Fapas® – Food Microbiology Proficiency Test Report 288

August 2023

PARTICIPANT LABORATORY NUMBER

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SUMMARY

1. The test materials for Fapas® – Food Microbiology proficiency test Distribution 288 were dispatched in August 2023. The test materials available in this Distribution were for the following proficiency tests:

M288e24	Enumeration of APC / Enterobacteriaceae / Coliforms / *Escherichia coli* (equivalent to 10 g Salad),
M288e26	Enumeration of APC / Enterobacteriaceae / Coagulase Positive Staphylococci / *Escherichia coli* (sponge swab),
M288d02	Detection of *Listeria monocytogenes* / *Listeria* spp. (sponge swab, x2),
M288d07	Detection of *Salmonella* spp. (sponge swab, x2),
M288d11	Detection of *Escherichia coli* O157:H7 (sponge swab, x2),
M287d17X	Detection of *Campylobacter* spp. (equivalent to 25 g Milk Powder, x2).

2. An assigned value (x_a) was determined for each proficiency test in enumeration and in conjunction with the standard deviation for proficiency (σ_p) was used to calculate a z-score for each result. However, those for coagulase positive staphylococci on sponge swab (cfu/swab and cfu/ml) and *Escherichia coli* on sponge swab (cfu/ml) are given for *information only.*

3. Results and assessments for the proficiency tests in enumeration are summarised as follows:

proficiency test in enumeration	assigned value, x_a	number of scores, $\|z\| \leq 2$	total number of scores	% $\|z\| \leq 2$
Aerobic Plate Count in Salad	4.32 $\log_{10}$ cfu/g	43	48	90
Enterobacteriaceae in Salad	3.81 $\log_{10}$ cfu/g	28	38	74
Coliforms in Salad	3.80 $\log_{10}$ cfu/g	26	38	68
Escherichia coli in Salad	3.36 $\log_{10}$ cfu/g	37	49	76
Aerobic Plate Count on Sponge Swab	5.02 $\log_{10}$ cfu/swab	23	51	45
Aerobic Plate Count on Sponge Swab	3.98 $\log_{10}$ cfu/ml	35	45	78
Enterobacteriaceae on Sponge Swab	4.79 $\log_{10}$ cfu/swab	23	51	45
Enterobacteriaceae on Sponge Swab	3.75 $\log_{10}$ cfu/ml	26	42	62

italics indicate for information only

proficiency test in enumeration (continued)	assigned value, x_a	number of scores, |z| ≤2	total number of scores	% |z| ≤2
Coagulase Positive Staphylococci on Sponge Swab	*4.12* $\log_{10}$ cfu/swab	*21*	50	*42*
Coagulase Positive Staphylococci on Sponge Swab	*3.08* $\log_{10}$ cfu/ml	*24*	39	*62*
Escherichia coli on Sponge Swab	3.22 $\log_{10}$ cfu/swab	24	51	47
Escherichia coli on Sponge Swab	*2.41* $\log_{10}$ cfu/ml	*28*	43	*65*

italics indicate for information only

4. Qualitative results for the proficiency tests in detection are assessed based on the presence or absence of the target organism in **both** of the test materials issued.

5. Results for the proficiency tests in detection are summarised as follows:

proficiency test in detection	intended result	number of satisfactory assessments	total number of assessments	satisfactory / agreement with intended result, %	false negatives, %	false positives, %
Listeria monocytogenes on Sponge Swab	test material A detected test material B not detected	36	40	90	8	5
Listeria spp. on Sponge Swab	test material A detected test material B not detected	36	40	90	10	3
Salmonella spp. on Sponge Swab	test material A not detected test material B detected	58	58	100	0	0
Escherichia coli O157:H7 on Sponge Swab	test material A detected test material B not detected	7	8	88	13	13
Campylobacter spp. in Milk Powder	test material A detected test material B not detected	9	12	75	17	25

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1. INTRODUCTION

1.1. Proficiency Testing

Proficiency testing aims to provide an independent assessment of the competence of participating laboratories. Together with the use of validated methods, proficiency testing is an essential element of laboratory quality assurance.

Further details of the Fapas® – Food Microbiology proficiency tests are available in our protocols [7, 8].

2. TEST MATERIAL

2.1. Preparation

Preparation of the samples for this proficiency test was sub-contracted to a laboratory meeting the quality requirements of the scheme's accreditation [3].

Fapas® – Food Microbiology test materials include background flora to simulate real conditions. Information for these organisms is given in APPENDIX I.

The test materials were stored at +4°C ±2°C until dispatch.

2.2. Homogeneity and Validation

For each proficiency test in enumeration, randomly selected test materials were analysed in duplicate by a laboratory meeting the quality requirements of the scheme's accreditation [3].

These data showed sufficient homogeneity and were not included in the subsequent calculation of the assigned values.

For each proficiency test in detection, ten percent of the test materials were analysed to verify the presence/absence of the target organism. In addition, two of each of the test materials positive for the target organism were also analysed by the most probable number technique to verify the level of organisms present. The data obtained is given in APPENDIX II.

2.3. Dispatch

The start date was 07 August 2023. Test materials were sent to 198 participants.

2.4. Storage and Preparation Instructions

Instructions regarding sample storage and preparation were made available on the Fapas® website [9].

Participants are reminded that it is crucial to the outcome of the proficiency tests that the instructions for the preparation of the test materials are followed exactly.

3. RESULTS

The instructions for reporting results were as follows:

- Start the analysis between 07 August and 16 August 2023.
- The results for enumeration tests must be reported as cfu/g, cfu/ml and cfu/swab.
- The results for detection tests must be reported as detected/not detected in 25 g and/or per swab (in English).

Results were submitted by 187 participants (94%) before the closing date for this test, 28 August 2023.

Each participant was given a laboratory number, assigned in order of receipt of results. The reported results are given in Tables 1 to 10.

The methods used by each participant are summarised in APPENDIX III.

4. STATISTICAL EVALUATION OF RESULTS

The results submitted by participants were statistically analysed in order to provide an assigned value for each proficiency test in enumeration. The assigned values were then used in combination with the standard deviation for proficiency, σ_p, to calculate a z-score [10] for each result. The procedure is detailed in the relevant protocols [7, 8].

Further background on the procedure followed can be found in the IUPAC International Harmonised Protocol for the Proficiency Testing of Analytical Chemistry Laboratories [11].

4.1. Calculation of the Assigned Value, x_a

The assigned value, x_a, for each test in enumeration was derived from the consensus of the results submitted by participants.

The procedure used to derive this consensus involved:

i) exclusion, if present, of any non numerical results i.e. qualitative or semi-quantitative results or results reported as zero,

ii) a $\log_{10}$ transformation of submitted results to obtain a normal distribution,

iii) exclusion, if present, of any results that were approximately 10, 100 or 1000 × greater or smaller than the majority of submitted results (as these were considered to be reporting errors).

For aerobic plate count in salad and *Escherichia coli* in salad examinations, this procedure was straightforward and the robust mean was chosen as the assigned value.

For enterobacteriaceae in salad, coliforms in salad and *Escherichia coli* on sponge swab (cfu/ml) examinations, the mode was chosen because the distributions were skewed. However, the assigned value and z-scores for *Escherichia coli* on sponge swab are provided for information only due to high uncertainty associated with the assigned value. Kernel density plot will be inserted respectively on Figures 2, 3 and 12.

For aerobic plate count on sponge swab (cfu/ml), enterobacteriaceae on sponge swab (cfu/swab) and enterobacteriaceae on sponge swab (cfu/ml), examinations, the major mode was chosen because the distributions were bimodal. Kernel density plot will be inserted respectively on Figures 6-8.

For aerobic plate count on sponge swab (cfu/swab), coagulase positive staphylococci on sponge swab (cfu/swab), coagulase positive staphylococci on sponge swab (cfu/ml) and *Escherichia coli* on sponge swab (cfu/swab) examinations, the major mode was chosen because the distributions were multimodal. However, the assigned value and z-scores for coagulase positive staphylococci on sponge swab (cfu/swab) and coagulase positive staphylococci on sponge swab (cfu/ml) are provided for information only due to high uncertainty associated with the assigned value. Kernel density plot will be inserted respectively on Figures 5, 9, 10 and 11.

The log difference between the two highest modes in each distribution for the proficiency test M288e26 "Enumeration of APC / Enterobacteriaceae / Coagulase Positive Staphylococci / *Escherichia coli* (sponge swab)" as well as the outcome of our internal investigation suggest that dilution or calculation error is the most probable reason for abnormal data distribution.

The assigned values for all proficiency tests in enumeration, together with their uncertainties are shown in Table 11.

4.2. Standard Deviation for Proficiency, σ_p

The standard deviation for proficiency, σp, was set at a value that reflects fitness-for-purpose for the analyses in question. The appropriate members of the Fapas® Advisory Committee have agreed this value corresponds to 0.25 $\log_{10}$ cfu/g. However, the standard deviation of the proficiency test "*Escherichia coli* on sponge swab" has been increased to 0.28 $\log_{10}$ cfu/ml and 0.28 l $\log_{10}$ cfu/swab. This was necessary to encompass the greater variance of the samples for this proficiency test.

The values for σ_p used to calculate z-scores from the reported results of this test are given in Table 11.

4.3. Individual z-Scores and Assessments

Participants' z-scores were calculated as:

$$z = \frac{(x - x_a)}{\sigma_p}$$

where x = the participant's reported result expressed as $\log_{10}$,
x_a = the assigned value, see Table 11,
and σ_p = the standard deviation for proficiency, see Table 11.

Participants' z-scores for all proficiency tests in enumeration are given in Tables 1 to 6 and shown as histograms in Figures 1 to 12. Those for coagulase positive staphylococci on sponge swab (cfu/swab and cfu/ml) and Escherichia coli on sponge swab (cfu/ml) are given *for information only*. It is possible for the z-scores published in this report to differ slightly from the z-score that can be calculated using the formula given above. These differences arise from the necessary rounding of the actual assigned values and standard deviations for proficiency prior to their publication in Table 11.

The number and percentage of z-scores in the range $-2 \leq z \leq 2$ for all proficiency tests in enumeration are given in Table 12.

Participants' results for the proficiency tests in detection are assessed based on the presence or absence of the target organism in **both** of the test materials issued. Assessments are given in Tables 7 to 10.

Intended results for these detection tests are shown in Table 13.

The number and percentage of satisfactory assessments are given in Table 14.

5. INTERPRETATION OF SCORES AND ASSESSMENTS

In normal circumstances, over time, about 95% of z-scores will lie in the range $-2 \leq z \leq 2$. Occasional scores in the range $2 < |z| < 3$ are to be expected, at a rate of 1 in 20. Whether or not such scores are of importance can only be decided by considering them in the context of the other scores obtained by that laboratory.

Scores where $|z| > 3$ are to be expected at a rate of about 1 in 300. Given this rarity, such z-scores very strongly indicate that the result is not fit-for-purpose and almost certainly requires investigation.

The consideration of a set or sequence of z-scores over time provides more useful information than a single z-score. Examples of suitable methods of comparison are provided in the IUPAC International Harmonised Protocol for the Proficiency Testing of Analytical Chemistry Laboratories [11].

Results submitted by participants for detections tests are assessed as either satisfactory (S) or not satisfactory (NS) as compared to the intended result.

6. REFERENCES

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2 GlobalSign AATL Document Signing FAQs, https://support.globalsign.com/aatl-document/aatl-document-signing-faqs accessed 24/03/2022.

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4 The ILAC Mutual Recognition Arrangement, https://ilac.org/ilac-mra-and-signatories/ accessed 24/03/2022.

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6 Lloyd's Register, Learn about ISO 9001 Quality Management Systems (QMS), https://www.lr.org/en-gb/iso-9001/ accessed 24/03/2022.

7 Fapas®, 2023, Protocol for Proficiency Testing Schemes, Version 8, January 2023, Part 1 – Common Principles.

8 Fapas®, 2023, Protocol for Proficiency Testing Schemes, Version 6, January 2023, Part 3 – Fapas® Food Microbiology scheme (FEPAS).

9 Fapas® – Food Microbiology safety data sheet and preparation instructions, https://fapas.com/technical-documentation, accessed 24/03/2022.

10 AMC Tech Brief No. 74, z-Scores and other scores in chemical proficiency testing – their meanings, and some common misconceptions, *Anal. Methods*, 2016, **8**, 5553.

11 Thompson, M., Ellison, S.L.R. and Wood, R., 2006, The International Harmonised Protocol for the Proficiency Testing of Analytical Chemistry Laboratories, *Pure Appl. Chem.*, **78**, No. 1, 145–196.

Table 1: Results and z-Scores for Aerobic Plate Count / Enumeration of Enterobacteriaceae in Salad

laboratory number	proficiency test							
	Aerobic Plate Count assigned value: 4.32 $\log_{10}$ cfu/g				Enterobacteriaceae assigned value: 3.81 $\log_{10}$ cfu/g			
	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score
002	24000	4.4	no	0.2	4800	3.7	no	-0.5
003	2.7E+4	4.4	no	0.4	7.0E+3	3.8	no	0.1
010	20000	4.3	no	-0.1	10000	4.0	no	0.8
011	23600	4.4	no	0.2	8050	3.9	no	0.4
012	11000	4.0	No	-1.1	4800	3.7	No	-0.5
017	56000	4.7	yes	1.7	7100	3.9	yes	0.2
018	2.5E+4	4.4	no	0.3	8.4E+3	3.9	no	0.5
024	1.7E+4	4.2	no	-0.4	4.7E+3	3.7	no	-0.5
025	27000	4.4	no	0.4				
027	2.0E+4	4.3	No	-0.1				
028	3.1E+4	4.5	no	0.7				
032	1.3E+8	8.1	no	**15.2**	8.2E+3	3.9	no	0.4
034	1.6E+4	4.2	no	-0.5	4.6E+3	3.7	no	-0.6
037	1.8E+4	4.3	no	-0.3	4.3E+2	2.6	no	**-4.7**
038	3.5E+4	4.5	NO	0.9				
040	6.4E+5	5.8	NO	**5.9**	3.4E+4	4.5	NO	**2.9**
041	1.6E+4	4.2	no	-0.5	5.4E+2	2.7	no	**-4.3**
042	3.0E4	4.5	NO	0.6	8.1E3	3.9	NO	0.4

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 1 (continued): Results and z-Scores for Aerobic Plate Count / Enumeration of Enterobacteriaceae in Salad

laboratory number	proficiency test							
	Aerobic Plate Count assigned value: 4.32 $\log_{10}$ cfu/g				Enterobacteriaceae assigned value: 3.81 $\log_{10}$ cfu/g			
	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score
043	23.6E+3	4.4	no	0.2	8.1E+3	3.9	no	0.4
048	1.4E+4	4.1	no	-0.7	1.3E+4	4.1	no	1.2
055	16200	4.2	No	-0.4	6200	3.8	No	-0.1
057	18700	4.3	No	-0.2	12700	4.1	No	1.2
058	25000 *	4.4	No	0.3	370 *	2.6	No	**-5.0**
059	2.4E+4	4.4	no	0.2	1.1E+3	3.0	no	**-3.1**
064	2.6E+4	4.4	NO	0.4	2.8E+3	3.4	NO	-1.4
065	2.3E+4	4.4	NO	0.2	8.5E+3	3.9	NO	0.5
068	1.2E+4	4.1	no	-1.0	1600	3.2	no	**-2.4**
072	2.4E+4	4.4	no	0.2	3.6E+3	3.6	no	-1.0
074	25000	4.4	no	0.3	8200	3.9	no	0.4
079	12050	4.1	NO	-1.0	645	2.8	NO	**-4.0**
092								
094	1.2E+6	6.1	no	**7.0**	2.0E+3	3.3	no	-2.0
095	2.0E+4	4.3		-0.1	3.4E+3	3.5	no	-1.1
099								
100	3.0E+4	4.5	10/08/2023	0.6				
101								

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 1 (continued): Results and z-Scores for Aerobic Plate Count / Enumeration of Enterobacteriaceae in Salad

laboratory number	proficiency test							
	Aerobic Plate Count assigned value: 4.32 $\log_{10}$ cfu/g				Enterobacteriaceae assigned value: 3.81 $\log_{10}$ cfu/g			
	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score
112	1.43E+4	4.2	no	-0.7	1.03E+3	3.0	no	**-3.2**
116								
122	18000	4.3	No	-0.3	5400	3.7	No	-0.3
128	24000	4.4	no	0.2				
130	2.6E+4	4.4	no	0.4	3.8E+3	3.6	no	-0.9
131								
133	3.7E+3	3.6	Yes	**-3.0**				
135	2.1E+4	4.3	no	0.0	6.8E+3	3.8	no	0.1
136	25000	4.4	no	0.3				
140	18000	4.3	no	-0.3				
157	15000	4.2	No	-0.6	1500	3.2	No	**-2.5**
159	3490 *	3.5	no	**-3.1**	190 *	2.3	no	**-6.1**
161	1.7E+4	4.2	No	-0.4	6.2E+3	3.8	No	-0.1
166	22636	4.4	YES	0.1	6091	3.8	YES	-0.1
170	2.44E+04	4.4	No	0.3				
171	60000 *	4.8	no	1.8	5000 *	3.7	no	-0.4
187	26000	4.4	no	0.4	12000	4.1	no	1.1

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 2: Results and z-Scores for Enumeration of Coliforms / *Escherichia coli* in Salad

laboratory number	proficiency test							
	Coliforms assigned value: 3.80 $\log_{10}$ cfu/g				*Escherichia coli* assigned value: 3.36 $\log_{10}$ cfu/g			
	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score
002	9900	4.0	no	0.8	1900	3.3	no	-0.3
003	7.0E+3	3.8	no	0.2	2.5E+3	3.4	no	0.2
010					3700	3.6	no	0.8
011	6900	3.8	no	0.2	3050	3.5	no	0.5
012	2500	3.4	No	-1.6	1400	3.1	No	-0.9
017	9000	4.0	yes	0.6	4000	3.6	yes	1.0
018	8.4E+3	3.9	no	0.5	2.9E+3	3.5	no	0.4
024	3.9E+3	3.6	no	-0.8	1.5E+3	3.2	no	-0.7
025	1300	3.1	no	**-2.7**	550	2.7	no	**-2.5**
027	8.0E+3	3.9	No	0.4				
028					4.0E+3	3.6	yes	1.0
032	9.3E+3	4.0	no	0.7	4.3E+3	3.6	no	1.1
034	3.6E+3	3.6	no	-1.0	3.0E+3	3.5	no	0.5
037	3.1E+2	2.5	no	**-5.2**	1.3E+2	2.1	NO	**-5.0**
038								
040	2.6E+4	4.4	NO	**2.5**	2.31E+4	4.4	NO	**4.0**
041	4.8E+2	2.7	no	**-4.5**	1.0E+2	2.0	no	**-5.4**
042	6.5E3	3.8	NO	0.1	2.6E3	3.4	NO	0.2

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 2 (continued): Results and z-Scores for Enumeration of Coliforms / *Escherichia coli* in Salad

laboratory number	proficiency test							
	Coliforms assigned value: 3.80 log_{10} cfu/g				*Escherichia coli* assigned value: 3.36 log_{10} cfu/g			
	result	log_{10}	Most probable number technique used (yes/no)	z-score	result	log_{10}	Most probable number technique used (yes/no)	z-score
043	9.6E+3	4.0	no	0.7	34.2E+2	3.5	no	0.7
048					4.0E+3	3.6	no	1.0
055	6000	3.8	No	-0.1	2000	3.3	No	-0.2
057					2820	3.5	No	0.4
058	310 *	2.5	No	**-5.2**	110 *	2.0	No	**-5.3**
059	1.0E+3	3.0	no	**-3.2**	3.5E+2	2.5	no	**-3.3**
064					2.1E+3	3.3	NO	-0.1
065	8.2E+3	3.9	NO	0.5	2.8E+3	3.4	NO	0.4
068	1800	3.3	no	**-2.2**	1500	3.2	no	-0.7
072	4.6E+3	3.7	yes	-0.5	1.8E+3	3.3	no	-0.4
074	7800	3.9	no	0.4	2900	3.5	no	0.4
079	630	2.8	NO	**-4.0**	<10		NO	
092					3800	3.6	NO	0.9
094	2.1E+3	3.3	no	-1.9	6.9E+2	2.8	no	**-2.1**
095	4.6E+3	3.7	yes	-0.5	1.1E+3	3.0	no	-1.3
099					2.3E+3	3.4	no	0.0
100					3.7E+3	3.6	10/08/2023	0.8
101					2500	3.4	yes	0.2

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 2 (continued): Results and z-Scores for Enumeration of Coliforms / *Escherichia coli* in Salad

laboratory number	proficiency test							
	Coliforms assigned value: 3.80 $\log_{10}$ cfu/g				*Escherichia coli* assigned value: 3.36 $\log_{10}$ cfu/g			
	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score
112	1.91E+3	3.3	no	**-2.1**	1.4E+3	3.1	no	-0.9
116					11000 *	4.0	YES	**2.7**
122	5200	3.7	No	-0.3	2200	3.3	No	-0.1
128					2500	3.4	no	0.2
130	4.3E+3	3.6	yes	-0.7	1.8E+3	3.3	no	-0.4
131					1.2E+2 *	2.1	no	**-5.1**
133								
135	7.5E+3	3.9	yes	0.3	7.5E+3	3.9	yes	**2.1**
136	5200	3.7	no	-0.3	1800	3.3	no	-0.4
140	1700	3.2	no	**-2.3**	580	2.8	no	**-2.4**
157	1200	3.1	No	**-2.9**	1000	3.0	No	-1.4
159	310 *	2.5	no	**-5.2**	170 *	2.2	no	**-4.5**
161	5.3E+3	3.7	No	-0.3	2.0E+3	3.3	No	-0.2
166	5818	3.8	YES	-0.1	1555	3.2	YES	-0.7
170	3.17E+03	3.5	No	-1.2	1.96E+03	3.3	No	-0.3
171					2200 *	3.3	no	-0.1
187	11000	4.0	no	1.0	6200	3.8	no	1.7

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 3: Results and z-Scores for Aerobic Plate Count on Sponge Swab

laboratory number	proficiency test					
	Aerobic Plate Count assigned value: 5.02 $\log_{10}$ cfu/swab			Aerobic Plate Count assigned value: 3.98 $\log_{10}$ cfu/ml		
	result	$\log_{10}$	z-score	result	$\log_{10}$	z-score
006	1.4E+6	6.1	**4.5**	1.4E+5	5.1	**4.7**
009						
014	9.7E+3	4.0	**-4.1**			
021						
026	3.6E+4	4.6	-1.9	3.6E+3	3.6	-1.7
030	4.8E+5	5.7	**2.6**	4.8E+4	4.7	**2.8**
047	12000	4.1	**-3.8**			
051	1.2E+5	5.1	0.2	1.2E+4	4.1	0.4
052	160000	5.2	0.7	16000	4.2	0.9
053	1.4E+6	6.1	**4.5**			
056				1.49E+4	4.2	0.8
059	4.0E+4	4.6	-1.7	4.0E+3	3.6	-1.5
060	11000 *	4.0	**-3.9**			
063	14000	4.1	**-3.5**			
066	7.9E+4	4.9	-0.5	7.9E+3	3.9	-0.3
073	5.1E+4	4.7	-1.3	5.1E+3	3.7	-1.1
075	4.4E+3	3.6	**-5.5**			
076	103636	5.0	0.0	10363	4.0	0.1

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 3 (continued): Results and z-Scores for Aerobic Plate Count on Sponge Swab

laboratory number	proficiency test					
	Aerobic Plate Count assigned value: 5.02 $\log_{10}$ cfu/swab			Aerobic Plate Count assigned value: 3.98 $\log_{10}$ cfu/ml		
	result	$\log_{10}$	z-score	result	$\log_{10}$	z-score
078						
080	12000	4.1	**-3.8**			
082	91000	5.0	-0.3	9100	4.0	-0.1
083	114545	5.1	0.1	12600	4.1	0.5
087	1.3E+5	5.1	0.4	1.3E+4	4.1	0.5
088	3.8E+3	3.6	**-5.8**			
089	4.0E+3	3.6	**-5.7**			
090	9.5E+4 *	5.0	-0.2	9.5E+3 *	4.0	0.0
091	135000	5.1	0.4	13500	4.1	0.6
092						
093				3980	3.6	-1.5
096	8.8E+4	4.9	-0.3	8.8E+3	3.9	-0.1
102	1.7E+4	4.2	**-3.2**			
103	4000 *	3.6	**-5.7**			
104	1.5E+5	5.2	0.6	1.5E+4	4.2	0.8
105	19000	4.3	**-3.0**	1900	3.3	**-2.8**
106	5700	3.8	**-5.1**			
108	1800 *	3.3	**-7.1**	1800 *	3.3	**-2.9**

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 3 (continued): Results and z-Scores for Aerobic Plate Count on Sponge Swab

laboratory number	proficiency test					
	Aerobic Plate Count assigned value: 5.02 $\log_{10}$ cfu/swab			Aerobic Plate Count assigned value: 3.98 $\log_{10}$ cfu/ml		
	result	$\log_{10}$	z-score	result	$\log_{10}$	z-score
112				8.75E+3	3.9	-0.1
113	1400000	6.1	**4.5**	14000	4.1	0.7
115				14600 *	4.2	0.7
124	1.6E+5	5.2	0.7	1.6E+4	4.2	0.9
127	5.6E+3	3.7	**-5.1**	5.6E+3	3.7	-0.9
129				1.2E+4 *	4.1	0.4
132	4.6E+4	4.7	-1.4	4.6E+3	3.7	-1.3
134	169100	5.2	0.8	16910	4.2	1.0
137	1.2E+5	5.1	0.2	1.2E+4	4.1	0.4
141				2.5E+4 #	4.4	1.7
146						
147						
148	9.9E+03	4.0	**-4.1**	9.9E+03	4.0	0.1
151	5.75E+3	3.8	**-5.1**			
154				700 *	2.8	**-4.5**
155						
156	1.04E+4	4.0	**-4.0**	1.04E+3	3.0	**-3.8**
160				5000	3.7	-1.1

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 3 (continued): Results and z-Scores for Aerobic Plate Count on Sponge Swab

laboratory number	proficiency test					
	Aerobic Plate Count assigned value: 5.02 $\log_{10}$ cfu/swab			Aerobic Plate Count assigned value: 3.98 $\log_{10}$ cfu/ml		
	result	$\log_{10}$	z-score	result	$\log_{10}$	z-score
162						
165	1.35E+5 *	5.1	0.4	1.35E+3 *	3.1	**-3.4**
167	5100	3.7	**-5.3**			
172				9500	4.0	0.0
173	7.0E+4 *	4.8	-0.7	7.0E+3 *	3.8	-0.5
174	7.2E+4 *	4.9	-0.7	7.2E+3 *	3.9	-0.5
175	6800	3.8	**-4.8**	680	2.8	**-4.6**
177	1.0E+5 *	5.0	-0.1	1.0E+3 *	3.0	**-3.9**
178				6400 *	3.8	-0.7
180				6200	3.8	-0.7
181	5.8E+5	5.8	**3.0**	5.8E+3	3.8	-0.9
182						
183	6.1E+5	5.8	**3.0**	6.1E+3	3.8	-0.8
184	80000 *	4.9	-0.5	800 *	2.9	**-4.3**
185	11000 *	4.0	**-3.9**			
186	6270	3.8	**-4.9**			
187	16000	4.2	**-3.3**			

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 4: Results and z-Scores for Enumeration of Enterobacteriaceae on Sponge Swab

laboratory number	proficiency test							
	Enterobacteriaceae assigned value: 4.79 log_{10} cfu/swab				Enterobacteriaceae assigned value: 3.75 log_{10} cfu/ml			
	result	log_{10}	Most probable number technique used (yes/no)	z-score	result	log_{10}	Most probable number technique used (yes/no)	z-score
006								
009	4600	3.7	TS EN ISO 21528-2	**-4.5**				
014	2.5E+3	3.4	No	**-5.6**				
021	1.8E+3	3.3	NO	**-6.1**	1.8E+3	3.3	NO	-2.0
026	6.4E+3	3.8	no	**-3.9**	6.4E+2	2.8	no	**-3.8**
030	1.6E+5	5.2	No	1.7	1.6E+4	4.2	No	1.8
047	7000	3.8	no	**-3.8**				
051	6.3E+4	4.8	No	0.0	6.3E+3	3.8	No	0.2
052	60000	4.8	No	0.0	6000	3.8	No	0.1
053	3.0E+5	5.5	NO	**2.8**				
056					7.50E+3	3.9	no	0.5
059	6.2E+3	3.8	no	**-4.0**	6.2E+2	2.8	no	**-3.8**
060	5600 *	3.7	no	**-4.2**				
063	7300	3.9	no	**-3.7**				
066	9.5E+4	5.0	no	0.8	9.5E+3	4.0	no	0.9
073								
075	2.7E+3	3.4	No	**-5.4**				
076	50909	4.7	no	-0.3	5090	3.7	no	-0.2

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 4 (continued): Results and z-Scores for Enumeration of Enterobacteriaceae on Sponge Swab

laboratory number	proficiency test							
	Enterobacteriaceae assigned value: 4.79 $\log_{10}$ cfu/swab				Enterobacteriaceae assigned value: 3.75 $\log_{10}$ cfu/ml			
	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score
078								
080	5600	3.7	yes	**-4.2**				
082	39000	4.6	NO	-0.8	3900	3.6	NO	-0.6
083	51818	4.7	NO	-0.3	5700	3.8	NO	0.0
087	8.6E+4	4.9	No	0.6	8.6E+3	3.9	No	0.7
088	5.8E+2	2.8	NO	**-8.1**				
089	6.2E+2	2.8	NO	**-8.0**				
090	4.7E+4 *	4.7	no	-0.5	4.7E+3 *	3.7	no	-0.3
091								
092								
093								
096	4.6E+4	4.7	NO	-0.5	4.6E+3	3.7	NO	-0.4
102	1.1E+4	4.0	No	**-3.0**				
103	640 *	2.8	no	**-7.9**				
104	9.1E+4	5.0	No	0.7	9.1E+3	4.0	No	0.8
105	11000	4.0	no	**-3.0**	1100	3.0	no	**-2.8**
106	11000	4.0	No	**-3.0**				
108	610 *	2.8	NO	**-8.0**	600 *	2.8	NO	**-3.9**

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 4 (continued): Results and z-Scores for Enumeration of Enterobacteriaceae on Sponge Swab

laboratory number	proficiency test							
	Enterobacteriaceae assigned value: 4.79 $\log_{10}$ cfu/swab				Enterobacteriaceae assigned value: 3.75 $\log_{10}$ cfu/ml			
	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score
112					1.22E+3	3.1	no	**-2.7**
113	400000	5.6	no	**3.3**	4000	3.6	no	-0.6
115					8800 *	3.9	no	0.8
124	6.9E+4	4.8	No	0.2	6.9E+3	3.8	No	0.3
127	1.8E+3	3.3	no	**-6.1**	1.8E+3	3.3	no	-2.0
129					2.1E+3 *	3.3	No	-1.7
132	4.2E+4	4.6	no	-0.7	4.2E+3	3.6	no	-0.5
134	93900	5.0	no	0.7	9390	4.0	no	0.9
137	8.0E+4	4.9	No	0.5	8.0E+3	3.9	No	0.6
141								
146	2.0E+4	4.3	no	-2.0	2.0E+2	2.3	no	**-5.8**
147	2.0 E+3		No		2.0E+2	2.3	No	**-5.8**
148	3.8E+03	3.6	N	**-4.8**	3.8E+03	3.6	N	-0.7
151	1.4E+3	3.1	NO	**-6.6**				
154								
155								
156	4.3E+3	3.6	NO	**-4.6**	4.3E+2	2.6	NO	**-4.5**
160					1100	3.0	NO	**-2.8**

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 4 (continued): Results and z-Scores for Enumeration of Enterobacteriaceae on Sponge Swab

laboratory number	proficiency test							
	Enterobacteriaceae assigned value: 4.79 $\log_{10}$ cfu/swab				Enterobacteriaceae assigned value: 3.75 $\log_{10}$ cfu/ml			
	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score	result	$\log_{10}$	Most probable number technique used (yes/no)	z-score
162								
165	8.5E+4 *	4.9	no	0.6	8.5E+2 *	2.9	no	**-3.3**
167	445	2.6	NO	**-8.6**				
172					2800	3.4	?No	-1.2
173	2.2E+4 *	4.3	NO	-1.8	2.2E+3 *	3.3	NO	-1.6
174	5.8E+4 *	4.8	não	-0.1	5.8E+3 *	3.8	não	0.0
175	940	3.0	no	**-7.3**	94	2.0	no	**-7.1**
177	6.5E+4 *	4.8	NO	0.1	6.5E+2 *	2.8	NO	**-3.8**
178					4100 *	3.6	no	-0.6
180					890	2.9	NO	**-3.2**
181	6.0E+4	4.8	no	0.0	6.0E+2	2.8	no	**-3.9**
182								
183	6.0E+4	4.8	No	0.0	6.0E+2	2.8	No	**-3.9**
184	49000 *	4.7	no	-0.4	490 *	2.7	no	**-4.2**
185	1100 *	3.0	no	**-7.0**				
186	5820	3.8	yes	**-4.1**				
187	6800	3.8	no	**-3.8**				

z-scores outside |z| >2 are shown in **bold,** see Section 5
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 5: Results and z-Scores for Enumeration of Coagulase Positive Staphylococci on Sponge Swab

laboratory number	proficiency test					
	Coagulase Positive Staphylococci assigned value: *4.12* $\log_{10}$ cfu/swab			Coagulase Positive Staphylococci assigned value: *3.08* $\log_{10}$ cfu/ml		
	result	$\log_{10}$	z-score	result	$\log_{10}$	z-score
006	2.1E+5	5.3	*4.8*	2.1E+4	4.3	*5.0*
009						
014	6.4E+2	2.8	*-5.3*			
021	2.8E+3	3.4	*-2.7*	2.8E+3	3.4	*1.5*
026						
030	3.3E+4	4.5	*1.6*	3.3E+3	3.5	*1.8*
047	1300	3.1	*-4.0*			
051	4.2E+3	3.6	*-2.0*	4.2E+2	2.6	*-1.8*
052						
053	2.3E+5	5.4	*5.0*			
056						
059	1.0E+3	3.0	*-4.5*	1.0E+2	2.0	*-4.3*
060	900 *	3.0	*-4.7*			
063						
066						
073	1.8E+3	3.3	*-3.5*	1.8E+2	2.3	*-3.3*
075	4.0E+2	2.6	*-6.1*			
076	11363	4.1	*-0.3*	1136	3.1	*-0.1*

z-scores outside |z| >2 are shown in **bold,** see Section 5
italics indicate for information only
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 5 (continued): Results and z-Scores for Enumeration of Coagulase Positive Staphylococci on Sponge Swab

laboratory number	proficiency test					
	Coagulase Positive Staphylococci assigned value: *4.12* $\log_{10}$ cfu/swab			Coagulase Positive Staphylococci assigned value: *3.08* $\log_{10}$ cfu/ml		
	result	$\log_{10}$	z-score	result	$\log_{10}$	z-score
078	3.5E+5	5.5	*5.7*	3.5E+3	3.5	*1.9*
080	1300	3.1	*-4.0*			
082	13000	4.1	*0.0*	1300	3.1	*0.1*
083	7000	3.8	*-1.1*	770	2.9	*-0.8*
087	2.1E+4	4.3	*0.8*	2.1E+3	3.3	*1.0*
088	4.0E+2	2.6	*-6.1*			
089	5.2E+2	2.7	*-5.6*			
090	1.2E+4 *	4.1	*-0.2*	1.2E+3 *	3.1	*0.0*
091	8100	3.9	*-0.9*	810	2.9	*-0.7*
092	24000	4.4	*1.0*	24000	4.4	*5.2*
093				100	2.0	*-4.3*
096	4.9E+3	3.7	*-1.7*	4.9E+2	2.7	*-1.6*
102	3.0E+3	3.5	*-2.6*			
103	660 *	2.8	*-5.2*			
104	9.0E+3	4.0	*-0.7*	9.0E+2	3.0	*-0.5*
105	1800	3.3	*-3.5*	180	2.3	*-3.3*
106						
108	320 *	2.5	*-6.5*	310 *	2.5	*-2.3*

z-scores outside |z| >2 are shown in **bold,** see Section 5
italics indicate for information only
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 5 (continued): Results and z-Scores for Enumeration of Coagulase Positive Staphylococci on Sponge Swab

laboratory number	proficiency test					
	Coagulase Positive Staphylococci assigned value: *4.12* $\log_{10}$ cfu/swab			Coagulase Positive Staphylococci assigned value: *3.08* $\log_{10}$ cfu/ml		
	result	$\log_{10}$	z-score	result	$\log_{10}$	z-score
112				1.25E+2	2.1	*-3.9*
113	220000	5.3	*4.9*	2200	3.3	*1.1*
115						
124	7.6E+3	3.9	*-1.0*	7.6E+2	2.9	*-0.8*
127						
129						
132	4.0E+3	3.6	*-2.1*	4.0E+2	2.6	*-1.9*
134	18590	4.3	*0.6*	1859	3.3	*0.8*
137	1.4E+4	4.1	*0.1*	1.4E+3	3.1	*0.3*
141						
146	6.7E+3	3.8	*-1.2*	6.7E+1	1.8	*-5.0*
147						
148	5.5E+02	2.7	*-5.5*	5.5E+02	2.7	*-1.3*
151	66	1.8	*-9.2*			
154						
155	16000	4.2	*0.3*			
156	7.95E+2	2.9	*-4.9*	7.95E+1	1.9	*-4.7*
160				<10		

z-scores outside |z| >2 are shown in **bold,** see Section 5
italics indicate for information only
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 5 (continued): Results and z-Scores for Enumeration of Coagulase Positive Staphylococci on Sponge Swab

laboratory number	proficiency test					
	Coagulase Positive Staphylococci assigned value: *4.12* $\log_{10}$ cfu/swab			Coagulase Positive Staphylococci assigned value: *3.08* $\log_{10}$ cfu/ml		
	result	$\log_{10}$	z-score	result	$\log_{10}$	z-score
162	2.0E+3	3.3	*-3.3*			
165	2.6E+4 *	4.4	*1.2*	2.6E+2 *	2.4	*-2.7*
167	380	2.6	*-6.2*			
172				1100	3.0	*-0.1*
173	1.8E+4 *	4.3	*0.5*	1.8E+3 *	3.3	*0.7*
174	1.9E+4 *	4.3	*0.6*	1.9E+3 *	3.3	*0.8*
175	100	2.0	*-8.5*	10	1.0	*-8.3*
177	1.4E+4 *	4.1	*0.1*	1.4E+2 *	2.1	*-3.7*
178				180 *	2.3	*-3.3*
180				1100	3.0	*-0.1*
181	1.2E+5	5.1	*3.8*	1.2E+3	3.1	*0.0*
182						
183	1.1E+5	5.0	*3.7*	1.1E+3	3.0	*-0.1*
184	11500 *	4.1	*-0.2*	115 *	2.1	*-4.1*
185						
186	1260	3.1	*-4.1*			
187	2300	3.4	*-3.0*			

z-scores outside |z| >2 are shown in **bold,** see Section 5
italics indicate for information only
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 6: Results and z-Scores for Enumeration of *Escherichia coli* on Sponge Swab

laboratory number	proficiency test							
	Escherichia coli assigned value: 3.22 log_{10} cfu/swab				*Escherichia coli* assigned value*: 2.41* log_{10} cfu/ml			
	result	log_{10}	Most probable number technique used (yes/no)	z-score	result	log_{10}	Most probable number technique used (yes/no)	z-score
006								
009								
014	5.2E+2	2.7	No	-1.8				
021	1.1E+3	3.0	YES	-0.7	1.1E+3	3.0	YES	*2.3*
026	3.0E+2	2.5	no	**-2.7**	3.0E+1	1.5	no	*-3.3*
030	4.8E+4	4.7	No	**5.2**	4.8E+3	3.7	No	*4.6*
047	1100	3.0	no	-0.7				
051	4.4E+3	3.6	No	1.5	4.4E+2	2.6	No	*0.8*
052	6000	3.8	No	2.0	600	2.8	No	*1.3*
053	5.9E+4	4.8	NO	**5.5**				
056								
059	8.0E+2	2.9	no	-1.1	8.0E+1	1.9	no	*-1.8*
060	60 *	1.8	no	**-5.2**				
063								
066								
073	1.5E+3	3.2	no	-0.2	1.5E+2	2.2	no	*-0.8*
075	0		No					
076	9000	4.0	no	**2.6**	900	3.0	no	*2.0*

z-scores outside |z| >2 are shown in **bold,** see Section 5
italics indicate for information only
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 6 (continued): Results and z-Scores for Enumeration of *Escherichia coli* on Sponge Swab

laboratory number	proficiency test							
	Escherichia coli assigned value: 3.22 log_{10} cfu/swab				*Escherichia coli* assigned value: *2.41* log_{10} cfu/ml			
	result	log_{10}	Most probable number technique used (yes/no)	z-score	result	log_{10}	Most probable number technique used (yes/no)	z-score
078								
080	2100	3.3	yes	0.4				
082	11000	4.0	NO	**2.9**	1100	3.0	NO	*2.3*
083	8727	3.9	NO	**2.6**	960	3.0	NO	*2.1*
087	1.0E+4	4.0	No	**2.8**	1.0E+3	3.0	No	*2.1*
088	6.0E+1	1.8	NO	**-5.2**				
089	240	2.4	YES	**-3.0**				
090	1.2E+4 *	4.1	no	**3.1**	1.2E+3 *	3.1	no	*2.4*
091	4000	3.6	No	1.4	400	2.6	No	*0.7*
092								
093					200	2.3	No	*-0.4*
096	4.4E+3	3.6	NO	1.5	4.4E+2	2.6	NO	*0.8*
102	1.8E+3	3.3	No	0.1				
103	150 *	2.2	no	**-3.7**				
104	4.0E+3	3.6	No	1.4	4.0E+2	2.6	No	*0.7*
105	2700	3.4	no	0.7	270	2.4	no	*0.1*
106	40	1.6	No	**-5.8**				
108	300 *	2.5	NO	**-2.7**	300 *	2.5	NO	*0.3*

z-scores outside |z| >2 are shown in **bold,** see Section 5
italics indicate for information only
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 6 (continued): Results and z-Scores for Enumeration of *Escherichia coli* on Sponge Swab

laboratory number	proficiency test							
	Escherichia coli assigned value: 3.22 log_{10} cfu/swab				*Escherichia coli* assigned value: *2.41* log_{10} cfu/ml			
	result	log_{10}	Most probable number technique used (yes/no)	z-score	result	log_{10}	Most probable number technique used (yes/no)	z-score
112					3.48E+2	2.5	no	*0.5*
113	110000	5.0	yes	**6.5**	1100	3.0	yes	*2.3*
115					2600 *	3.4	no	*3.6*
124	2.0E+3	3.3	No	0.3	2.0E+2	2.3	No	*-0.4*
127	1.6E+2	2.2	no	**-3.6**	1.6E+2	2.2	no	*-0.7*
129								
132	1.5E+3	3.2	no	-0.2	1.5E+2	2.2	no	*-0.8*
134	7700	3.9	no	**2.4**	770	2.9	no	*1.7*
137	2.1E+4	4.3	No	**3.9**	2.1E+3	3.3	No	*3.3*
141					93 #	2.0	Yes	*-1.6*
146	1.1E+4	4.0	no	**2.9**	1.1E+2	2.0	no	*-1.3*
147	1.75E+3	3.2	No	0.1	1.75E+2	2.2	No	*-0.6*
148	1.3E+03	3.1	N	-0.4	1.3E+03	3.1	N	*2.5*
151	1.356E+3	3.1	NO	-0.3				
154								
155	4300	3.6	no	1.5				
156	1.61E+3	3.2	YES	-0.1	1.61E+2	2.2	YES	*-0.7*
160					300	2.5	NO	*0.3*

z-scores outside |z| >2 are shown in **bold,** see Section 5
italics indicate for information only
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 6 (continued): Results and z-Scores for Enumeration of *Escherichia coli* on Sponge Swab

laboratory number	proficiency test							
	Escherichia coli assigned value: 3.22 log_{10} cfu/swab				*Escherichia coli* assigned value: *2.41* log_{10} cfu/ml			
	result	log_{10}	Most probable number technique used (yes/no)	z-score	result	log_{10}	Most probable number technique used (yes/no)	z-score
162								
165	2.2E+4 *	4.3	no	**4.0**	2.2E+2 *	2.3	no	*-0.2*
167								
172					590	2.8	No	*1.3*
173	2.0E+3 *	3.3	NO	0.3	2.0E+2 *	2.3	NO	*-0.4*
174	1.4E+4 *	4.1	não	**3.3**	1.3E+3 *	3.1	não	*2.5*
175	140	2.1	no	**-3.8**	14	1.1	no	*-4.5*
177	5.7E+4 *	4.8	NO	**5.5**	5.7E+2 *	2.8	NO	*1.2*
178					1000 *	3.0	no	*2.1*
180					230	2.4	SI	*-0.2*
181	2.4E+4	4.4	si	**4.1**	2.4E+2	2.4	si	*-0.1*
182	182	2.3	No	**-3.4**				
183	2.4E+4	4.4	No	**4.1**	2.4E+2	2.4	Yes	*-0.1*
184	4500 *	3.7	no	1.5	45 *	1.7	no	*-2.7*
185	1200 *	3.1	no	-0.5				
186	300	2.5	yes	**-2.7**				
187	1300	3.1	yes	-0.4				

z-scores outside |z| >2 are shown in **bold,** see Section 5
italics indicate for information only
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 7: Results and Assessments for *Listeria monocytogenes* / *Listeria* spp. on Sponge Swab

laboratory number	proficiency test					
	Listeria monocytogenes TMA consensus: 93% detected (positive) (intended result: detected) TMB consensus: 95% not detected (negative) (intended result: not detected)			*Listeria* spp. TMA consensus: 90% detected (positive) (intended result: detected) TMB consensus: 98% not detected (negative) (intended result: not detected)		
	result, TMA	result, TMB	assessment	result, TMA	result, TMB	assessment
004	detected	not detected	S	not detected	not detected	**NS**
005	detected	not detected	S	detected	not detected	S
013	detected	not detected	S	detected	not detected	S
019	detected	not detected	S			
022				detected	not detected	S
023	detected	not detected	S	detected	not detected	S
033	detected	not detected	S			
035	detected	not detected	S	detected	not detected	S
036	detected	not detected	S			

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 7 (continued): Results and Assessments for *Listeria monocytogenes* / *Listeria* spp. on Sponge Swab

laboratory number	proficiency test					
	Listeria monocytogenes TMA consensus: 93% detected (positive) (intended result: detected) TMB consensus: 95% not detected (negative) (intended result: not detected)			*Listeria* spp. TMA consensus: 90% detected (positive) (intended result: detected) TMB consensus: 98% not detected (negative) (intended result: not detected)		
	result, TMA	result, TMB	assessment	result, TMA	result, TMB	assessment
042	detected	not detected	S	detected	not detected	S
045				detected	not detected	S
046	not detected	not detected	**NS**	not detected	not detected	**NS**
047	detected	not detected	S	detected	not detected	S
049	detected	not detected	S	detected	not detected	S
050	detected	not detected	S	detected	not detected	S
051	detected	not detected	S	detected	not detected	S
062	detected *	not detected *	S	detected *	not detected *	S
071	detected	not detected	S	detected	not detected	S

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 7 (continued): Results and Assessments for *Listeria monocytogenes* / *Listeria* spp. on Sponge Swab

laboratory number	proficiency test					
	Listeria monocytogenes TMA consensus: 93% detected (positive) (intended result: detected) TMB consensus: 95% not detected (negative) (intended result: not detected)			*Listeria* spp. TMA consensus: 90% detected (positive) (intended result: detected) TMB consensus: 98% not detected (negative) (intended result: not detected)		
	result, TMA	result, TMB	assessment	result, TMA	result, TMB	assessment
077				detected *	not detected *	S
081	detected	not detected	S	detected	not detected	S
084				detected	not detected	S
086	detected	not detected	S	detected	not detected	S
090	not detected *	detected *	**NS**	not detected *	detected *	**NS**
096	detected	not detected	S			
102	detected	not detected	S			
104	detected *	not detected *	S	detected *	not detected *	S
108	not detected *	not detected *	**NS**	not detected *	not detected *	**NS**

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 7 (continued): Results and Assessments for *Listeria monocytogenes* / *Listeria* spp. on Sponge Swab

laboratory number	proficiency test					
	Listeria monocytogenes TMA consensus: 93% detected (positive) (intended result: detected) TMB consensus: 95% not detected (negative) (intended result: not detected)			*Listeria* spp. TMA consensus: 90% detected (positive) (intended result: detected) TMB consensus: 98% not detected (negative) (intended result: not detected)		
	result, TMA	result, TMB	assessment	result, TMA	result, TMB	assessment
110	detected *	detected *	**NS**			
111	detected *	not detected *	S	detected *	not detected *	S
114	detected	not detected	S	detected	not detected	S
117	detected	not detected	S	detected	not detected	S
120	detected	not detected	S	detected	not detected	S
121	detected	not detected	S	detected	not detected	S
123	detected	not detected	S	detected	not detected	S
124	detected	not detected	S	detected	not detected	S
125	detected	not detected	S	detected	not detected	S

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 7 (continued): Results and Assessments for *Listeria monocytogenes* / *Listeria* spp. on Sponge Swab

laboratory number	proficiency test					
	Listeria monocytogenes TMA consensus: 93% detected (positive) (intended result: detected) TMB consensus: 95% not detected (negative) (intended result: not detected)			*Listeria* spp. TMA consensus: 90% detected (positive) (intended result: detected) TMB consensus: 98% not detected (negative) (intended result: not detected)		
	result, TMA	result, TMB	assessment	result, TMA	result, TMB	assessment
126	detected	not detected	S	detected	not detected	S
138	detected *	not detected *	S	detected *	not detected *	S
143	detected	not detected	S	detected	not detected	S
145				detected	not detected	S
150	detected	not detected	S	detected	not detected	S
164	detected *	not detected *	S	detected *	not detected *	S
176				detected *	not detected *	S
179	detected *	not detected *	S	detected *	not detected *	S
184	detected *	not detected *	S	detected *	not detected *	S
185	detected *	not detected *	S	detected *	not detected *	S

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 8: Results and Assessments for *Salmonella* spp. on Sponge Swab

laboratory number	proficiency test		
	Salmonella spp. TMA consensus: 100% not detected (negative) (intended result: not detected) TMB consensus: 100% detected (positive) (intended result: detected)		
	result, TMA	result, TMB	assessment
001	not detected	detected	S
005	not detected	detected	S
008	not detected	detected	S
013	not detected	detected	S
014	not detected	detected	S
016	not detected	detected	S
019	not detected	detected	S
031	not detected	detected	S
033	not detected	detected	S
036	not detected	detected	S
039	not detected	detected	S
044	not detected	detected	S
046	not detected	detected	S
047	not detected	detected	S
048	not detected	detected	S
049	not detected	detected	S
051	not detected	detected	S
052	not detected	detected	S
059	not detected	detected	S

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 8 (continued): Results and Assessments for *Salmonella* spp. on Sponge Swab

laboratory number	proficiency test		
	Salmonella spp. TMA consensus: 100% not detected (negative) (intended result: not detected) TMB consensus: 100% detected (positive) (intended result: detected)		
	result, TMA	result, TMB	assessment
062	not detected *	detected *	S
067	not detected *	detected *	S
069	not detected	detected	S
070	not detected	detected	S
071	not detected	detected	S
081	not detected	detected	S
090	not detected	detected	S
096	not detected	detected	S
097	not detected	detected	S
102	not detected	detected	S
104	not detected *	detected *	S
108	not detected *	detected *	S
110	not detected *	detected *	S
111	not detected *	detected *	S
112	not detected	detected	S
114	not detected	detected	S
119	not detected	detected	S
120	not detected	detected	S
121	not detected	detected	S

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 8 (continued): Results and Assessments for *Salmonella* spp. on Sponge Swab

laboratory number	proficiency test		
	Salmonella spp. TMA consensus: 100% not detected (negative) (intended result: not detected) TMB consensus: 100% detected (positive) (intended result: detected)		
	result, TMA	result, TMB	assessment
124	not detected	detected	S
125	not detected	detected	S
126	not detected	detected	S
127	not detected	detected	S
132	not detected	detected	S
139	not detected *	detected *	S
142	not detected *	detected *	S
144	not detected *	detected *	S
149	not detected *	detected *	S
150	not detected	detected	S
152	not detected	detected	S
153	not detected	detected	S
158	not detected *	detected *	S
164	not detected *	detected *	S
168	not detected	detected	S
169	not detected *	detected *	S
178	not detected	detected	S
182	not detected	detected	S
184	not detected *	detected *	S
185	not detected *	detected *	S

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 9: Results and Assessments for *Escherichia coli* O157:H7 on Sponge Swab

laboratory number	proficiency test		
	Escherichia coli O157:H7 TMA consensus: 88% detected (positive) (intended result: detected) TMB consensus: 88% not detected (negative) (intended result: not detected)		
	result, TMA	result, TMB	assessment
015	detected	not detected	S
020	detected	not detected	S
079	detected	not detected	S
081	detected	not detected	S
086	detected	not detected	S
149	detected *	not detected *	S
153	not detected	detected	**NS**
185	detected *	not detected *	S

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 10: Results and Assessments for *Campylobacter* spp. in Milk Powder

laboratory number	proficiency test		
	Campylobacter spp. TMA consensus: 83% detected (positive) (intended result: detected) TMB consensus: 75% not detected (negative) (intended result: not detected)		
	result, TMA	result, TMB	assessment
003	detected	not detected	S
007	not detected	detected	**NS**
029	detected	not detected	S
054	detected	not detected	S
061	detected	not detected	S
085	detected	not detected	S
092	detected	not detected	S
098	detected	not detected	S
107	detected	detected	**NS**
109	detected	not detected	S
118	detected *	not detected *	S
163	not detected	detected	**NS**

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame
# samples received outside of the required time frame

Table 11: Assigned Values and Standard Deviations for Proficiency

proficiency test in enumeration	data points, *n*	assigned value, x_a	uncertainty, *u*	standard deviation for proficiency, σ_p	
Aerobic Plate Count in Salad	45	4.32 $\log_{10}$ cfu/g	0.02	ffp	0.250
Enterobacteriaceae in Salad	35	3.81 $\log_{10}$ cfu/g	0.05	ffp	0.250
Coliforms in Salad	34	3.80 $\log_{10}$ cfu/g	0.05	ffp	0.250
Escherichia coli in Salad	43	3.36 $\log_{10}$ cfu/g	0.04	ffp	0.250
Aerobic Plate Count on Sponge Swab	51	5.02 $\log_{10}$ cfu/swab	0.04	ffp	0.250
Aerobic Plate Count on Sponge Swab	45	3.98 $\log_{10}$ cfu/ml	0.04	ffp	0.250
Enterobacteriaceae on Sponge Swab	51	4.79 $\log_{10}$ cfu/swab	0.04	ffp	0.250
Enterobacteriaceae on Sponge Swab	42	3.75 $\log_{10}$ cfu/ml	0.05	ffp	0.250
Coagulase Positive Staphylococci on Sponge Swab	50	*4.12* $\log_{10}$ cfu/swab	*0.14*	ffp	*0.250*
Coagulase Positive Staphylococci on Sponge Swab	39	*3.08* $\log_{10}$ cfu/ml	*0.12*	ffp	*0.250*
Escherichia coli on Sponge Swab	51	3.22 $\log_{10}$ cfu/swab	0.04	ffp	0.280
Escherichia coli on Sponge Swab	43	*2.41* $\log_{10}$ cfu/ml	*0.12*	ffp	*0.280*

ffp = fitness-for-purpose criteria
italics indicate for information only

Table 12: Number and Percentage of z-Scores where |z| ≤2

proficiency test in enumeration	number of scores where |z| ≤2	total number of scores	% |z| ≤2
Aerobic Plate Count in Salad	43	48	90
Enterobacteriaceae in Salad	28	38	74
Coliforms in Salad	26	38	68
Escherichia coli in Salad	37	49	76
Aerobic Plate Count on Sponge Swab	23	51	45
Aerobic Plate Count on Sponge Swab	35	45	78
Enterobacteriaceae on Sponge Swab	23	51	45
Enterobacteriaceae on Sponge Swab	26	42	62
Coagulase Positive Staphylococci on Sponge Swab	*21*	50	*42*
Coagulase Positive Staphylococci on Sponge Swab	*24*	39	*62*
Escherichia coli on Sponge Swab	24	51	47
Escherichia coli on Sponge Swab	*28*	43	*65*

italics indicate for information only

Table 13: Intended Results for Proficiency Tests in Detection

proficiency test in detection	test material A	test material B
Listeria monocytogenes on Sponge Swab	detected	not detected
Listeria spp. on Sponge Swab	detected	not detected
Salmonella spp. on Sponge Swab	not detected	detected
Escherichia coli O157:H7 on Sponge Swab	detected	not detected
Campylobacter spp. in Milk Powder	detected	not detected

Table 14: Number and Percentage of Satisfactory Assessments and False Results for Proficiency Tests in Detection

proficiency test in detection	intended result	number of satisfactory assessments	total number of assessments	satisfactory / agreement with intended result, %	false negatives, %	false positives, %
Listeria monocytogenes on Sponge Swab	test material A detected test material B not detected	36	40	90	8	5
Listeria spp. on Sponge Swab	test material A detected test material B not detected	36	40	90	10	3
Salmonella spp. on Sponge Swab	test material A not detected test material B detected	58	58	100	0	0
Escherichia coli O157:H7 on Sponge Swab	test material A detected test material B not detected	7	8	88	13	13
Campylobacter spp. in Milk Powder	test material A detected test material B not detected	9	12	75	17	25

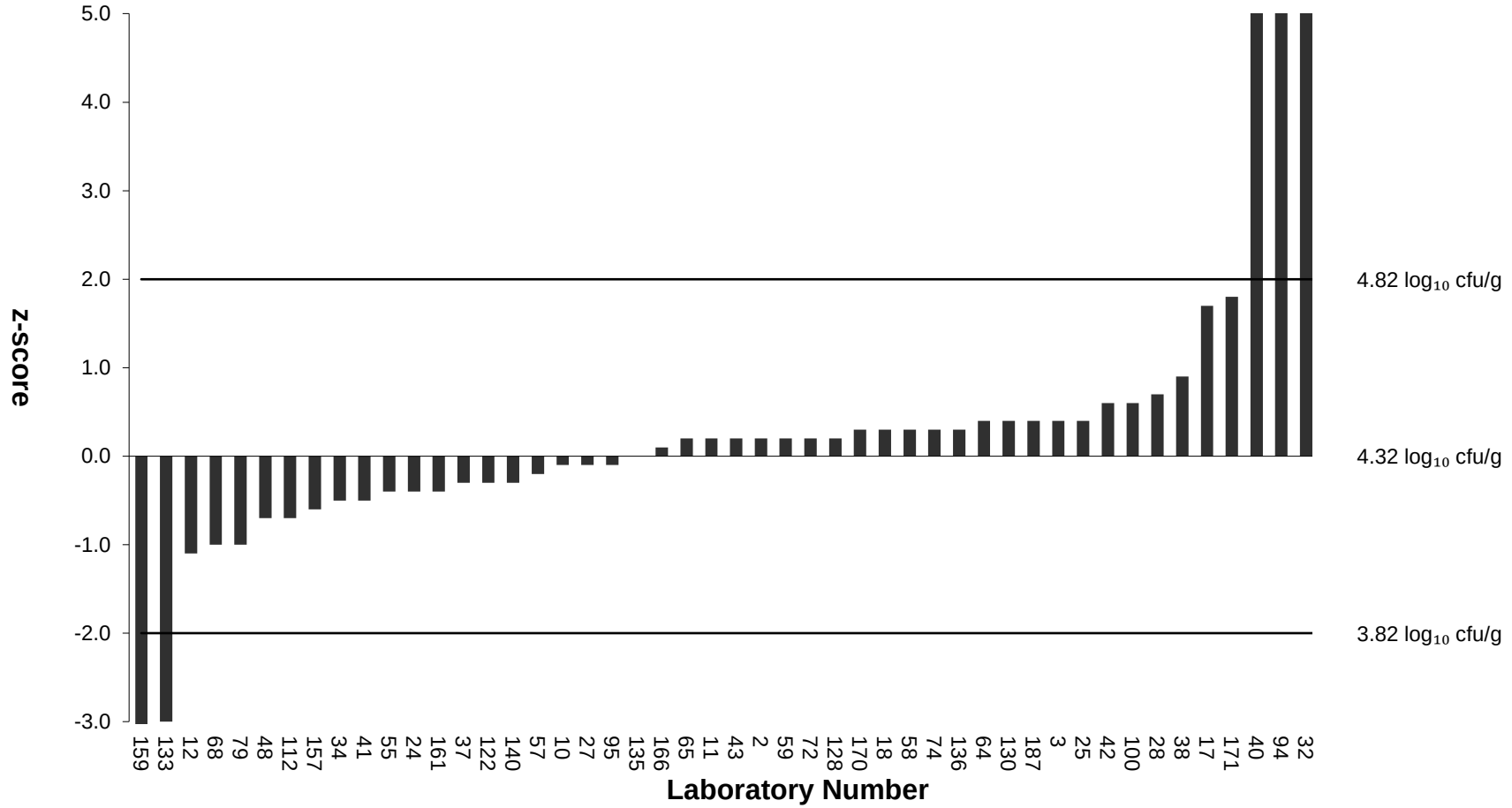

Figure 1: z-Scores for Aerobic Plate Count in Salad

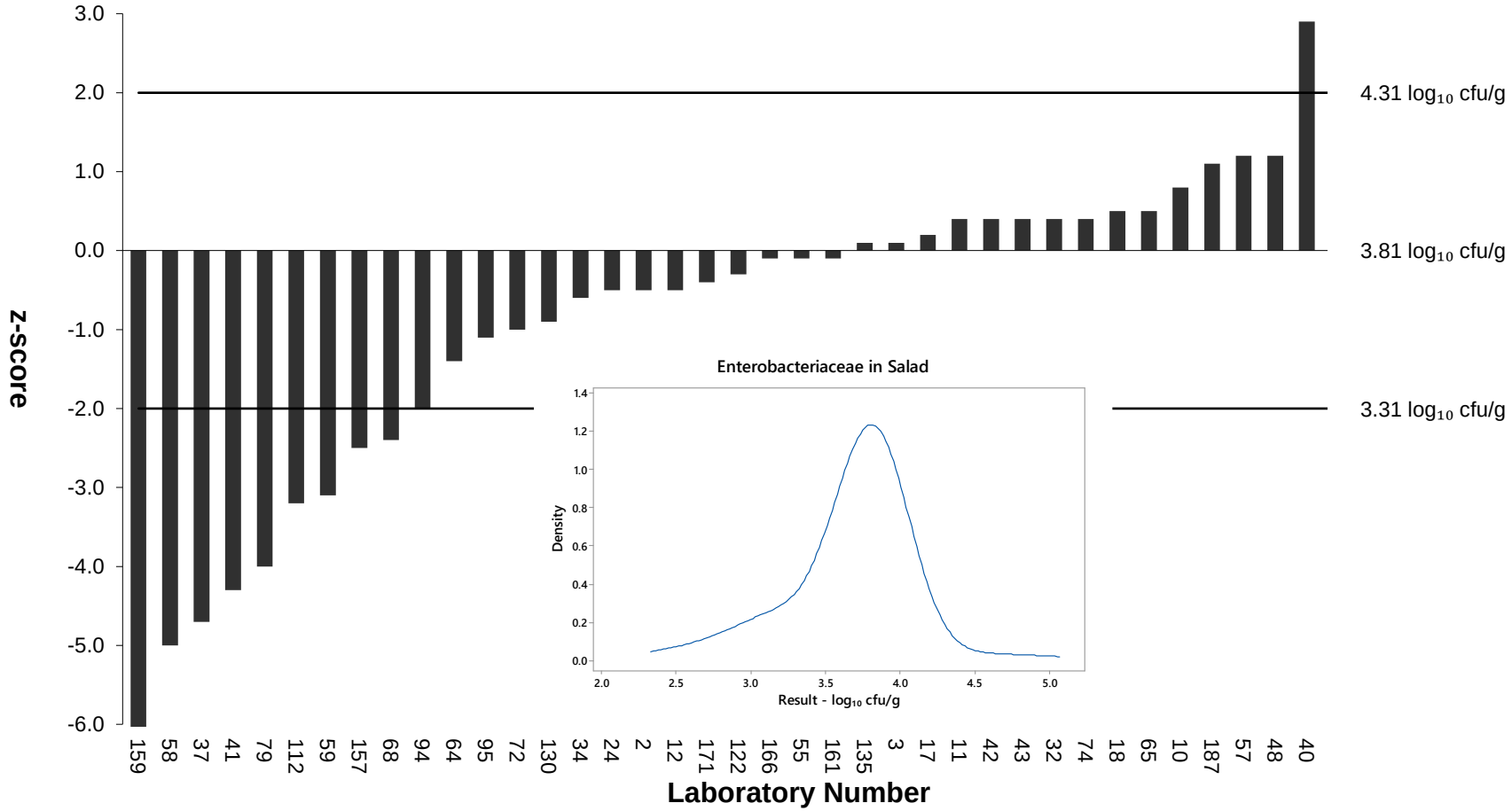

Figure 2: z-Scores for Enumeration of Enterobacteriaceae in Salad

insert shows the kernel density plot of the distribution of results submitted

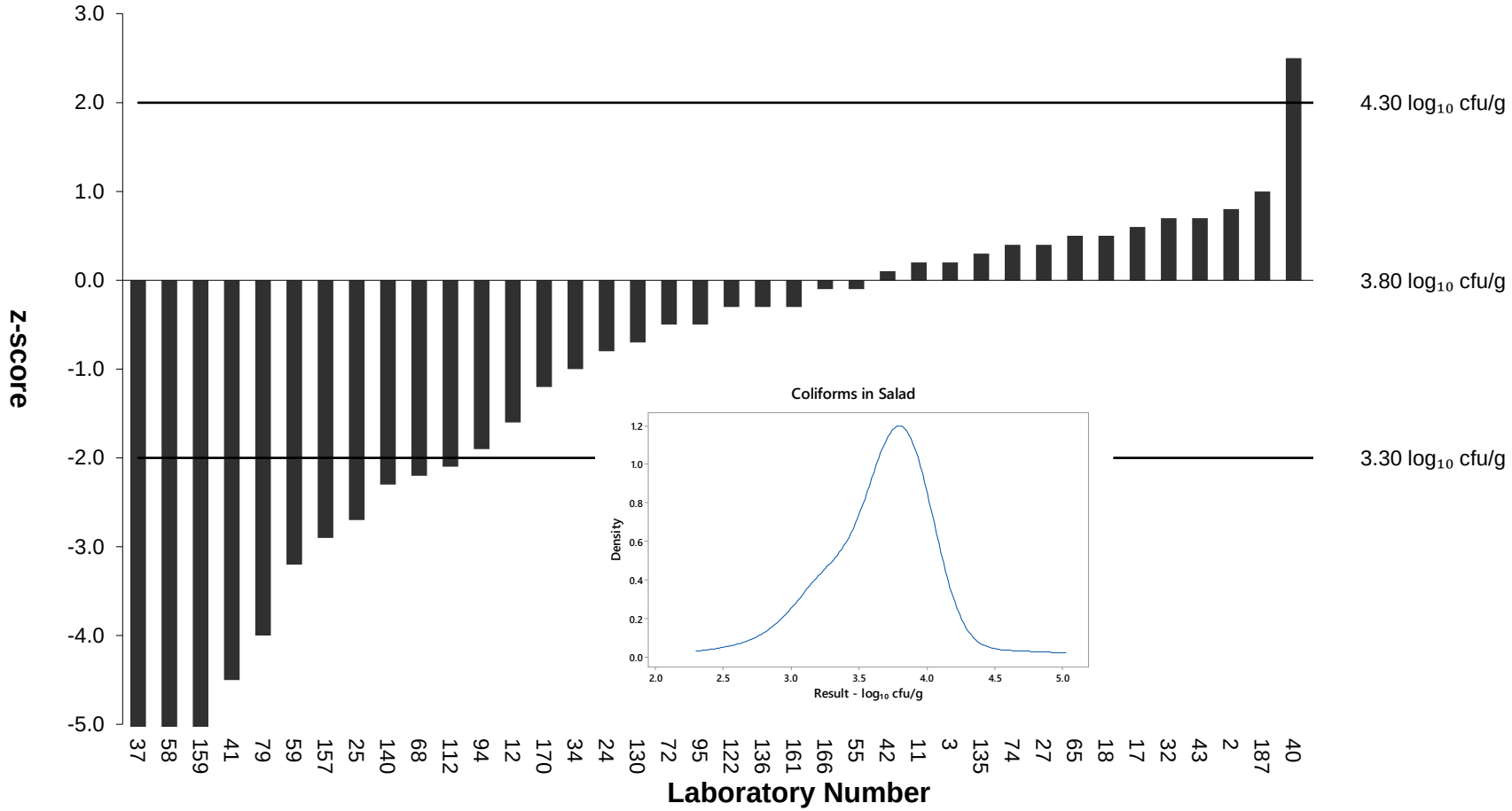

Figure 3: z-Scores for Enumeration of Coliforms in Salad

insert shows the kernel density plot of the distribution of results submitted

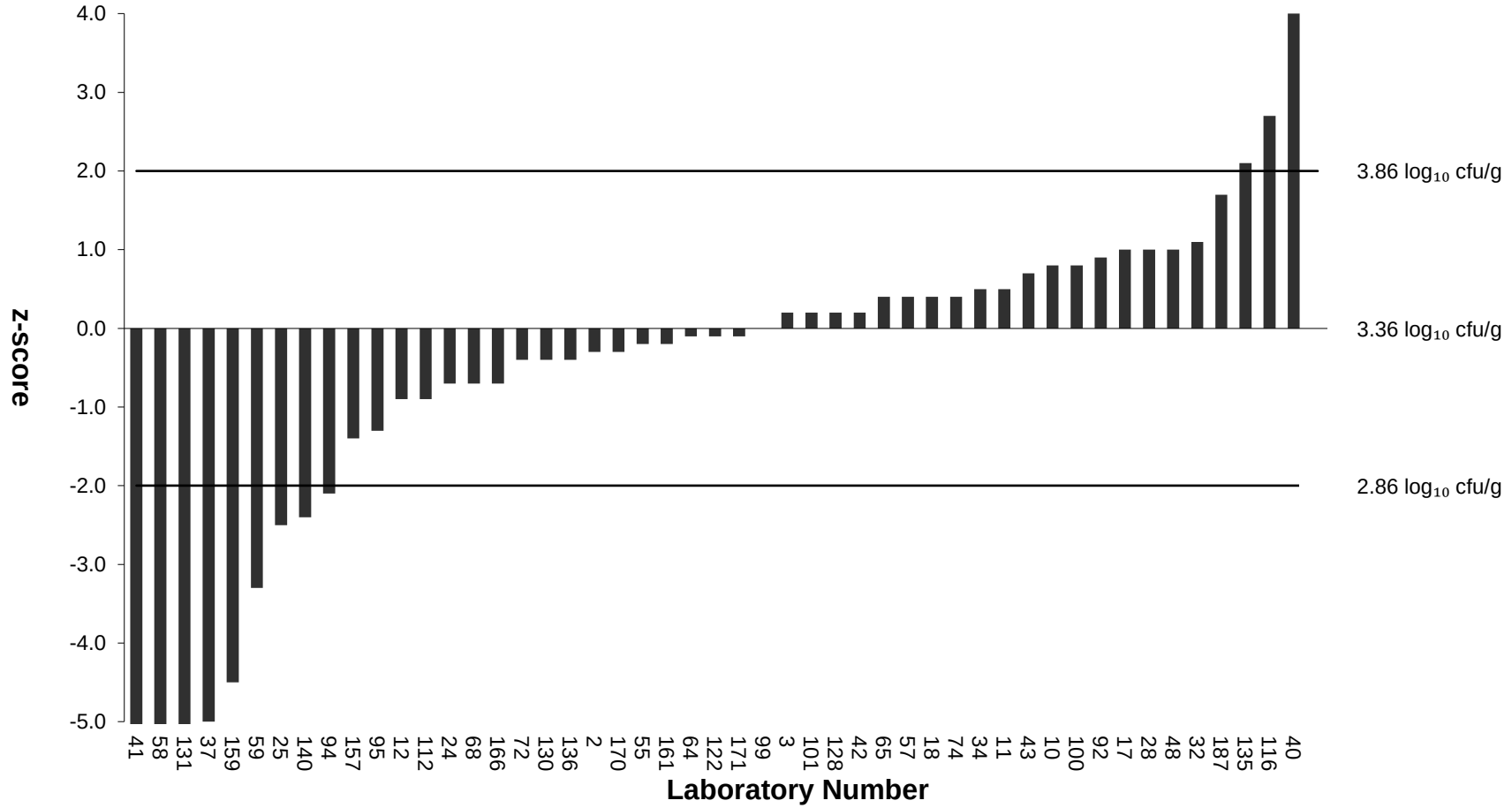

Figure 4: z-Scores for Enumeration of *Escherichia coli* in Salad

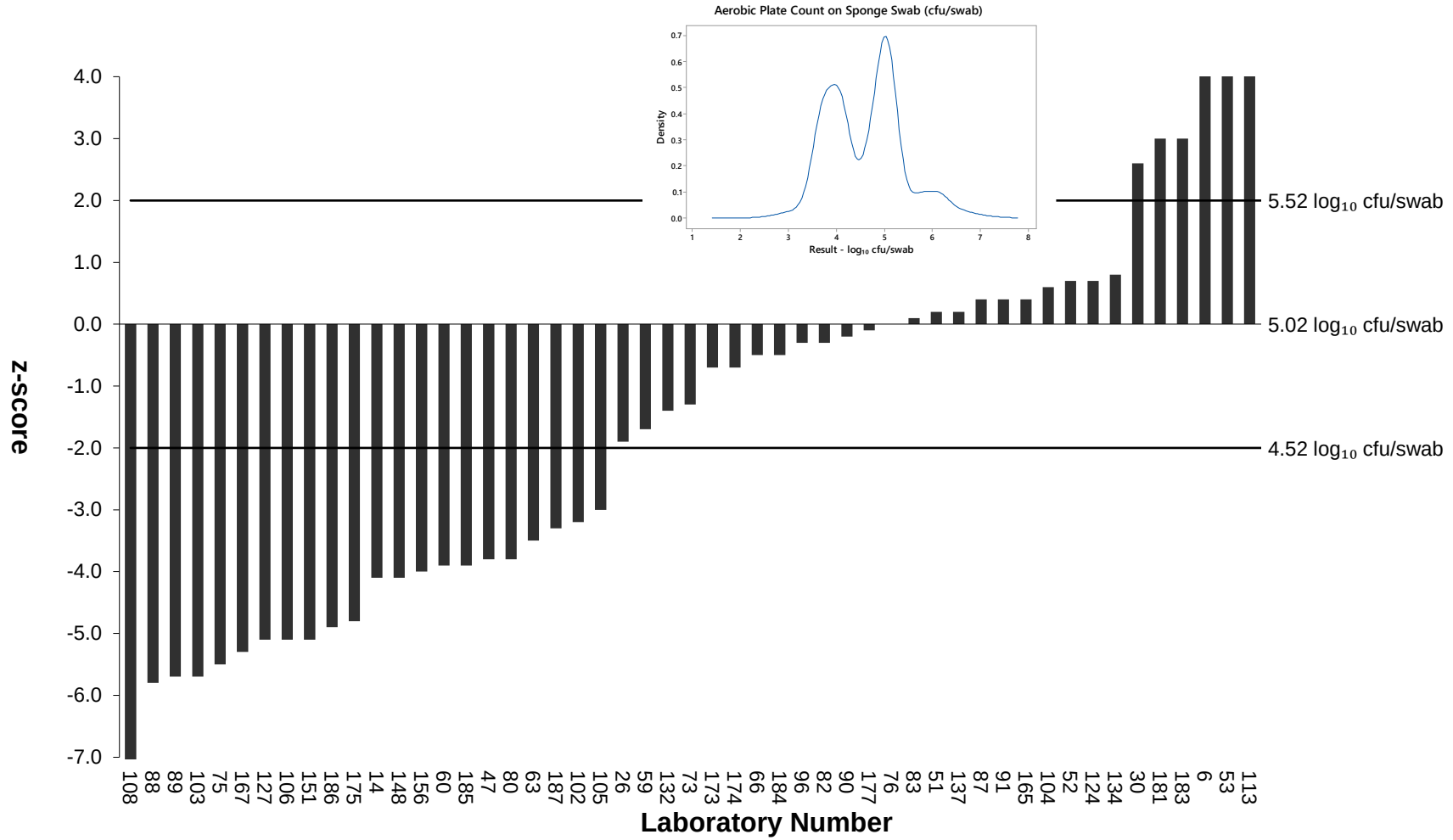

Figure 5: z-Scores for Aerobic Plate Count on Sponge Swab (cfu/swab)

insert shows the kernel density plot of the distribution of results submitted

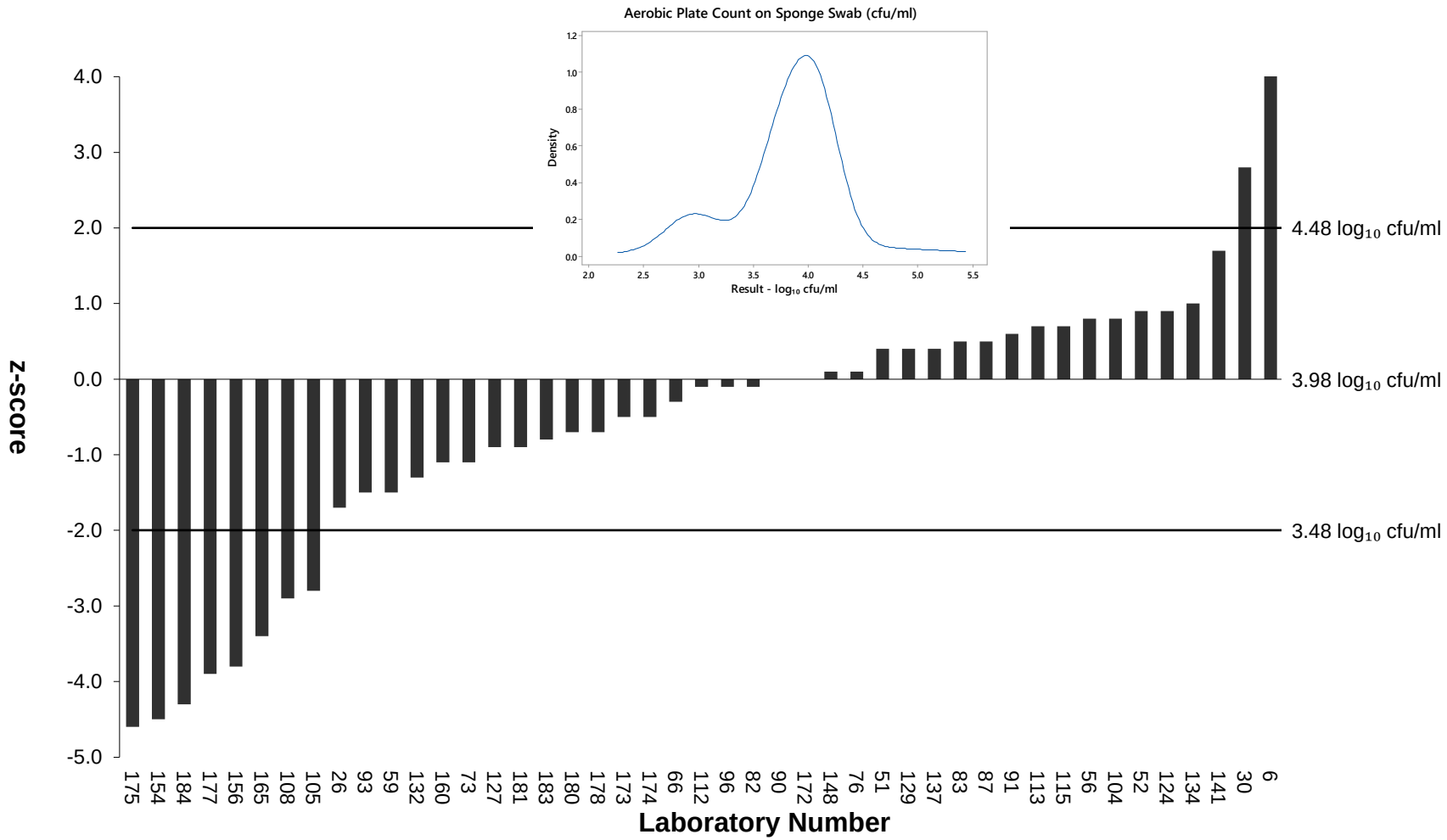

Figure 6: z-Scores for Aerobic Plate Count on Sponge Swab (cfu/ml)

insert shows the kernel density plot of the distribution of results submitted

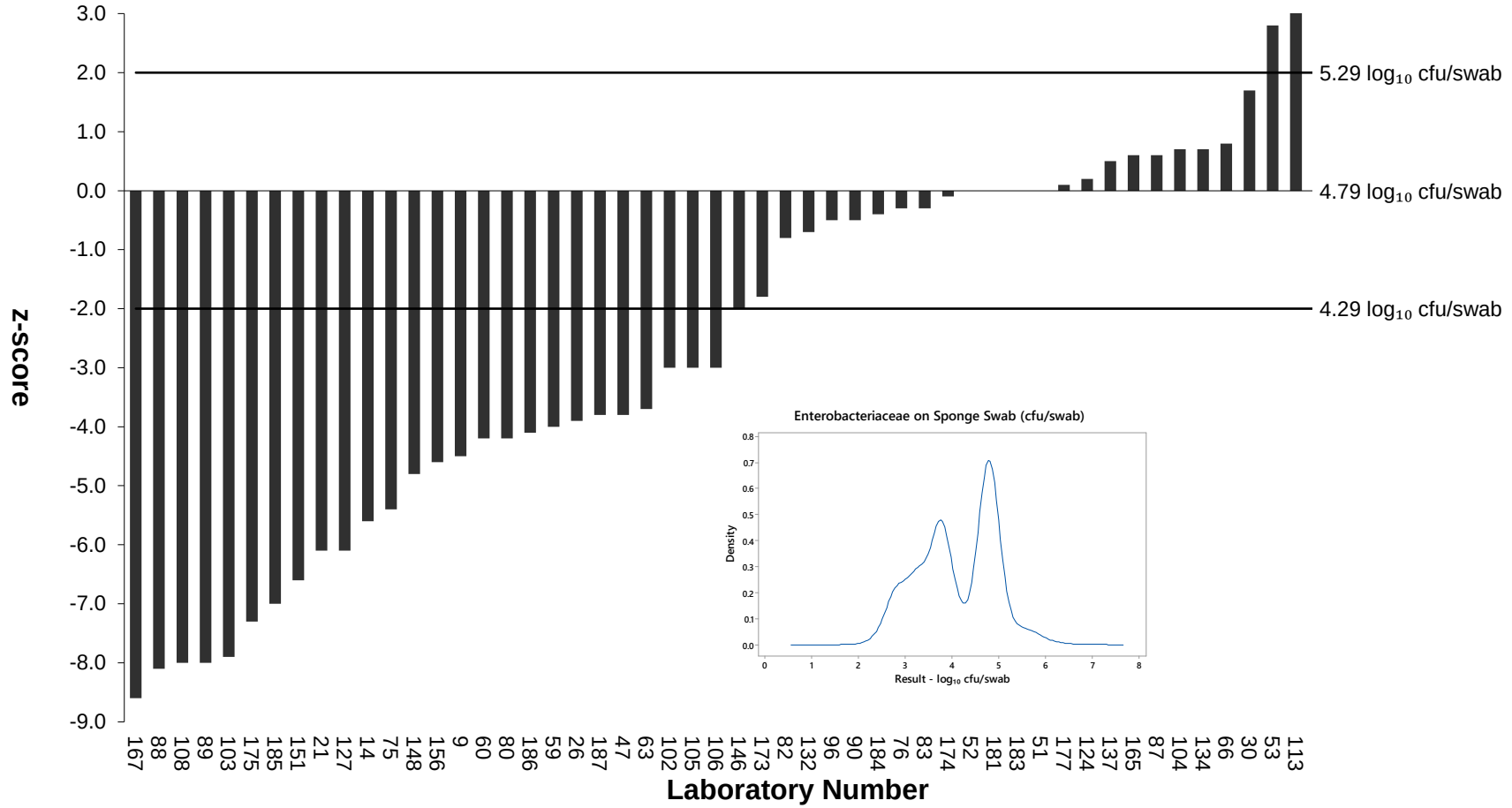

Figure 7: z-Scores for Enumeration of Enterobacteriaceae in Sponge Swab (cfu/swab)

insert shows the kernel density plot of the distribution of results submitted

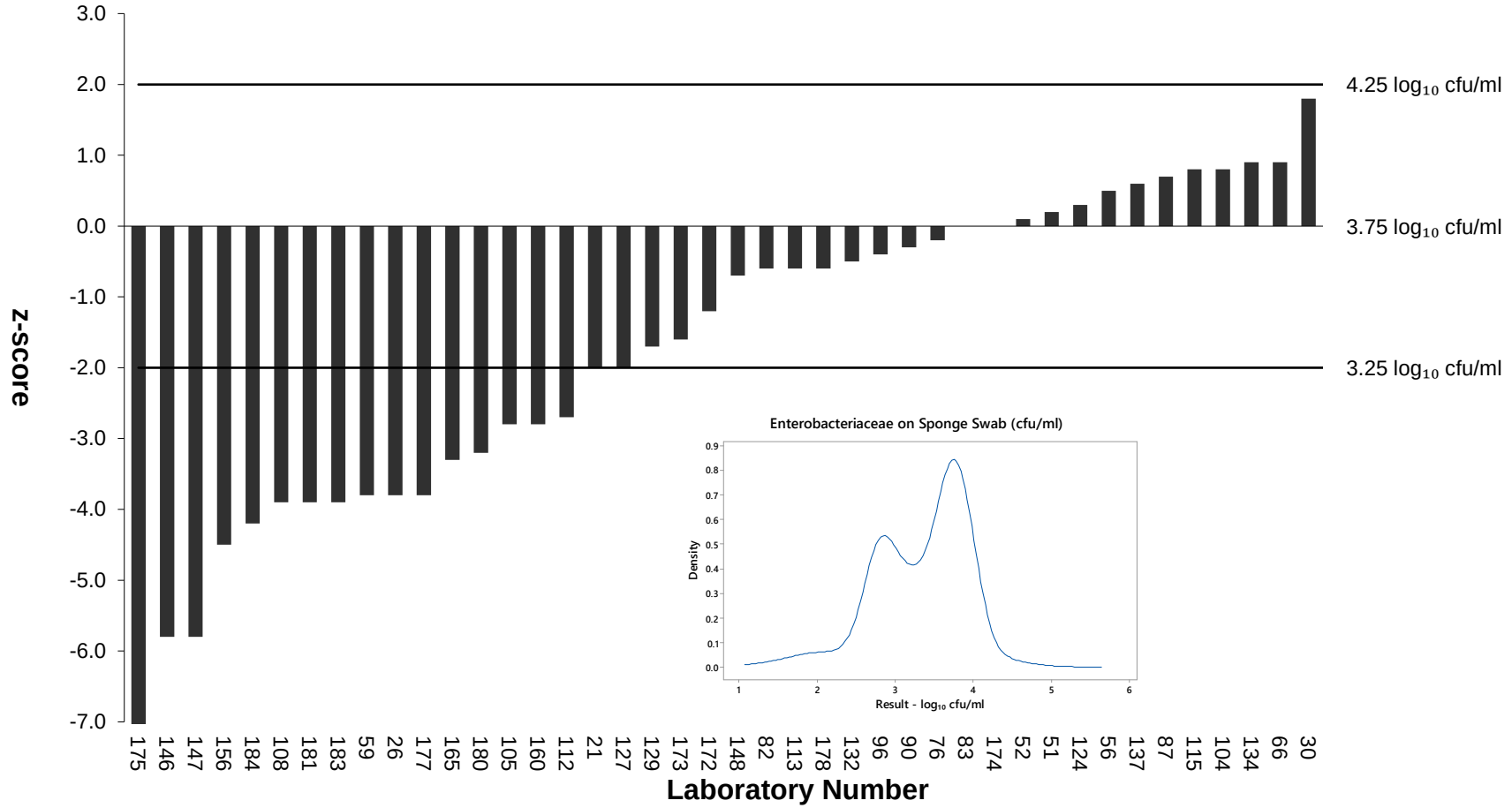

Figure 8: z-Scores for Enumeration of Enterobacteriaceae on Sponge Swab (cfu/ml)

insert shows the kernel density plot of the distribution of results submitted

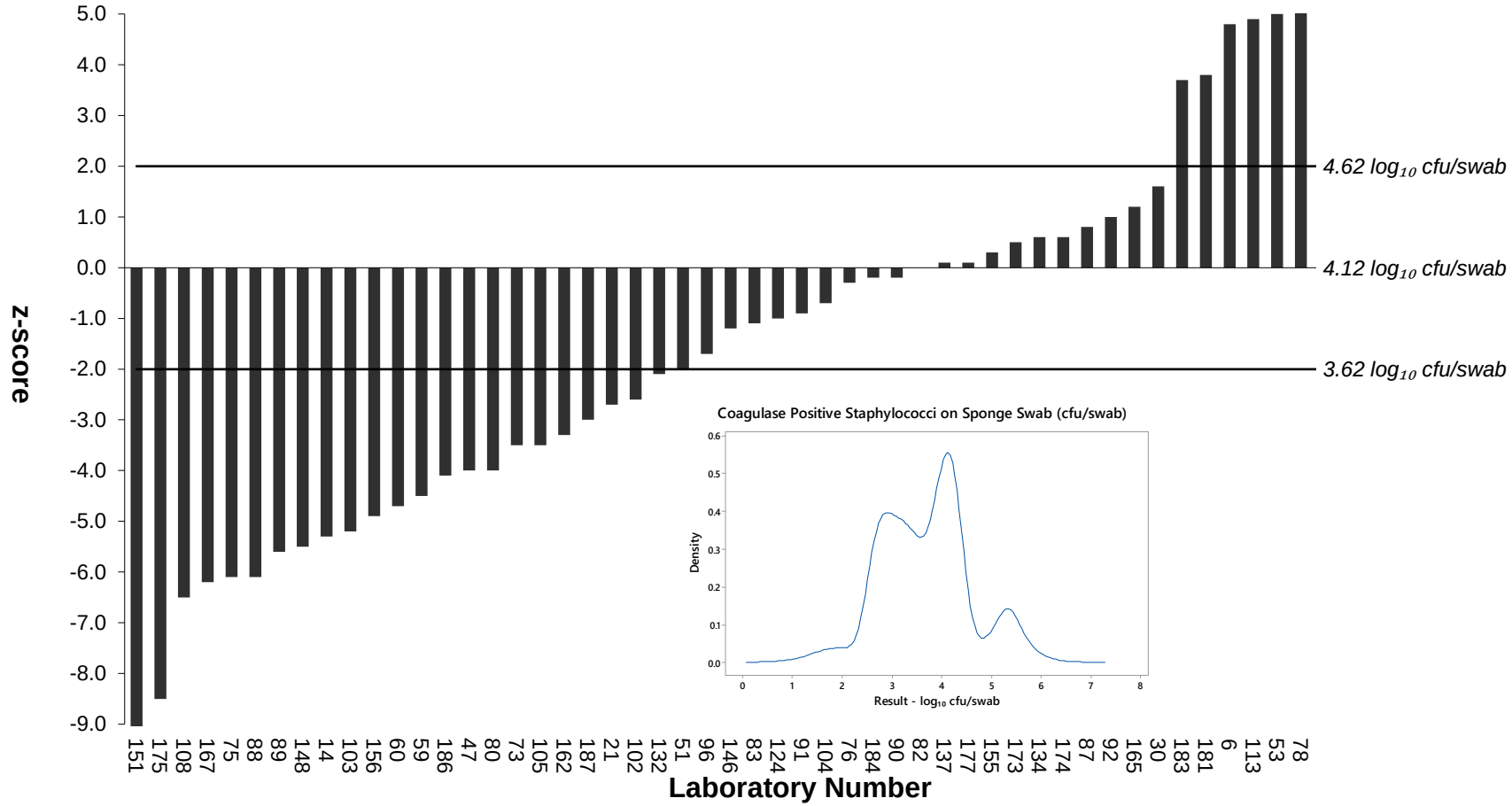

Figure 9: z-Scores for Enumeration of Coagulase Positive Staphylococci on Sponge Swab (cfu/swab)

this histogram is given for information only

insert shows the kernel density plot of the distribution of results submitted

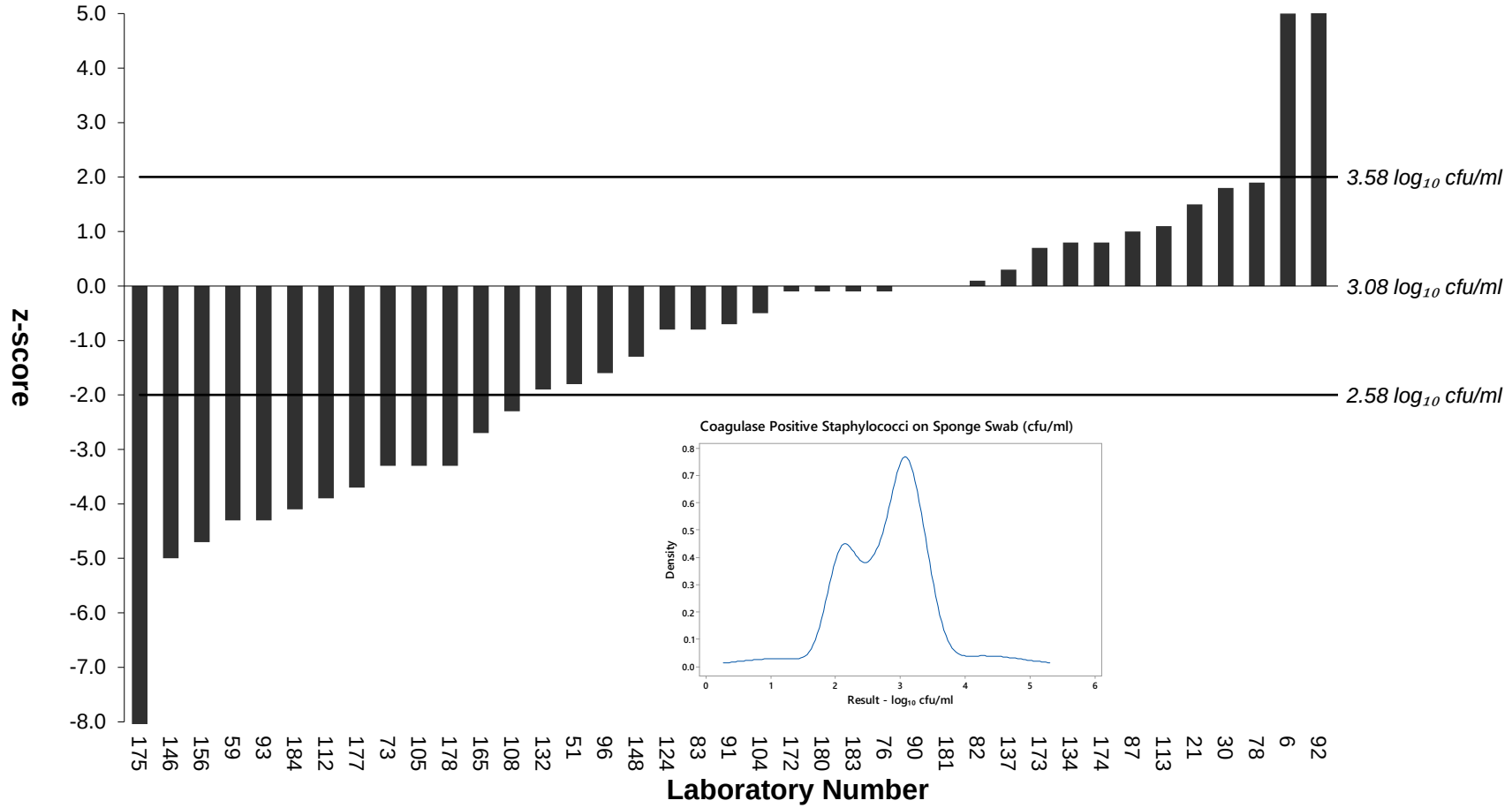

Figure 10: z-Scores for Enumeration of Coagulase Positive Staphylococci on Sponge Swab (cfu/ml)

this histogram is given for information only

insert shows the kernel density plot of the distribution of results submitted

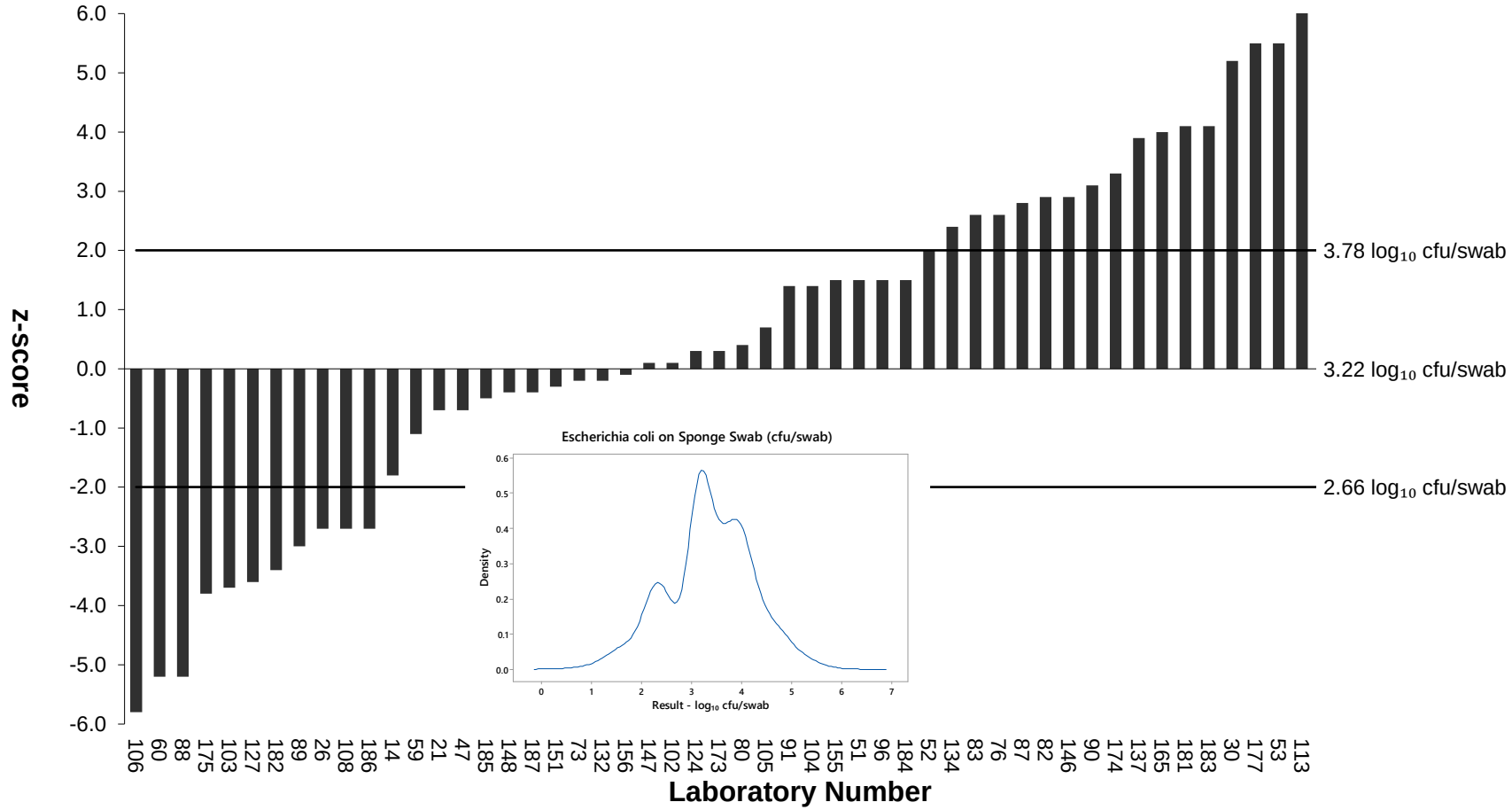

Figure 11: z-Scores for Enumeration of *Escherichia coli* on Sponge Swab (cfu/swab)

insert shows the kernel density plot of the distribution of results submitted

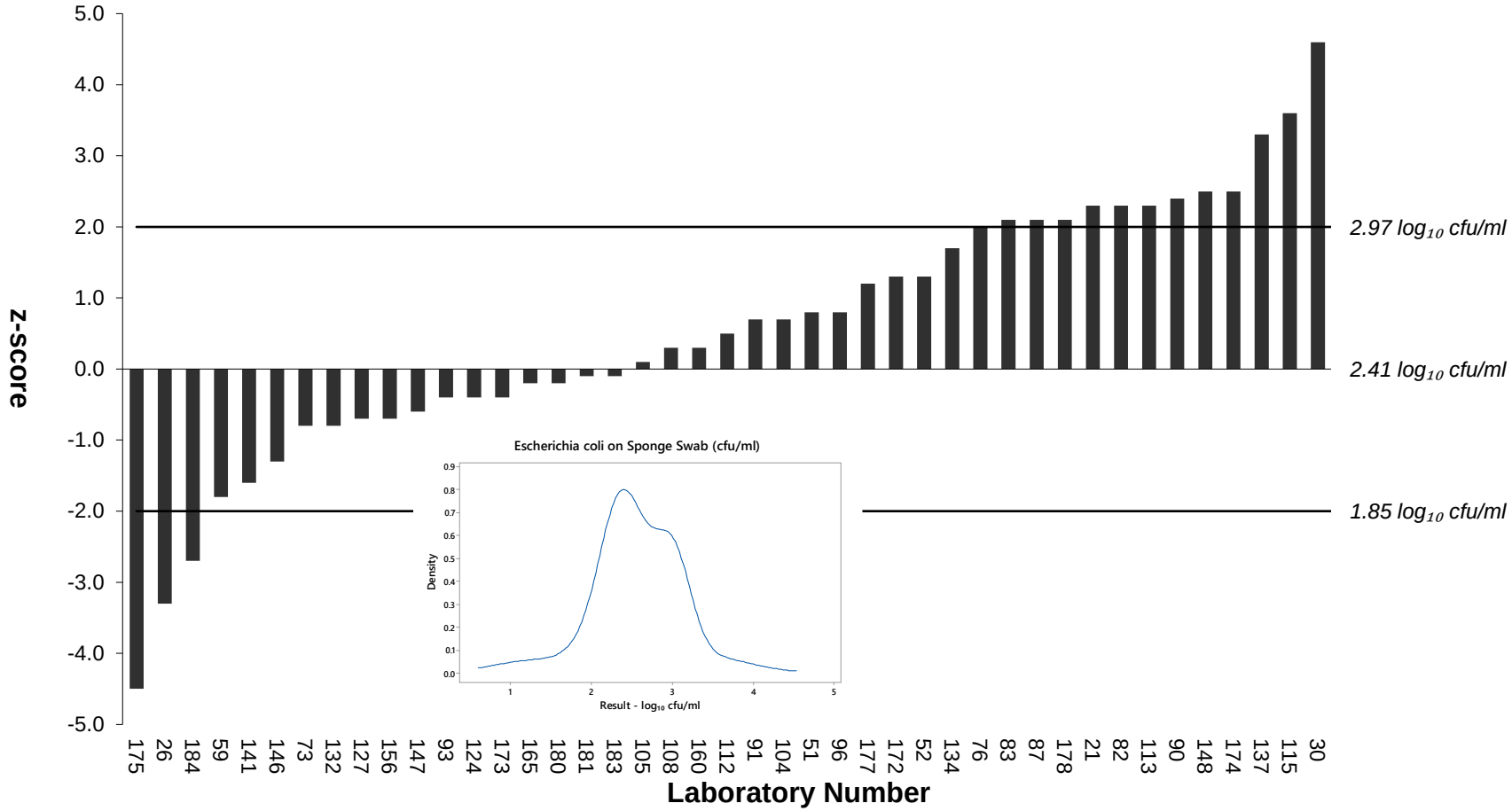

Figure 12: z-Scores for Enumeration of *Escherichia coli* on Sponge Swab (cfu/ml)

this histogram is given for information only

insert shows the kernel density plot of the distribution of results submitted

APPENDIX I: Organisms present in Fapas® – Food Microbiology Test Materials

proficiency test	matrix	target organism	background flora
enumeration of Aerobic Plate Count / Enterobacteriaceae / Coliforms / *Escherichia coli*	Salad	*Escherichia coli* *Klebsiella pneumoniae* *Bacillus cereus*	n/a
enumeration of Aerobic Plate Count / Enterobacteriaceae / Coagulase Positive Staphylococci / *Escherichia coli*	Sponge Swab	*E. coli* *Serratia marcescens* *Staphylococcus aureus* *B. cereus*	n/a
detection of *Listeria monocytogenes* / *Listeria* spp. test material A	Sponge Swab	*Listeria monocytogenes*	*Micrococcus luteus* *E. coli*
detection of *Listeria monocytogenes* / *Listeria* spp. test material B	Sponge Swab	n/a	*M. luteus* *E. coli*
detection of *Salmonella* spp. test material A	Sponge Swab	n/a	*M. luteus* *E. coli*
detection of *Salmonella* spp. test material B	Sponge Swab	*Salmonella typhimurium*	*M. luteus*
detection of *Escherichia coli* O157:H7 test material A	Sponge Swab	*Escherichia coli* O157:H7	*Kocuria rhizophila*
detection of *Escherichia coli* O157:H7 test material B	Sponge Swab	n/a	*E. coli* *K. rhizophila* *Lactobacillus plantarum*
detection of *Campylobacter* spp. test material A	Milk Powder	*Campylobacter jejuni*	*Pseudomonas aeruginosa* *Proteus mirabilis* *B. cereus*
detection of *Campylobacter* spp. test material B	Milk Powder	n/a	*P. aeruginosa* *P. mirabilis* *B. cereus*

n/a not applicable

APPENDIX II: Verification of Positive Qualitative Test Materials

target organism	level of target organism, as assessed by the most probable number technique, MPN/g
Listeria monocytogenes on Sponge Swab	3.3 (1.1 to 10*) / 13 (4.4 to 37*)
Salmonella typhimurium on Sponge Swab	21 (8.3 to 52*) / 17 (6.3 to 45*)
Escherichia coli O157:H7 on Sponge Swab	22 (8.6 to 54*) / 4.5 (1.5 to 14*)
Campylobacter jejuni in Milk Powder	49 (15 to 160*) / 49 (15 to 160*)

*confidence limit at >95%

APPENDIX III: Methods Used by Participants

Methods are tabulated according to the information supplied by participants, but some responses may have been combined or edited for clarity. Text that appears as unreadable symbols are derived from entries made using non-Western characters.

Aerobic Plate Count /Enumeration of Enterobacteriaceae / Coliforms / *Escherichia coli* in Salad

Accredited Method Used	laboratory number
no	012 025 037 064 068 159
yes	002 003 017 018 024 032 034 041 042 043 048 055 065 072 092 094 099 101 116 122 130 157 161 170 171 187

Method Based on an International Standard	laboratory number
no	025 040
yes	002 003 012 017 018 024 032 034 037 041 042 043 048 055 064 065 068 072 092 094 099 101 116 122 130 157 159 161 170 171

International Standard used	laboratory number
APC (pour plate) ISO 4833-1:2013	002 012 018 032 034 043 055 068 157 161 171
APC (spread plate) ISO 4833-2:2013	159
APC AOAC 990.12	017 018 037 041 094
Coliforms enumeration ISO 4832:2006	012 017 018 032 043 055 068 161
Coliforms enumeration AOAC 991.14	018 041 094
Enterobacteriaceae enumeration ISO 21528-1:2017	171
Enterobacteriaceae enumeration ISO 21528-2:2017	012 018 032 043 055 068 122 161
Escherichia coli enumeration ISO 16649-1:2018	017 171
Escherichia coli enumeration ISO 16649-2:2001	012 018 032 043 048 055 122 161 170
Escherichia coli enumeration ISO 16649-3:2015	116
Escherichia coli enumeration AOAC 991.14	041 072 094
Compendium of Methods for the Microbiological Examination of Foods, (2001) 4th Edition, Chapter 8: Enterobacteriaceae, Coliforms, and Escherichia coli as Quality and Safety Indicators (2).	017
Enterobacteriaceae AOAC 2003.01	041
Enterobacteriaceae enumeration AOAC 2003.01	018
Escherichia coli enumeration FDA-BAM chapter 4	068
Food code method(KOREA)	099
Korea Food public code	025
Korean Food Code	101
TFDA	130
TPC-CCFRA 1.1.1;2007 , Enterobacteriaceae-CCFRA 2.3.1; 2007 , Coliform-CCRFA 2.2.1;2007 , E.coli-CCFRA 2.4.2; 2003	040

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	002 003 017 025 032 034 037 040 042 048 064 072 099 130 157 159 170
Butterfield's Phosphate Buffer	024 068 116 122
Maximum Recovery Diluent (MRD)	012 018 055 092 161 171
Peptone Water	041 065
Phosphate Buffered Saline (PBS)	094
Ringer's Solution	043
Saline Solution	101

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	024 040 043 055 064 099 130 159
Enterobacteriaceae Enrichment broth (EE)	002
Medio mineral glutamato	116
PSD	157
Ringer Solution	017

Which Secondary Enrichment Medium Used	laboratory number
Brilliant Green Bile Lactose Broth (BGLB)	130
Rappaport Vassiliadis Broth (RV)	025
BPW	099
TBX	002

Plating Method Used	laboratory number
Pour plate	002 003 012 017 018 034 040 042 055 064 068 072 092 122 157 161 170 171
Spread plate	017 024 041 043 048 159
Overlay	068 116
Petrifilm (3M)	003 017 018 025 037 041 072 094 099 101 130

Inoculum Volume (ml)	laboratory number
0.01	116
0.1	017 024 043 048 068
1.0	002 003 012 017 018 025 032 034 037 040 041 042 055 064 065 068 072 092 094 101 122 130 157 159 161 170 171

Alternative/Rapid Method	laboratory number
Most Probable Number - Tube	130
PCR	043
Petrifilm (3M)	002 003 017 018 025 037 041 094 101

Incubation Temperature (°C)	laboratory number
30	034 055 064 157
35	003 017 024 025 037 041 072 099 122 130
37	002 040 043 068 094 101 116 159 161 171
44	048 092 170

Time Incubated (hours) Approximately	laboratory number
24	002 003 017 024 040 041 042 043 048 064 068 072 092 116 122 130 159 161 170 171
48	025 037 041 043 072 094 099 101
72	034 041 055 068 157 159 161

Confirmation of Organism's Identity	laboratory number
API 20E	122
Fermentation of Carbohydrates	017
Morphology	068
Oxidase reaction	002 017 034 064 161
PCR	043
VITEK	024 048 055 130

Which Selective/Chromogenic Medium Used for Aerobic Plate Count	laboratory number
Petrifilm (3M) Aerobic Plate Count	017 018 025 037 041 140
Plate Count Agar (PCA)	002 003 012 017 018 024 028 032 034 040 041 042 043 055 064 065 068 072 122 130 157 170 171
Tmpo AC	017

Which Selective/Chromogenic Medium Used for Enterobacteriaceae	laboratory number
Petrifilm (3M) Enterobacteriaceae	003 017 018 037 041
Violet Red Bile Dextrose Agar (VRBD)	072
Violet Red Bile Glucose Agar (VRBG)	002 012 017 018 032 034 040 043 055 064 065 068 122 130 157 171
Temp EB	017

Which Selective/Chromogenic Medium Used for Coliforms	laboratory number
Brilliant Green Bile Broth (BGBB)	017 122
Brilliant Green Bile Lactose Broth (BGLB)	018 072 130
Chromocult Coliform Agar	024 043
Lauryl Tryptose Broth	072
Petrifilm (3M) Colliforms	003 017 018 025 037 041 140
Violet Red Bile Agar (VRB)	012 040 055 068 157
Violet Red Bile Lactose Agar (VRBL)	002 018 032 034 043 065 170
Brilliance E. coli/ coliform selective medium	017

Which Selective/Chromogenic Medium Used for *E. coli*	laboratory number
Petrifilm (3M) E.Coli	003 017 018 025 037 041 072 099 101 140
Tryptone Bile Glucuronide Agar (TBX)	002 012 018 024 028 032 034 040 043 055 064 065 122 157 170 171
Tryptone Water	017
Eosine Methylene Blue Agar (EMB)	130
ECmug	068

Aerobic Plate Count / Enumeration of Enterobacteriaceae / Coagulase Positive Staphylococci / *Escherichia coli* on sponge swab

Accredited Method Used	laboratory number
no	026 051 075 090 092 103 115 147 165 167
yes	006 009 021 030 047 052 053 056 063 066 073 076 078 083 087 088 091 093 096 102 108 113 127 129 132 134 137 141 146 148 151 155 156 162 172 174 175 177 180 181 182 183 184 186 187

Method Based on an International Standard	laboratory number
no	180 181 183
yes	006 009 021 026 030 047 051 052 053 056 063 066 073 075 076 078 083 087 088 090 091 092 093 096 102 103 108 113 115 127 129 132 134 137 141 146 147 148 151 156 162 165 167 172 174 175 177 182 184 186 187

International Standard used	laboratory number
APC (pour plate) ISO 4833-1:2013	006 021 047 053 063 073 075 076 087 090 102 103 108 134 137 151 156 177 183
APC (spread plate) ISO 4833-2:2013	108
APC FDA/BAM Chapter 3	051 088 134 141 148
APC AOAC 990.12	093 175
Coliforms enumeration ISO 4832:2006	066 134
Coliforms enumeration ISO 4831:2006	051
Coliforms enumeration AOAC 991.14	134 175
CPS ISO 6888-1:1999 (Baird Parker)	021 075 134
CPS ISO 6888-2:1999 (RPF)	102 156
Enterobacteriaceae enumeration ISO 21528-1:2017	047 051 127 167
Enterobacteriaceae enumeration ISO 21528-2:2017	009 021 053 056 075 087 096 102 134 148 156 172 174
Escherichia coli enumeration ISO 16649-2:2001	026 053 073 075 087 102 134 148 177
Escherichia coli enumeration ISO 16649-3:2015	021 047
Escherichia coli enumeration AOAC 991.14	051 115 134 172 175 182
Aerobic Count Plate (AOAC 990.12) , E.coli (AOAC 991.14) , S.Aureus (AOAC 2003.8) , Enterobacteriaceae (AOAC 2003.01)	091
APC AFNOR certificate 3M 01/01-09/89	052
APC AFNOR certificate 3M 01/01-09/89, Enterobacteriaceae enumeration AFNOR certificate 3M 01/06-09/97, Escherichia coli AOAC 2018.13	052
DIN EN ISO 6888-2	047
EVN-R-RD-3-TP-3676 (2019) (ISO 6888-1:2021); EVN-R-RD-3-TP-3676 (2019) (ISO 6888-1:2021)	087
FDA/ BAM online	146
ISO 18593:2015	030
Petrifilm EB	129
PN-EN ISO 6888-1:2022-03	078
Staphylococcus aureus enumeration ISO 6888-1:2018	148

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	021 026 030 051 053 056 063 066 073 075 076 078 083 087 088 091 093 096 102 103 113 115 129 132 134 137 141 146 148 151 156 162 165 167 174 175 177 180 182
Butterfield's Phosphate Buffer	052 090
Maximum Recovery Diluent (MRD)	009 092 127
Peptone Water	006 181
Phosphate Buffered Saline (PBS)	172
Ringer's Solution	147
deionized water	154
Tryptone salt broth	108

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	026 030 051 053 056 076 088 091 093 102 103 113 115 127 134 141 156 165 167 174 175 180 184
NaCl Pepton	148
phosphate buffer	181

Which Secondary Enrichment Medium Used	laboratory number
Bolton Broth	148
Brilliant Green Bile Broth (BGBB)	147
Depending on the method	151
NONE	091 115
Plate Count Agar	102

Plating Method Used	laboratory number
Pour plate	009 021 026 030 051 053 063 073 075 076 083 087 088 096 103 108 113 127 129 132 134 137 141 147 148 156 165 167 172 175 177 180
Spread plate	021 056 075 078 083 087 088 108 132 134 154 162
Overlay	006 075 088 090 151 174
Petrifilm (3M)	051 052 091 093 115 129 134 146 172 175 182 184

Inoculum Volume (ml)	laboratory number
0.05	056
0.1	075 078 083 087 088 132 162
1.0	006 009 021 026 030 051 052 053 063 066 073 075 076 087 088 090 091 093 096 103 108 113 115 127 129 132 137 141 146 147 148 156 165 167 172 174 175 177 180 181 182

Alternative/Rapid Method	laboratory number
Compact dry	151
Most Probable Number - Tube	021 088
Petrifilm (3M)	030 051 087 090 091 093 127 129 134 146 147 175 182

Incubation Temperature (°C)	laboratory number
30	006 052 056 076 103 108 137 141 147 154 156
35	030 051 075 088 090 091 093 113 115 127 129 146 172 175 180 181 182
37	009 021 066 073 078 087 096 132 148 151 162 165 174
44	026

Time Incubated (hours) Approximately	laboratory number
24	009 021 026 051 052 056 075 087 088 096 115 129 146 148 165 174 175
36	066
48	021 030 051 052 073 078 087 088 090 091 093 113 127 129 132 147 148 151 154 162 172 175 180 181 182
72	006 076 087 103 108 137 141 156

Confirmation of Organism's Identity	laboratory number
API 20E	088
beta-glucoronidase activity	075 151
Coagulase reaction - tube test	021 073 075 078 087 148 162 165 175 181
Fermentation of Carbohydrates	087
IMViC test	132 146 181
Morphology	181
Oxidase reaction	021 056 075 087 148 172 181

Which Selective/Chromogenic Medium Used for Aerobic Plate Count	laboratory number
Petrifilm (3M) Aerobic Plate Count	051 052 090 134 175
Plate Count Agar (PCA)	006 014 021 026 047 051 053 063 066 073 075 076 083 087 088 089 096 102 103 108 113 127 132 134 137 148 151 156 165 167 173 174 175 177 181 183

Which Selective/Chromogenic Medium Used for Enterobacteriaceae	laboratory number
Petrifilm (3M) Enterobacteriaceae	052 090 127 134 147 173 175
Violet Red Bile Agar (VRB)	175
Violet Red Bile Dextrose Agar (VRBD)	026 047 087 165 167 181 183
Violet Red Bile Glucose Agar (VRBG)	009 014 021 030 051 053 075 076 088 089 096 102 103 108 113 132 134 137 148 156 174
Violet Red Bile Lactose Agar (VRBL)	066 151
Rapid enerobacteriaceae agar	083
Rapid Enterobacteriaceae	063
Rapid'Enterobacteriaceae	177

Which Selective/Chromogenic Medium Used for Coagulase Positive Staphylococci	laboratory number
Baird Parker Agar	030 075 076 083 088 089 132 134 162
Baird Parker Agar with Egg Yolk Potassium Tellurite	021 053 073 078 087 103 108 113 137 148 151 165 175 177 181 183
Baird Parker Agar with rabbit plasma fibrinogen (RPF)	006 014 047 096 102 103 156 167 174
Staph Express Count Plate	051 090 173

Which Selective/Chromogenic Medium Used for *E. coli*	laboratory number
Lauryl Sulphate Broth	088 089 113 156 181
Petrifilm (3M) E.Coli	030 051 090 127 134 147 175 182
Tryptone Bile Glucuronide Agar (TBX)	014 021 026 047 053 073 075 076 083 087 088 096 102 103 108 132 134 137 148 151 165 173 174 177
Petrifilm (3M) REC	052

Detection of *Listeria monocytogenes* and *Listeria* spp. on sponge swab

Accredited Method Used	laboratory number
no	005 013 051 090 110 114 126 138 164
yes	004 019 022 033 035 042 045 047 062 071 077 081 086 096 108 111 117 123 125 150 176 179

Method Based on an International Standard	laboratory number
no	005 019 033 035 062 110 114 117 176
yes	004 013 022 023 042 045 047 051 071 077 081 086 090 096 108 111 123 125 126 138 150 164 179

International Standard used	laboratory number
Listeria monocytogenes detection ISO 11290-1:2017	004 013 022 042 047 071 077 086 096 150 164
Aloa Oneday	110
Detección Molecular MDS	111
Health Canada - MFLP-101 Detection of Listeria spp. in Environmental Surface Samples Using the 3MTM Molecular Detection System Test Kit Version 2	176
ISO 11290 -1: 2017: Microbiology of the food chain and animal feeding stuffs-Horizontal method for the detection and enumeration of Listeria monocytogenes and of Listeria spp.	123
PCR	108

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	022 035 051 081 117 123 176 179
Half Fraser Broth	004 023 033 047 071 090 110 111 125 150 164
LEB 24	108
LMX + supplement	019
LSB	005
LSB (Biorad)	114

Which Primary Enrichment Medium Used	laboratory number
Fraser Broth	023 047 150 164 179
Half Fraser Broth	004 033 081 086 096 110 111 123 125 176
Listeria Enrichment Broth 1 (LEB)	005
24 LEB + 24 LEB Buffer Supplement	077
Actero Listeria Enrichment Broth	022
BAX Broth	117
Demi Fraser Broth	051
ListerListeria Enrichment Broth acc to FDY/IDF-FIL	013
LMX	019
RELM	071

Which Secondary Enrichment Medium Used	laboratory number
Fraser Broth	004 023 033 042 086 096 123 125 150 176
AGAR ALOA	179
LB	117
NO	110
none	126

Plating Method Used	laboratory number
Pour plate	004
Spread plate	019 023 047 096 110 114 117 125 126 150 179
Overlay	042

Inoculum Volume (ml)	laboratory number
0.01	042 096 114 125 126
0.1	019 086 110 117 150 176
DETECCION	179

Alternative/Rapid Method	laboratory number
Enzyme Immunoassay	164
Immunofluorescence assay	179
Loop Mediated Isothermal Amplification (LAMP)	051 081 090
MOLDI-TOF	004
PCR	022 033 042 114 176
VIDAS (ELFA)	035 045 125 126
miniVIDAS (ELFA)	019 096

Incubation Temperature (°C)	laboratory number
25	004
30	005 013 033 035 045 086 114 123 164
35	022 049 117 179
37	019 023 042 047 051 071 077 081 090 096 108 110 111 125 126 150 176

Time Incubated (hours) Approximately	laboratory number
24	004 005 019 022 033 035 042 051 071 077 081 086 090 108 111 114 117 123 126 150 164 176 179
36	045
48	013 049 096 110 125

Confirmation of Organism's Identity	laboratory number
Aesculin hydrolysis	090
API Listeria	013 019 081 096 125 126 150 179
CAMP test	004 019
Catalase reaction	023 081 123
Fermentation of Carbohydrates	086 123
Haemolysis	004 019 111 123
Morphology	013 081
Microscopy	013 123
Motility	022 081
PCR	042 164
VITEK	035 086 117
Microbact 12L	071

Which Selective/Chromogenic Medium Used for *Listeria* spp.	laboratory number
Agar Listeria Ottavani Agosti (ALOA)	004 019 042 047 071 081 110 123 125 126 138
PALCAM Agar	004 013 081 111 125 126 138
Chromogenic Listeria Agar (Oxoid)	096
Ottavani Agosti Agar (OAA)	013
Oxford Agar	035 081 123
Modified Oxford Agar (MOX)	086
Brilliance Listeria Agar (OCLA)	086
Rapid L. mono	033 081 114 117

Detection of *Salmonella* spp. on sponge swab

Accredited Method Used	laboratory number
no	005 013 051 067 070 090 110 111 114 126 150 152 164 168
yes	001 008 014 016 019 031 033 036 044 047 048 052 062 069 071 081 096 097 102 108 119 125 127 132 144 153 169 182

Method Based on an International Standard	laboratory number
no	005 019 033 062 070 102 110 114
yes	001 008 013 014 016 031 036 044 047 048 051 052 067 069 071 081 090 096 097 108 111 119 125 126 127 132 144 150 152 153 164 168 169 182

International Standard used	laboratory number
Salmonella spp. detection ISO 6579-1:2017	001 008 014 031 036 044 047 048 071 096 111 119 127 144 150 152 164 168 169
Salmonella spp. detection ISO 6579-2:2012	013
Salmonella spp. detection FDA/BAM Chapter 5	081 153
.	069
AOAC OMA 2016.01	081
KFDA method	097
PCR	005 108
Salmonella spp. detection ISO 6579-1:2017/Amd.1:2020	052
Screening VIDAS® EASY SLM AFNOR BIO 12/16-09/05	182

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	001 008 014 016 031 033 036 044 048 049 051 052 067 069 070 071 081 090 096 097 102 108 110 111 114 119 125 126 127 132 144 150 152 164 168 182
Peptone Water	005 019
BOW HQ	062
Buffered Peptone Water and IRIS Salmonella suplement	169
Lactose Broth	153

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	001 005 013 014 031 033 036 044 049 051 052 067 069 070 081 090 096 097 102 110 111 119 125 126 132 152
Mueller Kauffman Tetrathionate Novobiocin Broth (MKKTn)	008 048 127 168
Rappaport Vassiliadis Broth (RV)	150 153
Modified Semi-Solid Rappaport Vassiliadis (MSRV)	144
Rappaport Vassiliadis Soya Peptone(RVS)	071 164 168
Broth SX2	182
PW+SPT	019
Tetrathionate Broth, Rappaport-Vassiliadis(RV) Broth	016

Which Secondary Enrichment Medium Used	laboratory number
Rappaport Vassiliadis Broth (RV)	008 081 097 150
Rappaport Vassiliadis Soya Peptone(RVS)	001 013 031 036 048 090 096 102 119 125 127 132 144 152
Tetrathionate Broth	013 031 070 081 097 153
MSRV	052
none	126
nothing	005
Rappaport Vassiliadis Broth(RV) & Tetrathionate Broth(TT)	069
RVS and MKTTn broth	152
SX2	110
Xylose Lysine Desoxycholate Agar, Brilliant Green Sulfa Agar	016

Plating Method Used	laboratory number
Pour plate	144 168
Spread plate	008 016 019 031 090 096 097 102 114 125 126 127 150 152 153 169
Overlay	052 069 070

Inoculum Volume (ml)	laboratory number
0.001	031
0.01	096 097 114 125 126 127 152 168 169
0.1	001 013 016 019 052 090 110 111 144 150 182
0.5	044
1.0	008 013 069 070 153

Alternative/Rapid Method	laboratory number
Enzyme Immunoassay	164
Loop Mediated Isothermal Amplification (LAMP)	051 081 090 168
PCR	001 005 013 014 033 097 102 110 114
Petrifilm (3M)	016 127
VIDAS (ELFA)	036 119 125 126 132 144 182
miniVIDAS (ELFA)	019 067 096

Incubation Temperature (°C)	laboratory number
35	049 069 111 153 168
37	005 013 014 016 019 031 033 044 052 070 071 096 097 102 108 110 114 119 132 150 164 169
41.5	001 008 051 067 090 125 126 127 144 182
42	081

Time Incubated (hours) Approximately	laboratory number
18	013 033 049 102 110 111 114 164
24	001 005 008 014 016 019 031 044 051 052 067 070 071 081 090 096 097 108 119 126 127 144 150 153 168 169 182
48	052 125
72	069 132

Confirmation of Organism's Identity	laboratory number
API 20E	001 013 019 044 071 081 096 102 110 125 126 144 150 152 153
Fermentation of Carbohydrates	014
IMViC test	070
Indole production	119
Latex slide agglutination	019 169
Lysine Decarboxylase	052 119 168
Lysine Iron Agar	081 111
Morphology	013
Microscopy	013
Oxidase reaction	152
Serological agglutination test	008 048 119 152 168 182
PCR	013 016 048 164
VITEK	048 097
Triple Sugar Iron Agar (TSI)	019 052 069 081 090 119 132 168

Which Selective/Chromogenic Medium Used for *Salmonella* spp.	laboratory number
Bismuth Sulfite Agar (BSA)	051 081
Brilliant Green Agar (BGA)	016 070 081 097 119
Brilliance Salmonella Agar	127
Brilliant Green Phenol Red Lactose Sucrose Agar (BPLS)	013
Chromogenic Salmonella Agar (Oxoid)	071
Hektoen Agar	051 081
Modified Semi-Solid Rappaport Vassiliadis (MSRV)	052
Rambach Agar	048 168
Salmonella Chromogenic Medium	005 019 048 102 114
Xylose Lysine Desoxycholate Agar (XLD)	001 008 013 019 036 048 051 052 069 071 081 090 096 097 111 119 125 126 132 144 153 168 182
ASAP	052
Chromoagar	014
IRIS	110
MLCB-Agar	013

Detection of *Escherichia coli* O157 on sponge swab

Accredited Method Used	laboratory number
no	015 153
yes	081 086

Method Based on an International Standard	laboratory number
no	015
yes	081 086 153

International Standard used	laboratory number
Escherichia coli enumeration AOAC 991.14	153
AFNOR: UNI 03/10-03/15	086
AOAC OMA 2000.14/BAM Chapter 4A	081

Which Initial Suspension/Diluent Used	laboratory number
Butterfield's Phosphate Buffer	153
modified TSB with novobiocin	081

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	086

Plating Method Used	laboratory number
Spread plate	081
Petrifilm (3M)	153

Inoculum Volume (ml)	laboratory number
0.01	086
0.05	081
1.0	153

Alternative/Rapid Method	laboratory number
PCR	086
Reveal	081

Incubation Temperature (°C)	laboratory number
37	081
41.5	086

Time Incubated (hours) Approximately	laboratory number
18	081
24	086 153

Confirmation of Organism's Identity	laboratory number
API 20E	081 153
beta-glucoronidase activity	081
Indole production	081
Latex slide agglutination	081
Serological agglutination test	086

Which Selective/Chromogenic Medium Used for *E. coli* O157	laboratory number
Cefixine Tellurite Sorbitol MacConkey agar (CT-SMAC)	081 086
CHROMAgar O157	081 153

Detection of *Campylobacter* spp. in Milk Powder

Accredited Method Used	laboratory number
no	003 007 054 061 085
yes	029 092 098 109 118 163

Method Based on an International Standard	laboratory number
no	003 007 085 118 163
yes	029 054 061 092 098 109

International Standard used	laboratory number
Campylobacter spp. detection ISO 10272-1:2017	029 054 061 092 109
Campylobacter spp. detection FDA/BAM Chapter 7	085
Public Health England FNES15 [F21]	098

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	003
Bolton broth	061
Campy Food Broth	085

Which Primary Enrichment Medium Used	laboratory number
Bolton Boullion	163
Bolton broth	061
Campy Food Broth	085

Which Secondary Enrichment Medium Used	laboratory number
Bolton Broth	029 061 118

Plating Method Used	laboratory number
Spread plate	029 061 109
Overlay	092

Inoculum Volume (ml)	laboratory number
0.01	029 054 061 092 109
0.1	118

Alternative/Rapid Method	laboratory number
Loop Mediated Isothermal Amplification (LAMP)	003
PCR	109 118 163
VIDAS (ELFA)	085

Incubation Temperature (°C)	laboratory number
41.5	003 029 054 061 092
42	007 085 109 118 163

Time Incubated (hours) Approximately	laboratory number
24	003 007
48	029 054 061 085 092 109 118 163

Confirmation of Organism's Identity	laboratory number
API Campy	054
Catalase reaction	054 061
Hippurate Hydrolysis	054
Morphology	054
Microscopy	061
Motility	054
Oxidase reaction	054 061
PCR	109 118
VITEK	085

Which Selective/Chromogenic Medium Used for *Campylobacter* spp.	laboratory number
Campylobacter selective blood free agar (CCDA)	061
Modified Campylobacter selective blood free agar (mCCDA)	029 109 118
Karmali Agar	061 092
Skirrow Agar	029 109

APPENDIX IV: Fapas® SecureWeb, Protocol and Contact Details

1. Fapas® SECUREWEB

Access to the secure area of our website is only available to participants in our proficiency tests. Please contact us if you require a UserID and Password. Fapas® SecureWeb allows participants to:

- Obtain their laboratory numbers for the proficiency tests in which they have participated.
- View the results they submitted in past and current proficiency tests.
- Submit their results and methods for current tests.
- Review future tests they have ordered.
- Order proficiency tests, reference materials and quality control materials.
- Freely download copies of reports (PDF file), of proficiency tests in which they have participated.
- View charts of their z-scores obtained in previous Fapas® – Food Microbiology proficiency tests.

2. PROTOCOL

The Protocols [7, 8] set out how Fapas® – Food Microbiology is organised. Copies can be downloaded from our website.

3. CONTACT DETAILS

This report was prepared and authorised on behalf of Fapas® by Stilian Hristov (Round Coordinator). Participants with any comments or concerns about this proficiency test should contact:

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