as 'non-RTE' and were therefore not included in section 2.2 of this report. As these samples belong to a high risk food category for which a criterion is established in legislation, it was deemed prudent to assess the results against the limits specified in the criterion even though an error was made in the determination of the RTE status.

Table 2.9b Designation of salmonellae results* according to Commission Regulation (EC) No 2073/2005 and interim national microbiological guidelines

Quantitative/ Qualitative Test	Indicator/ Pathogen	Organism	Year	Designation according to i) Commission Regulation (EC) No 2073/2005 or 41 interim national microbiological guidelines (Note 1) No. of designated test results (% of total designated test results)			No. of test results which could not be designated (% of overall total)	Overall total
				Satisfactory	Unsatisfactory according to 2073/2005 or Unacceptable/potentially hazardous according to interim national microbiological guidelines	Total designated test results		
Qualitative	**Pathogen**	***Salmonella* spp.**	2007	5,932 (99.98%)	1 (0.02%)	5,933 (100%)	0	**5,993 (100%)**
			2008	5,455 (100%)	0	5,455 (100%)	0	**5,455 (100%)**

* Testing undertaken on samples of RTE food obtained during routine investigation

For further details on the interim national microbiological guidelines, see section 2.3.2. In both cases (interim national microbiological guidelines and Commission Regulation (EC) No 2073/2005), the limits are the same although the terminology used to designate the results differ:

Interim National Microbiological Guidelines		Commission Regulation (EC) No. 2073/2005	
Limit	Designation	Limit	Designation
Not detected in 25g	Satisfactory	Absence in 25g	Satisfactory
Detected in 25g	Unacceptable/potentially hazardous	Presence in 25g	Unsatisfactory

ii) S.I. No. 225/2007 European Communities (natural mineral waters, spring waters and other waters in bottles or containers) Regulations, 2007

S.I. No. 225/2007 lays down microbiological criteria for bottled water, i.e. any potable water offered for sale in a sealed container. Three types of bottled water are defined in this legislation:

- Natural mineral water
- Spring water
- Other waters which are intended for human consumption supplied in a bottle or container, other than waters which are medicinal products

The microbiological criteria and the point of compliance differ for each type of bottled water. For natural mineral water and spring water, microbiological criteria for parasites, pathogenic organisms, *E. coli*, coliforms, faecal streptococci, sporulated sulphite-reducing anaerobes, *P. aeruginosa* and total colony count apply at source and during marketing. For other waters, microbiological criteria for *E. coli*, Enterococci, *P. aeruginosa*, coliforms and colony counts apply only at the point the water is put into the bottle or container.

Bottled water is sampled routinely by EHOs in bottling establishments and at retail level. The results (*E. coli*, Enterococci, *P. aeruginosa* and coliforms) from routine samples analysed in 2007 and 2008 are presented in Tables 2.10. Due to inadequate information on sample description and stage of sampling, it was not possible to differentiate between the 3 types of water and assess compliance with the legislation. The consumption of bottled water containing certain bacteria or groups of bacteria and the implications for public health has been considered by the Scientific Committee of the FSAI (Scientific Committee FSAI, 2009).

Table 2.10 Results from routine sampling of bottled water*

Organism	Year	0 cfu/100ml or 250ml		>0 cfu/100ml or 250ml		Total**
		No.	%	No.	%	
E. coli	2007	52	94.5%	3	5.5%	**55**
	2008	58	95.1%	3	4.9%	**61**
Enterococci	2007	47	97.9%	1	2.1%	**48**
	2008	55	98.2%	1	1.8%	**56**
P. aeruginosa	2007	54	98.2%	1	1.8%	**55**
	2008	67	91.2%	6	8.2%	**73**
Coliforms	2007	44	84.6%	8	15.4%	**52**
	2008	57	79.2%	15	20.8%	**72**

* It is not possible to differentiate between the 3 types of water due to inadequate information on the sample description.

** 15 samples in 2007 and 25 samples in 2008 classified as non-RTE. These were included in this analysis.

2.3.2 Microbiological guidelines

In the absence of appropriate criteria (microbiological criteria are not established in legislation for every combination of food and microorganism), results are assessed against the interim national microbiological guidelines (FSAI, 2007c). The results are designated as satisfactory, acceptable, unsatisfactory or unacceptable/potentially hazardous. The designations relating to samples of RTE food obtained during routine investigation in 2007 and 2008 are presented in Table 2.11.

Table 2.11 Designation of results* according to interim national microbiological guidelines

Quantitative/ Qualitative Test	Indicator/ Pathogen	Organism	Year	Designation according to interim national microbiological guidelines No. of designated test results (% of total designated test results)				No. of test results which could not be designated (% of overall total)	Overall total
				Satisfactory /Acceptable	Unsatisfactory	Unacceptable/ Potentially hazardous	Total designated test results		
Quantitative	**Indicator (Note 1)**	***Enterobacter-iaceae* (Note 2)**	2007	3,203 (91.46%)	299 (8.54%)	N/A	3,502 (100%)	609 (14.8%)	**4,111 (100%)**
			2008	2,705 (91.66%)	246 (8.34%)	N/A	2,951 (100%)	490 (14.2%)	**3,441 (100%)**
		***E. coli* (Note 3)**	2007	5,340 (98.54%)	79 (1.46%)	N/A	5,419 (100%)	948 (14.89%)	**6,367 (100%)**
			2008	4,655 (98.89%)	52 (1.10%)	N/A	4,707 (100%)	744 (13.65%)	**5,451 (100%)**
		***Listeria* spp. (Note 4)**	2007	6,069 (99.95%)	3 (0.05%)	N/A	6,072 (100%)	0	**6,072 (100%)**
			2008	5,407 (99.92%)	4 (0.07%)	N/A	5,411 (100%)	0	**5,411 (100%)**
	Pathogen	**Presumptive *B. cereus***	2007	2,952 (99.63%)	6 (0.20%)	5 (0.17%)	2,963 (100%)	0	**2,963 (100%)**
			2008	2,524 (99.57%)	6 (0.23%)	5 (0.19%)	2,535 (100%)	0	**2,535 (100%)**
		Coagulase positive staphylococci (Note 5)	2007	6,283 (99.05%)	56 (0.88%)	4 (0.06%)	6,343 (100%)	12 (0.19%)	**6,355 (100%)**
			2008	5,385 (98.97%)	52 (0.95%)	4 (0.07%)	5,441 (100%)	9 (0.16%)	**5,450 (100%)**
		C. perfringens	2007	5,339 (99.77%)	12 (0.22%)	0	5,351 (100%)	0	**5,351 (100%)**
			2008	4,870 (99.83%)	8 (0.16%)	0	4,878 (100%)	0	**4,878 (100%)**
Qualitative	**Pathogen**	***Campylobacter* spp.**	2007	701 (100%)	N/A	0	701 (100%)	0	**701 (100%)**
			2008	610 (100%)	N/A	0	610 (100%)	0	**610 (100%)**
		***E. coli* O157**	2007	17 (100%)	N/A	0	17 (100%)	0	**17 (100%)**
			2008	6 (100%)	N/A	0	6 (100%)	0	**6 (100%)**

* Testing undertaken on samples of RTE food obtained during routine investigation

N/A: Not Applicable

Note 1. Examinations were undertaken for Aerobic Colony Count (ACC) but designations are not reported here. For further information see section 4.3.1.4 of this report.

Note 2. The guideline for *Enterobacteriaceae* in the interim national microbiological guidelines (FSAI, 2007c) is not applicable to fresh fruit, vegetables and salad vegetables or foodstuffs containing these commodities. In 2007, 609 and in 2008, 490 *Enterobacteriaceae* test results were reported for samples containing these descriptions. These test results could not be designated.

Note 3. The guideline for *E. coli* specified in the interim national microbiological guidelines (FSAI, 2007c) is not applicable to:

1) Live bivalve molluscs and live echinoderms, tunicates and gastropods (no *E. coli* test results were reported for samples meeting this description)
2) Cheeses made from milk or whey that has undergone heat treatment (In 2007 and 2008, 139 and 126 *E. coli* test results were reported for these samples)**
3) Pre-cut fruit and vegetables which are RTE (in 2007 and 2008, 809 and 618 *E. coli* test results were reported for these samples)
4) Unpasteurised fruit and vegetable juices which are RTE (no *E. coli* test results reported for samples meeting this description)

Thus, 948 test results from 2007 and 744 test results from 2008 could not be designated for *E. coli*.

** Unless otherwise stated in the sample description, it was assumed that all cheeses had undergone a heat treatment.

Note 4. In 2007, one of the 3 results was also unsatisfactory for the *L. monocytogenes* criterion specified in Commission Regulation (EC) No. 2073/2005 (see Table 2.9a). In 2008, the 4 unsatisfactory results were also unsatisfactory for the *L. monocytogenes* criterion specified in Commission Regulation (EC) No. 2073/2005 (see Table 2.9a).

Note 5. The guideline for coagulase positive staphylococci specified in the interim national microbiological guidelines (FSAI, 2007c) applies to all RTE foods with the exception of:

1) Cheese made from raw milk (In 2008, 1 result was reported for a sample meeting this description. An alternative guideline has been proposed for cheese made from raw milk, i.e. satisfactory $<10^4$ cfu/g. Applying this alternative guideline, the result was designated as satisfactory)
2) Cheeses made from milk that has undergone a lower heat treatment than pasteurisation and ripened cheeses made from milk or whey that has undergone pasteurisation or a stronger heat treatment (no results were reported in 2007 or 2008 for samples meeting this description)
3) Shelled and shucked products of cooked crustaceans and molluscan shellfish (no results were reported in 2007 or 2008 for samples meeting this description)

Because of the way the result was reported by the OFML, 12 test results could not be designated in 2007 and 8 test results could not be designated in 2008 (these results were reported with a '<' symbol; therefore, it was not to determine whether the results should be designated as unsatisfactory, acceptable or satisfactory).

2.3.3 Details of samples designated as unsatisfactory or unacceptable/potentially hazardous for one or more microbiological parameter

In 2007, 6.5% (426/6,565) samples, i.e. samples of RTE foods obtained during routine investigation, were designated as unsatisfactory or unacceptable/potentially hazardous for one or more microbiological parameters.

Of these, 392 samples were designated as unsatisfactory or unacceptable/potentially hazardous for one microbiological parameter, 31 samples were designated as unsatisfactory or unacceptable/potentially hazardous for 2 microbiological parameters and 3 samples were designated as unsatisfactory or unacceptable/potentially hazardous for 3 microbiological parameters. A similar pattern was observed in 2008 (Table 2.12).

Table 2.12 Samples designated as unsatisfactory or unacceptable potentially hazardous* for one or more microbiological parameter

No. of microbiological parameters	No. (%) of samples	
	2007	2008
1 parameter	392	308
2 parameters	31	33
3 parameters	3	1
Total no. of samples unsatisfactory or unacceptable potentially hazardous for 1 or more microbiological parameter	**426 (6.5%)**	**342 (6.1%)**
Total no. of samples examined	**6,565 (100%)**	**5,598 (100%)**

* Samples were designated as unsatisfactory according to either Commission Regulation (EC) No 2073/2005 or the interim national microbiological guidelines (FSAI, 2007c)

Samples were designated as unacceptably/potentially hazardous according to interim national microbiological guidelines (FSAI, 2007c).

Further information is provided in Tables 2.13a (2007) and 2.13b (2008) on the samples designated as unsatisfactory or unacceptable/potentially hazardous for 2 or more microbiological parameters. These tables highlight i) the microbiological parameters leading to this designation and ii) the sample description.

Table 2.13a Samples designated as unsatisfactory or unacceptable/potentially hazardous for 2 or more microbiological parameters in 2007 (n=34 samples)

Interim National Microbiological Guidelines		Commission Regulation (EC) No 2073/2005	No. of samples	Sample description as recorded by the EHO (EU Code)
Unsatisfactory	Unacceptable/ Potentially hazardous	Unsatisfactory		
Enterobacteriaceae and *E. coli*			14	Chicken, n=4 (EU code 3) Cooked beef (EU code 3) Lasagne (EU code 3) Cooked duck (EU code 3) Duck (EU code 3) Cooked spaghetti (EU code 7) Prawn crispy fried wanton (EU code 4) Egg fried rice (EU code 2) Gravy (EU code 6) Fresh cream éclair (EU code 7) Éclair, choc icing with cream (EU code 7)
Enterobacteriaceae and Coagulase positive staphylococci			5	Beef pieces (EU code 3) Fish cake (EU code 4) Sliced turkey (EU code 3) Boiled rice (EU code 7) Cream (EU code 1)
Enterobacteriaceae and Presumptive *B. cereus*			1	Vegetable soup (EU code 6)
E.coli and *C. perfringens*			1	Cooked turkey slices (EU code 3)
E.coli and Coagulase positive staphylococci			5	Cooked salmon (deli) (EU code 4) Salami/parmesan (EU code 3) Homemade coleslaw (EU code 17) Mushroom pate (EU code 17) Salami garlic onion (EU code 3)
Enterobacteriaceae and *E. coli* and Presumptive *B. cereus*			2	Cooked rice (EU code 7) Chicken (EU code 3)
E. coli	Coagulase positive staphylococci		2	Cream cake (EU code 7) Chicken (EU code 3)
Enterobacteriaceae	Presumptive *B. cereus*		2	Rice (EU code 7) Soup (EU code 6)
Enterobacteriaceae and *E. coli*	Presumptive *B. cereus*		1	Cottage pie (beef/veal) (EU code 3)
E. coli		*L. monocytogenes*	1	Rice salad (EU code 17)
Total			**34**	

Table 2.13b Samples designated as unsatisfactory or unacceptable/potentially hazardous for 2 or more microbiological parameters in 2008 (n=34 samples)

National Microbiological Guidelines: Guidance Note No. 3		Commission Regulation (EC) No 2073/2005	No. of samples	Sample description (EU Code)
Unsatisfactory	Unacceptable/ Potentially hazardous	Unsatisfactory		
Enterobacteriaceae and *E. coli*			13	Cooked chicken (n=4) (EU code 3) Chicken (stuffing and mayo) (EU code 3) Turkey/ham and stuffing (EU code 3) Cooked duck (EU code 3) Roast beef dinner (EU code 3) Egg mayonnaise (n=2) (EU code 2) Whipped cream (EU code 1) Buffalo mozzarella (EU code 1) Fried rice (EU code 7)
Enterobacteriaceae and Coagulase positive staphylococci			5	Fish cake mix (EU code 4) Sliced beef (EU code 3) Tuna and sweetcorn (EU code 4) Brie cheese (EU code 1) Couscous (EU code 7)
Enterobacteriaceae and Presumptive *B. cereus*			1	Lasagne (EU code 3)
C. perfringens and presumptive *B. cereus*			1	Nutmeg (EU code 9)
E. coli and coagulase positive staphylococci			3	Iced cream slice (EU code 7) Crab salad (EU code 17) Fish chowder (base) (EU code 6)
Enterobacteriaceae and *E.coli* and coagulase positive staphylococci			1	Cooked chicken breast (EU code 3)
E .coli	Presumptive *B. cereus*		2	Pasta tuna nicoise (EU code 4) Boiled rice (EU code 7)
Enterobacteriaceae	Coagulase positive staphylococci		2	Grated cheese (EU code 1) Breaded brie (EU code 1)
Enterobacteriaceae	*Bacillus sphaericus*		2	Sliced pork (EU code 3) Egg fried rice (EU code 2)
Enterobacteriaceae		*L. monocytogenes*	3	Corned beef (EU code 3) Duck (EU code 3) Cooked ham (EU code 3)
E. coli		*L. monocytogenes*	1	Boiled rice (EU code 7)
Total			**34**	

Main Findings Arising from Section 2.3 on Microbiological Results

- There was a very low incidence of unsatisfactory and unacceptable/potentially hazardous results for pathogenic microorganisms in both 2007 and 2008. Over this two year period, only 0.04% (5/11,519) of results were designated as unsatisfactory for *L. monocytogenes*, 0.008% (1/11,388) of results were unsatisfactory/unacceptable potentially hazardous for *Salmonella* spp., 0.4% (22/5,498) of results were unsatisfactory/unacceptable potentially hazardous for *B. cereus*, 0.98% (116/11,784) of results were unsatisfactory/unacceptable potentially hazardous for coagulase positive staphylococci and 0.2% (20/10,229) of results were unsatisfactory for C. *perfringens*.
- The highest prevalence of unsatisfactory results occurred for the indicator organisms, *Enterobacteriaceae* and *E. coli*. Regarding *Enterobacteriaceae*, 8.54% (n=299) and 8.34% (n=246) of test results were designated as unsatisfactory in 2007 and 2008, respectively. Regarding *E. coli*, 1.46% (n=79) and 1.10% (n=52) of test results were designated as unsatisfactory in 2007 and 2008, respectively.
- A high proportion of *Enterobacteriaceae* test results could not be designated, i.e. as satisfactory, acceptable or unsatisfactory, as testing was undertaken on inappropriate foodstuffs. *Enterobacteriaceae* are not appropriate indicators for fresh fruit, vegetables and salad vegetables or foodstuffs containing these commodities.
- Some *E. coli* results (14.3%, 1,692/11,818) could not be designated due to the absence of appropriate standards/guidelines for *E. coli* in specific food commodities, i.e. certain cheeses and shelled and shucked products of cooked crustaceans and molluscan shellfish.
- Due to inadequate sample descriptions, it was difficult to determine whether the salmonellae test results should be assessed against the limit specified in Commission Regulation 2073/2005 (as amended) or the interim national microbiological guidelines.

  Microbiological criteria are specified in Commission Regulation (EC) No 2073/2005 for *Salmonella* spp. in certain RTE food commodities. In all cases, the limit is 'absence in 25g'. Failure to comply means the foodstuff must be withdraw/recalled from the market. Interim national microbiological guidelines are established for *Salmonella* spp. in all other RTE food commodities. Again, the limit is 'absence in 25g'. Foodstuffs failing to comply with this guideline are deemed 'unsafe' as defined by Article 14 of Regulation 178/2002. Unsafe foodstuffs must be withdrawn/recalled from the market.

  Inadequate sample descriptions cause problems if salmonellae are detected and the legal basis for the withdrawal/recall is required.
- If a foodstuff fails to comply with a food safety criterion or fails to comply with a microbiological guideline and is defined as 'unsafe' (Article 14 of Regulation 178/2002), it must be withdrawn or recalled from the market in accordance with Article 19 of Regulation 178/2002. In addition, the food business operator must take any other corrective actions defined in their HACCP based procedures and find the cause of the unsatisfactory result. With the exception of product recalls, data on the type of corrective action implemented by the food business operator are currently not collected by the FSAI.

Strengths, Weaknesses and General comments arising from Section 2.3 (microbiological results)

1) The extensive work undertaken by the EHS and the OFMLs has provided a large body of data on the microbiological safety and quality of foods. These microbiological data can be used to inform decisions regarding future approaches to official sampling and testing.

2) There is duplication in the designation of results. Some OFMLs undertake these designations; however, in most situations they are undertaken by the EHO upon receipt of the laboratory report. They are also undertaken at national level by the FSAI.

3) At national level, detailed sample descriptions and RTE classifications are essential to determine whether results should be designated against the criteria specified in legislation or the interim national microbiological guidelines (difficulties with the reporting of sample descriptions has been discussed earlier in this report), e.g. the criteria specified in Commission Regulation 2073/2005 for *Salmonella* spp. apply to certain categories of RTE foods and the interim national microbiological guidelines for *Salmonella* spp. applies to all other RTE foods.

4) A high proportion of test results could not be designated, i.e. as satisfactory, acceptable, unsatisfactory, unacceptable/potentially hazardous, as standards or guidelines are not established for certain food commodities, e.g. *E. coli* in certain cheeses. Consideration should be given by the FSAI to the establishment of national guidelines for these food commodities. If guidelines are not considered appropriate, the relevance of testing should be reviewed.

5) A smaller proportion of test results could not be designated, i.e. as satisfactory or acceptable, due to the reporting mechanism used by the OFML, e.g. some coagulase positive staphylococci results were reported as <100cfu/g and therefore it was not possible to determine whether these results should be classified as satisfactory (<20cfu/g) or acceptable (20-<100cfu/g) according to the interim national microbiological guidelines. No problem was encountered with designating unsatisfactory results.

4) Regarding *Listeria* spp., variations were noted between OFMLs in the reporting of results. Further information is provided in Appendix 4. Standardisation with respect to reporting of results is desirable.

3. REVIEW OF SELECTED INTERNATIONAL MICROBIOLOGICAL FOOD MONITORING DATA

3.1 Introduction

This section summarises data from reports of sampling programs in Northern Ireland and Scotland. These were deemed to be broadly similar to Ireland in terms of diet and economic development.

Many difficulties were encountered when comparing these data, i.e.

1. Details were not provided about sampling and analytical methods. Without knowing these, one cannot confidently draw valid comparisons between these data.
2. No background information was provided about the food control administrative systems in place and therefore, it was not possible to determine if these data reflect all activities of multi-agency food control services. Furthermore, no rationale was provided for the sample numbers, test parameters or food categories analysed. Without knowing these data, it was not possible to explain the differences observed between countries/regions.
3. Regarding sample numbers, comparisons are made between countries per capita; however, the statistical basis, if any, upon which such sampling took place is not known.

In the EU, difficulties have been recognised with the comparison of food control data. In particular, the lack of standardised data, e.g. lack of information on random versus targeted sampling; entry of results below the limit of detection; food descriptions and categorisations, was noted at an EU workshop held in Berlin on 10-11 May 2007.

In recognition of this problem in relation to zoonotic pathogens, the EFSA Task Force on Zoonoses Data Collection has been working on the harmonisation of sampling and analysis across EU Member States. It has published a number of technical specifications relevant to the monitoring of food at retail level:

- Technical specifications for the monitoring and reporting of verotoxigenic *Escherichia coli* (VTEC) on animals and food (VTEC surveys on animals and food) (EFSA, 2009a)
- Proposed technical specifications for a survey on *Listeria monocytogenes* in selected categories of ready-to-eat food at retail in the EU (EFSA, 2009b)
- Report of the Task Force on Zoonoses Data Collection on proposed technical specifications for a co-ordinated monitoring programme for *Salmonella* and *Campylobacter* in broiler meat in the EU (EFSA, 2006)

In addition, the EFSA Zoonoses Unit has commissioned a report titled '*Survey Methods for Pathogens in Food*' (Käsbohrer *et al*, 2010). The aim of the report is to (i) develop harmonised survey methods for *Salmonella* spp., *Campylobacter* spp., *L. monocytogenes*, VTEC and *Yersina* spp. in foodstuffs; and (ii) to suggest how to analyse the data, both nationally and at EU level.

3.2 Data from Other Countries/Regions

3.2.1 Northern Ireland

Information from Northern Ireland on food sampling for microbiological analysis was sourced from a '*Report of the Northern Ireland Strategic Committee on Food Surveillance concerning Food Sampling by District Councils in Northern Ireland in 2007*' (Northern Ireland Strategic Committee on Food Surveillance, 2007). During 2007, 5,878 samples were submitted for microbiological examinations. This is equivalent to approximately 3.36 samples per 1,000 population (based on 2007 population estimate for Northern Ireland)[1]. The 13,446 samples taken in the Republic of Ireland during the same period equate to approximately 3.13 samples per 1,000 population, i.e. the sampling frequency does not differ greatly between Northern Ireland and the Republic of Ireland.

[1] The Northern Ireland report refers to an informal historical agreement regarding sampling rates for microbiological examinations, i.e. approximately 8 samples per 1,000 population. However, in recent years, the microbiological sampling allocation has been reduced. No rationale was provided for the reduction in sampling rates.

Similar to the Republic of Ireland, a wide range of foods were sampled for the purpose of microbiological examination. Meat and meat products (EU code 3) and prepared dishes (EU code 17) were the most frequently sampled foods in both countries.

In Northern Ireland, foods were examined for pathogenic (*Salmonella* spp., *Campylobacter* spp., *E. coli* O157, *Listeria* spp. and *Clostridium perfringens*) and indicator (*E. coli*, *Enterobacteriaceae*, *B. cereus* and *S. aureus*) microorganisms. The results are presented in Table 3.1. Similar to the Republic of Ireland, pathogenic microorganisms were only detected in a small number of samples; while indicator microorganisms were detected at unsatisfactory levels in a higher number of samples (the highest failure was for *Enterobacteriaceae*).

Table 3.1 Results from microbiological food monitoring in Northern Ireland, 2007

a) Pathogenic Microorganism (n=6,149 samples)*

Pathogen	No. (%) of Tests		
	Negative	Positive	Total
Salmonella spp.	5,975 (100%)	0 (0%)	**5,975**
Campylobacter spp.	379 (99.5%)	2 (0.5%)	**381**
E. coli O157	62 (100%)	0 (0%)	**62**
Listeria spp. – detected by quantitative test**	5,104 (99.9%)	7 (0.1%)	**5,111**
Listeria spp. – detected by qualitative test**	328 (94.8%)	18 (5.2%)	**346**
C. perfringens	5,427 (99.7%)	15 (0.3%)	**5,442**

* Results are presented for RTE and non-RTE foods (no differentiation was made in the NI report)

** The quantitative method is less sensitive, e.g. the detection limit is 20cfu/g compared with 'detection in 25g'

b) Indicator Microorganisms

Organism	Designation of Results*			
	Satisfactory	Acceptable	Unsatisfactory	Total
E. coli	4,970 (98.53%)	32 (0.63%)	42 (0.83%)	**5,044**
Enterobacteriaceae	4,139 (86.28%)	467 (9.73%)	191 (3.98%)	**4,797**
S. aureus	5,193 (99.76%)	2 (0.03%)	10 (0.19%)	**5,205**
B. cereus	4,869 (99.97%)	1 (0.03%)	0 (0%)	**4,870**

* Results are designated according to the PHLS guidelines (Gilbert, R.J *et al.*, 2000)

3.2.2 Scotland

According to a report on food sampling in Scotland (Scottish Food Enforcement Liaison Committee's Research Working Group, 2007), 7,547 samples were obtained for microbiological analysis in 2007. This is equivalent to 1.46 samples per 1,000 population, i.e. just under half the Irish sampling rate. Samples submitted by local authorities are classified as enforcement/investigative samples (taken in response to a particular incident, allegation, or contravention) or surveillance/monitoring samples (taken as part of a local authority's routine sampling plan or as part of a regional/national survey). For the purposes of the Scottish report, all figures were combined.

Similar to the Republic of Ireland, a wide range of foods were sampled in Scotland for the purpose of microbiological examination. Meat and meat products (EU code 3) and prepared dishes (EU code 17) were the most frequently sampled foods in both countries.

Microbiological examinations were undertaken for pathogenic and indicator microorganisms.

Regarding pathogenic microorganisms, the report focuses on five key pathogens: *Salmonella* spp., *Campylobacter* spp., *E. coli* O157, *Listeria monocytogenes* and *Clostridium perfringens*. The number of examinations by food category is presented in Table 3.2. The report states that the number of examinations is influenced by legislative requirements, national and regional surveys. Only a small number of samples (11 samples of RTE food and 23 samples of raw food) contained pathogens at levels that exceeded the legislative or guideline levels (Table 3.3).

Regarding indicator microorganisms, the report focuses on total viable counts (TVCs[2]). Examinations were conducted on approximately 80% of all samples of RTE foods. Most examinations for TVCs were undertaken on prepared dishes (primarily sandwiches and takeaway meals) and meat and meat products (primarily cooked meat and cooked poultry). Approximately three-quarters of samples examined for TVCs were reported as satisfactory.

Table 3.2 No. of examinations for pathogenic microorganisms by sample type (microbiological food monitoring by Scottish Local Authorities, 2007)

Food Category	Total No. of Samples	Total No. of Examinations by Pathogen Type				
		Salmonella spp.	*Campylobacter* spp.	*E. coli* O157	*L. monocytogenes*	*C. perfringens*
Additives	20	18	0	0	2	2
Bakery Products and Cereal	81	8	0	1	61	65
Beverages	6	0	0	0	0	0
Cakes and Confectionery	283	50	21	0	205	203
Dairy Products	883	60	13	21	569	256
Drinks	143	13	1	3	7	4
Eggs and Egg Products	68	23	0	0	39	25
Fish and Shellfish	453	147	41	39	501	280
Food for Particular Nutritional Uses	27	12	0	5	4	18
Fruit and Vegetables	365	111	57	42	248	193
Herbs and Spices	149	137	0	1	39	60
Ice-cream and Desserts	479	52	3	0	422	241
Materials and Articles in Contact with Food	62	0	0	3	0	0
Meat and Meat Products, Game and Poultry	1,660	298	191	156	1,279	1,117
Nuts and Nut Products, Snacks	44	25	0	0	9	7
Prepared Dishes	1,855	245	117	12	1,346	1,304
Soups, Broths and Sauces	158	13	3	3	133	112
Others	811	21	0	86	285	12
Total	**7,547**	**1,233**	**447**	**372**	**5,149**	**3,899**

[2] Total Viable Count (TVC) is also known as the Aerobic Colony Count (ACC) or Standard Plate Count.

Table 3.3 Results following testing for pathogenic microorganisms in Scotland, 2007

Pathogen	No. (%) of Tests		
	Satisfactory	Unsatisfactory	Total
Salmonella spp.	1,226 (99.4%)	7 (0.6%)*	1,233
Campylobacter spp.	426 (95.3%)	21(4.7%)**	447
E. coli O157	372 (100%)	0 (0%)	372
L. monocytogenes	5,147 (99.9%)	2 (0.04%)‡	5,149
C. perfringens	3,888 (99.7%)	11 (0.3%)‡‡	3,899

* 6 results occurred in RTE products and one result occurred in a raw product (raw chicken)

** 21 unsatisfactory results occurred in raw chicken (all RTE foods were satisfactory)

‡ 2 unsatisfactory results occurred in RTE fish products

‡‡ Includes 7 results within the acceptable range, 3 results within the unsatisfactory range and 1 result which was unacceptable/potentially hazardous

3.3 Conclusions

From a review of the data presented in section 3.2, it would appear (subject to the caveats outlined in section 3.1) that:

- The level of sampling per capita is higher in Ireland than in Scotland
- The categories of RTE foodstuffs sampled in Ireland are similar to Northern Ireland and Scotland, i.e. meat and meat products and prepared dishes are predominantly sampled
- RTE foods sampled at retail level in Ireland are examined for a wider range of microbiological parameters than Northern Ireland and Scotland

4. DISCUSSION AND CONCLUSIONS

4.1 Data Quality

The data analysed in Section 2 of this report are generally of good quality and give an accurate representation of the routine sampling and microbiological examinations undertaken by the HSE.

However, there are areas where the quality of the data could be improved. Areas for improvement are identified by the data collection and analysis team at the FSAI on an on-going basis. For the period 2004 – 2009, areas for improvement were identified through quality assurance processes during data collection and collation. These areas were addressed during discussions with the HSE on standardisation and enhancement of data capture practices. This has resulted in significant improvements, e.g. standardised data fields and national valid values (where appropriate) have been agreed. These are currently being compared with recently published EFSA specifications to identify future directions for both the FSAI and the 7 OFML data systems to ensure continual improvement. The continuation of these improvements will ensure greater speed and ease of collation of data at national level and more timely data analysis with fewer resources. Furthermore, it will allow more meaningful conclusions to be drawn about these data.

Data fields where improvements in data capture at the point of sampling would be most beneficial are:

4.1.1 RTE status

The correct classification of samples by RTE status is essential to assess the public health significance of the microbiological results, e.g. the public health significance is different if a pathogen is detected in a RTE compared to a non-RTE food. Furthermore, correct classification is necessary to ensure results are assessed against the appropriate microbiological standards or guidelines.

4.1.2 EU category

Designation of the correct EU code to each sample is essential as errors will skew national data (analysis of EU category provides an overview of the foodstuffs sampled at national level).

To date, errors have been corrected by some but not all of the OFMLs. Further errors are amended by the FSAI data team during data collection and quality assurance processes; however, due to inadequate sample descriptions, it is not always possible to identify these errors.

4.1.3 Sample description

Variation exists in the terminology used by EHOs to describe the sample and in the level of detail provided. Sometimes the sample description is too brief to allow a full understanding of the food. Three examples are provided:

i) "Burger" does not indicate whether the sample is chicken, beef, vegetarian, lamb or fish. Furthermore, it does not indicate whether the sample includes bun and salad (these samples would be categorised as EU Code 17) or meat only (these samples would be categorised as EU Code 3). These differences often need to be understood in order to retrieve appropriate records for analysis.

ii) 'Bottled water' does not indicate whether the water is a 'natural mineral water', 'spring water' or 'other water'. These three categories of bottled water are defined in legislation and different microbiological criteria apply to each category.

In this review, assessment of compliance with the relevant criteria was problematic as adequate sample descriptions were not provided. Although specific labelling requirements are laid down in legislation for each category of bottled water it was acknowledged that this labelling is often unclear causing problems for EHOs when completing the sample description on the sample submission form. Similar difficulties were highlighted in a survey on the microbiological safety and quality of bottled water which was conducted as part of the National Microbiological Surveillance Program in 2007. Since the completion of that survey, considerable work has been on-going at national level with respect to bottled water. The NSAI has revised its national standard for packaged water (NSAI, 2010). In addition, the FSAI has published a Guidance Note entitled '*Guidance for Enforcement of Legislation applicable to Natural Mineral Waters, Spring Waters and Other Bottled Waters*' (FSAI, 2010). Both documents include labelling requirements for bottled water and thus improvements are expected in this regard.

iii) Microbiological criteria are specified in legislation for *Salmonella* spp. in certain RTE food commodities. Guidelines are established for *Salmonella* spp. in all other RTE food commodities. Due to inadequate sample descriptions, it was often difficult to determine whether the salmonellae results should be assessed against the criteria or the guidelines. Although the limits are the same, i.e. *Salmonella* spp. should be absent in 25g, problems would arise if the basis for the designation of the results were required.

The working group acknowledged that EFSA is in the process of developing a more comprehensive and detailed food classification system. This new classification system is expected to become available within the next 2 to 3 years and should alleviate some of the current problems. The balance between the level of detail to be captured to ensure full understanding of the nature of the sample and the level of complexity of the new system is one of the significant challenges faced by the EFSA Working Group.

Other data fields where improvements in data capture at the point of sampling would be beneficial include 'Purpose for Investigation', 'Cooked Status', 'Food Chain Stage' and 'Survey Reference'. Electronic data captured at the point of sampling (and potentially with integrated category coding), could contribute to data quality improvements in all these data fields. Furthermore, the possibility of a single national OFML data system would be one potential solution to some of the known data quality and data sharing issues.

4.2 Sampling

EHOs are required to verify that food business operators are complying with their legal obligation to produce safe food. Through their inspection program, the EHS address high-risk food businesses as a priority, i.e. EHOs target businesses which pose the greatest potential risk to the population should a food safety control failure occur. This is a requirement of the service contract agreement between the HSE and the FSAI.

Sampling of foodstuffs for microbiological examination is routinely undertaken to verify compliance. This review shows the extensive work undertaken by both the EHS and the OFMLs in this regard. Over the two year period reviewed in this report (2007 and 2008), a total of 12,163 samples of RTE food were obtained during routine investigations. Bearing in mind the caveats discussed in section 3 of this report, it can be noted that per capita, the number of samples examined in the Republic of Ireland is comparable with Northern Ireland (3.36 samples per 1,000 population). However, it is considerably higher than Scotland (1.46 samples per 1,000 populations).

The necessity to sample depends on the nature of the foodstuff and the risk of the hazard occurring, which in turn will be determined by the robustness of the controls implemented by the food business operator. Where controls are robust and even inherent, e.g. cooking, pasteurisation, addition of preservative, sampling should be minimal and in some cases may not even be necessary if EHOs can verify compliance through alternative means, e.g. i) assessing physical parameters such as time, temperature and pH at critical control points (CCPs), ii) ensuring that the cold chain is being maintained, iii) ensuring good hygiene practices are being implemented etc. Where controls are less robust or where there is suspicion that controls are not implemented appropriately, sampling for microbiological examination should be considered. This approach towards official sampling is specified by the European Commission in their guidance document on official controls (EC, 2006).

Currently, EHOs sample mainly at retail level, although a small proportion of sampling may be undertaken in establishments manufacturing foods. At retail level, most sampling is undertaken in supermarkets and catering establishments. While sampling at this stage of the food chain is advantageous (it is the last opportunity to verify food safety prior to consumption) it may not be the most appropriate stage to sample all foodstuffs, e.g. it may be more appropriate to sample pre-packaged foods, i.e. foods not pre-packaged on the retail establishments, earlier in the food chain, e.g. central distribution centers, manufacturing establishments etc., as these products are not exposed to handling in retail establishments. Furthermore, this would avoid repeat/multiple sampling of these foodstuffs in retail establishments throughout the country. This working group acknowledged that this approach has been proposed by the National Sampling Review Group.

This review has shown that single rather than batch samples are obtained at retail level. This approach is permitted by the EC when sampling is conducted in the context of a monitoring and surveillance programme. However, it is important to highlight the limitations associated with single samples, e.g. if the contamination level of the production batch is low and/or the contaminant is distributed unevenly within the production batch the probability of detecting a pathogen or indicator organism in a single sample is low. Furthermore, a single sample will not allow assessment of compliance/non-compliance with a food safety standard specified in Commission Regulation 2073/2005 as these standards require batch samples (usually n=5) to be taken. A single sample will only allow assessment against the microbiological limit specified in the standard. The working group noted that where sampling is conducted earlier in the food chain, batch sampling should be undertaken.

Regarding sample type, this review was only able to focus on samples of RTE food and thus no comment can be made about samples of foods which were non-RTE. Regarding samples of RTE foods, certain food categories were sampled more often, i.e. EU Code 3 (Meat and meat products, game and poultry) and EU code 17 (Prepared dishes). Bearing in mind the caveats discussed in section 3 of this report, it can be noted that this dominance has also been reported in the data from the other countries reviewed. Many sample types exist within each of these food categories; however, further analysis of the Irish data by sample type was problematic and thus no conclusions can be made.

4.3 Microbiological Examinations

Over the two year period investigated (2007 and 2008), a total of 87,216 microbiological examinations were conducted on the 12,163 samples of RTE foods obtained during routine investigations. This represents a mean of 7 microbiological examinations per sample. Most foods were examined for the same suite of microbiological parameters. These included both indicator and pathogenic microorganisms. Bearing in mind the caveats discussed in section 3 of this report, it can be noted that i) the RTE foods sampled during routine investigations in Ireland were examined for a wider range of microbiological parameters than the other countries reviewed and ii) the contamination levels in Irish RTE foods are comparable with other countries.

Further details on examinations undertaken for both indicator and pathogenic microorganisms are discussed below.

4.3.1 Examination of RTE foods for indicator microorganisms

Indicator microorganisms are useful in the assessment of food safety as they tend to be present in higher numbers than most pathogens and identification is relatively rapid and easy to perform (HPA, 2009). Indicator microorganisms *per se* do not pose a risk to public health; however, they indicate that the food has been i) exposed to conditions which increase the risk of pathogen contamination or ii) held under conditions conducive for pathogen growth (Buchanan, 2000). Quantitative examinations are undertaken for indicator organisms. The presence of these organisms, above a certain limit, highlights that corrective actions should be implemented by the food business to prevent the occurrence of microbiological risk from pathogenic microorganisms.

This review has shown that RTE foodstuffs are routinely tested for 4 indicator microorganisms, i.e. *Enterobacteriaceae*, *E. coli*, *Listeria* spp. and Aerobic Colony Count (ACC). Microbiological criteria are established in legislation for indicator microorganisms in certain foodstuffs; however, these criteria are only applicable during or at the end of the manufacturing process (they are not applicable to foodstuffs at the point-of-sale). For this reason, the results from the microbiological examinations reviewed in this report were assessed against the interim national microbiological guidelines which apply to RTE foods sampled at the point of sale (FSAI, 2007c).

4.3.1.1 *Enterobacteriaceae*

The *Enterobacteriaceae* family includes species that originate from a wide variety of sources, i.e. the intestinal tract of animals, the intestinal tract of humans, plants and the environment. *Enterobacteriaceae* are killed by cooking; therefore, their presence in heat processed food indicates inadequate cooking or post process contamination. High levels are expected on fresh fruit, vegetables and salad vegetables; therefore, they are not useful indicators for these commodities or foods containing these commodities (FSAI, 2003; HPA, 2009).

Over the two year period investigated, 7,552 examinations for *Enterobacteriaceae* were undertaken on a broad range of foodstuffs (Tables 2.6a and 2.6b). Applying the interim national microbiological guidelines to these results, 8.45% (545/6,453) were designated as unsatisfactory (Table 2.11). This was the largest percentage of unsatisfactory results recorded for any microbiological parameter (bearing in mind the caveats discussed in section 3 of this report, it can be noted that this finding has also been reported in other countries). Of particular importance was the finding that 14.5% (1,099/7,552) of results could not be designated as examinations were inappropriately conducted on foods where this parameter is not relevant, i.e. fresh fruit, vegetables and salad vegetables or foods containing these commodities, e.g. sandwiches.

4.3.1.2 *E. coli*

E. coli is a member of the *Enterobacteriaceae* family which occurs in the faeces of all mammals. It is used as a faecal indicator to assess the hygiene status of food and water. Its presence in raw RTE foods is indicative of faecal contamination; while, its presence in cooked RTE food indicates inadequate cooking and/or post process contamination. Most *E. coli* are commensal bacteria, i.e. they are unlikely to be associated with disease when ingested by healthy people, however, some strains may be pathogenic.

Over the two year period investigated, 11,818 examinations for *E. coli* were undertaken on a broad range of foodstuffs (Tables 2.6a and 2.6b). Over 1% (131/10,126) of results were designated unsatisfactory when assessed against the interim national microbiological guidelines (Table 2.11).

Of particular importance was the finding that 14.3% (1,692/11,818) of results could not be designated. This is because the guideline for *E. coli* in RTE foods (applicable to foodstuffs sampled at the point-of-sale) is not relevant to four specific food commodities:

- Live bivalve molluscs and live echinoderms, tunicates and gastropods
- Cheeses made from milk or whey that has undergone heat treatment
- Pre-cut fruit and vegetables, RTE
- Unpasteurised fruit and vegetable, RTE

The guideline is not applicable to live bivalve molluscs and live echinoderms, tunicates and gastropods' as a food safety criterion is established in Commission Regulation (EC) No 2073/2005 for these commodities. This takes precedence over the guideline.

The guideline is not applicable to the other commodities as more lenient standards are established in legislation for *E. coli* in these commodities at the end of their manufacture/production (therefore, it is not logical to apply a stricter guideline to these foods when they are placed on the market).

The absence of national microbiological guidelines for these commodities has been noted by the FSAI in the '*Interim National Microbiological Guidelines for RTE Foods Sampled at the Point of Sale*' (FSAI, 2007c). When these guidelines are finalised by the FSAI, particular consideration will be given to the establishment of guidelines for *E. coli* in these food commodities.

4.3.1.3 *Listeria* spp.

Listeria spp. are ubiquitous in the environment. Among the 7 species of *Listeria*, only *Listeria monocytogenes* is commonly pathogenic for humans. Although Listeria spp. are killed by temperature regimes such as 70˚C for 2 minutes, they are more heat resistant than *Enterobacteriaceae*. Furthermore, they are capable of growing under normal refrigeration conditions (<5˚C).

Listeria spp. are used as indicators to assess the hygiene status of a food. Their presence in cooked RTE food indicates inadequate cooking and/or post process contamination. Furthermore, their presence should be viewed as an indicator of an increased risk of *L. monocytogenes* contamination.

Both qualitative and quantitative examinations are routinely undertaken for *Listeria* spp. The analysis of the data on *Listeria* spp. is particularly challenging because of the variation in reporting formats. This is related in part to variation in methods used by the different OFMLs and in part to the intrinsic complexity of the issue. Further information is provided in Appendix 4.

Over the two year period investigated, 11,483 quantitative examinations for *Listeria* spp. were undertaken on a broad range of foodstuffs (Tables 2.6a and 2.6b). Applying the interim national microbiological guideline for *Listeria* spp. in RTE foods to these results, 0.1% (7/11,483) were designated as unsatisfactory (Table 2.11). (*L. monocytogenes* >100 cfu/g were reported in 5 of these 7 samples. These 5 samples did not comply with the microbiological standard specified in Commission Regulation (EC) No. 2073/2005. For further information please see section 4.3.2.3).

Regarding qualitative examinations, 4,125 qualitative examinations were undertaken in 2007. *Listeria* spp. were detected in 3.5% (144/4,125) of samples and 53.4% (77/144) of these were reported as *L. monocytogenes*. In 2008, 792 qualitative tests were undertaken. *Listeria* spp. were detected in 2.2% (17/792) of samples and 70.5% (12/17) were reported as *L. monocytogenes*. Although there are no interim national microbiological guidelines (FSAI, 2007c) for the qualitative examination of RTE foods for *Listeria* spp., this type of examination provides useful information for risk assessments, e.g. the qualitative examination of RTE foods early in their shelf-life may provide information which would not be attained by quantitative testing alone, i.e. it may indicate the presence of *Listeria* spp. even when the level of *Listeria* spp. is too low to be quantified.

4.3.1.4 ACC

The ACC, also known as the Total Viable Count, Total Plate Count or Standard Plate Count, differs from the other indicator organisms discussed as it is an indicator of food quality rather than food safety. Over 10,666 ACC tests were carried out in 2007 and 2008 for a broad range of foodstuffs (Tables 2.6a and 2.6b).

ACC levels in RTE foods vary according to product type and the type of processing the product has received, e.g. the ACC levels of raw RTE food commodities such as salad vegetables are likely to be much higher than heat processed foods. The ACC levels in heat processed foods will also vary according to processing type, e.g. pasteurisation, baking or canning, and duration of processing. To reflect this, national microbiological guidelines are established for 5 categories of RTE foods (categories A to E). The ACC guidelines differ for each category (FSAI, 2003).

The diversity of food products and the production methods used means a good understanding of the product is needed to designate the ACC results against the appropriate guidelines (HPA, 2009). As EHOs have a good understanding of the product they have sampled, designation against the appropriate guideline is possible, although difficulties are often encountered. These designations are not reported to the FSAI (no information is transmitted directly from the EHO to the FSAI) and therefore must be repeated at national level. This is problematic because the sample descriptions provided are not suitable for that purpose. For this reason, it was not possible to designate the ACC results collated in this study using the national microbiological guidelines (FSAI, 2003).

4.3.2 Examination of RTE foods for pathogenic microorganisms

Pathogenic microorganisms are those which have the potential to cause disease. The OFMLs test RTE foodstuffs for the following pathogenic microorganisms: *Campylobacter* spp., *Salmonella* spp., *L. monocytogenes*, *B. cereus*, coagulase positive staphylococci (*S. aureus*), *E. coli* O157 and *C. perfringens*.

Qualitative examinations, which determine whether the pathogen is present or absent in the quantity of foodstuff examined, are undertaken for some pathogenic microorganisms, e.g. *Salmonella* spp., *Campylobacter* spp. Quantitative examinations are undertaken when the quantity of pathogen present in the foodstuff needs to be considered, e.g. *L. monocytogenes*, *B. cereus*, coagulase positive staphylococci (*S. aureus*).

Microbiological criteria are established in legislation (Commission Regulation (EC) No 2073/2005) for pathogenic microorganisms in certain foodstuffs. These criteria are applicable to products placed in the market during their shelf-life. Where appropriate, the results from the microbiological examinations reviewed in this report were assessed against the limits specified in these criteria. Where criteria did not exist, the results were assessed against the interim national microbiological guidelines which apply to RTE foods sampled at the point-of-sale (FSAI, 2007c).

To support the discussions relating to each pathogen, data from other sources are also presented, i.e.

i) Food data

Data on the trends and sources of zoonoses compiled at national level by the FSAI and European level by EFSA are presented.

ii) Human data

Statutory notifications of infectious diseases in Ireland are collated by the Health Protection Surveillance Centre (HPSC). Medical practitioners and clinical directors of diagnostic laboratories have a legal obligation to report these infectious diseases (S.I. No. 707 of 2003) to the Medical Officer of Health who then notifies the HPSC. All notification data are entered into a national web-based information system known as CIDR (Computerised Infectious Disease Reporting). Laboratory, clinical and epidemiological information relevant to each case is aggregated. Standard reports based on aggregate data are generated by the HPSC on an annual, quarterly, monthly and weekly basis. Certain caveats are associated with these notifications and it is important that these are highlighted:

1) Under-reporting of infectious diseases is common, e.g. not everyone who experiences a gastrointestinal illness will seek medical attention, therefore, the number of notifications does not equal the number of cases (i.e. the number ill).
2) Many notifiable diseases, e.g. salmonellosis, camplyobacteriosis, listeriosis, can be transmitted via a number of routes, e.g. person-to-person spread, foodborne, waterborne; therefore, it cannot be assumed that all of these notifications are linked to the consumption of contaminated food.

Data are also presented on foodborne outbreaks collated at both national and European level.

4.3.2.1 *Campylobacter* spp.

Campylobacteriosis is the most common bacterial cause of gastroenteritis in Ireland and Europe. The HPSC in Ireland was notified of 1,758 cases in 2008 (41.4 cases per 100,000) and 1891 cases in 2007 (45 cases per 100,000) (HPSC, 2008 and 2009). The European incidence rate for 2008 was 40.7 cases per 100,000 (EFSA, 2010a).

Poultry meat has been identified as a major source of campylobacteriosis in Ireland (Danis *et al*., 2009) and the EU (EFSA, 2005a). It has been estimated that handling, preparation and consumption of broiler meat may account for 20% to 30% of human cases of campylobacteriosis in the EU (EFSA, 2010b). Cross-contamination of RTE foods, direct hand-to-mouth transfer during food preparation and to a lesser extent the consumption of undercooked poultry meat, has been identified as important modes of transmission (EFSA, 2005a).

This review has shown that 701 and 610 examinations for *Campylobacter* spp. were conducted on RTE foods sampled routinely in 2007 and 2008, respectively (Tables 2.8a and 2.8b). Microbiological criteria are not established in legislation for *Campylobacter* spp. in RTE foods placed on the market; however, interim national guidelines exist (*Campylobacter* spp. should be absent in 25g of the RTE food examined (FSAI, 2007c)). Applying these guidelines, all results were designated as satisfactory (Table 2.11). Over 50% (674/1,311) of the samples examined contained 'chicken' in their sample description. As thorough cooking readily eliminates *Campylobacter* spp., the value of testing cooked poultry for this pathogen needs to be considered. Furthermore, knowing that i) the incidence of *Campylobacter* spp. is high on poultry carcasses and raw poultry meat in Ireland (EFSA 2010c; FSAI, 2009) and ii) cross contamination is an important mode of transmission to consumers (EFSA, 2005a); microbiological studies which improve our understanding of these cross contamination routes or provide data for quantitative microbial risk assessment (QMRA) should be considered. Studies of this nature would be a better use of resources than routine examination of cooked RTE foods for *Campylobacter* spp.

Studies of this nature have already been undertaken as part of the National Microbiological Surveillance Program, e.g. a survey carried out in 2008 highlighted the prevalence of *Campylobacter* spp. on i) the external surface of pre-packaged raw poultry and ii) retail shelves carrying this product. It identified the potential for cross contamination from raw poultry and poultry packaging to hands, shopping baskets, RTE foods etc. Data generated from these surveys contribute to the protection of public health by broadening our understanding of the etiology of infection and informing risk management decisions for the control the hazards.

Examination of raw RTE foods, e.g. salads, vegetables etc, for *Campylobacter* spp. is still appropriate particularly if these foodstuffs do not undergo any step in their processing to eliminate *Campylobacter* spp. Examination of raw non-RTE foods, e.g. raw meats, for *Campylobacter* spp. at retail level should take into consideration sampling and examinations undertaken earlier in the food chain by DAFF. However, periodic examinations at retail level may provide useful data for QMRAs or for validation of the effectiveness of the proposed *Campylobacter* spp. control programme in poultry (FSAI, 2011).

4.3.2.2 *Salmonella* spp.

Salmonellosis is the second most common bacterial cause of gastroenteritis in Ireland and Europe. In Ireland, the HPSC was notified of 449 confirmed cases in 2008 (10.6 cases per 100,000) and 440 confirmed cases in 2007 (10.76 cases per 100,000) (HPSC, 2008 and 2009). The European incidence rate for 2008 was 26.4 cases per 100,000 (EFSA, 2010a). Furthermore, it was the organism most commonly implicated in foodborne outbreaks (EFSA, 2010a).

The common reservoir of *Salmonella* spp. is the intestinal tract of domestic and wild animals; thus, foodstuffs of both animal and plant origin are potential sources of infections. In the EU, among the foodborne cases and foodborne outbreaks of human salmonellosis, eggs and egg products are the most frequently implicated sources. Meat is also an important source of foodborne salmonellosis, with poultry and pork being commonly implicated (EFSA, 2008a).

In Ireland, a significant amount of food sampling is undertaken in processing establishments. These include samples taken by industry as part of their own checks and samples taken by DAFF for official control purposes (FSAI, 2009). For the period 2006 and 2007, these data show that 1.5% (205/13,284) of raw pork/raw pork products and 2.5% (418/16,196) of raw poultry meat/raw poultry products were positive for *Salmonella* spp. Examinations for *Salmonella* spp. were also undertaken on RTE poultry meat products (n=8,498) and RTE pork meat products (n=9,820). *Salmonella* spp. were detected on 0.3% of RTE poultry meat products and 0.09% of RTE pork meat products. *Salmonella* spp. was not a significant contaminant of other meat and meat products, milk/dairy products or eggs/egg products.

Regarding retail samples, this review has shown that 5,993 and 5,455 examinations for *Salmonella* spp. were conducted on RTE foods obtained during routine investigations in 2007 and 2008, respectively (Tables 2.8a and 2.8b). Over this period, *Salmonella* spp. were only detected in one sample (Table 2.9b). A wide variety of foods were sampled; however, over a third of all examinations were conducted on samples of RTE food categorised as EU Code 3 (Meat and meat products, game and poultry). As these foods are routinely sampled in processing establishments (by other agencies and food business operators) and *Salmonella* spp. are rarely detected (thorough cooking eliminates this pathogen), the necessity to sample cooked RTE foods routinely at retail level should be reviewed. However, specific consideration should be given to cooked meats which are sliced in the retail establishment, where the potential for cross contamination with raw meat is identified.

4.3.2.3 *L. monocytogenes*

In Ireland, 21 cases of human listeriosis were notified in 2007 (0.5 cases per 100,000) and 13 (0.3 cases per 100,000) in 2008 (HPSC, 2008 and 2009). The European incidence rate for 2008 was 0.3 cases per 100,000 (EFSA, 2010a).

The foods associated with the transmission of listeriosis are mostly RTE foods that support the growth of *L. monocytogenes* (EFSA, 2007a). Microbiological criteria have been implemented in Europe for various categories of RTE foods, e.g. foods intended for immunocompromised consumers, foods supporting or not supporting growth of *L. monocytogenes*. Application of microbiological criteria is only one of several management activities to ensure RTE foods do not pose a serious risk to public health. These criteria assist in controlling the levels of *L. monocytogenes* (whether absence in 25g, as required for some foods or ≤100 cfu/g, as required for other foods) at the point of consumption.

In Ireland, RTE foods sampled in processing establishments are regularly examined for *L. monocytogenes* as part of official control activities by DAFF and the SFPA. Data presented in the 'Report on Zoonoses in Ireland 2006 and 2007' (FSAI, 2009) show that a limited amount of testing was undertaken for RTE meat and meat products (n=544) and smoked fish (n=19); while more extensive sampling was undertaken for cheese (n=997) and other dairy products (n=704). Regarding the latter two categories, *L. monocytogenes* were detected in 11.5% (115/997) of cheese and 0.7% (5/704) of other dairy products. *L. monocytogenes* was not detected in any of the RTE meat, meat products or smoked fish sampled.

Regarding retail samples, this review has shown that 6,072 and 5,411 quantitative examinations were undertaken on RTE foods sampled routinely in 2007 and 2008 (Tables 2.6a and 2.6b). A wide variety of foods were examined over this period, with the vast majority being categorised as EU Code 3 (Meat and meat products, game and poultry) and EU Code 17 (Prepared dishes). Over this two year period, *L. monocytogenes* levels >100 cfu/g were only reported for 0.04% (5/11,483) of examinations (Table 2.9a).

4.3.2.4 *B. cereus*

B. cereus can cause two types of foodborne disease; (1) vomiting due to the ingestion of an emetic toxin preformed in the food and a (2) diarrhoeal illness due to the ingestion of bacterial cells/spores which produce enterotoxin in the small intestine (EFSA, 2005b). Although foodborne infection caused by *B. cereus* has been a notifiable disease in Ireland since 2004, few notifications have been reported (HPSC, 2008 and 2009). However, *B. cereus* and other pathogenic *Bacillus* spp. have been identified as the cause of foodborne outbreaks in the EU. Of the 5,332 foodborne outbreaks reported in the EU in 2008, 2.3% (n=124) were attributed to *Bacillus* spp. (EFSA, 2010a).

Low levels of *B. cereus* cells or spores are found on virtually every raw agricultural commodity. Although these levels are generally too low to cause food poisoning, the ability of *B. cereus* to form spores, ensures its survival through all stages of the food chain.

This review has shown that 5,498 examinations for *B. cereus* were undertaken in 2007 and 2008 on a wide range of RTE foods sampled at retail level (Tables 2.6a and 2.6b). Microbiological criteria are not established in legislation for *B. cereus*; therefore, results were assessed against the interim national microbiological guidelines which apply to RTE foods sampled at the point-of-sale. Applying these guidelines, 0.2% (n=12) of results were designated unsatisfactory and a further 0.2% (n=10) were designated unacceptable/potentially hazardous (Table 2.11).

Examinations for this organism are rarely undertaken on foods sampled earlier in the food chain by other agencies as part of their official control activities.

4.3.2.5 Coagulase positive staphylococci (*S. aureus*)

Staphylococcal food poisoning is caused by ingestion of a heat stable toxin formed by coagulase positive staphylococci in food (the bacterium must grow to levels $>10^5$ cfu/g before producing sufficient quantities of the heat-stable staphylococcal toxin to cause illness). Most coagulase positive staphylococci are *Staphylococcus aureus*. Occasionally, coagulase positive strains of *S. intermedius* and *S. hyicus* may be encountered. Although staphylococcal food poisoning has been a notifiable disease in Ireland since 2004, few notifications have been reported (HPSC, 2008 and 2009). However, coagulase positive staphylococci have caused foodborne outbreaks in the EU. Of the 5,332 foodborne outbreaks reported in the EU in 2008, 5.5% (n=291) were attributed to coagulase positive staphylococci (EFSA, 2010a)

Coagulase positive staphylococci are ubiquitous organisms occurring on the skin and mucous membranes of most warm blooded animals including all food animals and humans. They are commonly detected in foods of animal origin such as raw meat and raw bulk milk; however, they are poor competitors and rarely causes food poisoning in raw products (an exception being milk from a mastitic cow). Approximately 50% of humans are carriers of these organisms and food handlers are frequently implicated in their transmission to food. They are of particular concern in RTE foods that receive post processing handling and subsequent temperature abuse during storage.

This review has shown that 11,805 coagulase positive staphylococci examinations were undertaken in 2007 and 2008 on a wide variety of RTE foods sampled at retail level (Tables 2.6a and 2.6b). Microbiological criteria are not established for coagulase positive staphylococci in RTE foods placed on the market (although criteria are established for certain cheeses, milks and fishery products either during or at the end of their manufacturing process). For this reason, results were assessed against the interim national microbiological guidelines which apply to RTE foods sampled at the point of sale. Applying these guidelines, 0.9% (108/11,784) of results were designated unsatisfactory and 0.07% (8/11,784) unacceptable/potentially hazardous (Table 2.11).

Testing for the staphylococcal enterotoxin is not routinely conducted. It is only conducted if the coagulase positive staphylococcal count exceeds 10^5 cfu/g. Applying this approach to certain cheeses sampled at retail level needs to be considered as it may give a false sense of security regarding product safety (staphylococcal counts but not enterotoxin levels are known to decrease during the ripening and storage of certain cheeses (EC, 2003)). Testing these products earlier in the food chain, i.e. during the manufacturing process when the staphylococcal count is expected to be the highest, would be more appropriate and would meet legislative requirements.

4.3.2.6 VTEC

VTEC are important zoonotic agents which are able to cause severe and life threatening diseases in humans. VTEC can be transmitted to humans through contact with contaminated food, water, environment and animals, or by person-to-person contact. In 2008, 226 cases of VTEC were notified to HPSC (5.3 cases per 100,000); while, in 2007 the number of cases notified was 167 (3.9 cases per 100,000) (HPSC, 2008 and 2009). The European incidence rate for 2008 was 0.7 cases per 100,000 population (EFSA, 2010a).

Ruminants (particularly cattle) are recognised as the main natural reservoir of VTEC, in particular *E. coli* O157. While person-to-person transmission and exposure to untreated private water supplies are important transmission routes for VTEC in Ireland, foodstuffs subject to faecal contamination from ruminants can present a hazard for human VTEC infection (EFSA, 2007b). The presence of *E. coli* O157 in food is of particular concern as the minimum infectious dose is estimated to be as low as 10 viable bacteria.

In abattoirs and processing plants, implementation of good hygiene practices and monitoring for microbiological indicators (*Enterobacteriaceae* and generic *E. coli*) are legal requirements. These are considered to be the most effective method for reducing the public health risks for VTEC infections. Examinations for these indicator organisms may also be undertaken by official agencies as part of their official control activities; however, examinations for VTEC are rarely undertaken.

This review has shown that 23 examinations for *E. coli* O157 were undertaken on RTE foods obtained for routine investigation in 2007 and 2008 (Tables 2.8a and 2.8b). Microbiological criteria are not established in legislation for *E. coli* O157 in RTE foods placed on the market. For this reason, results of the 23 examinations were assessed against the interim national microbiological guidelines which apply to RTE foods sampled at the point of sale. Applying these guidelines, all results were designated as satisfactory, i.e. *E. coli* O157 were not detected in 25g, Table 2.11.

4.3.2.7 *C. perfringens*

In 2008, one case of *Clostridium perfringens* (type A) foodborne disease was notified to the HPSC. No case was notified in 2007 (HPSC, 2008 and 2009).

In most instances, poisoning by *C. perfringens* is caused by temperature abuse of prepared foods. Small numbers of the organisms are often present after cooking and multiply to food poisoning levels during the cooling and storage of prepared foods. Meats, meat products, and gravy are the foods most frequently implicated.

At retail level, this review has shown that 10,229 quantitative examinations for *C. perfringens* were undertaken on RTE foods obtained for routine investigation in 2007 and 2008 (Tables 2.6a and 2.6b). These examinations were undertaken on a broad range of foodstuffs. Microbiological criteria are not established in legislation for *C. perfringens* in RTE foods placed on the market. For this reason, results of the examinations were assessed against the interim national microbiological guidelines which apply to RTE foods sampled at the point-of- sale. Applying these guidelines, 0.2% (20/10,229) of results were designated unsatisfactory (Table 2.11).

Microbiological examinations for *C. perfringens*, are not usually undertaken by other official agencies earlier in the food chain, as part of their official control activities.

4.3.3 Other testing

4.3.3.1 Molecular typing

Molecular typing of pathogens isolated from food is essential for i) monitoring the emergence, persistence or spread of specific strains in foods and through food systems and ii) determining the source of foodborne outbreaks.

The importance of molecular typing was demonstrated during a *Salmonella* Agona outbreak which occurred in 2008. The molecular typing of human isolates by the National Salmonella Reference Laboratory Galway (NSRL) was instrumental in the early detection of this outbreak. Furthermore, molecular typing of S. Agona isolates from food, identified strains which were indistinguishable (or distinguishable by one band) from the human isolates. This evidence, together with evidence from epidemiological investigations, indicated meat products produced at an Irish manufacturing plant as the source of the outbreak. This incident clearly illustrates the importance of rapid source attribution so that control measures can be implemented to curb the outbreak.

Currently, all *Salmonella* spp. isolates from the OFMLs are submitted to the NSRL. All food isolates are typed, results are reported back to the OFMLs and supplementary reports are then issued to the FSAI. VTEC isolates (clinical, food and water) are referred to the HSE Dublin Mid-Leinster Public Health Laboratory (HSE-DML) at Cherry Orchard Hospital for verotoxin typing and further molecular typing (pulse field gel electrophoresis (PFGE)). However, little or no typing is undertaken for other pathogenic microorganisms.

4.3.3.2 Antimicrobial susceptibility testing

Foodborne bacteria, including known pathogens and commensal bacteria, display a diverse range of resistance to antimicrobial agents of human and veterinary importance, and any further spread of resistance among bacteria in foods is likely to have an influence on human exposure (EFSA, 2008b). Particular concern has been raised regarding the development of antimicrobial resistance in *Salmonella* spp. and *Campylobacter* spp., the two most commonly reported zoonotic diseases in the EU (ECDC *et al.*, 2009).

In the EU, there are legal obligations for Member States to monitor antimicrobial resistance. Directive 2003/99/EC requires Member States to monitor antimicrobial resistance in *Salmonella* spp., *Campylobacter jejuni* and *Campylobacter coli* from cattle, pigs, poultry and food of animal origin derived from these species. Furthermore, Commission Decision 2007/407/EC specifically requires antimicrobial resistance monitoring in *Salmonella* isolates (collected through control and monitoring programs) from poultry and slaughter pigs.

Currently, antimicrobial susceptibility testing on *Salmonella* isolates from the OFMLs is undertaken in the NSRL. Isolates of other pathogenic microorganisms are not subjected to antimicrobial susceptibility testing.

4.3.3.3 Viruses

Viruses are a potential risk to public health when they are present in food. A FAO/WHO expert meeting on viruses in food (FAO/WHO, 2008) concluded that viruses play a major role in the burden of infectious intestinal disease; however, the proportion of foodborne illness attributable to viruses is difficult to determine due to under-reporting, the lack of testing and the difficulty in determining the proportion of disease transmitted by foodborne routes relative to other common routes. The FAO/WHO expert meeting concluded that the virus-commodity combinations of highest priority are Noroviruses and hepatitis A virus in shellfish, fresh produce and prepared foods.

Foods are not currently tested in the OFMLs for viruses. In the past, absence of testing may have been due to lack of adequate test methods; however, in recent years, the development and number of methods for the detection of foodborne viruses has increased considerably. Currently, methods for virus detection in bivalve molluscan shellfish are well established (some methods are accredited by national bodies in a number of countries, while others are in the process of being validated for international accreditation). The National Reference Laboratory at the Marine Institute uses real-time PCR procedures for the detection of Norovirus (NoV) and hepatitis A virus (HAV) in shellfish. Testing is routinely undertaken for NoV but not HAV (the NoV method is accredited). The number of available detection methods for foodborne viruses in other food matrices has also increased (FAO/WHO, 2008).

5. OVERALL CONCLUSIONS

This review has highlighted the extensive work undertaken by the EHS and the OFMLs in the area of food sampling and microbiological examinations.

These data enabled the working group identify both strengths and weaknesses with the approach to sampling and microbiological examinations. These strengths and weaknesses, which are highlighted at appropriate points throughout the report, inform the recommendations presented in section 6. The aim of these recommendations is to improve the efficiency and efficacy of the service.

6. RECOMMENDATIONS

6.1 General Recommendation

A formal national strategy on food sampling and relevant microbiological examination should be developed by the FSAI in consultation with appropriate agencies.

The following recommendations relate specifically to the HSE.

6.2 Recommendations Relating to Sampling

Overall Recommendation

Sampling should be undertaken only where it is likely to inform action. When sampling is undertaken, consideration should be given to the following: sampling reason, sample type, sample source and sample numbers, i.e. single versus batch samples. Data collated by sampling officers should be relevant, accurate and complete. Furthermore, to ensure consistency at national level, the HSE should ensure that data are collected and formatted in the same way in all regions.

Sub-recommendations

6.2.1 More emphasis should be placed on targeted rather than random sampling. Surveillance studies, i.e. surveillance of specific foodstuffs, investigation of cross contamination routes and environmental contamination, are examples of targeted sampling. These studies contribute to enhanced food safety by broadening our understanding of the etiology of infection and informing risk management decisions for the control of hazards.

6.2.2 During routine sampling, the decision to sample foodstuffs should be based on the probability of the hazard occurring which in turn will be determined by the robustness of the controls implemented by the food business operator, e.g. although sampling of cooked RTE foods is beneficial in certain situations, it is not always the most effective use of resources. Assessing physical parameters at critical control points (CCPs), ensuring that the cold chain is being maintained and ensuring good hygiene practices are being implemented may be more appropriate tools for verifying the safety of these foodstuffs. These tools already form an integral part of environmental health service food safety audits.

6.2.3 Where appropriate, foodstuffs (in particular, pre-packaged foodstuffs) should be sampled as early as possible in the food chain. At retail level, emphasis should be placed on loose foods, i.e. foods not pre-packaged on the retail establishments, as this is the last stage these foods are handled prior to sale.

6.2.4 When sampling is conducted to assess compliance with microbiological standards, the sampling plans specified in legislation must be respected (i.e. batch samples must be taken). In the context of monitoring at the retail level, single samples may be all that is practical. Batch sampling should not be problematic when sampling is conducted earlier in the food chain.

6.2.5 A national sample request form should be developed through consultation between the FSAI and the HSE and implemented throughout the HSE (the HSE sampling review group has commenced work in this area).

6.3 Recommendations Relating to Microbiological Examinations

Overall Recommendation

Microbiological examinations should be restricted to those parameters relevant for the foodstuff under examination. To ensure comparability of results at national level and to facilitate analysis of the data, all OFMLs must adopt an agreed laboratory method for each parameter, maintain their database in a uniform structure and report the laboratory results to the FSAI in a standard electronic format.

Sub-recommendations

6.3.1 Microbiological examinations should be restricted to those parameters relevant to the foodstuff under examination. These parameters should be specified by the FSAI in consultation with stakeholders. If an OFML is unable to deliver the specified examinations using the specified methods, it should not examine the foodstuff in question.

6.3.2 Microbiological examination for coagulase positive staphylococci in cheese should generally be conducted early in the food chain (i.e. during the manufacturing process when the staphylococcal count is expected to be the highest) rather than at retail level.

6.3.3 Examinations for *Enterobacteriaceae* should not be conducted on fresh fruit, vegetables and salad vegetables or foods containing these commodities.

6.3.4 Where sampling of cooked RTE food is required (see recommendation 6.2.2), unless there is a specific indication to examine for other organisms, microbiological examinations should be restricted to *Enterobacteriaceae*, *E. coli* and *L. monocytogenes*/other *Listeria* spp.

6.3.5 The differential application of the qualitative method for the detection of *L. monocytogenes* and the quantitative method for the enumeration of *Listeria* species including *L. monocytogenes* currently in operation is appropriate.

RTE foods intended for infants and RTE foods for special medical purposes: Only qualitative examinations are undertaken.

All other RTE foods: Qualitative and quantitative examinations are undertaken on foodstuffs sampled early in their shelf-life. Only quantitative examinations are undertaken on foodstuffs sampled later in their shelf-life. For further information, see Appendix 5.

6.3.6 To ensure comparability of results at national level, all OFMLs must utilise uniform laboratory methods for each parameter.

6.3.7 There is a particular need to prioritise the adoption of a uniform method for performance, interpretation and reporting of the quantitative method for enumeration of *Listeria* species including *L. monocytogenes* in all OFMLs.

6.3.8 Where examinations are undertaken for the purpose of assessing compliance with microbiological standards, the laboratory methods specified in legislation must be utilised without variation.

6.3.9 Where methods are not specified in legislation, research and development on the application of new methods of analysis is a valuable role of OFMLs. When a new method is validated in more than one OFML as superior in one or more respects to existing methods, it may be adopted by the HSE as the new 'standard method' in consultation with the FSAI. All OFMLs performing the relevant analysis must then adopt the new standard method for that examination.

6.3.10 Pathogens isolated from food or food processing environments (*L. monocytogenes*, *Salmonella* spp., coagulase positive staphylococci and *Bacillus cereus*) should be stored for a minimum of two years and appropriate typing should be performed wherever possible.

6.3.11 Antimicrobial susceptibility testing should be conducted where appropriate on food isolates of zoonotic pathogens. A common approach should be adopted in all OFMLs in consultation with the FSAI.

6.3.12 The cessation of certain sampling and microbiological examinations, i.e. those which are no longer required by the FSAI, should allow a cost-neutral redirection of resources for food microbiology. These resources should address current needs, i.e. development of methods for examination of foods for viral and protozoan contaminants and enhanced reference laboratory services for typing of foodborne pathogens.

6.3.13 To ensure comparability of results at national level, all OFMLs must report laboratory results in the same format.

6.4 Recommendations Relating to Designation of Results

Overall Recommendation

Results should be designated against the appropriate standards or guidelines. These designations should be undertaken by the OFML and reported to the EHS and the FSAI.

Sub-recommendations

6.4.1 The FSAI should consider the necessity to establish national microbiological guidelines for specific combination of foods and microorganisms, where guidelines or standards are currently not available. Where guidelines are not appropriate, examination of the foodstuff for that parameter should not be undertaken.

6.4.2 OFMLs should designate all results against the appropriate standards or guidelines and report these designations to both the EHS and the FSAI.

6.4.3 The FSAI should provide more guidance on the designation of results against the national microbiological guidelines for aerobic colony counts (ACC).

6.5 Recommendations Relating to the Data Submitted to the FSAI

Overall Recommendation

The quality of data submitted to the FSAI should be continuously improved in terms of accuracy, completeness, standardisation, timeliness and accessibility.

Sub-recommendations

6.5.1 The FSAI and the HSE should continue to examine ways to improve data quality in terms of accuracy, completeness, standardisation, timeliness and accessibility.

6.5.2 Implementation of EFSA's guidance on Standard Sample Description (SSD) elements and food classification should be undertaken in Ireland on a national basis. The FSAI should provide comprehensive training to relevant staff of the HSE on this issue.

6.5.3 The possibility of a single national OFML data system should be considered. Otherwise, the LIMS in each OFML should be configured in the same way to ensure consistency in data capture.

7. BIBLIOGRAPHY

Buchanan, R.L. (2000) Acquisition of Microbiological data to enhance food safety. *Journal of Food protection*, Vol 62, No 6, 832-838

Commission Decision 2007/407/EC: Commission Decision of 12 June 2007 on a harmonised monitoring of antimicrobial resistance in *Salmonella* in poultry and pigs

Commission Regulation (EC) No 2073/2005 of 15 November 2005 on microbiological criteria for foodstuffs http://www.fsai.ie/uploadedFiles/Consol_Reg2073_2005.pdf

Danis, K., Renzi, M., O'Neill, W., Smyth, B., McKeown, P., Foley, B., Tohani, V. and Devine, M. (2009) Risk factors for sporadic *Campylobacter* infection: an all-Ireland case-control study, *Eurosurveillance*, vol. 14, no. 7, p. 8

DIRECTIVE 2003/99/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 November 2003 on the monitoring of zoonoses and zoonotic agents, amending Council Decision 90/424/EEC and repealing Council Directive 92/117/EEC

EC (European Commission) (2003) Opinion of the scientific committee on veterinary measures relating to public health on staphylococcal enterotoxins in milk products, particularly cheeses. http://ec.europa.eu/food/fs/sc/scv/out61_en.pdf

EC (European Commission) (2006) EC guidance document on official controls, under Regulation (EC) No 882/2004, concerning microbiological sampling and testing of foodstuffs http://www.fsai.ie/uploadedFiles/Legislation/Food_Legisation_Links/Official_Control_Of_Foodstuffs/EU_Guidance_882.pdf

ECDC (European Centre for Disease Prevention and Control), EFSA (European Food Safety Authority), EMEA (European Medicines Agency), SCENIHR (Scientific Committee on Emerging and Newly Identified Health Risks) (2009) Joint Opinion on antimicrobial resistance (AMR) focused on zoonotic infections http://www.efsa.europa.eu/en/scdocs/doc/1372.pdf

EFSA (European Food Safety Authority) (2005a) Opinion of the Scientific Panel on Biological Hazards on *Campylobacter* in animals and foodstuffs. *EFSA Journal* 173 1-10. www.efsa.europa.eu

EFSA (European Food Safety Authority) (2005b) Opinion of the Scientific Panel on Biological hazards on *Bacillus cereus* and other *Bacillus* spp. in foodstuffs. *EFSA Journal* 175, 1-48

EFSA (European Food Safety Authority) (2006) Report of Task Force on Zoonoses Data Collection on proposed technical specifications for a coordinated monitoring programme for *Salmonella* and *Campylobacter* in broiler meat in the EU, *EFSA Journal* 92, 1-33

EFSA (European Food Safety Authority) (2007a) Scientific Opinion of the Panel on Biological Hazards on a request from the European Commission on Request for updating the former SCVPH opinion on *Listeria monocytogenes* risk related to ready-to-eat foods and scientific advice on different levels of *Listeria monocytogenes* in ready-to-eat foods and the related risk for human illness. *EFSA Journal* 599, 1-42

EFSA (European Food Safety Authority) (2007b) Scientific Opinion of the Panel on Biological Hazards on a request from EFSA on monitoring of verotoxigenic Escherichia coli (VTEC) and identification of human pathogenic VTEC types. *EFSA Journal* 579, 1-61

EFSA (European Food Safety Authority) (2008a) Scientific Opinion of the Panel on Biological Hazards on a request from the European Commission on a quantitative microbiological risk assessment on *Salmonella* in meat: Source attribution for human salmonellosis from meat. *EFSA Journal* 625, 1-32

EFSA (European Food Safety Authority) (2008b) Foodborne antimicrobial resistance as a biological hazard[1] - Scientific Opinion of the Panel on Biological Hazards http://www.efsa.europa.eu/en/scdocs/scdoc/765.htm

EFSA (European Food Safety Authority) (2009a) Technical specifications for the monitoring and reporting of verotoxigenic *Escherichia coli* (VTEC) on animals and food (VTEC surveys on animals and food) on request of EFSA. *EFSA Journal* 7(11):1366

EFSA (European Food Safety Authority) (2009b) Report of Task Force on Zoonoses Data Collection on proposed technical specifications for a survey on *Listeria monocytogenes* in selected categories of ready-to-eat food at retail in the EU, *EFSA Journal* 300, 1- 66

EFSA (European Food Safety Authority) (2010a) The Community Summary Report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in the European Union in 2008. *EFSA Journal* 8(1):1496

EFSA (European Food Safety Authority) (2010b) Panel on Biological Hazards Scientific Opinion on Quantification of the risk posed by broiler meat to human campylobacteriosis in the EU. *EFSA Journal* 8(1):1437

EFSA (European Food Safety Authority) (2010c) Analysis of the baseline survey on the prevalence of *Campylobacter* in broiler batches and of *Campylobacter* and *Salmonella* on broiler carcasses in the EU, 2008, Part A: *Campylobacter* and *Salmonella* prevalence estimates. *EFSA Journal* 8(03):1503

FAO/WHO (Food and Agricultural Organization of the United Nations/ World Health Organization) (2008) Viruses in food: scientific advice to support risk management activities. *Microbiological Risk Assessment* Series 13 ftp://ftp.fao.org/docrep/fao/011/i0451e/i0451e00.pdf

Food Safety Authority of Ireland Act, 1998 http://www.fsai.ie/legislation/fsai_act_related.html

FSAI (Food Safety Authority of Ireland) (2009) The consumption of Bottled Water containing Certain Bacteria or Groups of Bacteria and the Implications for Public Health http://www.fsai.ie/WorkArea/DownloadAsset.aspx?id=9286

FSAI (Food Safety Authority of Ireland) (2001) Guidance Note on the EU Classification of Food http://www.fsai.ie/resources_and_publications/guidance_notes.html#Directory1

FSAI (Food Safety Authority of Ireland) (2003) Guidelines for the interpretation of results of microbiological analysis of some ready-to-eat foods sampled at the point-of-sale

FSAI (Food Safety Authority of Ireland) (2004) Code of Practice No. 1 for the Health Service Executive on the Risk Categorisation of Food Businesses (Revision 1) http://www.fsai.ie/assets/0/86/204/0480c537-c066-4a43-91ac-336b8a584a2e.pdf

FSAI (Food Safety Authority of Ireland) (2007a) The National Control Plan for Ireland for the period from 1st January 2007 to 31st December, 2011 http://www.fsai.ie/uploadedFiles/About_Us/service_contracts/national_control_plan/national_control_plan_2007_2011.pdf

FSAI (Food Safety Authority of Ireland) (2007b) Annual Report, 2007 http://www.fsai.ie/resources_and_publications/annual_reports.html

FSAI (Food Safety Authority of Ireland) (2007c) Interim Guidance Note https://safetynet.fsai.ie/sharedfiles/sharedfiles_list.asp?dateFilterWeeks=&sharedfilecat_id=123&sharedfile_cat_name=Microbiological+Criteria+%26+Microbiological+Guidelines

FSAI (Food Safety Authority of Ireland) (2008) FSAI Annual Report, 2008 http://www.fsai.ie/resources_and_publications/annual_reports.html

FSAI (Food Safety Authority of Ireland) (2009) Report on Zoonoses in Ireland 2006 and 2007

FSAI (Food Safety Authority of Ireland) (2010) Guidance Note No.25-Guidance for Enforcement of Legislation Applicable to: Natural Mineral Waters, Spring Waters and Other Bottled Waters http://www.fsai.ie/resources_and_publications/guidance_notes.html#Directory1

FSAI (Food Safety Authority of Ireland) (2011) Recommendations for a practical control programme for *campylobacter* in the poultry production and slaughter chain

Gilbert, R.J., de Louvois, J., Donovan, T., Little, C., Nye, K., Ribeiro, C.D., Richards, J., Roberts and Bolton, F.J. (2000) Guidelines for the microbiological quality of some ready-to-eat foods sampled at the point of sale Communicable disease and public health, Vol 3, No 3 http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1194947422163

HPA (Health Protection Agency) (2009) Guidelines for assessing the microbiological safety of ready-to-eat foods placed on the market

HPSC (Health Protection Surveillance Centre) (2008) Annual Report for 2007 of the Health Protection Surveillance Centre, Ireland

HPSC (Health Protection Surveillance Centre) (2009) Annual Report for 2008 of the Health Protection Surveillance Centre, Ireland

Käsbohrer, A., Tenhagen, B.A., Appel, B. and Fetsch, A. (2010) Development of harmonised survey methods for food-borne pathogens in foodstuffs in the European Union http://www.efsa.europa.eu/en/supporting/doc/83e.pdf

Northern Ireland Strategic Committee on Food Surveillance (2007) Report of the Northern Ireland Strategic Committee on Food Surveillance concerning Food Sampling by District Councils in Northern Ireland in 2007 http://www.food.gov.uk/multimedia/pdfs/fsfs2007report.pdf

NSAI (National Standards Authority of Ireland) (2010) I.S. 432.Packaged groundwater

Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety http://www.fsai.ie/uploadedFiles/Consol_Reg178_2002(1).pdf

Regulation (EC) No 882/2004 of the European Parliament and of the Council of 29 April 2004 on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules http://www.fsai.ie/uploadedFiles/Consol_Reg882_2004.pdf

Scottish Food Enforcement Liaison Committee's Research Working Group (2007) Scottish Local Authority Food Sampling (2007) http://www.food.gov.uk/multimedia/pdfs/slafsreport.pdf

S.I. No. 707 of 2003 Infectious Disease (Amendment) (No. 3) Regulations, 2003 http://www.irishstatutebook.ie/2003/en/si/0707.html

S.I. No. 225 of 2007 European Communities (natural mineral waters, spring waters and other waters in bottles or containers) Regulations, 2007 http://www.fsai.ie/uploadedFiles/Legislation/SI_225_2007.pdf

8. MEMBERS OF THE SCIENTIFIC COMMITTEE OF THE FSAI

Prof. Albert Flynn (Chair)
University College, Cork

Dr Catherine Adley
University of Limerick

Dr Colette Bonner
Dept of Health and Children

Prof. Emeritus Dan Collins
University College, Dublin

Prof. Martin Cormican
National University of Ireland, Galway

Prof. Colin Hill
University College, Cork

Prof. Brian McKenna
University College, Dublin

Dr Paul McKeown
Health Protection Surveillance Centre

Dr Terry McMahon
Marine Institute

Dr Michael O'Keeffe
Residue Specialist

Dr Dan O'Sullivan
Dept of Agriculture, Fisheries and Food

Mr Ray Parle
Health Service Executive

Dr Iona Pratt
Food Safety Authority of Ireland

Prof. Michael Ryan
University College, Dublin

Ms Paula Barry Walsh
Dept of Agriculture, Fisheries and Food

9. MEMBERS OF THE MICROBIOLOGY SUB-COMMITTEE OF THE FSAI

Prof. Martin Cormican (Chair)
National University of Ireland, Galway

Dr Catherine Adley
University of Limerick

Dr Tom Beresford
Teagasc

Dr Cyril Carroll
National University of Ireland, Galway

Prof. Emeritus Dan Collins
University College, Dublin

Ms Helen Cowman (Deceased)
Health Service Executive

Dr Bill Doré
Marine Institute

Dr Geraldine Duffy
Teagasc, Ashtown Food Research Centre

Dr Michael Fallon
Dept of Agriculture, Fisheries and Food

Prof. Seamus Fanning
University College, Dublin

Dr Paul McKeown
Health Protection Surveillance Centre

Mr David Nolan
Dept of Agriculture, Fisheries and Food

Mr Ray Parle
Health Service Executive

Dr Neil Rowan
Athlone Institute of Technology

Ms Paula Barry Walsh
Dept of Agriculture, Fisheries and Food

10. MEMBERS OF THE WORKING GROUP

Dr Tom Beresford (Chair)
Teagasc

Dr Catherine Adley
University of Limerick

Professor Martin Cormican
National University of Ireland, Galway

Ms Anne Cowley
Food Safety Authority of Ireland

Ms Helen Cowman (Deceased)
Health Service Executive

Dr Geraldine Duffy
Teagasc, Ashtown Food Research Centre

Dr Mary Friel
Food Safety Authority of Ireland

Dr Patricia Garvey
Health Protection Surveillance Centre

Dr Kathryn Holmes
Food Safety Authority of Ireland

Ms Eileen O'Dea
Food Safety Authority of Ireland

Mr Ray Parle
Health Service Executive

Mr Vincent Young
Public Analyst Laboratory, Dublin

11. APPENDICES

APPENDIX 1. BACKGROUND INFORMATION

1.1 Role of the Food Safety Authority of Ireland

The Food Safety Authority of Ireland (FSAI) is responsible for the enforcement of all food legislation in Ireland. The FSAI carries out this enforcement function through service contracts with official agencies. Section 48 of the FSAI Act, 1998 gives the legislative basis for this. These contracts, which are legal agreements to enforce food safety legislation, outline an agreed level and standard of food safety activity that the agencies perform as agents of the FSAI.

The official agencies with whom the FSAI has contracts are:

- County Councils and City Councils
- Health Service Executive
- Department of Agriculture, Fisheries and Food
- Marine Institute
- National Standards Authority of Ireland
- Sea Fisheries Protection Authority

There are also Memoranda of Understanding (MoU) in place between the FSAI and some agencies. An MoU sets out a framework for co-operation in relation to food safety activities. The FSAI has MoUs with the Radiological Protection Institute of Ireland and Customs and Excise, who do enforcement work. In addition, the FSAI has MoUs with Bord Iascaigh Mhara, Bord Bia, Teagasc, FSA-NI and SafeFood.

1.2 Service Contract with the HSE

The FSAI has a service contract with the HSE to provide the following food control services:

- Environmental Health Services
- Food Safety Laboratory Services
- Public Health Medical Services

1.2.1 The Environmental Health Service (EHS)

The EHS provides a range of food safety/food control services in accordance with its service contract with the FSAI. These services include inspection of relevant food businesses together with food sampling to ensure compliance with food law, the management of food alerts and outbreaks, and a range of compliance building/education measures. The HSE is responsible for import controls on products of non-animal origin.

The HSE is divided into four geographical regions: Southern Region, Western Region, Dublin Mid-Leinster Region and Dublin North Eastern Region. There are between seven and nine environmental health sections in each region, thirty three nationally. Environmental health services are delivered under the supervision of a Principal Environmental Health Officer (FSAI, 2007a).

Inspection of food businesses

In 2007 and 2008 EHOs supervised over 42,000 food establishments. These accounted for over 92% of the establishments supervised by all official agencies (Table A1.1) (FSAI, 2007b; FSAI, 2008).

Table A1.1 Number of food establishments supervised by official agencies in 2007 and 2008

Supervising Agency	Number (%) of Establishments	
	2007	2008
Health Service Executive	42,210 (92.8%)	43,926 (92.6%)
Sea-Fisheries Protection Authority	2,214 (4.9%)	2,486 (5.2%)
Department of Agriculture, Fisheries and Food	637 (1.4%)	627 (1.3%)
Local Authorities	442 (1.0%)	410 (0.9%)
Total	**45,503 (100%)**	**47,449 (100%)**

Of the establishments supervised by the HSE in 2007 and 2008, over 69% belonged to the service sector and over 22% to the retail sector (Table A1.2). Establishments in the service sector include hotels, public houses, nursing homes and takeaways, as well as food stalls at outdoor events. Establishments in the retail sector include delicatessens, supermarkets, butchers etc (FSAI, 2007b; FSAI, 2008).

Table A1.2 Number of Food Establishments Supervised by the HSE in 2007 and 2008

Business Category*	Number (%) of Establishments	
	2007	2008
Service Sector	29,273 (69.4%)	30,478 (69.4%)
Retailers	9,629 (22.8%)	9,982 (22.7%)
Manufacturers and Packers	1,278 (3.0%)	1,370 (3.1%)
Distributors and Transporters	1,157 (2.7%)	1,249 (2.8%)
Manufacturers Selling Primarily on a Retail Basis	832 (2.0%)	810 (1.8%)
Primary Producers	41 (0.1%)	37 (0.1%)
Total	**42,210**	**43,926 (100%)**

* **The HSE is responsible for official controls on i) food products of non-animal origin at import, manufacturing, processing, wholesale, and distribution and ii) food products of both animal and non-animal origin at retail level.**

Each food business is assigned a risk category, i.e. high-risk, e.g. a bakery selling egg/cream based products, medium-risk, e.g. a butcher selling only raw meat, or low-risk, e.g. a grocery store selling pre-packaged foods only, and the frequency of inspection is determined by the risk category assigned (FSAI, 2004). In 2008, planned inspections were carried out on 82% of establishments categorised as high-risk, 70% of establishments categorised as medium-risk and 29% of establishments categorised as low-risk (FSAI, 2008).

Sampling for microbiological analysis

Food samples are regularly obtained by EHOs from the inspected establishments for official control purposes[1].

Samples are taken for routine examination (sampling program agreed at local level between EHOs and the OFMLs of the HSE) and surveillance purposes (local surveys and national surveys[∞]). In addition, the sampling program has in-built flexibility to allow for unplanned sampling activities, e.g. to support enforcement activities or during the investigation of complaints, suspected foodborne illness and in response to rapid alerts.

Samples are taken for a wide range of foods, with ready-to-eat (RTE) foods sampled at the point-of-sale being the priority for microbiological examination.

[1] 'Official control' means any form of control that the competent authority or the Community performs for the verification of compliance with feed and food law, animal health and animal welfare rules (Regulation (EC) No 882/2004)

[∞] National surveys are agreed between the EHS, the OFML and the FSAI. Appendix 2 lists the national microbiological surveys which have been undertaken since 2001.

However, it should be noted that there are logistical problems associated with certain types of sampling, for example, 'out of hours' sampling and the sampling of hot foods. This influences both the sample type and the sample source. These issues are currently being addressed by the HSE through working groups, including the National Sampling Review Group.

At the time of sampling, EHOs complete a sample submission form which captures information about the sample, the location of sampling, the reason for sampling and other details if required. This form is submitted with the sample to the OFML. The sample submission form is specific to each OFML, i.e. there are 7 different sample submission forms. Although there is an agreed dataset of fields to be recorded and relevant national valid values, there is no national sample submission form; however, this is currently being reviewed by the National Sampling Review Group. The aim is to produce one national sample submission form.

The samples obtained by the EHS for microbiological examinations account for approximately 44% of samples obtained from all official agencies for microbiological examinations every year.

1.2.2 Food Safety Laboratory Service

The HSE operates the Food Safety Laboratory Service (FSLS). This network of laboratories comprises of three regional Public Analyst Laboratories (PALs) responsible for physical/chemical analysis of food and food related samples and seven OFMLs responsible for the microbiological examination of foodstuffs. All of these laboratories are accredited to ISO 17025, by the Irish National Accreditation Board, for a comprehensive range of analytical methods. These laboratories examine samples taken during official control activities mainly by EHOs.

The seven OFMLs of the HSE are listed below:

- Public Health Laboratory, Limerick,
- Public Health Laboratory, Sligo General Hospital, Sligo
- Public Health Laboratory, Waterford Regional Hospital, Waterford
- Public Analyst Laboratory, Sir Patrick Duns Hospital, Grand Canal Street, Dublin
- Public Health Microbiology Laboratory, St Finbarr's Hospital, Cork
- Public Health Microbiology Laboratory, Cherry Orchard Hospital, Dublin
- Public Health Microbiology Laboratory, University College Galway

These laboratories generally operate on a regional basis, receiving samples (and sample submission forms) from a number of neighbouring environmental health offices (Table A1.3).

Table A1.3 Relationship between location of sampling (HSE region/area) and location of microbiological examination (OFML)

HSE Region (location of sampling)	OFML Conducting Microbiological Examination
HSE Dublin Mid-Leinster Region	Public Health Microbiology Laboratory, Dublin Public Analysts Laboratory, Dublin
HSE Western Region	Public Health Microbiology Laboratory, Galway Public Health Microbiology Laboratory, Sligo Public Health Microbiology Laboratory, Limerick
HSE Dublin North Eastern Region	Public Health Microbiology Laboratory, Dublin Public Analysts Laboratory, Dublin
HSE Southern Region	Public Health Microbiology Laboratory, Cork, Public Health Microbiology Laboratory, Waterford

In general, each OFML determines the microbiological parameters to be examined (the only exception being national microbiological surveys where the microbiological parameters are predetermined). There is no uniform policy across OFMLs regarding the type of examinations undertaken. Some OFMLs undertake the same suite of microbiological examinations, e.g. 7 or 8 tests, on all samples. Other OFMLs are more specific and only undertake microbiological examinations which are relevant to the sample type.

Interpretation of microbiological results is another area where inconsistency exists at national level. Some OFMLs interpret the results by assessing them against the relevant microbiological standards or guidelines. Where the laboratory offers an interpretation or expresses an opinion on compliance in relation to accredited work, the laboratory report includes a statement excluding such opinions from the scope of accreditation. Other OFMLs do not interpret the results (in these cases interpretation of results would be the responsibility of the EHO).

When microbiological examinations are complete, each OFML issues a report to the relevant EHO/principal EHO. Data regarding these reports are also transmitted to the FSAI with a delay of 7 days from the issuing of the report to the EHS. Further details are provided in section 1.3.

1.2.3 Public Health Medical Service

The Health Protection Surveillance Centre (HPSC), is part of the HSE, and is the national agency with responsibility for the surveillance of communicable diseases in Ireland.

Statutory notifications of notifiable diseases in Ireland are collated by the HPSC. Medical practitioners and clinical directors of diagnostic laboratories have a legal obligation (S.I. No. 707 of 2003) to report notifiable infectious diseases to the Medical Officer of Health who then informs the HPSC. All notification data are entered into a national web-based information system known as CIDR (Computerised Infectious Disease Reporting). Laboratory, clinical and epidemiological information relevant to each case is aggregated. Standard reports based on aggregate data are generated by the HPSC on an annual, quarterly, monthly and weekly basis. There are some limitations associated with these notifications and these are highlighted below:

1) Underreporting of infectious diseases by clinicians is common; therefore, the number of notifications does not equal the number of cases, i.e. the number ill

2) Many notifiable diseases, e.g. salmonellosis, camplyobacteriosis, listeriosis, can be transmitted via a number of routes other than food; therefore, it cannot be assumed that all of these notifications are linked to the consumption of contaminated food

1.3 Collection of Food Data

1.3.1 Obligations of the FSAI and official agencies

Under Section 16 of the FSAI Act, 1998, the FSAI is obliged to:

- Collect and assess statistical data on the official control of food
- Collect, assess or otherwise analyse such data relating to the production and consumption of food

This encompasses assessment of statistical data on foodborne diseases including foodborne zoonotic diseases and contaminants. Official control of food includes the systems of inspection and control over production, manufacturing, storage, sale or use of food.

In addition, the FSAI may:

- Collect information concerning the hygiene and safety of food that will facilitate the performance of its functions

Official agencies are obliged to co-operate with the FSAI in meeting these requirements of the FSAI Act. In addition, the official agencies are required, under service contract, to progress and develop computerised information management systems for inspection and sampling as well as computerised reporting of surveillance data. Regarding the OFMLs, computerised information management systems are in place and continue to be developed and expanded. There remains considerable scope for improvement in the area of linkages between the OFMLs, EHS and the FSAI.

1.3.2 Data collection and data collection strategy

The data collected under this remit is via two mechanisms:

- Periodic summary reports from all official agencies
- Electronic extracts of individual data records

The periodic summary reports are collected annually from all agencies under section 48(8) of the FSAI Act. The format of these reports has evolved over the past 10 years to improve the collation and comparability of data collected from agencies performing similar functions. In addition to these annual reports, official agencies also submit semesterly, quarterly and monthly reports in various forms which are collated and analysed nationally.

Due to the restricted utility of collated summary reports, the FSAI data collection strategy is to replace these with datasets containing individual records regarding i) each sample and its analysis or ii) each establishment and its inspections. These individual records will be uploaded to the National Food Safety Surveillance database (NFSS2) and links between the establishments and their corresponding samples will be available. The level of detail of the data fields specified in these datasets provides much greater flexibility of analysis and reporting, allowing the FSAI to respond to unanticipated and emerging analytical needs more dynamically.

A significant area of focus for the data management team at the FSAI is to encourage the convergence of data standards in the large number of source systems nationwide. This will ultimately improve the collation and analysis of national data and position the official agencies well for future consolidation of systems where possible. In addition, the team are actively involved in international data standards development with the European Statistics Agency (Eurostat) and the European Food Safety Authority (EFSA) to improve the Europe-wide collation and analysis of data for risk assessment and management.

1.3.3 FSAI data collection from the OFML of the HSE

Before 2010, hard copy reports were generated by each OFML for every sample examined. Each report contained i) information from the sample submission form and ii) the microbiological results. Each report was issued to i) the EHS, i.e. the EHO who submitted the sample and/or the relevant PEHO, and ii) the FSAI, where the information was entered manually into a database. To ensure data received through this mechanism were comparable, validations and standardisation were undertaken at FSAI and feedback was given to OFMLs to promote the convergence of data standards nationally. Data are held in the FSAI national database, NFSS1, for the period 2002 to 2007 and in the FSAI national database, NFSS2, for the period 2008 to 2009.

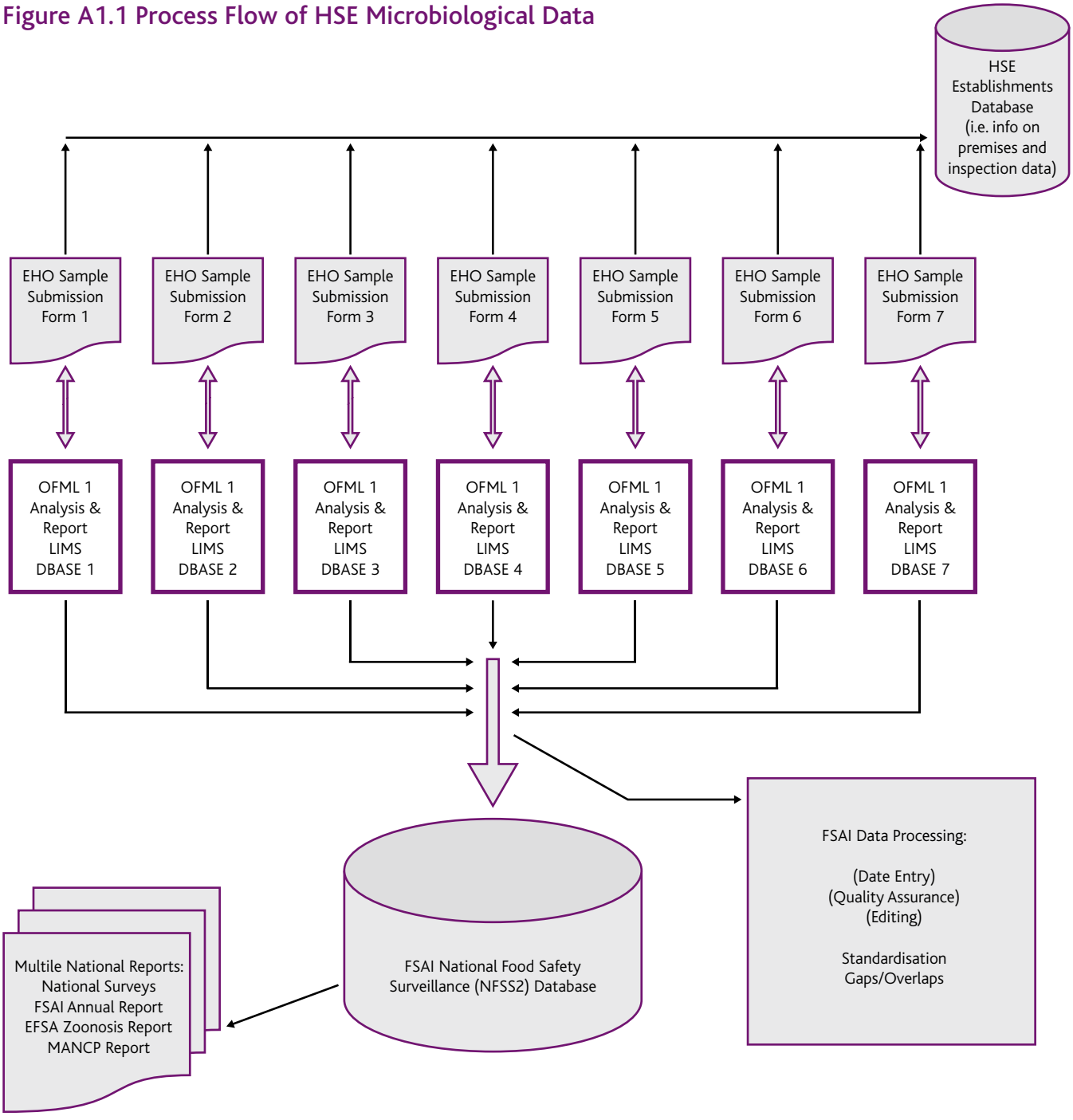
Since 2010, data are being uploaded electronically to the National Food Safety Surveillance database, NFSS2. To date, regular data transmissions have been received from a number of OFMLs and work is progressing on electronic data transmission from the remainder of OFMLs. The data flow from the point of sampling by the EHO to report generation by the FSAI is represented diagrammatically in Figure A1.1. Information relating to each sample, i.e. information from the sample submission form and the microbiological results for that sample, is entered by the OFML into their Laboratory Information Management System (LIMS). These data are collected electronically from the seven LIMS by the FSAI, transmitted via an automated system and uploaded to the National Food Safety Surveillance Database (NFSS2). The planned frequency is at least monthly to facilitate timely use of the data for risk assessment and management of the national sampling plan. The OFMLs still issue hard copy reports to EHOs but the FSAI no longer receives printed copies.

The FSAI performs a series of validation and standardisation processes to bring the data of the seven different LIMS into a national, standardised, quality assured format in NFSS2. The processing steps related to manual data entry (pre-2010) are outlined in brackets in the FSAI Data Processing box to the bottom right of the diagram.

Once the data are finalised, they are used by the FSAI for the generation of reports, e.g. the FSAI annual report, the national zoonoses report and the EFSA Zoonoses report, and on-going management of the service contracts, press and parliamentary queries, and Irish and EU reporting. Data from each national microbiological surveillance program are collated and analysed and reports are published on the FSAI website: http://www.fsai.ie/monitoring_and_enforcement/monitoring/surveillance/microbiological_surveillance.html.

This database also allows links between the microbiological results and the EHS establishments' database which records the risk categories and the inspection history of each establishment. Work is on-going in this area. The FSAI will be able to query, analyse and report these data via a web-based reporting tool.

Figure A1.1 Process Flow of HSE Microbiological Data



NOTE: Information relating to each sample, i.e. information from the sample submission form and the microbiological results for that sample, is entered by the OFML into their Laboratory Information Management System (LIMS). The FSAI collects data electronically from the seven Laboratory Information Management Systems, these data are then transmitted via an automated system and uploaded to the National Food Safety Surveillance Database (NFSS2).

APPENDIX 2. NATIONAL MICROBIOLOGICAL SURVEILLANCE PROGRAMME 2001-2010

2010

- Bacteriological and chemical safety of RTE dried seeds and RTE nuts
- Microbiological safety and quality of bottled water

2009

- Pre-packed sandwiches
- Swab samples from cooked meat slicers

2008

- Prevalence of *Salmonella* spp. in pork sausages
- Microbiological quality of whipped and scooped ice-cream
- Sampling of surface of poultry packaging and examination of handling and cleaning practices in poultry meat display cabinet

2007

- Microbiological quality of ice for cooling drinks
- Microbiological safety of unpasteurised fruit and vegetable juices (including smoothies)
- Microbiological safety and quality of bottled water

2006

- Microbiological safety and quality of raw mushrooms
- Microbiological safety of dried infant formulae and dried dietary foods for special medical purposes intended for infants below 6 months of age
- Examination of the microbiological status of food preparation surfaces

2005

- Bacteriological quality and safety of loose sliced cooked ham
- Bacteriological safety of cheese made from pasteurised milk
- Bacteriological safety of pre-packaged mixed salads

2004

- Bacteriological safety and quality of fermented meat
- Bacteriological safety of cheeses made from raw or thermised milk
- Bacteriological and toxicological safety of herbs and spices

2003

- Microbiological quality/safety of pre-packed cooked sliced ham
- Microbiological quality/safety of cooked crustaceans and molluscan shellfish
- Bacteriological safety of eggs produced under the Bord Bia Quality Assurance Scheme (EQAS)
- Microbiological quality and safety of pre-prepared rice

2002

- Ice for cooling drinks
- Pre-prepared and left over gravy
- Pre-packaged sandwiches
- Part 1: Microbiological quality of (i) pre-cut fresh fruits and vegetables, (ii) sprouted seeds and (iii) fruit and vegetable juices (unpasteurised)

  Part 2: Assessment of compliance with the HACCP requirement of Council Directive 93/43/EEC in premises producing and/or selling the products in Part 1

2001

- Cakes and pastries with perishable fillings and toppings
- Refrigerated cooked chicken pieces
- Soft ice-cream
- Smoked salmon

APPENDIX 3. EU CODES AND EU CATEGORIES

EU Code	EU Category
1	Dairy products
2	Eggs and egg products
3	Meat and meat products, game and poultry
4	Fish, shellfish and molluscs
5	Fats and oils
6	Soups, broths and sauces
7	Cereals and bakery products
8	Fruit and vegetables
9	Herbs and spices
10	Non-alcoholic beverages
11	Wine
12	Alcoholic beverages (other than wine)
13	Ices and deserts
14	Cocoa and cocoa preparations, coffee and tea
15	Confectionery
16	Nuts and nut products, snacks
17	Prepared dishes
18	Foodstuffs intended for special nutritional uses
19	Additives
20	Materials and articles intended to come into contact with foodstuffs
21	Others

APPENDIX 4. MICROBIOLOGICAL EXAMINATIONS FOR *LISTERIA* SPP./*L. MONOCYTOGENES*

The analysis of the data on *Listeria* spp. is particularly challenging because of the variation in reporting formats. This is related in part to variation in methods used by the different OFMLs and in part to the intrinsic complexity of the issue.

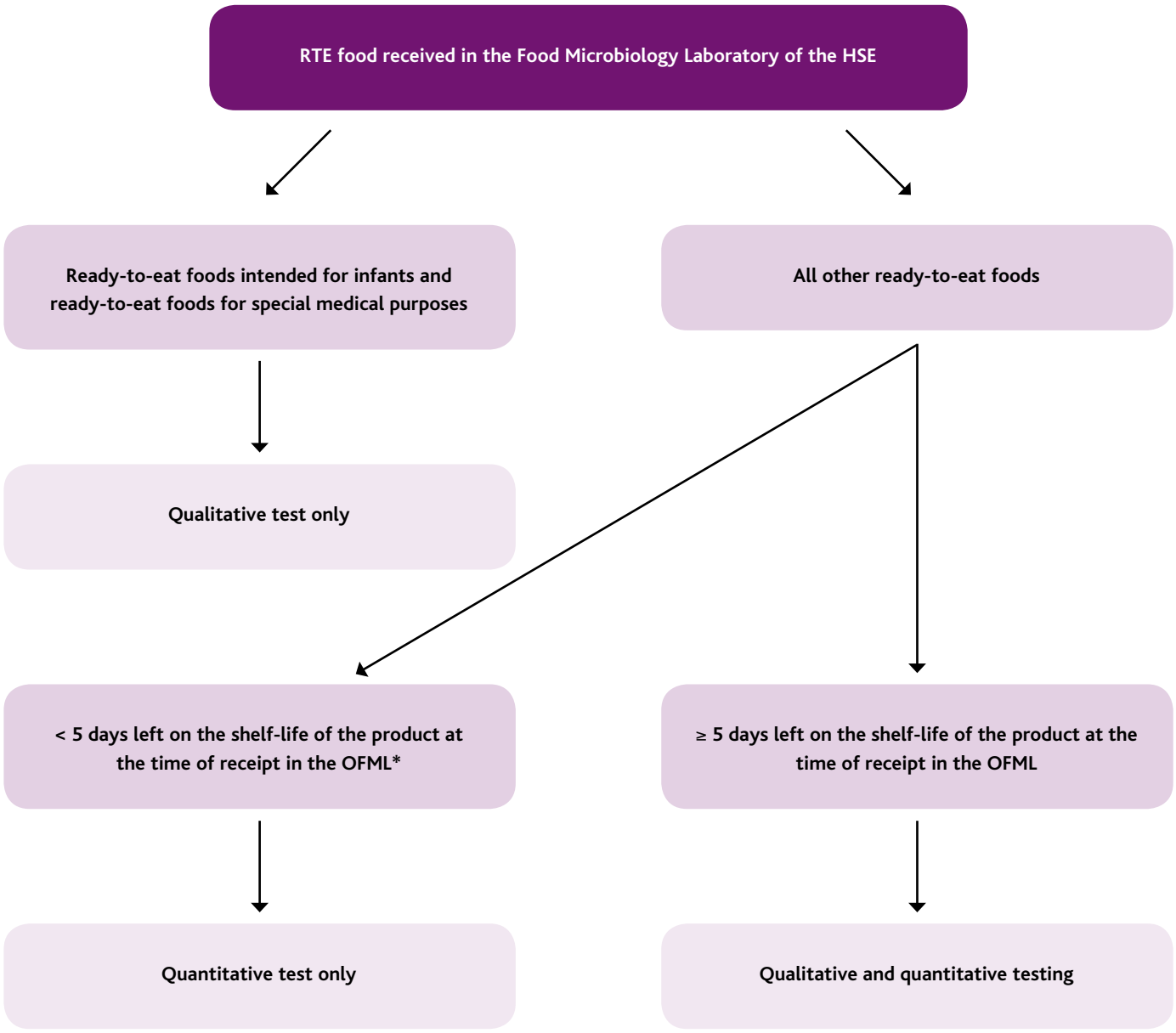
Reporting of results for the qualitative test for *L. monocytogenes* is relatively straightforward. The results are generally reported as 'detected in 25g' or 'not detected in 25g'. Occasionally, samples of less than 25g are processed and reported. These results can be collated in the FSAI national database; however, it is most practical to exclude them from analysis as they represent a relatively small proportion of reports and they are not directly comparable with the results from the standard 25g sample.

With respect to the quantitative test, the first step in the process allows one to determine if any colonies of *Listeria* spp. are detected from the examination of a 1g sample. If colonies are not detected, the format of the report issued varies, i.e. some OFMLs report the result as less than 10 cfu/g, others as less than 100 cfu/g and others somewhere between. This variation in reporting is related to variation in the laboratory method. This creates heterogeneity in the database which complicates analysis.

If colonies are detected, a number of colonies (generally 10) are selected for identification to species level. Based on this identification a report may document: i) the detection of *L. monocytogenes* (with number of cfu/g), ii) detection of *Listeria* spp. other than *L. monocytogenes* (with number of cfu/g) or iii) the detection of *L. monocytogenes* and other *Listeria* spp. (with number of cfu/g). *Listeria* spp. that are not *L. monocytogenes* are generally reported as *Listeria* spp. This lacks clarity as the term *Listeria* spp. includes *L. monocytogenes*. The term *Listeria* spp. other than *L. monocytogenes* may be more appropriate.

A uniform method for performance, interpretation and reporting of test results is essential for quantitative testing for *Listeria* spp. Where *Listeria* spp. are detected, differentiation should be made between the enumeration of *L. monocytogenes* and the enumeration of other *Listeria* spp.

APPENDIX 5. FLOW SHEET FOR DETERMINING THE APPROPRIATE TESTING FOR *L. MONOCYTOGENES*



* This includes i) long shelf life products which are nearing the end of their shelf-life and ii) short shelf-life products. In both cases <5 days will remain on the shelf-life of the products; therefore, quantitative testing alone is most appropriate.

APPENDIX 6. IMPLEMENTATION OF RECOMMENDATIONS – PROGRESS TO DATE

Ref. Number	Overall Recommendation	Current Status of the Recommendation June 2011	Summary of Status
6.1	**General recommendation** A formal national strategy on food sampling and relevant microbiological examination should be developed by the FSAI in consultation with appropriate agencies.	This is work in progress with the HSE and other official agencies.	Work in progress
6.2	**Recommendations relating to sampling**		
	Overall recommendation Sampling should be undertaken only where it is likely to inform action. When sampling is undertaken, consideration should be given to the following: sampling reason, sample type, sample source and sample numbers, i.e. single versus batch samples. Data collated by sampling officers should be relevant, accurate and complete. Furthermore, to ensure consistency at national level, the HSE should ensure that data are collected and formatted in the same way in all regions.	See sub-recommendations for details	
	Sub-recommendations		
6.2.1	More emphasis should be placed on targeted rather than random sampling. Surveillance studies, i.e. surveillance of specific foodstuffs, investigation of cross-contamination routes and environmental contamination, are examples of targeted sampling. These studies contribute to enhanced food safety by broadening our understanding of the etiology of infection and informing risk management decisions for the control of hazards.	Since 2010, there has been an increased emphasis on targeted sampling and for 2011, approximately two thirds of sampling is targeted through 2 FSAI/ HSE and 2 HSE national sampling surveys which focus on surveillance of specific foods and premises types. Routine sampling is now targeted at manufacturing premises and premises further back the supply chain.	In place

Ref. Number	Overall Recommendation	Current Status of the Recommendation June 2011	Summary of Status
6.2.2	During routine sampling, the decision to sample foodstuffs should be based on the probability of the hazard occurring, which in turn, will be determined by the robustness of the controls implemented by the food business operator, e.g. although sampling of cooked RTE foods is beneficial in certain situations, it is not always the most effective use of resources. Assessing physical parameters at critical control points (CCPs), ensuring that the cold chain is being maintained and ensuring good hygiene practices are being implemented may be more appropriate tools for verifying the safety of these foodstuffs. These tools already form an integral part of environmental health service food safety audits.	This recommendation as detailed in 6.2.2 is already being implemented by the EHS.	Work in progress
6.2.3	Where appropriate, foodstuffs (in particular pre-packaged foodstuffs), should be sampled as early as possible in the food chain. At retail level, emphasis should be placed on loose foods, i.e. foods not pre-packaged on the retail establishments, as this is the last stage these foods are handled prior to sale.	This recommendation is already implemented by the EHS. Emphasis is placed on sampling loose food. Food manufactured in Ireland will already be sampled at manufacturing level by the official agencies responsible for the supervision of the manufacturing premises.	In place
6.2.4	When sampling is conducted to assess compliance with microbiological standards, the sampling plans specified in legislation must be respected, i.e. batch samples must be taken. In the context of monitoring at the retail level, single samples may be all that is practical. Batch sampling should not be problematic when sampling is conducted earlier in the food chain.	The EHS is sampling in accordance with the sampling plans in Regulation 2073/2005 since January 2011, where batch samples are practical and feasible.	In place
6.2.5	A national sample request form should be developed through consultation between the FSAI and the HSE and implemented throughout the HSE (the National Sampling Review Group has commenced work in this area).	During 2010, a national sample request form was developed for sample submission through consultation between the FSAI, EHS, OFMLs and PALs. This was designed to reflect national data standards which are based on EFSA defined reporting recommendations. The EFSA recommendations are intended to become mandatory over time and Ireland is now well placed to comply with them. The new sample request form is being implemented for sampling from 1st May 2011.	Work in progress

Ref. Number	Overall Recommendation	Current Status of the Recommendation June 2011	Summary of Status
6.3	**Recommendations relating to microbiological examinations**		
	Overall recommendation: Microbiological examinations should be restricted to those parameters relevant for the foodstuff under examination. To ensure comparability of results at national level and to facilitate analysis of the data: all OFMLs must adopt an agreed laboratory method for each parameter, maintain their database in a uniform structure and report the laboratory results to the FSAI in a standard electronic format.	See sub-recommendations for detail on microbiological examinations and laboratory methods. Regarding electronic reporting of laboratory results to the FSAI - this is done through a standard mechanism and similar formats from all HSE laboratories. Differences between the 7 laboratory databases preclude standard electronic format which should be possible from the planned single national LIMS database.	Work in progress
6.3.1	Microbiological examinations should be restricted to those parameters relevant to the foodstuff under examination. These parameters should be specified by the FSAI in consultation with stakeholders. If an OFML is unable to deliver the specified examinations using the specified methods, it should not examine the foodstuff in question.	The OFMLs agree with the need to restrict microbiological examination to relevant tests and have commenced a process of rationalisation of microbiological testing. As a first step, the OFMLs have agreed to implement a uniform approach to the format of test results on laboratory reports and are examining examples of negative and positive results for each parameter from each laboratory with the objective of obtaining agreement on a standardised reporting format. The OFMLs do not accept the need for all laboratories to use the exact methods specified in the legislation but that results should be comparable in terms of limit of detection and reporting format and this will be achieved when a uniform approach to the format of laboratory reports is in place. See 6.3.6 and 6.3.8	Work in progress for the review of parameters foods are tested for
6.3.2	Microbiological examination for coagulase positive staphylococci in cheese should generally be conducted early in the food chain, i.e. during the manufacturing process when the staphylococcal count is expected to be the highest, rather than at retail level.	The OFMLs agree and this has been implemented where it is possible to clearly identify the food type at sample intake to the laboratory. The new sample submission form includes a heading on sample details which will facilitate implementation of this recommendation.	Work in progress
6.3.4	Where sampling of cooked RTE food is required (see recommendation 6.2.2), unless there is a specific indication to examine for other organisms, microbiological examinations should be restricted to *Enterobacteriaceae*, *E. coli* and *L. monocytogenes*/other *Listeria* spp.	This will be examined as part of the process of rationalisation of microbiological testing by the OFMLs.	Work in progress

Ref. Number	Overall Recommendation	Current Status of the Recommendation June 2011	Summary of Status
6.3.5	The differential application of the qualitative method for the detection of *L. monocytogenes* and the quantitative method for the enumeration of *Listeria* species including *L. monocytogenes* currently in operation is appropriate. **RTE foods intended for infants and RTE foods for special medical purposes:** Only qualitative examinations are undertaken. **All other RTE foods:** Qualitative and quantitative examinations are undertaken on foodstuffs sampled early in their shelf-life. Only quantitative examinations are undertaken on foodstuffs sampled later in their shelf-life. For further information, see Appendix 5.	This has been fully implemented by the OFMLs since 2008.	In place
6.3.6	To ensure comparability of results at national level, all OFMLs must utilise uniform laboratory methods for each parameter.	The OFMLs agree that results should be comparable across the laboratories and will achieve this through using validated accredited methods and consistent reporting (see 6.3.1). However, the OFMLs do not accept the need for all laboratories to use uniform methods. The OFMLs have highlighted deficiencies in some of the specified legislative methods and the resources required to bring all of the laboratories to using uniform methods as barriers to use of uniform methods. The OFMLs do not accept the benefit of having uniform methods among the laboratories, when validated accredited methods are used.	Recommend-ation not accepted by OFMLs
6.3.7	There is a particular need to prioritise the adoption of a uniform method for performance, interpretation and reporting of the quantitative method for enumeration of *Listeria* species including *L. monocytogenes* in all OFMLs.	This will be achieved through consistent reporting across all of the laboratories (see 6.3.1).	Work in progress
6.3.8	Where examinations are undertaken for the purpose of assessing compliance with microbiological standards, the laboratory methods specified in legislation must be utilised without variation.	See 6.3.6	Recommend-ation not accepted by OFMLs

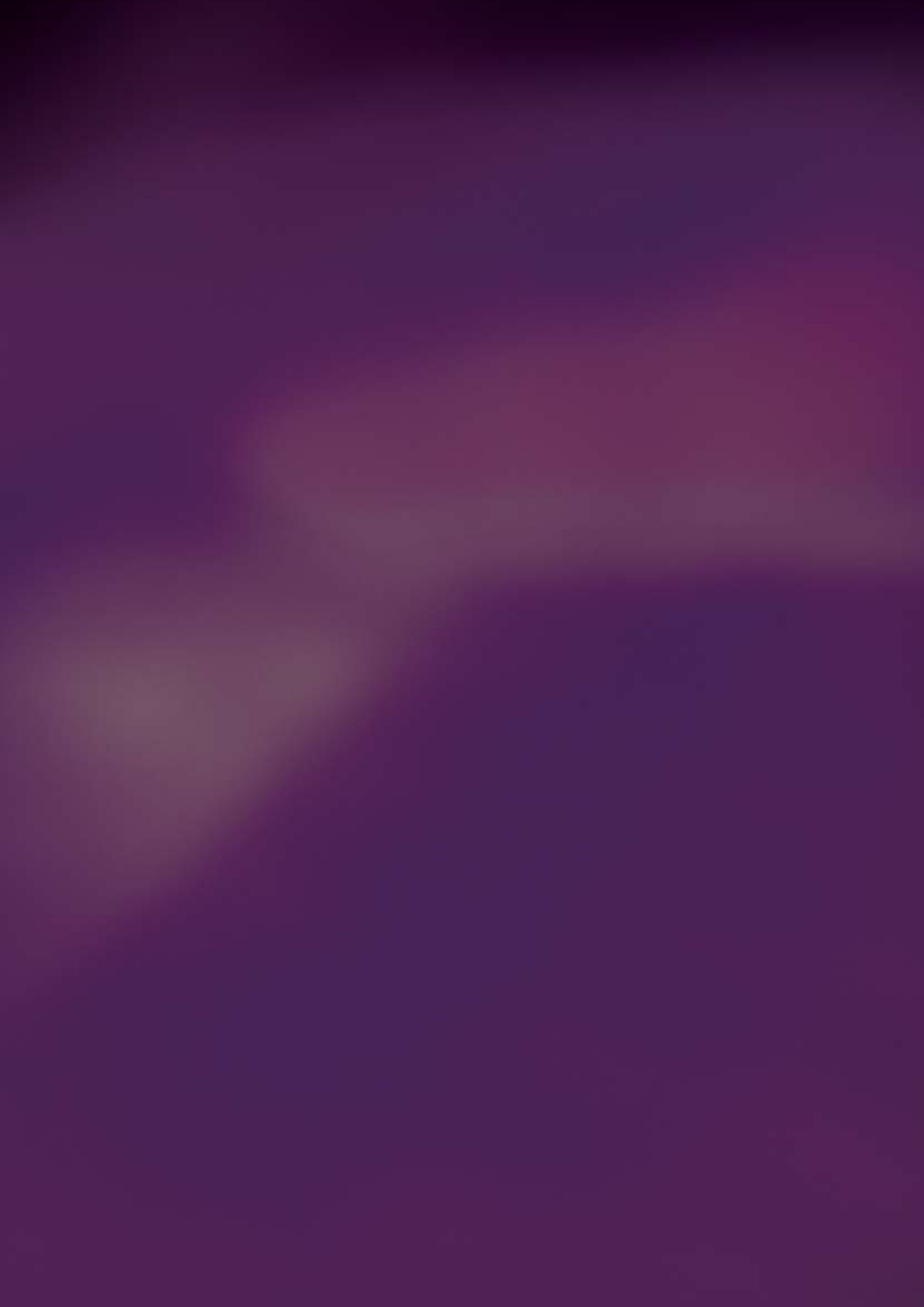
Ref. Number	Overall Recommendation	Current Status of the Recommendation June 2011	Summary of Status
6.3.9	Where methods are not specified in legislation, research and development on the application of new methods of analysis is a valuable role of OFMLs. When a new method is validated in more than one OFML as superior in one or more respects to existing methods, it may be adopted by the HSE as the new standard method in consultation with the FSAI. All OFMLs performing the relevant analysis must then adopt the new standard method for that examination.	In relation to the adoption of standard methods, the OFMLs do not agree with the recommendation (See 6.3.6).	Recommend-ation not accepted by OFMLs
6.3.10	Pathogens isolated from food or food processing environments (*L. monocytogenes*, *Salmonella* spp., coagulase positive staphylococci and *Bacillus cereus*) should be stored for a minimum of tw o years and appropriate typing should be performed wherever possible.	The OFMLs agree that significant pathogens should be stored for two years and most laboratories are already doing this. Appropriate typing is carried out on isolates in HSE laboratories, laboratories of other official agencies or external laboratories as required.	In place
6.3.11	Antimicrobial susceptibility testing should be conducted where appropriate on food isolates of zoonotic pathogens. A common approach should be adopted in all OFMLs in consultation with the FSAI.	The OFMLs agree in principle with the need for antimicrobial susceptibility testing where appropriate. Further discussion is needed on: which isolates this is appropriate for, what the role of National Reference Laboratories is, which laboratories should carry out the testing and collection of data on antimicrobial resistance and typing. This will need to be explored in conjunction with the National Reference Laboratories and other official laboratories.	Work in progress
6.3.12	The cessation of certain sampling and microbiological examinations , i.e. those which are no longer required by the FSAI, should allow a cost-neutral redirection of resources for food microbiology. These resources should address current needs, i.e. development of methods for examination of foods for viral and protozoan contaminants and enhanced reference laboratory services for typing of foodborne pathogens.	The OFMLs have commenced a process of rationalisation of test results and as part of this and the ongoing development of the laboratories the OFMLs agree that resources will be directed towards current method development and testing needs as they become available. It is recognised that there are stakeholders other than the FSAI with regard to cessation of certain microbiological examinations.	Work in progress
6.3.13	To ensure comparability of results at national level, all OFMLs must report laboratory results in the same format.	The OFMLs have agreed to implement a uniform approach to the format of test results on laboratory reports and are examining examples of negative and positive results for each parameter from each laboratory with the objective of obtaining agreement on a standardised reporting format.	Work in progress

Ref. Number	Overall Recommendation	Current Status of the Recommendation June 2011	Summary of Status
6.4	**Recommendations relating to designation of results**		
	Overall recommendation: Results should be designated against the appropriate standards or guidelines. These designations should be undertaken by the OFML and reported to the EHS and the FSAI.	**See sub -recommendations for detail.**	
6.4.1	The FSAI should consider the necessity to establish national microbiological guidelines for specific combination of foods and microorganisms, where guidelines or standards are currently not available. Where guidelines are not appropriate, examination of the foodstuff for that parameter should not be undertaken.	The FSAI will be establishing national microbiological guidelines for specific combinations of foods and microorganisms where guidelines are not currently available. This work has commenced as part of the Revision of FSAI Guidance Note No. 3. The OFMLs agree in principle that where guidelines are not appropriate, examination of the foodstuff for that parameter should not be undertaken except in the case of new/emerging pathogens or outbreak situations.	Work in progress for national micro-biological guidelines
6.4.2	OFMLs should designate all results against the appropriate standards or guidelines and report these designations to both the EHS and the FSAI.	The OFMLs agree however there are some issues to be further reviewed with FSAI and among the OFMLs before this can be implemented. Adjustments to the HSE LIMS systems to accommodate and transmit to the FSAI laboratory designations at both result and sample level are complete as part of the implementation of the national sample request form. This includes the legislation or guidance which is the basis of the designation.	Work in progress
6.4.3	The FSAI should provide more guidance on the designation of results against the national microbiological guidelines for aerobic colony counts (ACC).	Guidance will be provided by the FSAI in the revision of Guidance Note No. 3.	Work in progress

Ref. Number	Overall Recommendation	Current Status of the Recommendation June 2011	Summary of Status
6.5	**Recommendations relating to the data submitted to the FSAI**		
	Overall recommendation: The quality of data submitted to the FSAI should be continuously improved in terms of accuracy, completeness, standardisation, timeliness and accessibility.	See sub-recommendations for detail	
6.5.1	The FSAI and HSE should continue to examine ways to improve data quality in terms of accuracy, completeness, standardisation, timeliness and accessibility.	**Accuracy:** Separation of data items into discrete data fields continues to improve. **Completeness:** Issues with inclusion of all official samples analysed in the HSE laboratories continue to be addressed with the FSAI. Issues with inclusion of all required data fields are largely resolved with some remaining items of lesser priority still in progress. **Standardisation:** There has been a considerable improvement in the standardisation of data and this should continue to improve with the implementation of the nationally defined valid values for all National Sample Submission form fields. **Timeliness:** There has been a considerable improvement in the timeliness of submission of data with data now transmitted from each of the 7 OFMLs to the FSAI every week. Back data for Jan 2010 to date has been transmitted successfully in the agreed format for 5 of the 7. The remaining 2 are in progress. **Accessibility:** The FSAI continues to work on the collation of HSE lab data into an accessible, national database.	Work in progress

Ref. Number	Overall Recommendation	Current Status of the Recommendation June 2011	Summary of Status
6.5.2	Implementation of EFSA Guidance on Standard Sample Description (SSD) elements and food classification should be undertaken in Ireland on a national basis. The FSAI should provide comprehensive training to relevant staff of the HSE on this issue.	The EFSA SSD is designed for chemical data. It is largely applicable to microbiological data as well with some exceptions (mainly in the valid values lists and mandatory status of fields). The FSAI evaluated the guidance and used that to inform the development of the NSSF in consultation with the HSE. Implementation of the NSSF in the HSE LIMS will bring our information systems largely into compliance with the EFSA SSD which is currently a voluntary standard. Training of one HSE Sampling Officer per team was carried out by the FSAI in December 2010 in advance of the introduction of the National Food Sample submission form (NSSF). Support documentation for the NSSF was circulated by the FSAI in early 2011 to the HSE EHS and labs. Further clarifications were circulated by the EHS nationally. The FSAI has offered further training to the HSE. Training needs will be reviewed when implementation of the form is reviewed in September, 2011. Further changes to the EFSA SSD will be discussed in Autumn 2011 which will coincide with the planned review of the use of the NSSF by the HSE. There will be ongoing discussions and adjustments.	Work in progress
6.5.3	The possibility of a single national OFML data system should be considered. Otherwise, the LIMS in each OFML should be configured in the same way to ensure consistency in data capture.	There are plans to commence implementing a single national database in 2011. However, the lack of a HSE Assistant National Director over the laboratories and anticipated scarcity of funding is hindering developments in this area. The ongoing dialogue between the FSAI and the HSE laboratories on data quality has resulted in consistency improvements. Continued efforts in this should position HSE laboratories well for future consolidation of LIMS.	Work in progress

NOTES



Food Safety
AUTHORITY OF IRELAND

Food Safety Authority of Ireland
Abbey Court, Lower Abbey Street,
Dublin 1

Udarás Sábháilteachta Bia na hEireann
Cúirt na Mainistreach, Sráid na Mainistrach íocht.,
Baile Átha Cliath 1

Advice Line: 1890 336677
Telephone: +353 1 817 1300
Facsimile: +353 1 817 1301
E-mail: info@fsai.ie
www.fsai.ie