The National Marine Biological Analytical Quality Control Scheme
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Ring Test Bulletin – OMB RT01

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June 2010
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RING TEST DETAILS

Ring Test - OMB 01

Type /Contents - Biomass estimations of opportunist macroalgae

Circulated - 26th April 2010

Completion Date - 28th May 2010

Number of Participating Laboratories - 12

Number of Results Recieved - 12

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1 Introduction

For a number of years there has been a quality control over the submission of biological data. This now extends through all biological elements including macroalgae and angiosperms. This ensures consistency of data being reported for management purposes and has been primarily driven by international analytical standards due to the Water Framework Directive. The QC scheme aims to facilitate improvements in biological assessment whilst maintaining the standard of marine biological data. The scheme is able to ensure consistency between laboratories and field staff with improved confidence in ecological quality status.

The National Marine Biological Analytical Quality Control (NMBAQC) Scheme addresses one main issue relating to macroalgae data collection:

- The determination of algal biomass

This is the first year in which biomass of macroalgae has been included as an element of the NMBAQC scheme and included a single exercise. Test material was distributed to participating laboratories and from which data forms were completed and returned.

Twelve laboratories completed the macroalgae biomass component of the NMBAQC scheme. All of the participating laboratories were government, no private consultancy took part in this particular exercise.

Due to the limited number of samples distributed only a single set of results was permitted per Laboratories. It was possible for each sample to be completed by a different participants, however, this was not recorded within the final results.

Currently this scheme does not provide a means of qualifying performance levels. It offers a means of assessing personal and laboratory performance from which continued training requirements may be identified or from which improvements in current field and laboratory procedures may be addressed. Certain targets have been applied to the assessment of the results based on Z-scores allowing “Pass” or “Fail” flags to be assigned accordingly; however, these have no weighting and merely act to identify those results which were considered significantly different based on comparisons between laboratories. These flags have no current bearing on the acceptability of data from such participating laboratories.

1.1 Summary of Performance.

This report presents the findings of the macroalgae biomass component for the first year of operation within the National Marine Biological Analytical Quality Control (NMBAQC) Scheme. This component consisted of a single exercise producing a single set of results from each laboratory.

The results for each for the exercise are presented and discussed with comments provided on the overall participant performance.

2 Summary of Macroalgae Biomass Component

2.1 Introduction

There was one exercise for the assessment of biomass of macroalgae which took the form of three representative artificial samples. This exercise is described in full below to include details of distribution and logistics, procedures for determination of biomass, completion of test result forms and full analysis and comparison of final submitted results.

In order to assess the accuracy of determining biomass of opportunistic macroalgae, samples were supplied that consisted of j-cloth material that had been cut and finely shredded in order to mimic species of *Ulva* (and *Enteromorpha*). three representative samples were been supplied to be processed. (It was not considered practicable to obtain reliably replicate samples of natural material). Sediment and debris commonly found within areas of algal growth were mixed into the samples with small amounts of water. For each sample wet weight and dry weight had to be calculated.

2.2 Logistics

Each sample was distributed within an airtight plastic container. Each sample within the container was separately sealed within a ziplock plastic bag to retain and moisture. The samples were distributed either via first class mail or recorded delivery, depending upon personal requirements. All instructions and additional test material was distributed on CD, within the parcel, to each laboratory. Each disc contained description of methods and data submission forms. Participants were provided a month to complete the test and return the results. Only one set of results could be submitted from each laboratory although it was possible to have up to three participants completed the samples.

Email has been the primary means of communication for all participating laboratories subsequent to the initial postal distribution of test material.

2.3 Methods

Three samples were provided and labelled from A to C. Identical weights were provided for all participants.

Sample A – 80g

Sample B – 16g

Sample C – 47g

Due to the nature of the samples they could be kept for several days retaining most of the moisture. However, much of the water was removed prior to distribution to reduce weight during transport therefore it was necessary to add additional water to each of the samples prior to commencement of the tests to enable rehydration of the material. The exact amount of water added was dependent upon the sample;

Sample A – add 300ml; Sample B – add 100ml; Sample C – add 200ml

2.3.1 Method for Wet Weight

Each of the samples required rinsing free of all sediment. The samples were fully washed in a bucket to ensure no loss of sample until the water ran clear and all debris was removed. Once the samples were adequately washed they were squeezed of excess water. This was achieved by hand using samples no larger than the size of a tennis ball to ensure it fit in the palm of the hand and be properly squeezed. Where the sample was large it was divided into smaller clumps for squeezing. The samples was squeezed until no additional running water could be removed by hand (over-enthusiastic squeezing of actual algal samples might damage cell membranes and lose 'genuine' weight). At this stage the whole sample was weighed on a calibrated balance to two decimal places. The exact method used for rinsing and squeezing should have be consistent with that used in the field which may vary between laboratories.

2.3.2 Method for Dry Weight

Once each of the samples had been wet weighed they were laid and spread out on a sorting tray or similar container. By spreading the samples this aided with the drying process. The samples were left to air dry for 24 hours. The samples were checked regularly and the drying/weighing process was continued until constant mass was achieved. The unchanged dry weight was the final weight to be used.

Please input the final results for the wet and dry weight for each sample into the final worksheet provided. Where more than one person has participated in the test please provide details of all involved.

2.4 Analysis and Data Submissions

Spreadsheet based forms were distributed with the test material to standardise the format in which the results were submitted. These results will be retained and stored appropriately. Each participant was required to submit a dry weight and a wet weight for each of the 3 samples provided.

2.5 Confidentiality

To preserve the confidentiality of participating laboratories, each participant is allocated a four digit laboratory code from which they can identify their results. These codes are randomly assigned. The initial letters (MA) refer to the scheme this is followed by the scheme year which refers to the year in which the NMBAQC scheme original commenced, the final two digits represent the laboratory. For example, laboratory twelve in scheme year seventeen will be recorded as MA1712.

2.5 Results

The results have been collated and represented in various formats to enable full comparisons between participants and samples. These are detailed in the following section with a summary of these results provided at the end of the report.

The raw data shows the range of results submitted from each laboratory with details of the range of values (Table 1). The raw data indicates the range of results increased as the sample weight increased, this was evident for both the wet and dry weights. Table 2 provides further indicates of the level of deviation between submitted dry weight results and actual results. For most laboratories

the level of deviation was between 0.72 and 3.56. However, one set of results showed significant deviation from actual results indicting some error during processing. This may be due to procedures used, inadequate rinsing or incomplete drying. As the wet weight from this laboratory did not significantly deviate from the average, this doesn't provide evidence of inadequate rinsing therefore it may be concluded in this instance that the samples were not sufficiently dried.

Table 1. Raw Data results from each laboratory including both dry and wet weights.

	Sample A		Sample B		Sample C	
Lab Code	Wet weight	Dry Weight 80g	Wet weight	Dry Weight 16g	Wet weight	Dry Weight 47g
MA1714	259.91	82.14	49.54	16.75	149.65	48.18
MA1710	264.2	80.64	52.18	16.91	152.21	48.55
MA1717	426	89	94	17	230	48
MA1706	251.61	81.93	48.47	17.16	154.57	47.62
MA1705	322.1	82.1	71.8	17.6	175.2	48.7
MA1709	271.3	82.8	60.4	16.2	161.6	50.3
MA1702					147.47	47.72
MA1703	272.89	83.5	61.2	16.3	161.6	47.4
MA1701	375.8	81.3	59.4	15.5	192.2	46
MA1708	391.9	89	63.2	16.9	207.5	46.2
MA1718	233.4	81.2	41.6	16.2	131.8	47.3
MA1711	260	132	60	17	165	82
Max	426	132	94	17.6	230	82
Min	233.4	80.64	41.6	15.5	131.8	46
Range	192.6	51.36	52.4	2.1	98.2	36
Average	302.65	87.78	60.16	16.68	169.07	50.66

Table 2. Deviation of dry weight results from actual dry weight including average deviation per laboratory.

	Sample A	Sample B	Sample C	
Lab Code	Dry Weight 80	Dry Weight 16	Dry Weight 47	
MA1714	2.14	0.75	1.18	1.356666667
MA1710	0.64	0.91	1.55	1.033333333
MA1717	9	1	1	3.666666667
MA1706	1.93	1.16	0.62	1.236666667
MA1705	2.1	1.6	1.7	1.8
MA1709	2.8	0.2	3.3	2.1
MA1702			0.72	0.72
MA1703	3.5	0.3	0.4	1.4
MA1701	1.3	0.5	1	0.933333333
MA1708	9	0.9	0.8	3.566666667
MA1718	1.2	0.2	0.3	0.566666667
MA1711	52	1	35	29.33333333

Z-scores were calculated to indicate how much each participants weight results deviated from the mean. It uses the following formula:

$$Z = \frac{X - \mu}{\delta}$$

A Z-score of greater than +/- 2.0 was considered to be outside an acceptable limit of deviation from the mean. This value was used assign a 'Fail' or 'Pass' flag on the data (Table 3). In total five results were flagged as 'Fail', most z-scores were within +/- 1.0. The full range of Z-score results can be seen in Figure 1.

A second Z-score was calculated based on deviation from the actual known dry weight using the same criteria to flag 'Pass' and 'Fail'. Table 4 indicates a total of four 'Fails'. The Z-scores for sample B are considerably higher than for the other two samples with many Z-scores ranging between +1 and +2 (Figure 2). The reduced weight of this sample may make it more difficult to achieve a high level of accuracy when compared with the other two samples.

Table 3. Z-scores for wet and dry weight based on the mean per sample.

	Sample A						Sample B						Sample C					
Lab Code	WW	Z-score	Flag	DW (80g)	Z-score	Flag	WW	Z-score	Flag	DW (16g)	Z-score	Flag	WW	Z-score	Flag	DW (47g)	Z-score	Flag
MA1714	259.91	-0.649	Pass	82.14	-0.377	Pass	49.54	-0.761	Pass	16.75	0.114	Pass	149.65	-0.694	Pass	48.18	-0.250	Pass
MA1710	264.2	-0.584	Pass	80.64	-0.478	Pass	52.18	-0.572	Pass	16.91	0.389	Pass	152.21	-0.602	Pass	48.55	-0.213	Pass
MA1717	426	1.875	Pass	89	0.081	Pass	94	2.424	Fail	17	0.544	Pass	230	2.177	Fail	48	-0.268	Pass
MA1706	251.61	-0.776	Pass	81.93	-0.391	Pass	48.47	-0.838	Pass	17.16	0.819	Pass	154.57	-0.518	Pass	47.62	-0.306	Pass
MA1705	322.1	0.296	Pass	82.1	-0.380	Pass	71.8	0.834	Pass	17.6	1.575	Pass	175.2	0.219	Pass	48.7	-0.198	Pass
MA1709	271.3	-0.476	Pass	82.8	-0.333	Pass	60.4	0.017	Pass	16.2	-0.831	Pass	161.6	-0.267	Pass	50.3	-0.037	Pass
MA1702													147.47	-0.772	Pass	47.72	-0.296	Pass
MA1703	272.89	-0.452	Pass	83.5	-0.286	Pass	61.2	0.074	Pass	16.3	-0.659	Pass	161.6	-0.267	Pass	47.4	-0.329	Pass
MA1701	375.8	1.112	Pass	81.3	-0.434	Pass	59.4	-0.055	Pass	15.5	-2.034	Fail	192.2	0.827	Pass	46	-0.470	Pass
MA1708	391.9	1.356	Pass	89	0.081	Pass	63.2	0.218	Pass	16.9	0.372	Pass	207.5	1.373	Pass	46.2	-0.449	Pass
MA1718	233.4	-1.052	Pass	81.2	-0.440	Pass	41.6	-1.330	Pass	16.2	-0.831	Pass	131.8	-1.331	Pass	47.3	-0.339	Pass
MA1711	260	-0.648	Pass	132	2.957	Fail	60	-0.012	Pass	17	0.544	Pass	165	-0.145	Pass	82	3.155	Fail
Mean	302.65			87.78			60.16			16.68			169.07			50.66		
StDev	65.805			14.953			13.961			0.582			27.989			9.933		

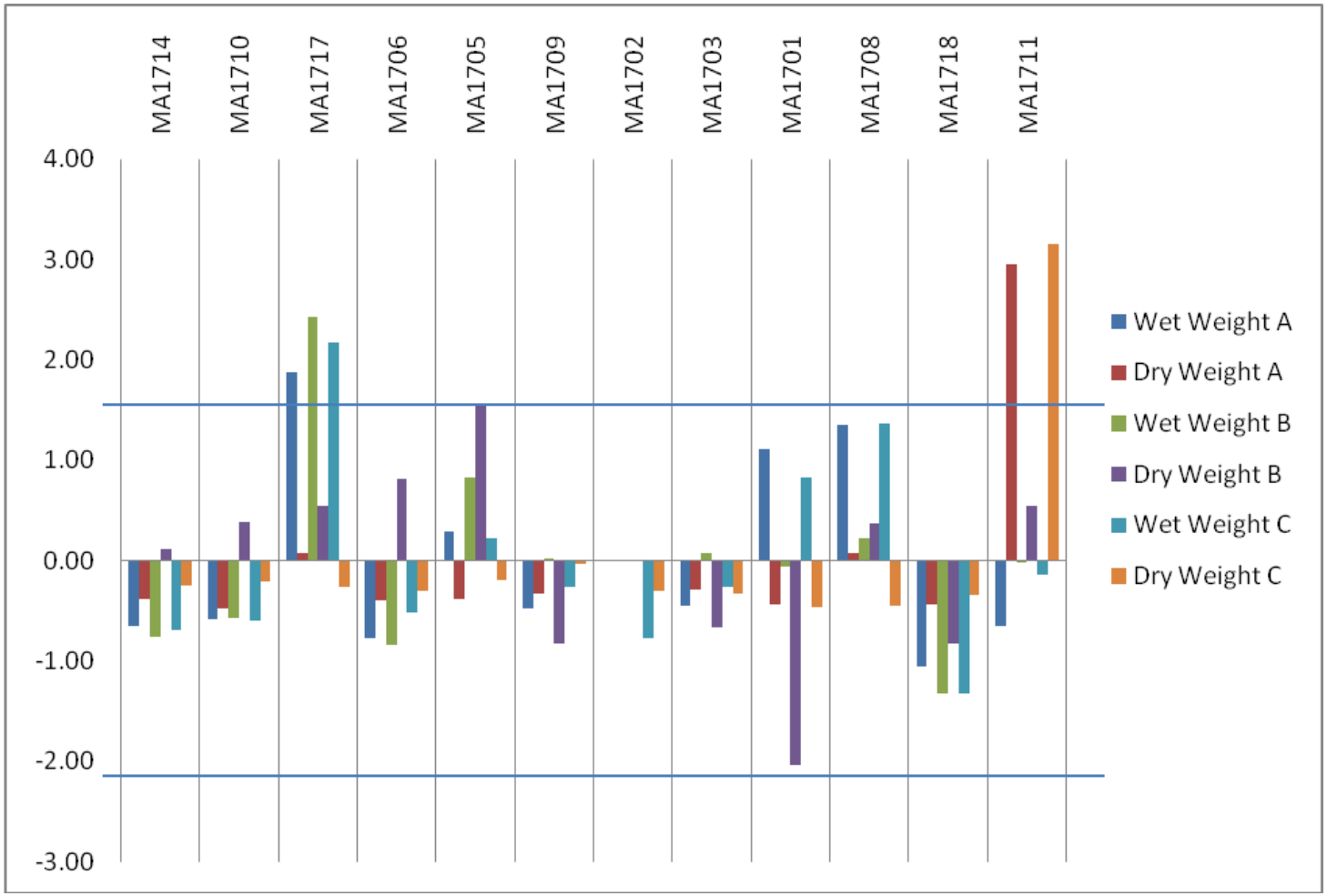

Figure 1. Graph of Z-scores based on deviation from mean

Table 4. Z-scores for dry weight based on the actual weight per sample.

	Sample A			Sample B			Sample C		
Lab Code	DW (80g)	Z-score	Flag	DW (16g)	Z-score	Flag	DW (47g)	Z-score	Flag
MA1714	82.14	0.143	Pass	16.75	1.289	Pass	48.18	0.119	Pass
MA1710	80.64	0.043	Pass	16.91	1.564	Pass	48.55	0.156	Pass
MA1717	89	0.602	Pass	17	1.719	Pass	48	0.101	Pass
MA1706	81.93	0.129	Pass	17.16	1.994	Pass	47.62	0.062	Pass
MA1705	82.1	0.140	Pass	17.6	2.750	Fail	48.7	0.171	Pass
MA1709	82.8	0.187	Pass	16.2	0.344	Pass	50.3	0.332	Pass
MA1702			Pass			Pass	47.72	0.072	Pass
MA1703	83.5	0.234	Pass	16.3	0.516	Pass	47.4	0.040	Pass
MA1701	81.3	0.087	Pass	15.5	-0.859	Pass	46	-0.101	Pass
MA1708	89	0.602	Pass	16.9	1.547	Pass	46.2	-0.081	Pass
MA1718	81.2	0.080	Pass	16.2	0.344	Pass	47.3	0.030	Pass
MA1711	132	3.477	Fail	17	1.719	Pass	82	3.524	Fail
Mean	87.78			16.68			50.66		
StDev	14.953			0.582			9.933		

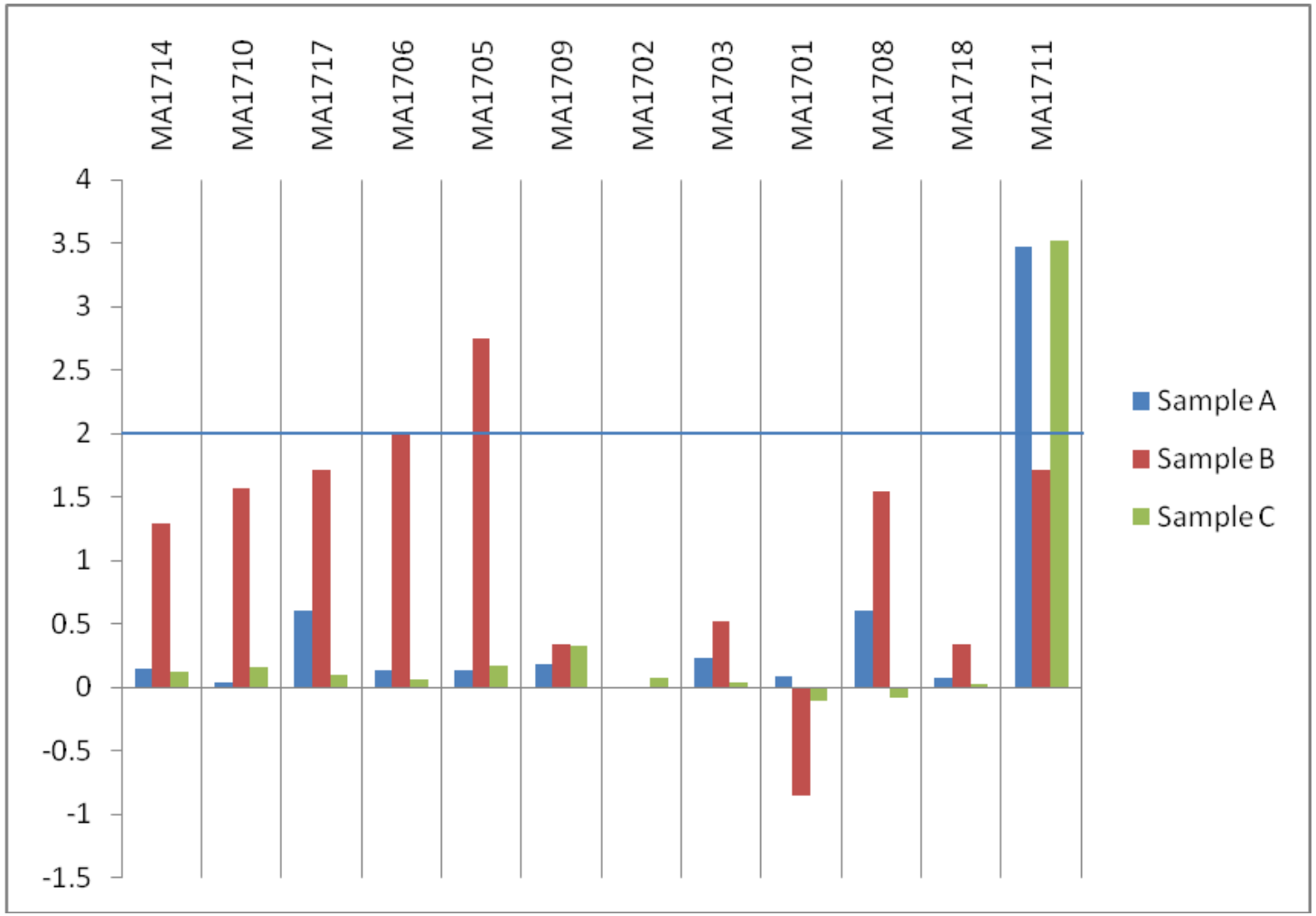

Figure 2. Graph of Z-scores based on deviation from actual weight

3 Conclusions and Recommendations

Excluding the two anomalous dry weights for sample A and sample B, the results do indicate a much higher level of accuracy associated with dry weight than wet weight. This suggests the techniques used between laboratories to rinse and squeeze vary considerable and may also do so between participants within the same laboratory. The wet weights appear to be highly depended upon the participant involved with the processing. There may be future requirements to include biomass analysis within a workshop to further discuss processing procedures and levels of intensity for manual removal of debris and water.

The use of artificial material to mimic opportunist algal species does not fully represent the conditions experienced within the field. However, in order to assimilate an exercise within which a standard sample weight can be distributed, there are few alternatives. Each sample is required to have identical dry weight free of any additional debris prior to distribution. On arrival to the participating laboratory, assurance needs to be provided that the sample will not be degrade in any way and will be identical to both its distribution state and to other samples distributed at the same time. This is necessary for results to be accurately compared both against other laboratories and against the original weight. It may be possible in the future to utilise alternative materials that may be more representative of the texture and general nature of opportunist but at this stage alternative materials have not been tested with the same success rate.

During this first cycle of the macroalgae biomass scheme there were slow and missing returns from some laboratories which lead to some delays in processing and subsequent reporting and feedback of results. In subsequent years reminders will be distributed prior to the completion deadline for the exercise.

A number of result spreadsheet forms were not completed, omitting necessary information this further caused delays in processing the results.