The National Marine Biological
Analytical Quality Control Scheme

Particle Size Results
PS47

Authors: **Adam Procter & Sarah Hussey**

Reviewed by: Richard Arnold

Approved by: Richard Arnold

Contact: Adam Procter
adam.procter@unicomarine.com

Thomson Unicomarine Ltd.

Date of Issue: 30th May 2013

Contents

Tables

Figures

Appendices

Table 1. Summary of the replicate benchmark analysis and particle size information received from participating laboratories for the forty-seventh PSA NMBAQC Scheme.

Benchmark Data

Sample	Method	% Gravel	% Sand	% Silt	Median ϕ	Mean ϕ	Sediment Description (Post analysis)
PS47 1960	NMBAQC	28.54	71.46	0.00	1.357	-0.162	Gravelly Sand
PS47 1961	NMBAQC	28.27	71.73	0.00	1.326	-0.171	Gravelly Sand
PS47 1962	NMBAQC	28.70	71.30	0.00	1.346	-0.163	Gravelly Sand
PS47 1963	NMBAQC	28.75	71.25	0.00	1.344	-0.172	Gravelly Sand
PS47 1964	NMBAQC	28.68	71.32	0.00	1.380	-0.146	Gravelly Sand
PS47 1965	NMBAQC	28.72	71.28	0.00	1.315	-0.022	Gravelly Sand
PS47 1966	NMBAQC	28.68	71.32	0.00	1.393	-0.139	Gravelly Sand
PS47 1967	NMBAQC	28.68	71.32	0.00	1.370	-0.150	Gravelly Sand
PS47 1968	NMBAQC	28.66	71.34	0.00	1.365	-0.157	Gravelly Sand
PS47 1969	NMBAQC	28.69	71.31	0.00	1.369	-0.156	Gravelly Sand
TUM AVERAGE	NMBAQC	28.64	71.36	0.00	1.36	-0.144	

Participant Data

Lab	Method	% Gravel	% Sand	% Silt	Sediment Description (Post analysis)
LB_1901	NMBAQC	29.72	70.28	0.00	Gravelly sand
LB_1903	NMBAQC	29.26	70.74	0.00	Gravelly sand
LB_1904	NMBAQC	30.16	69.84	0.00	Gravelly sand
LB_1905	NMBAQC	28.96	71.04	0.00	Gravelly sand
LB_1908	OTHER	34.53	64.94	0.53	Sandy gravel
LB_1909	NMBAQC	29.46	70.54	0.00	Gravelly sand
LB_1910	NMBAQC	28.95	71.01	0.04	Gravelly sand
LB_1917	NMBAQC	30.61	69.39	0.00	Sandy gravel
LB_1921	NMBAQC	30.64	69.36	0.00	Sandy gravel
LB_1955	NMBAQC	31.92	68.08	0.00	Sandy gravel
LB_1958	NMBAQC	28.84	71.16	0.00	Gravelly sand

Key to methods

NMBAQC - States following NMBAQC PSA SOP for supporting biological data

OTHER - Following a diferent SOP.

Figure 1. Benchmark particle size distribution curves for PS47 resulting from analysis of ten replicate samples.

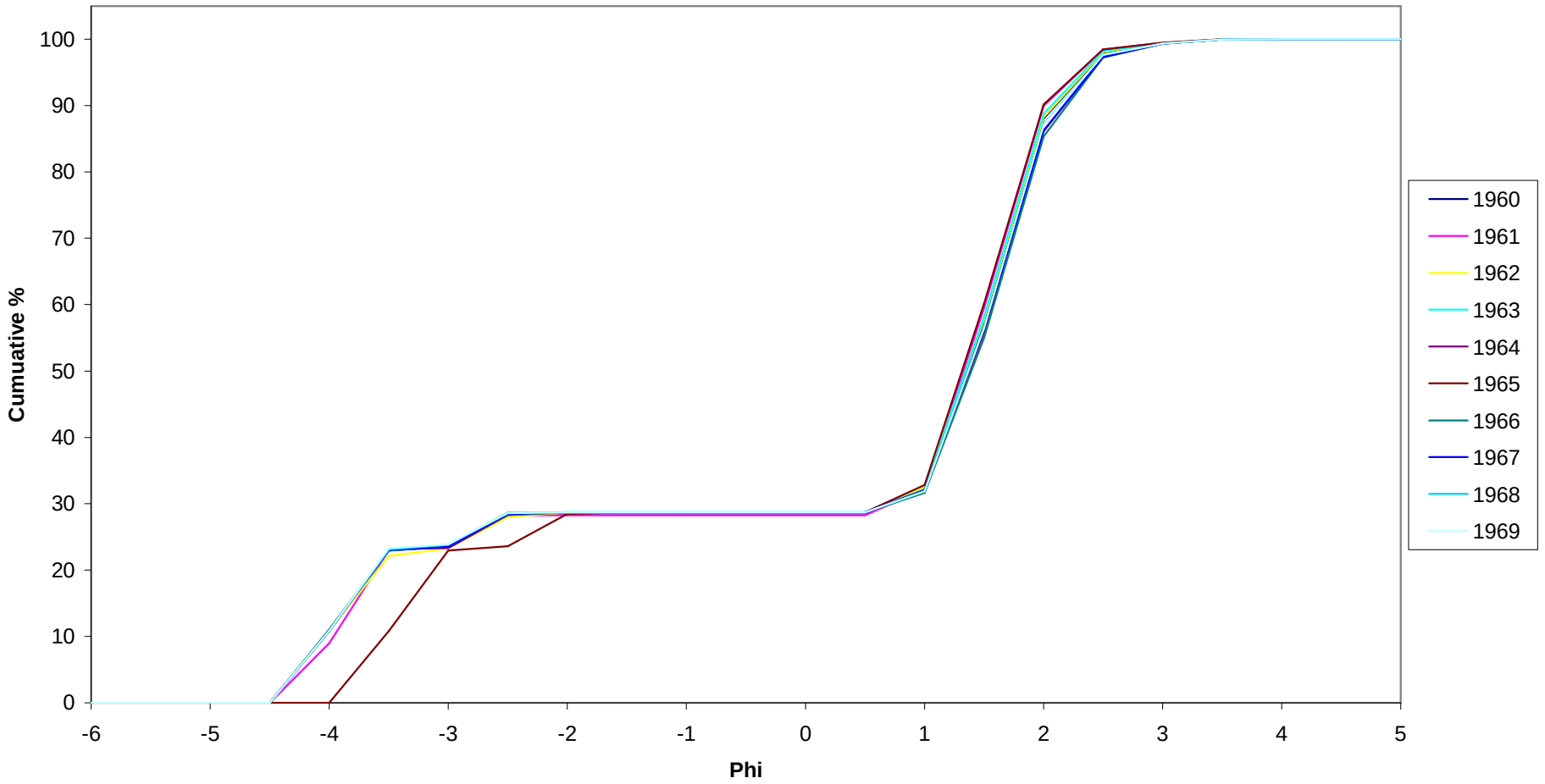


Figure 2. Particle size distribution curves from all participating laboratories for sediment samples from PS47.

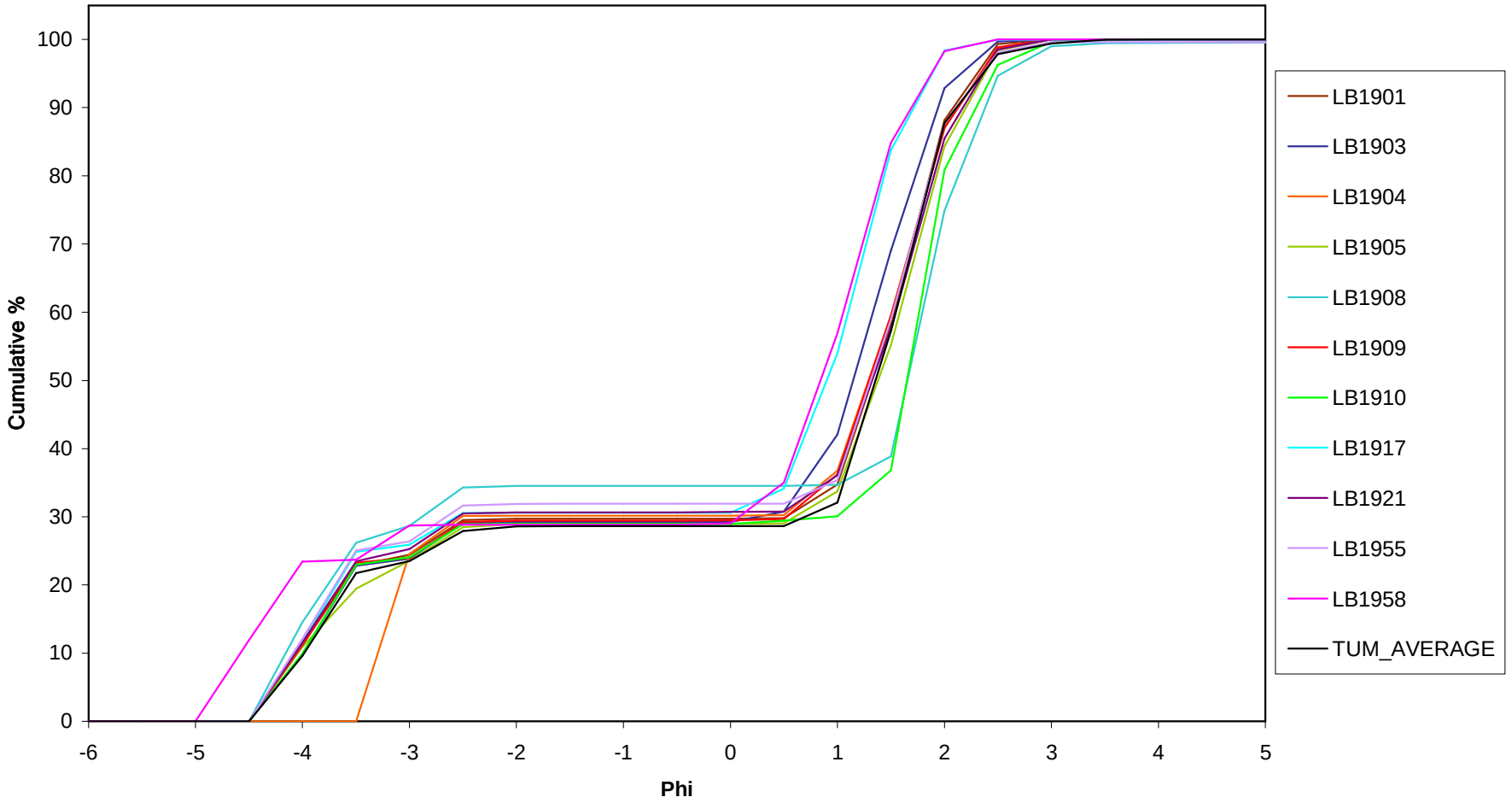


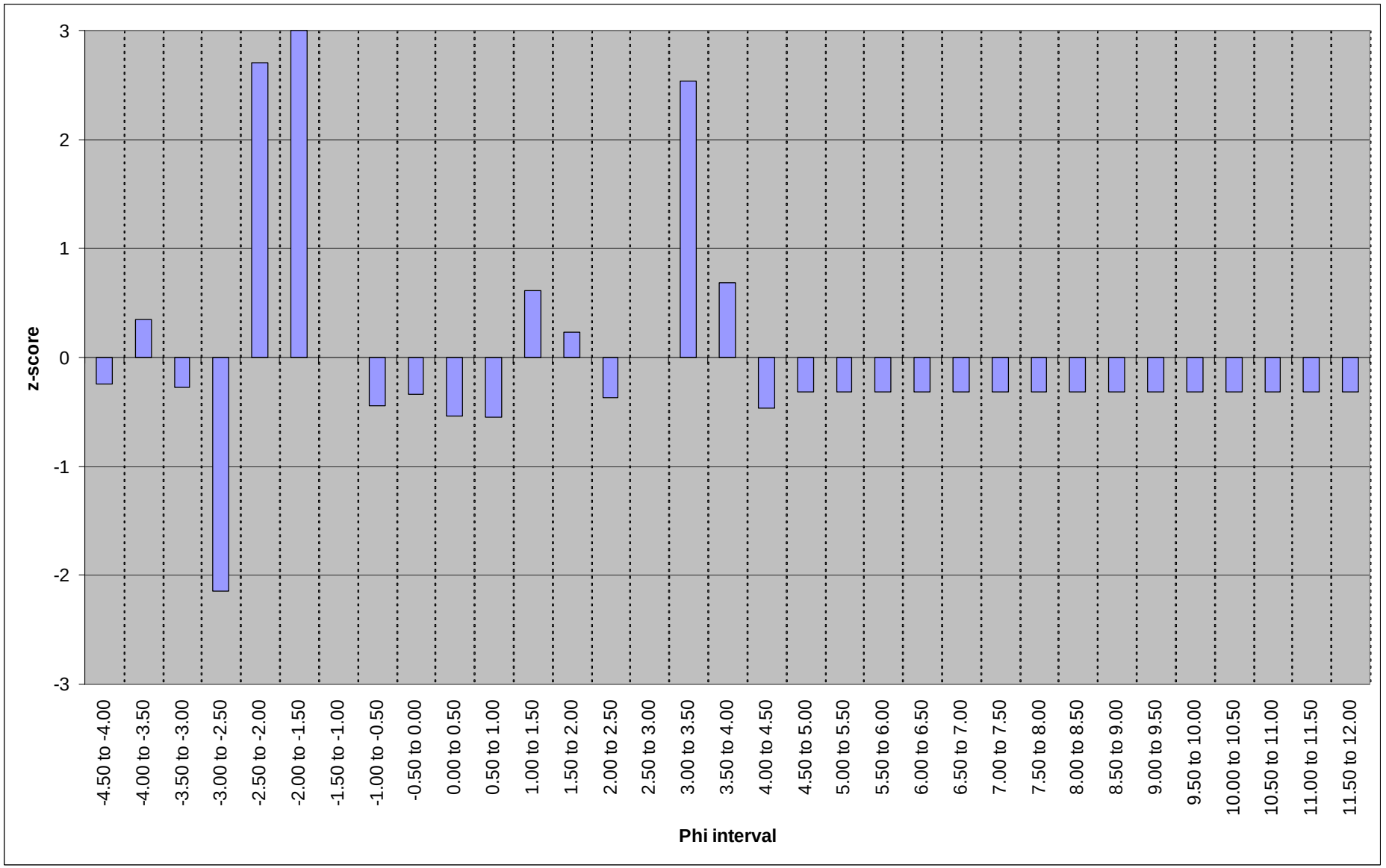
Table 2. Summary of z-scores for each half-phi interval for PS47; data from all participating laboratories included in mean and standard deviation calculations.

	-6.50 to -6.00	-6.00 to -5.50	-5.50 to -5.00	-5.00 to -4.50	-4.50 to -4.00	-4.00 to -3.50	-3.50 to -3.00	-3.00 to -2.50	-2.50 to -2.00	-2.00 to -1.50	-1.50 to -1.00	-1.00 to -0.50	-0.50 to 0.00	0.00 to 0.50	0.50 to 1.00	1.00 to 1.50	1.50 to 2.00	2.00 to 2.50	2.50 to 3.00	3.00 to 3.50
TUM AVERAGE	0	0	0	0	-0.24039	0.344362	-0.27833	-2.14472	2.705102	2.994866	0	-0.44189	-0.33509	-0.54052	-0.547	0.611008	0.2343	-0.36538	-0.00381	2.530545
LB1901	0	0	0	0	0.218577	0.207117	-0.30738	-0.10437	0.045406	-0.15892	0	-0.44189	-0.33509	-0.46861	-0.26751	0.407552	0.141227	-0.13038	-0.74303	-0.31444
LB1903	0	0	0	0	-0.16558	0.567495	-0.38203	0.179722	-0.12148	-0.15892	0	2.748502	-0.33509	0.88737	0.958744	0.84655	-0.72647	-1.09824	-1.08691	-0.31444
LB1904	0	0	0	0	-2.96954	-2.95536	3.119018	1.224603	-0.75955	-0.15892	0	-0.44189	-0.33509	-0.47069	0.040488	0.296111	-0.18718	-0.0499	-0.15686	-0.31444
LB1905	0	0	0	0	0.147685	-0.6406	0.063002	-0.58659	1.547446	-0.15892	0	-0.44189	-0.33509	-0.48758	-0.30695	0.123516	0.047162	0.521442	-0.00189	-0.31444
LB1908	0	0	0	0	1.168968	0.211843	-0.17168	1.355303	0.160762	-0.15892	0	-0.44189	-0.33509	-0.52588	-1.17745	-2.14236	1.044829	1.801917	2.296819	1.758375
LB1909	0	0	0	0	0.210341	0.334124	-0.4336	0.238287	0.178019	-0.15892	0	-0.44189	-0.26523	-0.33529	0.043143	0.356913	-0.18884	0.024083	-0.35879	-0.31444
LB1910	0	0	0	0	-0.14033	0.592392	-0.38312	-0.85522	-0.70379	-0.15892	0	-0.44189	-0.33509	-0.05953	-1.08482	-1.8087	2.217115	0.825861	1.442774	1.071565
LB1917	0	0	0	0	0.320524	0.662139	-0.38691	-1.4381	-0.60606	-0.15892	0	-0.44189	-0.33509	2.863373	2.594914	1.214269	-2.07056	-2.26573	-1.31607	-0.31444
LB1921	0	0	0	0	0.320274	0.281263	-0.2758	0.171384	-0.03058	-0.15892	0	1.22854	3.144669	-0.50481	-0.18251	0.124993	-0.13964	0.294293	-0.09328	-0.31444
LB1965	0	0	0	0	0.466476	0.573917	-0.34254	0.187596	0.557708	1.589228	0	-0.44189	-0.33509	-0.53893	-0.55002	0.401719	-0.01589	-0.29893	-0.07886	-0.31444
LB1968	0	0	0	0	0.423612	0.165671	-0.49897	-0.37262	-0.26787	-0.15892	0	-0.44189	-0.19869	-0.35942	-0.06803	0.179428	-0.12175	0.375583	0.096107	-0.31444
Mean	0	0	0	0	10.42589	10.88774	3.624743	5.163586	0.173626	0.001529	0	0.000426	0.007443	0.554548	6.320082	20.50859	28.85148	11.73785	1.57974	0.06166
St. Dev	0	0	0	0	3.510943	3.684061	6.702788	0.359942	0.201395	0.009622	0	0.000964	0.022212	1.025952	5.226894	7.637599	6.876774	4.46846	1.200347	0.196095

	3.50 to 4.00	4.00 to 4.50	4.50 to 5.00	5.00 to 5.50	5.50 to 6.00	6.00 to 6.50	6.50 to 7.00	7.00 to 7.50	7.50 to 8.00	8.00 to 8.50	8.50 to 9.00	9.00 to 9.50	9.50 to 10.00	10.00 to 10.50	10.50 to 11.00	11.00 to 11.50	11.50 to 12.00	12.00 to 12.50	12.50 to 13.00	13.00 to 13.50
TUM AVERAGE	0.689246	-0.46636	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	0	0	0
LB1901	-0.4515	-0.46636	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	0	0	0
LB1903	-0.4515	-0.46636	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	0	0	0
LB1904	-0.4515	-0.46636	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	0	0	0
LB1905	-0.4515	-0.46636	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	0	0	0
LB1908	1.544991	2.230182	3.149183	3.149183	3.149183	3.149183	3.149183	3.149183	3.149183	3.149183	3.149183	3.149183	3.149183	3.149183	3.149183	3.149183	3.149183	0	0	0
LB1909	-0.4515	-0.46636	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	0	0	0
LB1910	2.518504	1.967095	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	0	0	0
LB1917	-0.4515	-0.46636	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	0	0	0
LB1921	-0.4515	-0.46636	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	0	0	0
LB1965	-0.4515	-0.46636	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	0	0	0
LB1968	-0.4515	-0.46636	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	-0.31492	0	0	0
Mean	0.009925	0.007566	0.004773	0.005269	0.005412	0.005153	0.004647	0.004072	0.003502	0.002933	0.002337	0.001741	0.001387	0.00125	0.00106	0.000617	7.38E-05	0	0	0
St. Dev	0.021983	0.016223	0.015157	0.016732	0.017184	0.016363	0.014755	0.01293	0.011121	0.009312	0.00742	0.005527	0.004405	0.003969	0.003366	0.00196	0.000234	0	0	0

z-score >1.96 or <-1.96
All values equal zero

Figure 3. Summary of z-scores for the benchmark data (TUM Average); when data from all participating laboratories are included in mean and standard deviation calculations.



Results of SIMPROF testing on PSA Ring test PS47 data

Data was entered into PRIMER v. 6.1.13 in half-phi intervals; any missing data was entered as zero. The data did not need to be transformed as all data was on a similar percentage scale. A Euclidean distance matrix was created from the data; The Euclidean distance between two samples (labs) *j* and *k,* is defined algebraically as $d_{jk} = \sqrt{\sum_{i=1}^{p}(y_{ij} - y_{ik})^2}$. From this distance matrix cluster analysis was carried out including a SIMPROF test at a 5% significance level. The red SIMPROF lines on the dendrogram indicate labs that cannot be distinguished from each other at the 5% significance level; the black lines indicate labs that can be distinguished from each other. The results are presented as a cluster dendrogram (Figure 4) and non-metric Multi-Dimensional Scaling (MDS) diagrams (Figures 5) below. It is important to note that, although the MDS plot is bounded by a box, the box does not represent either axes or scale. Two samples with a high similarity index will appear close together while those less similar will appear further apart. The ‘ correct’ configuration of sample points will be multidimensional and the plot represents the best 2-dimensional solution to the problem. The technique should be viewed as complementary to cluster analysis, offering a different perspective of the same information.

Figure 4. Cluster dendrogram of PS47 including all laboratories, with the benchmark replicates (TUM average).

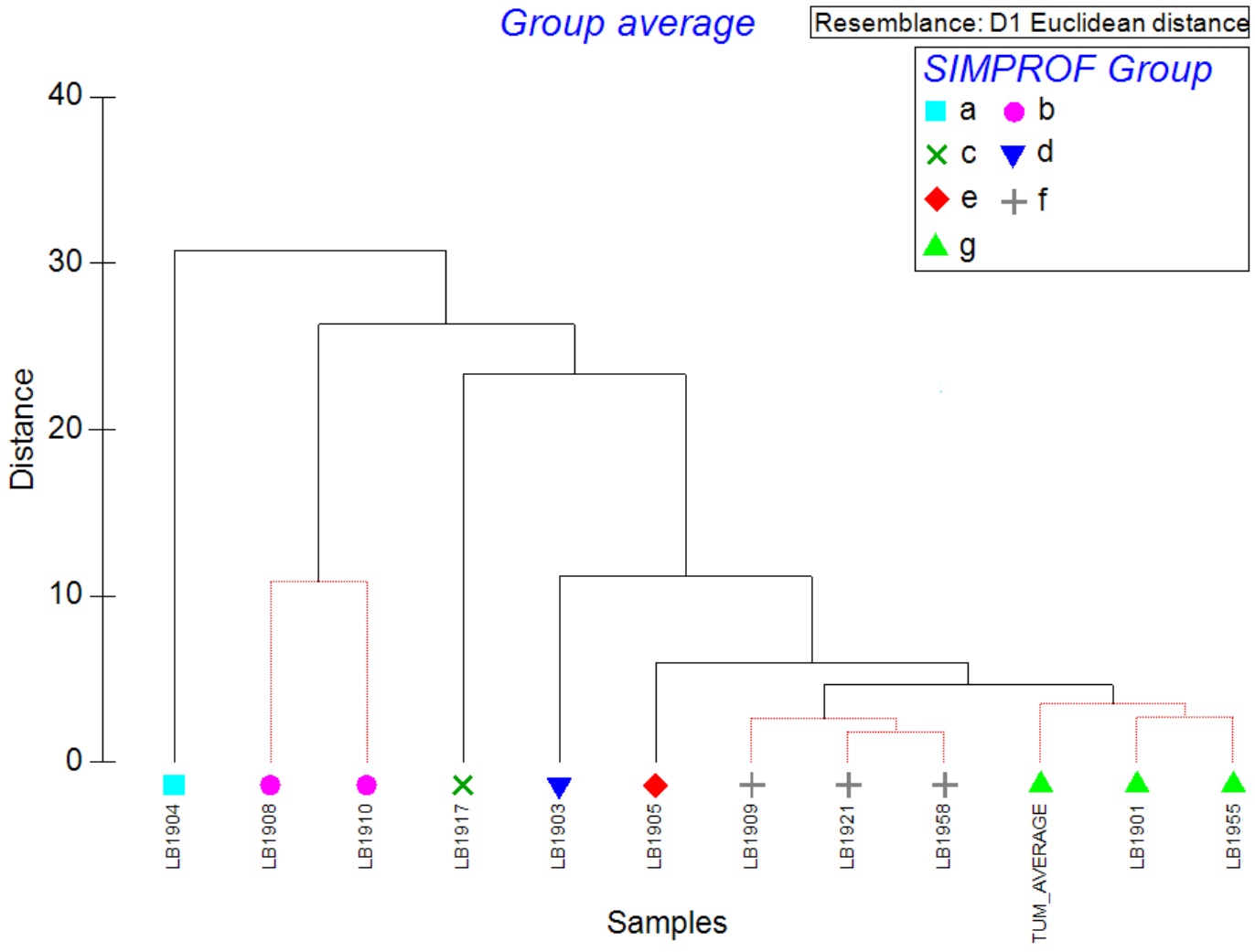
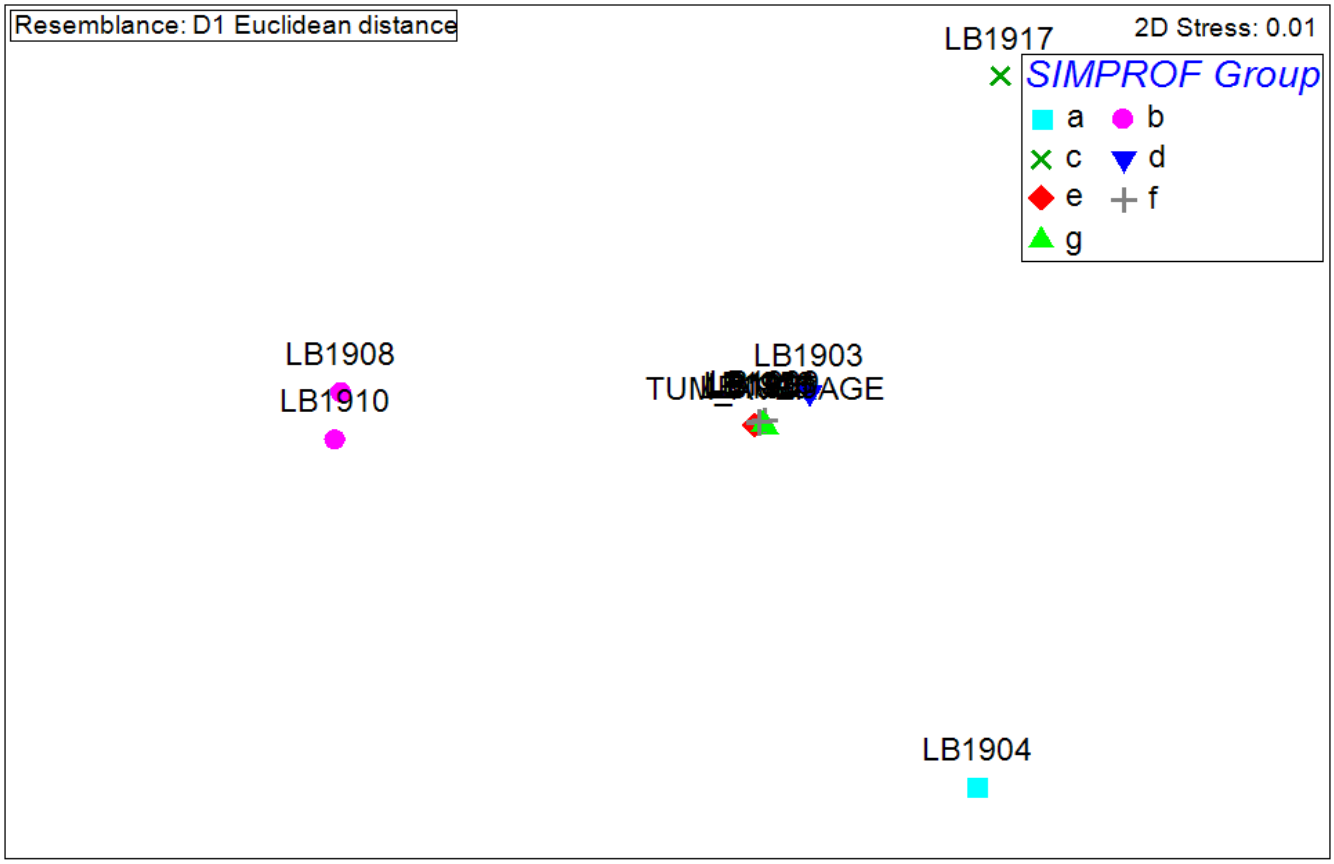
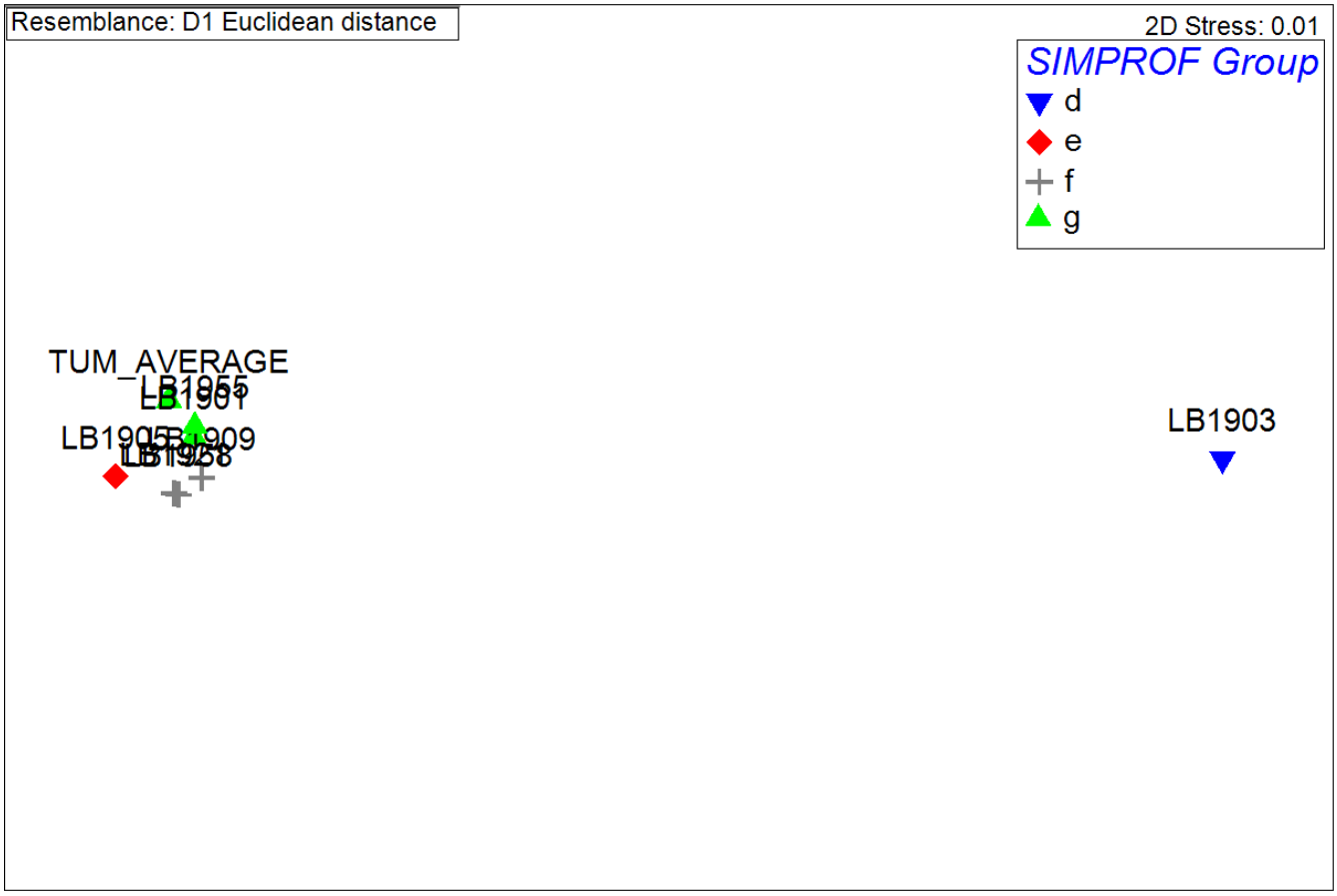


Figure 5. MDS plots of PS47 with the benchmark replicates (TUM AVERAGE) averaged; (a) including all laboratories, (b) a subset of cluster groups d through g, and (c) a subset of cluster groups e, f, and g.

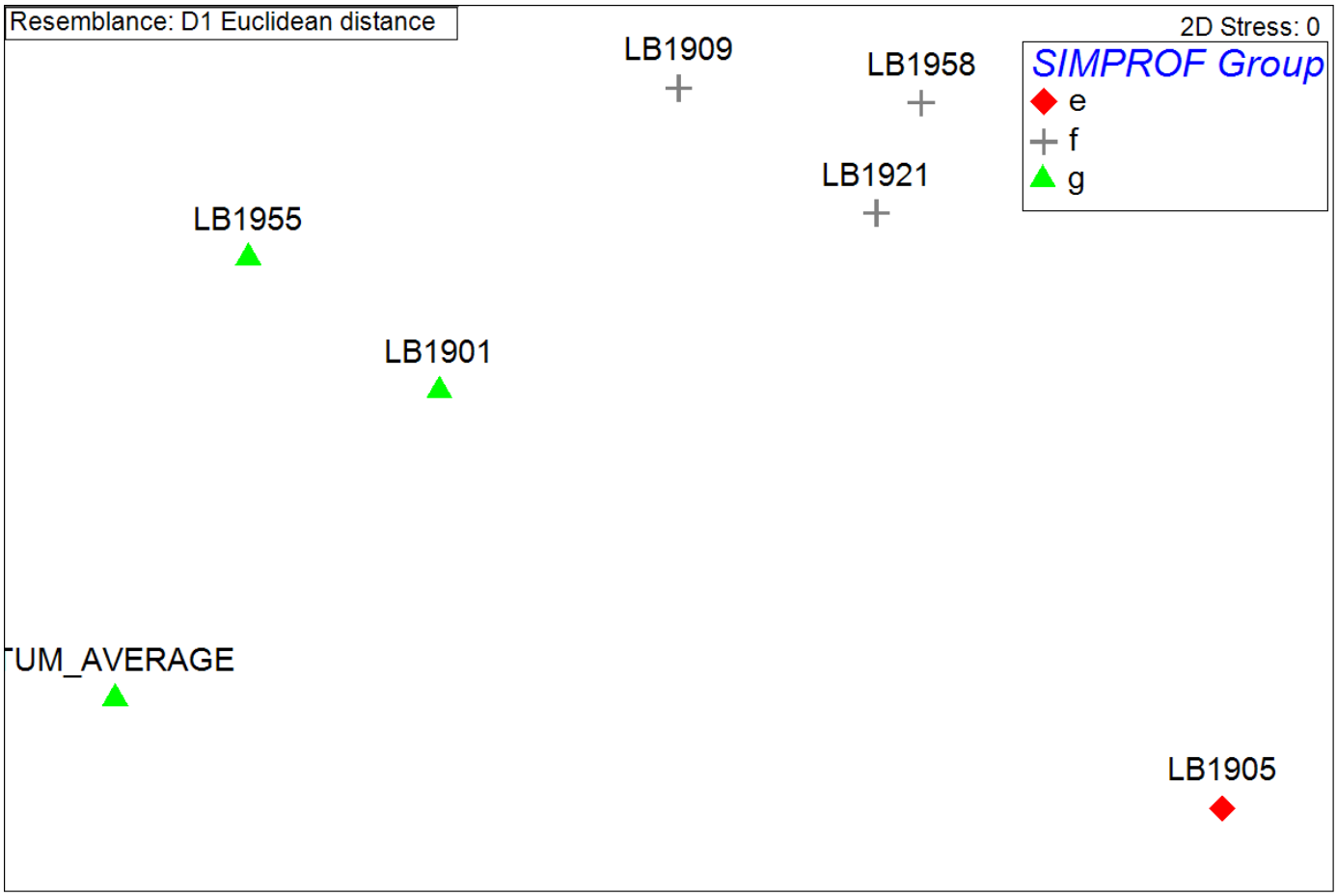
5a.



5b.



5c.



The cluster analysis separates the laboratories into 7 SIMPROF cluster groups; four of these groups each comprise a single lab.

Cluster group A is formed of a single laboratory (LB1904), the cumulative percentage curve in figure 2 shows that LB1904 had a sharp rise in percentage at -3.5 phi.

Cluster group B comprises of two laboratories (LB1908 and LB1910). Table 1 shows both laboratories recorded a small percentage of silt compared to other laboratories. This is corroborated by Table 2 which shows both laboratories recording results above phi 4.0 (LB1910) and 4.5 (LB1908) respectively. This accounts for the deviation of z-scores for LB1908 from phi 4.0 - 12. The differences shown by LB1908 could also be attributed by adhering to a slightly different methodology than the NMBAQC Scheme standard.

Cluster group C is formed of a single laboratory (LB1917). This could be attributed to LB1917 recording a higher percentage of particles (between phi 0.00 and 1.00) than all other laboratories.

Cluster group D is formed of a single laboratory (LB1903). The cumulative percentage curve in figure 2 shows that LB1903 has a comparatively higher percentage increase (between 0.5 and 2.5).

Cluster groups E (LB1905), F (LB1909, LB1921 and LB1958) and G (LB1901, LB1955, and the TUM AVERAGE) have cumulative percentage curves that look very similar to one another. Cluster group E recorded a slightly lower percentage of particles (between phi -3.5 and -3) compared to other laboratories (omitting LB1904). Cluster analysis of groups F and G shows their separation just above the 5% significance level.

Appendices

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	PS47
LabCode:	LB1901
Sample Code:	PS471901
Equipment used (e.g. laser model and range):	Endecotts Test Sieves, Malvern Mastersizer 2000 Laser Diffractor (Model: MAL1002178)
Method used:	NMBAQC PSA SOP for supporting biological data*
Peroxide pre-treatment used:	NO*
Chemical dispersant used:	NO*
Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	Volume % (mark as "0" for not analysed or no material)
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**11.1933**
-4.00 to -3.50; 11.2 mm	**11.6508**
-3.50 to -3.00; 8 mm	**1.5644**
-3.00 to -2.50; 5.6 mm	**5.1260**
-2.50 to -2.00; 4 mm	**0.1828**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.0738
0.50 to 1.00; (500 µm)	4.9219
1.00 to 1.50; (353.6 µm)	23.6213
1.50 to 2.00; (250 µm)	29.8227
2.00 to 2.50; (176.8 µm)	11.1553
2.50 to 3.00; (125 µm)	0.6878
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

NMBAQCS - PS Exercise Data Workbook
(Page 2 - Final Merged Data Submission)

Return to Thomson Unicomarine Ltd. by 05-04-13

Exercise Code:	**PS47**
LabCode:	**LB1903**
Sample Code:	**PS471903**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	Volume/Weight (mark as "0" for not analysed or no material)
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**64.0200**
-4.00 to -3.50; 11.2 mm	**84.4000**
-3.50 to -3.00; 8 mm	**6.9200**
-3.00 to -2.50; 5.6 mm	**34.0000**
-2.50 to -2.00; 4 mm	**0.9700**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0200**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	9.5267
0.50 to 1.00; (500 µm)	73.6888
1.00 to 1.50; (353.6 µm)	175.4159
1.50 to 2.00; (250 µm)	155.1359
2.00 to 2.50; (176.8 µm)	44.4187
2.50 to 3.00; (125 µm)	1.7888
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

NMBAQCS - PS Exercise Data Workbook
(Page 2 - Final Merged Data Submission)

Return to Thomson Unicomarine Ltd. by 05-04-13

Exercise Code:	**PS47**
LabCode:	**LB1904**
Sample Code:	**PS471904**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	Volume/Weight (mark as "0" for not analysed or no material)
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**154.3800**
-3.00 to -2.50; 5.6 mm	**35.2700**
-2.50 to -2.00; 4 mm	**0.1300**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.4508
0.50 to 1.00; (500 µm)	41.1060
1.00 to 1.50; (353.6 µm)	143.2995
1.50 to 2.00; (250 µm)	173.4701
2.00 to 2.50; (176.8 µm)	72.4667
2.50 to 3.00; (125 µm)	8.7568
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

NMBAQCS - PS Exercise Data Workbook
(Page 2 - Final Merged Data Submission)

Return to Thomson Unicomarine Ltd. by 05-04-13

Exercise Code:	**PS47**
LabCode:	**LB1905**
Sample Code:	**PS471905**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**72.0188**
-4.00 to -3.50; 11.2 mm	**56.1161**
-3.50 to -3.00; 8 mm	**26.6312**
-3.00 to -2.50; 5.6 mm	**32.5892**
-2.50 to -2.00; 4 mm	**3.1933**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.3574
0.50 to 1.00; (500 µm)	31.0310
1.00 to 1.50; (353.6 µm)	141.1629
1.50 to 2.00; (250 µm)	191.9891
2.00 to 2.50; (176.8 µm)	92.5727
2.50 to 3.00; (125 µm)	10.3804
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Exercise Code:	PS47
LabCode:	LB1908
Sample Code:	PS471908
Equipment used (e.g. laser model and range):	Endecotts Test Sieves, Malvern Mastersizer Micro Laser Diffractor (Model: MAF5000)
Method used:	Sub-sample oven dried @ 105°C to constant weight, wet split at 63µm, followed by dry sieving >63um
Peroxide pre-treatment used:	NO*
Chemical dispersant used:	NO*
Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	Volume % (mark as "0" for not analysed or no material)
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**14.5301**
-4.00 to -3.50; 11.2 mm	**11.6682**
-3.50 to -3.00; 8 mm	**2.4740**
-3.00 to -2.50; 5.6 mm	**5.6514**
-2.50 to -2.00; 4 mm	**0.2060**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	**0.0150**
0.50 to 1.00; (500 µm)	**0.1657**
1.00 to 1.50; (353.6 µm)	**4.1461**
1.50 to 2.00; (250 µm)	**36.0365**
2.00 to 2.50; (176.8 µm)	**19.7896**
2.50 to 3.00; (125 µm)	**4.3367**
3.00 to 3.50; (88.39 µm)	**0.4065**
3.50 to 4.00; (62.5 µm)	**0.0439**
4.00 to 4.50; (44.19 µm)	0.0437
4.50 to 5.00; (31.25 µm)	0.0525
5.00 to 5.50; (22.097 µm)	0.0580
5.50 to 6.00; (15.625 µm)	0.0595
6.00 to 6.50; (11.049 µm)	0.0567
6.50 to 7.00; (7.813 µm)	0.0511
7.00 to 7.50; (5.524 µm)	0.0448
7.50 to 8.00; (3.906 µm)	0.0385
8.00 to 8.50; (2.762 µm)	0.0323
8.50 to 9.00; (1.953 µm)	0.0257
9.00 to 9.50; (1.381 µm)	0.0191
9.50 to 10.00; (0.977 µm)	0.0153
10.00 to 10.50; (0.691 µm)	0.0138
10.50 to 11.00; (0.488 µm)	0.0117
11.00 to 11.50; (0.345 µm)	0.0068
11.50 to 12.00; (0.244 µm)	0.0008
12.00 to 12.50; (0.173 µm)	"0"
12.50 to 13.00; (0.122 µm)	"0"
13.00 to 13.50; (0.086 µm)	"0"

NMBAQCS - PS Exercise Data Workbook
(Page 2 - Final Merged Data Submission)

Return to Thomson Unicomarine Ltd. by 05-04-13

Exercise Code:	**PS47**
LabCode:	**LB1909**
Sample Code:	**PS471909**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.00**
-6.00 to -5.50; 45 mm	**0.00**
-5.50 to -5.00; 31.5 mm	**0.00**
-5.00 to -4.50; 22.4 mm	**0.00**
-4.50 to -4.00; 16 mm	**71.95**
-4.00 to -3.50; 11.2 mm	**78.10**
-3.50 to -3.00; 8 mm	**4.63**
-3.00 to -2.50; 5.6 mm	**33.83**
-2.50 to -2.00; 4 mm	**1.35**
-2.00 to -1.50; 2.8 mm	**0.00**
-1.50 to -1.00; 2 mm	**0.00**
-1.00 to -0.50; 1.4 mm	**0.00**
-0.50 to 0.00; 1 mm	**0.01**
0.00 to 0.50; (707 µm)	1.36
0.50 to 1.00; (500 µm)	42.18
1.00 to 1.50; (353.6 µm)	149.74
1.50 to 2.00; (250 µm)	177.57
2.00 to 2.50; (176.8 µm)	76.34
2.50 to 3.00; (125 µm)	7.41
3.00 to 3.50; (88.39 µm)	0.00
3.50 to 4.00; (62.5 µm)	0.00
4.00 to 4.50; (44.19 µm)	0.00
4.50 to 5.00; (31.25 µm)	0.00
5.00 to 5.50; (22.097 µm)	0.00
5.50 to 6.00; (15.625 µm)	0.00
6.00 to 6.50; (11.049 µm)	0.00
6.50 to 7.00; (7.813 µm)	0.00
7.00 to 7.50; (5.524 µm)	0.00
7.50 to 8.00; (3.906 µm)	0.00
8.00 to 8.50; (2.762 µm)	0.00
8.50 to 9.00; (1.953 µm)	0.00
9.00 to 9.50; (1.381 µm)	0.00
9.50 to 10.00; (0.977 µm)	0.00
10.00 to 10.50; (0.691 µm)	0.00
10.50 to 11.00; (0.488 µm)	0.00
11.00 to 11.50; (0.345 µm)	0.00
11.50 to 12.00; (0.244 µm)	0.00
12.00 to 12.50; (0.173 µm)	0.00
12.50 to 13.00; (0.122 µm)	0.00
13.00 to 13.50; (0.086 µm)	0.00

Exercise Code:	PS47
LabCode:	LB1910
Sample Code:	PS471910
Equipment used (e.g. laser model and range):	*Retsch AS200 sirve shaker*
Method used:	A modified methodology from NMBAQC PSA SOP for supporting biological data*
Peroxide pre-treatment used:	NO*
Chemical dispersant used:	NO*
Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	Volume/Weight (mark as "0" for not analysed or no material)
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**9.9332**
-4.00 to -3.50; 11.2 mm	**13.0701**
-3.50 to -3.00; 8 mm	**1.0568**
-3.00 to -2.50; 5.6 mm	**4.8558**
-2.50 to -2.00; 4 mm	**0.0319**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.4935
0.50 to 1.00; (500 µm)	0.6499
1.00 to 1.50; (353.6 µm)	6.6945
1.50 to 2.00; (250 µm)	44.0981
2.00 to 2.50; (176.8 µm)	15.4282
2.50 to 3.00; (125 µm)	3.3116
3.00 to 3.50; (88.39 µm)	0.2718
3.50 to 4.00; (62.5 µm)	0.0653
4.00 to 4.50; (44.19 µm)	0.0395
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

NMBAQCS - PS Exercise Data Workbook
(Page 2 - Final Merged Data Submission)

Return to Thomson Unicomarine Ltd. by 05-04-13

Exercise Code:	**PS47**
LabCode:	**LB1917**
Sample Code:	**PS471917**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	Volume/Weight (mark as "0" for not analysed or no material)
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**71.6800**
-4.00 to -3.50; 11.2 mm	**82.7000**
-3.50 to -3.00; 8 mm	**6.4000**
-3.00 to -2.50; 5.6 mm	**28.8300**
-2.50 to -2.00; 4 mm	**0.3200**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	21.6707
0.50 to 1.00; (500 µm)	123.3846
1.00 to 1.50; (353.6 µm)	184.8135
1.50 to 2.00; (250 µm)	90.6779
2.00 to 2.50; (176.8 µm)	10.0126
2.50 to 3.00; (125 µm)	0.0000
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

NMBAQCS - PS Exercise Data Workbook
(Page 2 - Final Merged Data Submission)

Return to Thomson Unicomarine Ltd. by 05-04-13

Exercise Code:	**PS47**
LabCode:	**LB1921**
Sample Code:	**PS471921**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	Volume/Weight (mark as "0" for not analysed or no material)
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**71.7300**
-4.00 to -3.50; 11.2 mm	**74.0500**
-3.50 to -3.00; 8 mm	**11.0300**
-3.00 to -2.50; 5.6 mm	**32.4500**
-2.50 to -2.00; 4 mm	**1.0400**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0100**
-0.50 to 0.00; 1 mm	**0.4800**
0.00 to 0.50; (707 µm)	0.2275
0.50 to 1.00; (500 µm)	33.3247
1.00 to 1.50; (353.6 µm)	133.2910
1.50 to 2.00; (250 µm)	173.2101
2.00 to 2.50; (176.8 µm)	81.0611
2.50 to 3.00; (125 µm)	9.1151
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

NMBAQCS - PS Exercise Data Workbook
(Page 2 - Final Merged Data Submission)

Return to Thomson Unicomarine Ltd. by 05-04-13

Exercise Code:	**PS47**
LabCode:	**LB1955**
Sample Code:	**PS471955**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**63.9000**
-4.00 to -3.50; 11.2 mm	**75.3000**
-3.50 to -3.00; 8 mm	**48.4000**
-3.00 to -2.50; 5.6 mm	**129.4000**
-2.50 to -2.00; 4 mm	**79.5000**
-2.00 to -1.50; 2.8 mm	**11.6000**
-1.50 to -1.00; 2 mm	**22.5000**
-1.00 to -0.50; 1.4 mm	**1.7000**
-0.50 to 0.00; 1 mm	**0.2000**
0.00 to 0.50; (707 µm)	0.0775
0.50 to 1.00; (500 µm)	0.0571
1.00 to 1.50; (353.6 µm)	0.0434
1.50 to 2.00; (250 µm)	0.0369
2.00 to 2.50; (176.8 µm)	0.0405
2.50 to 3.00; (125 µm)	0.0347
3.00 to 3.50; (88.39 µm)	0.0289
3.50 to 4.00; (62.5 µm)	0.0240
4.00 to 4.50; (44.19 µm)	0.0139
4.50 to 5.00; (31.25 µm)	0.0086
5.00 to 5.50; (22.097 µm)	0.0065
5.50 to 6.00; (15.625 µm)	0.0045
6.00 to 6.50; (11.049 µm)	0.0036
6.50 to 7.00; (7.813 µm)	0.0033
7.00 to 7.50; (5.524 µm)	0.0032
7.50 to 8.00; (3.906 µm)	0.0029
8.00 to 8.50; (2.762 µm)	0.0025
8.50 to 9.00; (1.953 µm)	0.0020
9.00 to 9.50; (1.381 µm)	0.0015
9.50 to 10.00; (0.977 µm)	0.0011
10.00 to 10.50; (0.691 µm)	0.0009
10.50 to 11.00; (0.488 µm)	0.0007
11.00 to 11.50; (0.345 µm)	0.0005
11.50 to 12.00; (0.244 µm)	0.0004
12.00 to 12.50; (0.173 µm)	0.0003
12.50 to 13.00; (0.122 µm)	0.0002
13.00 to 13.50; (0.086 µm)	0.0002

NMBAQCS - PS Exercise Data Workbook
(Page 2 - Final Merged Data Submission)

Return to Thomson Unicomarine Ltd. by 05-04-13

Exercise Code:	**PS47**
LabCode:	**LB1958**
Sample Code:	**PS471958**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**78.6400**
-4.00 to -3.50; 11.2 mm	**75.9000**
-3.50 to -3.00; 8 mm	**1.8500**
-3.00 to -2.50; 5.6 mm	**33.2000**
-2.50 to -2.00; 4 mm	**0.7900**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0200**
0.00 to 0.50; (707 µm)	1.2265
0.50 to 1.00; (500 µm)	39.3721
1.00 to 1.50; (353.6 µm)	144.4254
1.50 to 2.00; (250 µm)	184.9248
2.00 to 2.50; (176.8 µm)	88.5612
2.50 to 3.00; (125 µm)	11.1895
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 2. Z-score calculations when data from all participating laboratories are included in mean and standard deviation calculations.

	-4.50 to -4.00	z-score	-4.00 to -3.50	z-score	-3.50 to -3.00	z-score	-3.00 to -2.50	z-score	-2.50 to -2.00	z-score	-2.00 to -1.50	z-score
TUM AVER	9.581906	-0.24039	12.15639	0.344362	1.759136	-0.27833	4.391612	-2.14472	0.718419	2.705102	0.030345	2.994866
LB1901	11.1933	0.218577	11.65077	0.207117	1.564431	-0.30738	5.126021	-0.10437	0.18277	0.045406	0	-0.15892
LB1903	9.844536	-0.16558	12.97843	0.567495	1.064108	-0.38203	5.228276	0.179722	0.14916	-0.12148	0	-0.15892
LB1904	0	-2.96954	0	-2.95536	24.53085	3.119016	5.604373	1.224603	0.020657	-0.75955	0	-0.15892
LB1905	10.9444	0.147685	8.527736	-0.6406	4.047035	0.063002	4.952448	-0.58659	0.485273	1.547446	0	-0.15892
LB1908	14.53007	1.168968	11.66818	0.211843	2.474003	-0.17168	5.651418	1.355303	0.206002	0.160762	0	-0.15892
LB1909	11.16439	0.210341	12.11867	0.334124	0.718431	-0.4336	5.249356	0.238287	0.209478	0.178019	0	-0.15892
LB1910	9.933192	-0.14033	13.07015	0.592392	1.056787	-0.38312	4.855755	-0.85522	0.031886	-0.70379	0	-0.15892
LB1917	11.55123	0.320524	13.3271	0.662139	1.03136	-0.38691	4.645954	-1.4381	0.051568	-0.60606	0	-0.15892
LB1921	11.55035	0.320274	11.92393	0.281263	1.77611	-0.2758	5.225275	0.171384	0.167466	-0.03058	0	-0.15892
LB1955	12.06015	0.465476	13.00209	0.573917	1.328803	-0.34254	5.231111	0.187598	0.285945	0.557708	0.01682	1.589228
LB1958	11.91317	0.423612	11.49808	0.165671	0.280256	-0.49897	5.029465	-0.37262	0.119677	-0.26787	0	-0.15892
Mean	10.42589		10.88774		3.624743		5.163586		0.173626		0.001529	
St Dev	3.510943		3.684061		6.702788		0.359942		0.201395		0.009822	

	-1.50 to -1.00	z-score	-1.00 to -0.50	z-score	-0.50 to 0.00	z-score	0.00 to 0.50	z-score	0.50 to 1.00	z-score	1.00 to 1.50	z-score
TUM AVER	0	0	0	-0.44189	0	-0.33509	0	-0.54052	3.460973	-0.547	25.17523	0.811008
LB1901	0	0	0	-0.44189	0	-0.33509	0.073778	-0.46861	4.921856	-0.26751	23.62131	0.407552
LB1903	0	0	0.003075	2.748502	0	-0.33509	1.464947	0.88737	11.33133	0.958744	26.9742	0.84655
LB1904	0	0	0	-0.44189	0	-0.33509	0.071638	-0.47069	6.531709	0.040488	22.77017	0.296111
LB1905	0	0	0	-0.44189	0	-0.33509	0.054319	-0.48758	4.715662	-0.30695	21.45195	0.123516
LB1908	0	0	0	-0.44189	0	-0.33509	0.015025	-0.52588	0.165672	-1.17745	4.146139	-2.14236
LB1909	0	0	0	-0.44189	0.001552	-0.26523	0.210556	-0.33529	6.545585	0.043143	23.23455	0.356913
LB1910	0	0	0	-0.44189	0	-0.33509	0.493471	-0.05953	0.649863	-1.08482	6.694503	-1.8087
LB1917	0	0	0	-0.44189	0	-0.33509	3.492231	2.863373	19.88342	2.594914	29.78269	1.214269
LB1921	0	0	0.00161	1.22854	0.077292	3.144669	0.03664	-0.50481	5.366117	-0.18251	21.46324	0.124993
LB1955	0	0	0	-0.44189	0	-0.33509	0.001629	-0.53893	3.445194	-0.55002	23.57676	0.401719
LB1958	0	0	0	-0.44189	0.00303	-0.19869	0.185797	-0.35942	5.964481	-0.06803	21.87899	0.179428
Mean	0		0.000426		0.007443		0.554548		6.320082		20.50859	
St Dev	0		0.000964		0.022212		1.025952		5.226894		7.637599	

	1.50 to 2.00	z-score	2.00 to 2.50	z-score	2.50 to 3.00	z-score	3.00 to 3.50	z-score	3.50 to 4.00	z-score	4.00 to 4.50	z-score
TUM AVER	30.46271	0.2343	10.10515	-0.36538	1.575166	-0.00381	0.557888	2.530546	0.025077	0.689246	0	-0.46636
LB1901	29.82267	0.141227	11.15525	-0.13038	0.687843	-0.74303	0	-0.31444	0	-0.4515	0	-0.46636
LB1903	23.85569	-0.72647	6.830394	-1.09824	0.275071	-1.08691	0	-0.31444	0	-0.4515	0	-0.46636
LB1904	27.56426	-0.18718	11.5149	-0.0499	1.391452	-0.15686	0	-0.31444	0	-0.4515	0	-0.46636
LB1905	29.17581	0.047162	14.06789	0.521442	1.577466	-0.00189	0	-0.31444	0	-0.4515	0	-0.46636
LB1908	36.03653	1.044829	19.78965	1.801917	4.336721	2.296819	0.406469	1.758375	0.043889	1.544991	0.043746	2.230182
LB1909	27.5529	-0.18884	11.84547	0.024083	1.149066	-0.35879	0	-0.31444	0	-0.4515	0	-0.46636
LB1910	44.09809	2.217115	15.42818	0.825861	3.31157	1.442774	0.271789	1.071565	0.06529	2.518504	0.039478	1.967095
LB1917	14.61273	-2.07056	1.613537	-2.28573	0	-1.31607	0	-0.31444	0	-0.4515	0	-0.46636
LB1921	27.89123	-0.13964	13.05289	0.294293	1.467769	-0.09328	0	-0.31444	0	-0.4515	0	-0.46636
LB1955	28.74218	-0.01589	10.4021	-0.29893	1.485086	-0.07886	0	-0.31444	0	-0.4515	0	-0.46636
LB1958	28.01424	-0.12175	13.41613	0.375583	1.695102	0.096107	0	-0.31444	0	-0.4515	0	-0.46636
Mean	28.85148		11.73785		1.57974		0.06166		0.009925		0.007566	
St Dev	6.876774		4.46846		1.200347		0.196095		0.021983		0.016223	

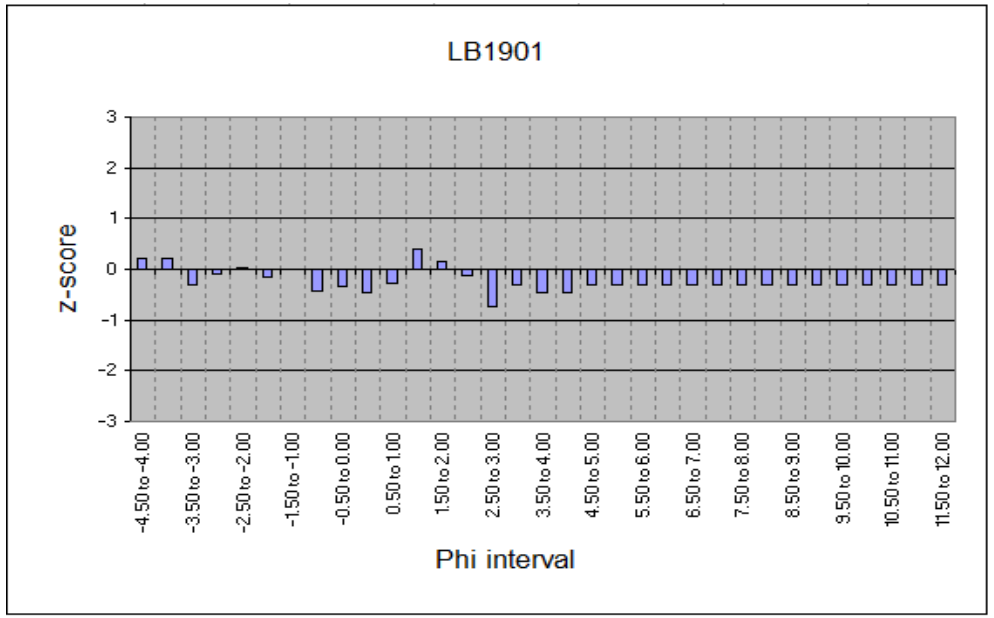
	4.50 to 5.00	z-score	5.00 to 5.50	z-score	5.50 to 6.00	z-score	6.00 to 6.50	z-score	6.50 to 7.00	z-score	7.00 to 7.50	z-score
TUM AVER	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1901	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1903	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1904	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1905	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1908	0.052506	3.149183	0.05796	3.149183	0.059527	3.149183	0.056684	3.149183	0.051114	3.149183	0.04479	3.149183
LB1909	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1910	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1917	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1921	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1955	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1958	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
Mean	0.004773		0.005269		0.005412		0.005153		0.004647		0.004072	
St Dev	0.015157		0.016732		0.017184		0.016363		0.014755		0.01293	

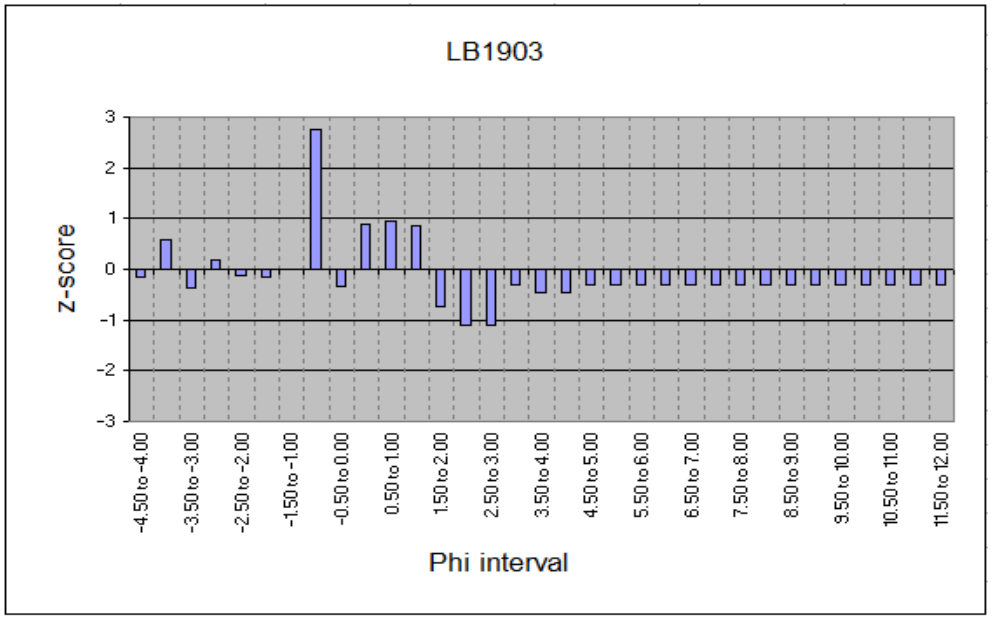
Appendix 2. Z-score calculations when data from all participating laboratories are included in mean and standard deviation calculations.

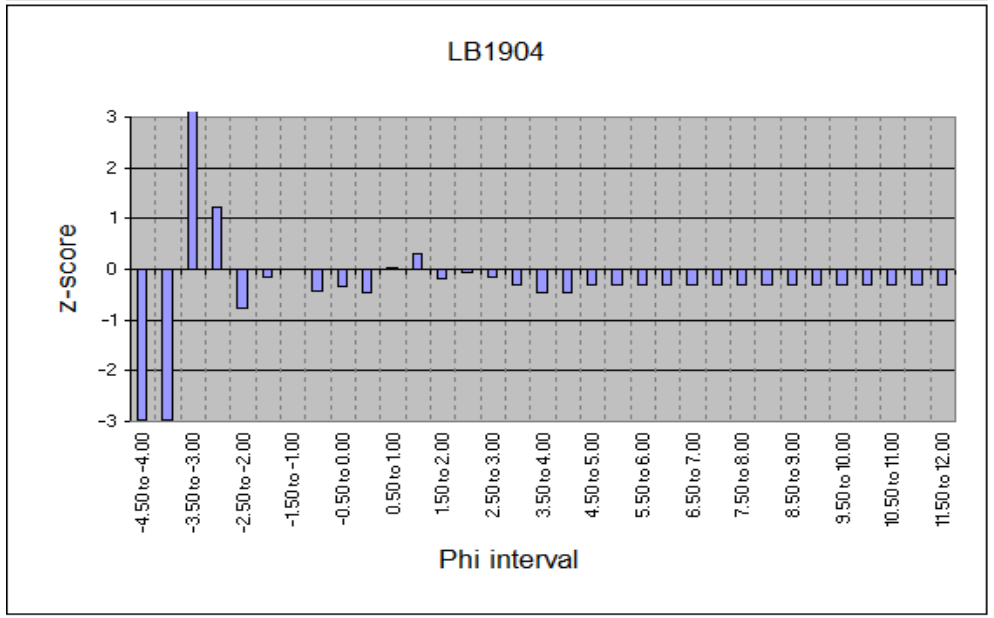
	7.50 to 8.00	z-score	8.00 to 8.50	z-score	8.50 to 9.00	z-score	9.00 to 9.50	z-score	9.50 to 10.00	z-score	10.00 to 10.5	z-score
TUM AVER	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1901	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1903	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1904	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1905	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1908	0.038524	3.149183	0.032258	3.149183	0.025702	3.149183	0.019146	3.149183	0.015259	3.149183	0.01375	3.149183
LB1909	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1910	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1917	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1921	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1955	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
LB1958	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492	0	-0.31492
Mean	0.003502		0.002933		0.002337		0.001741		0.001387		0.00125	
St. Dev	0.011121		0.009312		0.00742		0.005527		0.004405		0.003969	

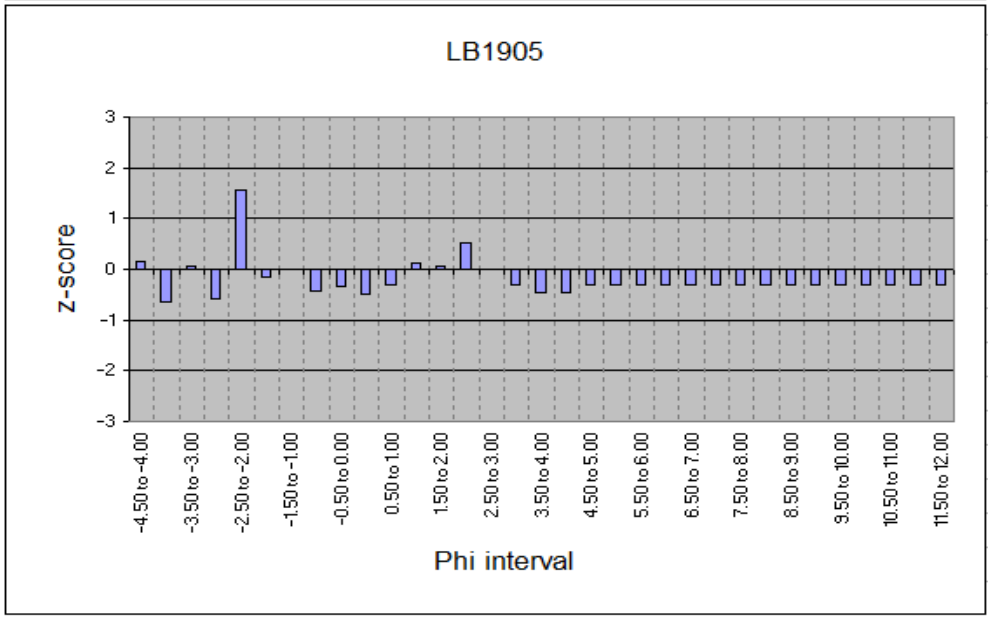
	10.50 to 11.00	z-score	11.00 to 11.50	z-score	11.50 to 12.00	z-score	12.00 to 12.50	z-score	12.50 to 13.00	z-score	13.00 to 13.50	z-score
TUM AVER	0	-0.31492	0	-0.31492	0	-0.31492	0	0	0	0	0	0
LB1901	0	-0.31492	0	-0.31492	0	-0.31492	0	0	0	0	0	0
LB1903	0	-0.31492	0	-0.31492	0	-0.31492	0	0	0	0	0	0
LB1904	0	-0.31492	0	-0.31492	0	-0.31492	0	0	0	0	0	0
LB1905	0	-0.31492	0	-0.31492	0	-0.31492	0	0	0	0	0	0
LB1908	0.011662	3.149183	0.006788	3.149183	0.000812	3.149183	0	0	0	0	0	0
LB1909	0	-0.31492	0	-0.31492	0	-0.31492	0	0	0	0	0	0
LB1910	0	-0.31492	0	-0.31492	0	-0.31492	0	0	0	0	0	0
LB1917	0	-0.31492	0	-0.31492	0	-0.31492	0	0	0	0	0	0
LB1921	0	-0.31492	0	-0.31492	0	-0.31492	0	0	0	0	0	0
LB1955	0	-0.31492	0	-0.31492	0	-0.31492	0	0	0	0	0	0
LB1958	0	-0.31492	0	-0.31492	0	-0.31492	0	0	0	0	0	0
Mean	0.00106		0.000617		7.38E-05		0	0	0	0	0	0
St. Dev	0.003366		0.00196		0.000234		0	0	0	0	0	0

Appendix 3. Summary of z-scores for each half-phi interval for PS47; when data from all participating laboratories included in the mean and standard deviation calculations.

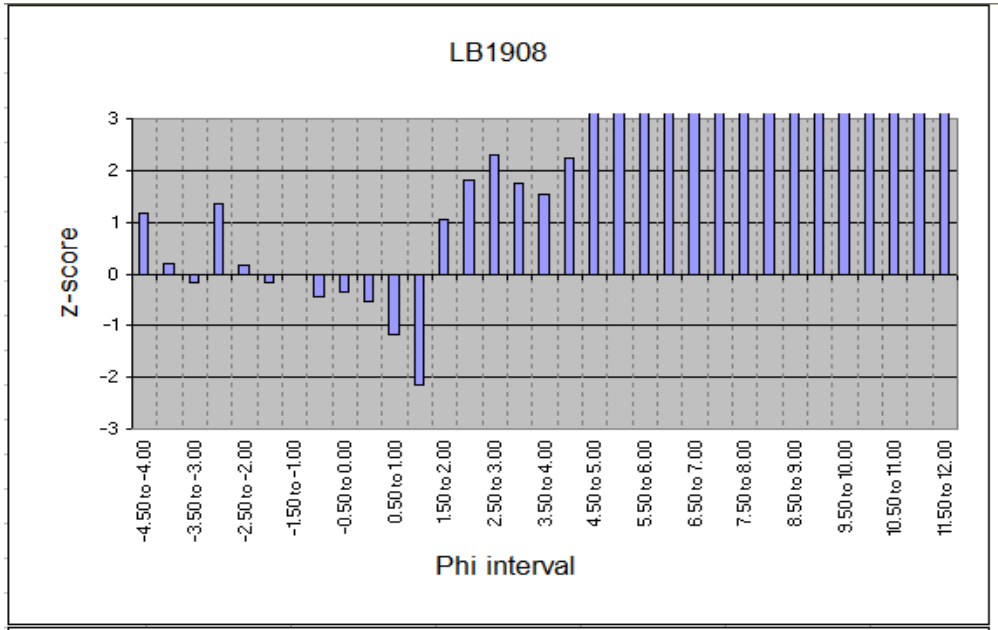


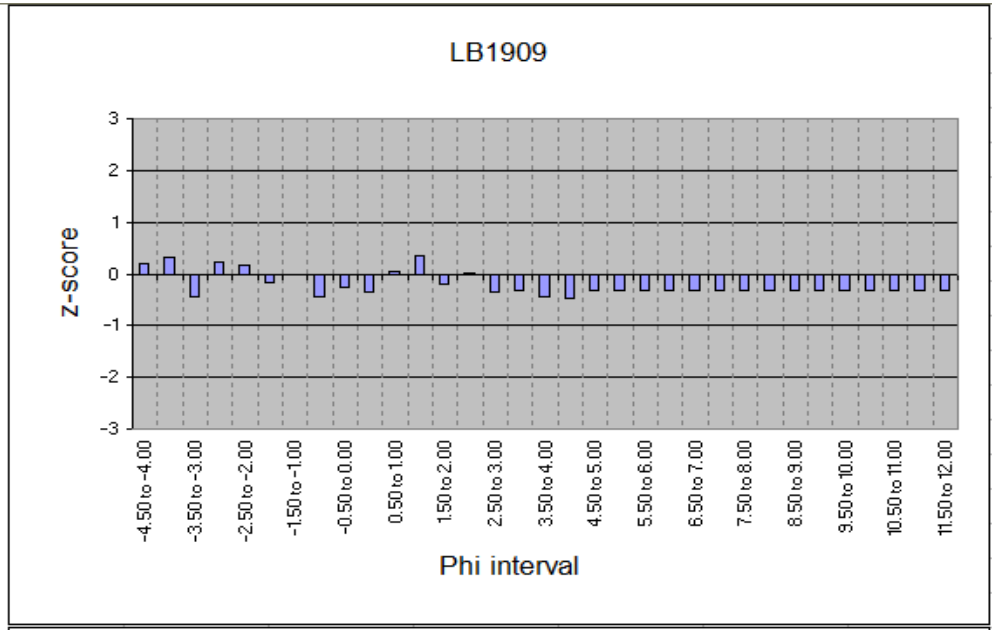


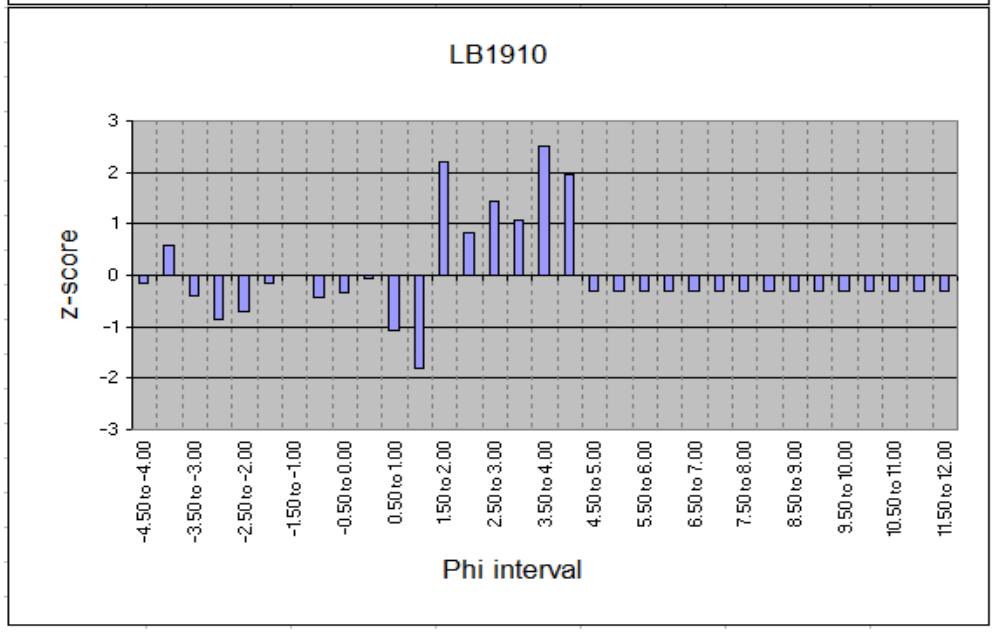


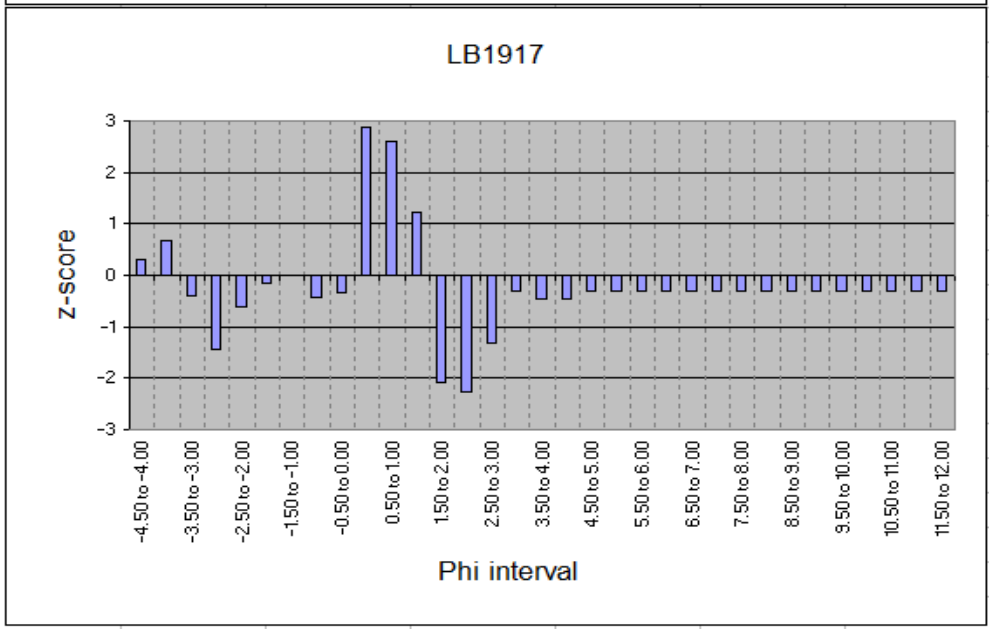


Appendix 3. Summary of z-scores for each half-phi interval for PS47; when data from all participating laboratories included in the mean and standard deviation calculations.









Appendix 3. Summary of z-scores for each half-phi interval for PS47; when data from all participating laboratories included in the mean and standard deviation calculations.