NE ATLANTIC MARINE BIOLOGICAL ANALYTICAL QUALITY CONTROL SCHEME

Annual Report
2015/2016

A report prepared by the NMBAQC Coordinating Committee – 2017

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This Annual Report provides synopsis of the scheme year's activities over 2015/2016, the 22nd year of the NMBAQC scheme. Detailed information about each of the scheme components is now available as separate reports or bulletins on the scheme's website. The relevant documents are all cited here and the reader is directed via hyperlinks to the NMBAQC website as appropriate. In January 2016 a name change for the N in NMBAQC from National to NE Atlantic was agreed by the Marine Assessment and Reporting Group (MARG) and Healthy and Biologically Diverse Seas Evidence Group (HBDSEG) to reflect the wider scope for NMBAQC. Participants from Europe have been active in the scheme for a number of years, and the change from UK "National" to "North East Atlantic" reflects this participation level.

The NMBAQC coordinating committee held 4 meetings during 2015-2016 on 5th August 2015, 2nd November 2015, 25th January 2016 and 18th April 2016. The minutes of the meetings are on the NMBAQC web site **http://www.nmbaqcs.org/reports/**.

Committee Membership for 2015/2016 is shown in Appendix 1.

1 Scheme Review

The scope of the NMBAQC scheme continued to develop in 2015/2016 to encompass the requirement to provide quality assurance for assessments under the Water Framework Directive (WFD), for which monitoring commenced in the UK in 2007. The scheme still maintains its role to provide Analytical Quality Control for Invertebrate and Particle Size data collected for UK CSEMP (Clean Seas Environment Monitoring Programme). Under the UK Marine Monitoring and Assessment Strategy (UKMMAS) the NMBAQC scheme coordinating committee reports to the Healthy and Biologically Diverse Seas Evidence Group (HBDSEG).

All components followed a similar format to the previous year and involved training and testing exercises for the Invertebrate, Particle Size, Fish, Phytoplankton and Macroalgae components. A tender for the macroalgae component was awarded to Wells Marine for one year only.

The 2015-2016 participation level in the NMBAQC was similar to the previous year (see Appendix 2).

Summaries of all the component activities are provided below:

2 Invertebrate component

Contract Manager: Myles O'Reilly, Scottish Environment Protection Agency.
Component Administrator: David Hall, Apem Ltd.

2.1 Summary of activities

Scheme year 2015/2016 (year 22) followed the format of year 2014/15 (with the exception that the Macrobenthic Exercise was dropped through lack of participant interest). A series of components, modules and exercises involved the distribution of test materials to participating laboratories and the centralised examination of returned data and samples. The labelling and distribution procedures employed previously have been maintained. Specific details can be found in previous Scheme annual reports. Forty-one laboratories participated in the benthic invertebrate component of the NMBAQC Scheme in 2015/2016 (year 22). Sixteen participants were Competent Monitoring Authorities (CMAs) and twenty-five were private consultancies. One of the participants was a consortium of sole traders. Twelve of the CMA participants were responsible for the Clean Seas Environment Monitoring Programme (CSEMP) or Water Framework Directive (WFD) sample analysis.

This component consisted of three modules (each with one or more exercises):

- Own Sample module (OS) - re-analysis by APEM Ltd. of three own samples supplied by each of the participating laboratories;
- Invertebrate Ring Test module (RT) - identification of two sets of twenty-five invertebrate specimens; and
- LR, Laboratory Reference module (LR) - re-identification by APEM Ltd. of a set of twenty-five specimens supplied by each of the participating laboratories.

The analytical procedures of the various modules were the same as for 2014/15 (year 21) of the Scheme.

2.2 Summary of exercise results

Two Ring Tests (RT) of 25 specimens were distributed (RT49 and RT50). Both sets contained 25 invertebrate specimens, the second (RT50) was targeted at amphipods and similar taxa. For RT49 each participating laboratory (a total of 21 participants) recorded on average 3.5 generic differences and 5.7 specific differences. Seven taxa (two annelids, two sipunculans and three molluscs) were responsible for almost two thirds (61%) of the specific differences. For RT50 each participating laboratory (a total of 22 participants) recorded on average 2.2 generic differences and 5.5 specific differences. Six taxa (five gammaridean amphipods and one caprellid) were responsible for almost half (49.6%) of the specific differences.

Laboratory Reference (LR): Nine laboratories signed up for the LR20 module and seven laboratories submitted their specimens for confirmation. Two of the laboratories submitted less than the allowed 25 specimens. Most misidentifications were found to be for Annelida, Crustacea and Mollusca belonging to genera which are either speciose, or for which the taxonomy has yet to be finalized. The majority of taxonomic errors could be attributed to the submitted polychaetes (50%) and crustacea (27%).

The revised protocols of Scheme Year 10 for 'blind' Own Sample (OS) audits were continued in this Scheme year. Laboratories were asked to submit full completed data matrices from their previous year's CSEMP/WFD, or similar alternative sampling programmes. The OS 'Pass/Fail' flagging system, introduced in Scheme year 8, was continued (see Description of the Scheme Standards for the Benthic Invertebrate Component). In OS59-61, extraction efficiency (of individuals) was better than 90% in 91% of the comparisons and better than 95% in 77% of all comparisons. 100% of countable taxa were extracted from the sample residues in 55% of samples. The Bray-Curtis similarity index ranged from 0% to 100% with an average figure of 93%. The Bray-Curtis similarity index was greater than 95% in 72% of comparisons; in 84% of cases the value of the index was greater than 90% and, therefore, achieved 'Pass' flags. Fifteen samples (16%) achieved 'Pass-Excellent' flags with Bray-Curtis similarity scores of 100%.

2.3 Issues and recommendations

The total numbers of samples for which the participating laboratories submitted data to APEM Ltd to choose audit Own Samples ranged from 6 and 8 (less than the requested minimum of 12) to 279. The average number of samples data for selection was 38. It is evident that some laboratories use the Scheme as a complete audit check of their entire year's work, whereas some laboratories chose certain projects for submission, and may even do so prior to analysis. The latter approach would undermine the purpose of auditing if the analyst(s) know beforehand which surveys or projects are going to be audited.

Since the beginning of the Own Sample Module, 1409 admissible samples have been received (OS01-61). Of these, 245 samples (21%) have fallen below the 90% Pass mark. Overall, these results are acceptable and show the efficacy of the OS module, although a dip in quality was been noticed in year 20 and 21 compared with the previous four years, there has been a marked improvement in 2015/2016. Some participating laboratories should be able to improve their results by reviewing their extraction methods and their use of taxonomic literature and identification keys.

It is imperative that failing CSEMP/WFD samples, audited through the Own Sample Module, are addressed. Remedial action should be conducted upon the associated CSEMP/WFD replicates to improve the flagged data.

Late submissions are still the major contributing factor for delaying the production of exercise bulletins / reports. There were continued problems associated with the measurement of biomass for individual species. Also, specimens were being provided in containers which are not airtight and, as a consequence specimens were dry and in some case identification was impossible. Participants are reminded that Own Samples should be submitted to the APEM Ltd. in 70% IDA, ***not*** in formaldehyde.

Participants submitting data for laboratory reference exercises should add a note on location of sample to aid identification, complete the 'literature used' section to enable additional information to be gathered regarding incorrect identification and attempt to identify the specimen/specimens to species and complete the 'confidence level' section of their datasheets.

There was a problem with mixtures of specimens being sent out under both RT exercises this year which led to a significant amount of extra time required in sorting out these issues and delayed the production the ring test bulletins. APEM appreciate the discussions that these errors created and believe they led to a greater understanding in the taxonomy of these groups (for example, specimen 21 in RT50, the talitrid) but also appreciate that all specimens sent out under the ring tests should be the same for all participants. Extra vigilance will be employed when preparing difficult specimens for future ring tests.

The Own Sample Module has shown repeated taxonomic errors for some laboratories over several years. Participating laboratories are encouraged to redress or resolve disagreements for taxonomic errors reported in their Own Samples even if their samples achieve an overall 'Pass' flag.

There are still some problems of individuals and taxa missed at the sorting stage of Own Sample analysis. This is an area that is often the major contributing factor in samples with 'Fail' flags or low Bray-Curtis similarity indices. When taxa and individuals are missed during the extraction of fauna from the sediment, laboratories should determine why certain taxa have not been extracted. This could be due to the taxon not being recognised as countable, or due to problems with the effect of stains upon the specimens. There may also be a problem within certain taxonomic groups (e.g. crustaceans floating within sample or molluscs settled within the coarser sediment fractions). Additional training may be required and a review of existing extraction techniques and internal quality control measures may be beneficial. Remedial action should concentrate on the specific causes of the failure and should be targeted accordingly e.g. analyst or method related discrepancies. Additional guidance for Own Sample 'next steps' following audit results will be created to ensure that all participants and other stakeholders are aware of the route to quality assured data.

2.4 Reports & Taxonomic literature

Benthic Invertebrate Component Annual Report, 2015/2016 (Year 22)
Milner, C., Hall, D.H., and O'Reilly, M., 2016. Benthic Invertebrate component - Report from the contractor. Scheme Operation 2015/2016 (Year 22). A report to the NMBAQC Scheme co-ordinating committee. 27pp, July 2016

Own Sample Module Summary Report OS59, 60 & 61 – May 2016
Milner, C., Hall, D. and O'Reilly, M. (Ed.) 2016. National Marine Biological Analytical Quality Control Scheme. Own Sample Module Summary Report OS59, 60 & 61. Report to the NMBAQC Scheme participants. 21pp, May 2016.

RTB50 – Mar 2016
Milner, C., Worsfold, T., Hall, D., Ashelby, C. & Pears, S., 2016. National Marine Biological Analytical Quality Control Scheme. Ring Test Bulletin: RTB#50. Report to the NMBAQC Scheme participants. APEM Report NMBAQC RTB#50, 35pp, Mar, 2016.

RTB 49- Feb 2016
Milner, C., Worsfold, T., Hall, D. & Pears, S., 2016. National Marine Biological Analytical Quality Control Scheme. Ring Test Bulletin: RTB#49. Report to the NMBAQC Scheme participants. APEM Report NMBAQC RTB#49, 32pp, Feb, 2016.

3 Particle Size Analysis component

Contract Manager: Claire Mason, Cefas.
Component Administrator: David Hall, Apem Ltd.

3.1 *Summary of activities*

The Particle Size (PS) module and the new Particle Size Own Sample (PS-OS) module, introduced in the 2014/15 Scheme year, followed the same format as in 2014/15. There were changes to the reporting format: It was decided that for 2015/16 a simpler, clearer report was required. A revised report was created to compare primary and AQC sieve and laser data separately along with data merging accuracy and assess whether a representative sample was supplied for reprocessing. PS-OS exercises receive a “Good” or “Review” flag for each element; a “Review” flag is provided with additional comments highlighting errors and areas for improvement.

Sixteen laboratories signed up to participate in the 2015/16 PS Module exercises (PS56, PS57, PS58 and PS59); six were government laboratories and ten were private consultancies. Nine laboratories signed up to participate in the PS-OS Module exercises (PS-OS04, PS-OS05 and PS-OS06); seven were government laboratories and one was a private consultancy. One government laboratory had two Lab Codes to submit six PS-OS samples for AQC analysis.

3.2 *Summary of Results*

The particle size ring tests PS56, PS57, PS58 and PS59 appeared from an analysis of replicates to be good replicates with very little variance: the coefficient of variance for the D10, D50, D90 and Mean showed that the replicates had good reproducibility.

For PS56, results from participating laboratories showed a fair degree of variation in the distribution curves, this is not surprising given the nature of the sediment type and type of analysis required (laser diffraction). The mud from Barry Island contains aggregates, some containing coal and ash or slag as well as organics and shell fragments, clay, silt and a small amount of fine sand sized quartz; these need to be carefully dispersed before analysis. Procedures for dispersion are likely to differ between laboratories and can have a significant effect on results, as can the optical model used, and different algorithms in different instruments are also likely to interpret the diffraction patters differently.

The majority of results from participating laboratories were similar for PS57. Two participants received “FAIL – Bad” flags: both of these laboratories reported too much medium gravel, and one laborotory was the only one to report the sediment classified as coarse sand.

Results from participating laboratories were generally in accordance for PS58. Two participants did not use laser diffraction in accordance with the NMBAQC methodology, however one of these laboratories do not own a laser. These two laboratories, as well as 4 others, reported very little or no Silt/Clay fraction. Two laboratories reported too much Silt/Clay (10.4% and 23.4%, respectively); however, one of these re-submitted their results after the interim report after a mix up with PS59, their updated results reported a Silt/Clay fraction of 0.41%. Seven laboratoriesdid not provide re-proportioned laser data.

Results from participating laboratories in PS59 showed a fair degree of variation in the distribution curves. Two laboratories received “Fail” flags based on the z-scores. One reported the highest amount of gravel and no silt/clay; both laboratories had exceedingly high D50 results. Although they received a “PASS –Excellent” flag, two laboratories reported unacceptably high silt/clay fractions (27.54% and 21.82%, respectively).

Participating laboratories were asked to provide a visual description of the PS56, PS57, PS58 and PS59 samples prior to analysis and instructed to describe the sediment using the Folk triangle post analysis, as well as to report the percentages of gravel, sand and silt/clay in each exercise. Data were provided by all but one participating laboratories for PS56 and by all laboratories for PS57, although one laboratory did not provide a post analysis sediment description. Two participating laboratories did not provide any summary data for PS58 and one did not provide the post analysis sediment description. Three participating laboratories did not provide any summary data for PS59 and one did not provide the post analysis sediment description. APEM Ltd checked participants’ calculations using GRADISTAT based on the participants’ final merged data. Of the data provided for PS56, the majority were correct apart from two laboratories, which provided data a few per cent out for sand and silt/clay. For PS57 the majority of laboratories were correct; one laboratory data only summed to 99.8% and one only summed to 99.9%. Another reported a small silt/clay fraction (0.06%) that was not recorded in the APEM verification. All data provided for PS58 and PS59 was correct except for two laboratories for PS59.

For the PS-OS module there was generally good agreement between the participants and the AQC results, particularly in terms of basic sediment textural classification. There were a few discrepancies in the sieve data but these are to be expected due to factors such as breakage of particles during repeat analysis and variations in sieving time and vibration amplitude. In the laser results the AQC laboratory detected a higher clay fraction due to the higher resolution and sensitivity of the Coulter 13320 instrument used, and this was taken into consideration when comparing data. The main issue in the PS-OS module related to data merging, with a few of the participants not re-proportioning laser data to 100%; this had a knock-on effect on the final merged data.

3.3 Issues and recommendations

As in the previous year, the PS-OS module raised issues over the interpretation of the methodology set out in the NMBAQC Best Practice Guidelines (Mason, 2015; now updated to **Mason, 2016**) in particular how the laser analysis is undertaken. These guidelines, originally written in 2011, were based on the widespread use at that time amongst participants of Malvern Instruments laser diffraction instruments that have 15 –25 second standard run times and generally are restricted to the analysis of material <1mm in size. It has been demonstrated by Kenneth Pye Associates Ltd that, for the vast majority of samples, there is little practical benefit in routinely carrying out analysis of three replicate sub –samples if instruments are calibrated properly and accuracy is checked in the normal way using standards and laboratory reference materials, and if samples are homogenised properly both before the sub-sample is taken from the bulk sample and when the representative sample is taken from the laser pot. In relatively rare instances where samples consist very largely of >1mm size material and it is impractical to obtain a representative test sub-sample for laser analysis from the bulk sample, more consistent laser results can be obtained by taking a test sample from the wet separated < 1mm fraction of the sediment, rather than from the bulk.

The guidance has now been updated to incorporate most of these findings, with some further follow up expected at future NMBAQC PSA workshops. The guidance can be viewed in **Mason (2016).**

- Laboratories should ensure that their PS results are reported in the requested format.
- Participants should review their data prior to submission.
- Particle size (PS) exercises over the past twenty years have shown differences in the results obtained by different techniques (laser and sieve / pipette), in-house methods (e.g. pre-treatment) and also differences between equipment (e.g. Malvern Mastersizer 2000, Mastersizer X and Coulter LS230/ LS13320lasers). The PS data also indicate that the variance between laser and sieve results is further emphasised by certain sediment characteristics, notably particle shape and density (Blott and Pye, 2006, Sedimentology 53, 671-685; Blott *et al*., 2004, Forensic Geoscience - Principles, Techniques and Applications. Geological Society, London, Special Publications 232, 63-73.). The overall range of these variances needs to be determined if combining data sets derived from different methods.
- The current NMBAQC Scheme Pass/Fail criteria for the PS module are under review. For 2015/16 alternative flagging criteria using z-scores on descriptive statistics combined with robust statistics were used following a review of this method on data from 2014/15. However, this year's results have shown that even with robust statistics z-scores are not appropriate for creating "Pass" or "Fail" flags as variability in results can lead to participants receiving false "Pass" results. For 2016/17 (Scheme year 23) reports will follow a similar format to that of PS-OS reports with each section broken down for review, for example sieve processing, laser processing, data merging and summary statistics. Laboratories will then receive a "Good" or "Review" flag based on their results; "Review" flags will come with accompanying comments as to where mistakes have been made and how to correct them.
- The 2015/16 PS-OS module highlighted differences between the sensitivity of laser instruments and effects of dispersants. Comparison of laser data in the PS-OS results showed that the Beckman-Coulter LS13320 instrument used by the AQC lab, which includes a Polarization Intensity Differential Scattering (PIDS) which gives enhanced measurement capability in the size range 0.4 and 0.04 microns, indicates a higher clay content compared to other lasers models used by many of the NMBAQC scheme participants. It is therefore even more important that participants provide metadata regarding the laser model and optical model used, and about the dispersion methods, whether or not

ultrasonics were used before or after the run in addition to the possible use of chemical dispersant.
- The 2015/16 PS-OS module highlighted that participants do not always supply the samples in the requested format, i.e. dried > 1mm fraction, dried < 1mm fraction and a laser subsample taken from the bulk sample.

3.4 Reports

PSA Component Annual Report Year 22 (2015/16)

Finbow, L, Pye, K. and Hall, D. Particle Size component - Report from the contractor. Scheme Operation - Year 2015/2016. A report to the NMBAQC Scheme co-ordinating committee. 25pp, April 2016.

PS59 January 2016

Finbow, L. & Hall, D., 2016. National Marine Biological Analytical Quality Control Scheme. Particle Size Results: PS59. Report to the NMBAQC Scheme participants. Apem Report NMBAQCps59, 38pp, January 2016

PS58 January 2016

Finbow, L. & Hall, D., 2016. National Marine Biological Analytical Quality Control Scheme. Particle Size Results: PS58. Report to the NMBAQC Scheme participants. Apem Report NMBAQCps58, 38pp, January 2016

PS57 August 2015

Finbow, L. & Hall, D., 2015. National Marine Biological Analytical Quality Control Scheme. Particle Size Results: PS57. Report to the NMBAQC Scheme participants. Apem Report NMBAQCps57, 41pp, August 2015

PS56 August 2015

Finbow, L. & Hall, D., 2015. National Marine Biological Analytical Quality Control Scheme. Particle Size Results: PS56. Report to the NMBAQC Scheme participants. Apem Report NMBAQCps56, 47pp, August 2015

4 Fish component

Contract Manager: Jim Ellis, Cefas.
Component Administrator: Sarah Hussey, Thomson Unicomarine.

4.1 Summary of activities

The component followed the format of the previous year. A series of exercises involved the distribution of test materials to participating laboratories and the centralised examination of returned data and samples. Thirty one laboratories / fish teams participated in the Fish component of the Year 2015 / 2016 NMBAQC Scheme. Twenty five participants were government laboratories / fish teams, five were private consultancies and one was a research institute from Italy. Although some fish are sampled under the Clean Seas Environment Monitoring Programme (CSEMP) the number of target species is relatively few. However the requirement to monitor fish assemblages in transitional waters for the Water Framework Directive (WFD) provides the major impetus for the fish component exercises.

This component consisted of two official modules, each with a single exercise:

- Re-identification of a set of fifteen fish specimens supplied by each of the participating laboratories (Fish Reverse Ring Test module).
- Identification of one set of fifteen fish specimens circulated by the scheme contractor (FishRing Test module).

4.2 Summary of results

In total twenty-four laboratories / fish teams subscribed to F_RRT07, with twenty-three laboratories returning specimens for verification. One laboratory submitted data and specimens after the submission deadline. Seven laboratories submitted less than the specified number of taxa. In total three hundred and eight fish samples were submitted for verification.

In the majority of instances, identifications made by Thomson Unicomarine Ltd. were in agreement with those made by the participating laboratories with twenty four errors occurring from three hundred and eight identification submissions. Most identification issues were associated with gobies, with misidentifications amongst the following species: *Pomatoschistus microps; Pomatoschistus minutus* and *pictus*. Eight out of the forty five goby specimens submitted by participating laboratories were identified incorrectly. The herring fishes were another group which caused identification issues. The grey mullets just as previous years have indicated, caused identification issues (*Liza aurata; Chelon labrosus* and *Liza ramada*).

There were also discrepancies for species such as bull rout, five-bearded rocking and Corbin's sandeel. Potentially difficult taxa such as the gobies could be specifically targeted in future fish ring tests (F_RT exercises) to quantify and resolve problems via the circulation of standardised specimens.

F_RT09 contained fifteen fish specimens. The agreement at the generic level was good; thirteen errors were recorded from the sixteen data sets received via the fifteen participating laboratories. Agreement at the specific level was also good; with nineteen differences recorded. Six laboratories correctly identified all of the specimens. Differences were across a relatively broad range of taxa, some of which are described below.

The majority of the generic and specific differences were recorded from *Sardina pilchardus* (with four generic and four specific differences). Other differences recorded were for *Liza ramada, Mullus surmuletus, Chelidonichthys lucerna, Hyperoplus lanceolatus, Osmerus eperlanus* and *Ammodytes tobianus*.
Eight of the fifteen circulated specimens were correctly identified by all participating laboratories (*Merlangius merlangus, Pleuronectes platessa, Trachurus trachurus, Solea solea, Zeus faber, Sparus aurata, Sprattus sprattus* and *Clupea harengus*). Further details and analysis of results can be found in the Fish Ring Test Bulletin (Fish Ring Test Bulletin – F_RT09) which was circulated to each laboratory that supplied results for this exercise.

4.3 Issues and recommendations

A twaite shad was submitted as part of the reverse ring test (F_RRT07). Twaite shad (*Alosa fallax*) and Allis shad (*Alosa alosa*) can be very similar in appearance, especially as juveniles. The key factor when determining between the two are the gill rakers in structure and number. Allis shad have very fine feathery gill rakers while those of the twaite are stout and easily seen as individual structures (Henderson, 2014, Identification Guide to the Inshore Fish of the British Isles. Pisces Conservation Limited, Pennington). It is advised that gill raker structures are analysed prior to reverse ring test submission to contribute to an accurate identification. Gill raker counts should be taken from the first arch and should be carefully removed for analysis but be sent in addition to the fish specimen for future reverse ring test inclusions.

The following is a summary of the major points of importance.

- Participants are encouraged to continue to provide feedback to enable the protocols to be refined and to review the bulletin and provide feedback concerning content and format wherever appropriate.
- Laboratories should endeavour to submit their results within the requested time; this would greatly facilitate the analysis of results and effective feedback.
- Fish teams are to incorporate Fish teams are encouraged to collate fish identification literature to improve their identification skills and follow the most recent results in taxonomy. The new identification guide by Pete Henderson is recommended to all participating laboratories (Henderson, P. (2014). Identification Guide to the Inshore Fish of the British Isles. Pisces Conservation). Referring to websites such as FishBase and WoRMS is recommended to check the most recent names are used.
- It is strongly recommended that laboratories implement and expand in-house reference collections of fish; these collections could include images and physical specimens.
- Recurring errors have been highlighted in the identification of grey mullets (*Liza aurata; Chelon labrosus* and *Liza ramada*) and gobies (*Pomatoschistus microps; Pomatoschistus minutus* and *Pomatoschistus pictus*) in all reverse ring test exercises. These groups should be targeted at workshops or in future ring test exercises.
- Participants are encouraged to inform Thomson Unicomarine of difficult taxa that should be included in ring tests. Participants are also invited to submit specimens for use in such exercises (approximately 30 specimens of equal size and condition would be required for inclusion).
- Participants should not submit multiple sets of data if these data represent a replicated consensus; multiple data submissions are to allow sub-teams and individual analysts to receive specific results and feedback.

4.4 Reports

Fish Component Annual Report, Year 2015/2016

Hussey, S., 2016. Fish component - Report from the contractor. Scheme Operation - 2015/2016. A report to the NMBAQC Scheme co-ordinating committee. 14pp, May 2016.

FRT 09 April 2016
Hussey, S., 2016. NE Atlantic Marine Biological Analytical Quality Control Scheme. Fish Ring Test Bulletin: FRT#09. Report to the NMBAQC Scheme participants. Thomson Unicomarine Report NMBAQCfrtb#09, 20pp, April 2016.

RRT 07 - March 2016
Hussey,S., 2016. National Marine Biological Analytical Quality Control Scheme. Fish Reverse Ring Test: FRRT07. Final report to the NMBAQC Scheme participants. Thomson Unicomarine Report NMBAQC FRRT07, 34pp, March 2016.

5 Phytoplankton component

Scheme Administrator: Joe Silke, Marine Institute, Republic of Ireland.

5.1 Summary of activities

The Phytoplankton Bequalm intercomparison study in 2015 was designed to test the ability of analysts to identify and enumerate correctly marine phytoplankton species in lugol's preserved water samples. As in previous years, samples have been spiked using laboratory cultures. There were nine species of interest in this intercomparison exercise. These were: *Scrippsiella trochoidea* (Stein) Loeblich III, *Prorocentrum micans* Ehrenberg, *Pseudo-nitzschia australis* Frenguelli, *Lingulodinium polyedrum* (F.Stein) J.D.Dodge, *Paralia sulcata* (Ehrenberg) Cleve, *Dytilum brightwellii* (T.West) Grunow, *Guinardia delicatula* (Cleve) Hasle, *Coscinodiscus granii* Gough and *Asterionellopsis glacialis* (Castracane) Round.

Collaboration between the Marine Institute in Ireland and the IOC UNESCO Centre for Science and Communication of Harmful algae in Denmark on the Bequalm intercomparison exercise commenced in 2011. This collaboration involves the use of algal cultures from the Scandinavian Culture Collection of Algae and Protozoa in Copenhagen, cultures isolated from field samples and from the Marine Institute culture collection. This collaboration also includes the elaboration of a marine phytoplankton taxonomy quiz using an online platform called 'Ocean Teacher'. This online HAB quiz was designed by Jacob Larsen (IOC) and Rafael Salas (MI).

As part of this intercomparison exercise, a training workshop is held annually to discuss the results of the intercomparison exercise and to provide training in some areas of interest on phytoplankton taxonomy to the participants. This workshop has been held in various places over the years and it has taken the format of a 3 days training workshop with at least 2 days dedicated to lectures on algal groups in rooms equipped with microscopes and using live cultures (see workshop agenda: Annex 3). This workshop has become an important forum for scientists working on phytoplankton monitoring programmes from around the world to convene and be able to discuss taxonomical matters related to monitoring, new advances and finds, taxonomical nomenclature changes, looking at samples from different geographical areas and listen to relevant stories from other laboratories about issues with harmful algal events in their regions of relevant ecological importance.

5.2 Summary of results

- 89 analysts from 39 laboratories took part in this intercomparison exercise. 84 analysts returned sample results and 81 completed the online Hab quiz.
- There were 68 participants from laboratories across Europe, 18 from South America, 2 in Australia and 1 in Asia.
- There were nine species of interest in this intercomparison exercise. These were: *Scrippsiella trochoidea* (Stein) Loeblich III, *Prorocentrum micans* Ehrenberg, *Pseudo-nitzschia australis* Frenguelli, *Lingulodinium polyedrum* (F.Stein) J.D.Dodge, *Paralia sulcata* (Ehrenberg) Cleve, *Dytilum brightwellii* (T.West) Grunow, *Guinardia delicatula* (Cleve) Hasle, *Coscinodiscus granii* Gough and *Asterionellopsis glacialis* (Castracane) Round.
- The cell counts of the species *Asterionellopsis glacialis* and *Paralia sulcata* which did not preserve well in the samples were finally not used for statistical purposes.
- The average and confidence limit for each test item was calculated using the robust algorithm in annex C of ISO13528 which takes into account the heterogeneity of the samples and the between samples standard deviation from the homogeneity and stability test. ISO 13528 is only valid for quantitative data. We have used the consensus values from the participants.
- All measurands passed the F-test but not all passed ISO13528.The homogeneity test according to ISO 13528 was passed for 3 of the measurands (*S.trochoidea, P. micans , L. polyedrum*) and failed 4 (*P.australis, D.brightwellii, G.delicatula* and *C.granii*). The stability test passed 6 of the 7 measurands but failed *C.granii*.
- The consensus values new Standard deviation (STD) was used for all measurands regardless of the Pass/Fail flags from the homogeneity test.
- The assigned value uncertainties across all measurands for the test are negligible but the comparison with the homogeneity test suggests significant differences for some of the measurands. The relative STD for the measurands seems to be independent of the cell concentration and the frequency distribution is not normal across all measurands.
- Z-scores show a small number of action signals across all measurands. 4 red flags and 18 yellow flags from 588 flags is evidence of good performance overall. 4 analysts did not pass the full test. Below 80% of all scores. There is evidence of poor reproducibility between samples and also evidence of analyst results bias due to the volume of sample analysed.
- The Ocean teacher online HAB quiz results suggests a high rate of proficiency. 77% of analysts achieved a score over 90% (Proficient). Another 21% of analysts above 80% and 2% need improvement.
- There was a reasonably good consensus among analysts on species identification on questions Q1-Q4. However, analysts found it difficult to give an answer to genus level Even though answers were not used for the final mark.
- There were no real problems with numerical questions (Q5-Q11). 98.72% answered within the model answer given. ±1 cell tolerance was allowed in some answers. There are small differences caused by interpretation of what a viable cell is; Q5 an empty theca was counted. In Q11 opinion was divided: a cell only half visible on one side of the image gave a 70:30 counted in:out ratio. There is consensus among analysts on approach to enumeration, but small differences can mean large differences overall in sample cell counts.

- Questions 12 to 16 were 'short answer' type questions using videos for the identification of species. Some spelling mistakes and not following instructions properly meant some analysts lost marks here. Q16 caused technical problems to some analysts. Q16 also turned out to be the most difficult question in the quiz: identified correctly by 60% only. 30% identified incorrectly, 10% was not able to answer it.
- The questions Q17-18 on the taxonomical characters of *Pseudo-nitzschia* found that only 81% knows the difference between valve view and girdle view of these species when shown in an image. 7-8% confuses the stria and the interstria in *Pseudo-nitzschia.*
- The questions Q19-20 on the taxonomical characters of Protoperidinium showed that there are no problems with kofoidean tabulation of armoured dinoflagellates with mostly near perfect scores. All Protoperidinium marks were over 90%.
- Q21 to Q27 on *Protoperidinium* species identification were answered well. In Q21 *P.depressum* was easy to identify because of its distinctive large size. Q22 *P.conicum* differs from *P.leonis* on typical 'V' shape and spines, they can be confused as both are ortho-hexa. Q23 *P.divergens* caused most problems. This is confusedwith *P.crassipes* (13%) as both are meta-quadra, but diverging horns and horns in *P.crassipes* differ. Q24 *P.leonis* as above. Q25 & 27 are very distinctive if unusual *Protoperidinium* species. Q26 *P.pentagonum* another ortho-hexa like *P.leonis* and *P.conicum* but with a really wide sulcal area between horns.

5.3 Reports

Phytoplankton Enumeration And Identification Ring Test, 2015

Salas, R.G., Larsen, J., 2015. BEQUALM Phytoplankton proficiency test in the abundance and composition of marine microalgae 2015 report. PHY-ICN-15-MI1 VR 1.0. 117pp.

6 Macroalgae component

Contract Manager: Clare Scanlan, Scottish Environment Protection Agency.
Component Administrator: Emma Wells, Wells Marine.

6.1 Summary of activities

Identification of intertidal macroalgae

This is the tenth year in which the identification of intertidal macroalgae has been included as an element of the NMBAQC scheme, with the format following that of previous years. Four laboratories subscribed to the macroalgae ring test with all four laboratories submitting results with a total of ten participants. Three of the subscribing laboratories were government organisations and one was a private consultancy. Currently this scheme does not specify a definite qualifying performance level, and NMBAQC ring tests may be treated as training exercises. However, a pass rate of 80% is suggested as an indicator of good performance, which may be used by competent monitoring authorities for internal monitoring of performance.

Biomass of macroalgae

This is the seventh year in which biomass of macroalgae has been included as an element of the NMBAQC scheme and was included as a single exercise. The format followed that of previous years of the test (OMB RT01 – RT06 - see NMBAQC website).

Eight laboratories were issued with test material. All eight laboratories completed the macroalgae biomass component of the NMBAQC scheme. All of the participating laboratories were government; no private consultancy took part in this component of the macroalgae exercises. Due to the limited number of samples distributed, only a single set of results was permitted per laboratory unless more than one test was requested. It was possible for each sample to be completed by a different participant; however, this was not recorded within the final results.

Currently this scheme does not specify a definite qualifying performance level, and NMBAQC ring tests may be treated as training exercises. However, certain targets have been applied to the assessment of the results based on Z-scores allowing “Pass” or “Fail” flags to be assigned accordingly; these may be used by competent monitoring authorities for internal monitoring of performance. These flags have no current bearing on the acceptability of data from such participating laboratories.

Samples are synthetic, rather than composed of natural algal material. Natural samples would be subject to deterioration, and it is not feasible to ensure that each participant would receive a truly equivalent sample. This is in line with guidance on general requirements for proficiency testing (BS EN ISO/IEC 17043:2010).

Cover of macroalgae & seagrass
This is the seventh year in which % cover estimations of macroalgae have been included as an element of the NMBAQC scheme and the fifth year for which seagrass has been assessed as a separate entity. This included a single exercise for macroalgae and one for seagrass both of which were split into three smaller exercises based on methodology. The format followed that of previous years (RT01 – RT06). Test material was distributed to participating laboratories from which data forms were completed with macroalgae and seagrass % cover results and returned for analysis.

Ten laboratories were issued test material. All laboratories completed the % cover macroalgae/seagrass component of the NMBAQC scheme with a total of 27 participants. Of those laboratories submitting results, all ten were government organisations.

Due to the nature of the exercise there was no limit on the number of participants per lab. Laboratories were able to complete the % cover test that best represented the methodology used within their laboratory to allow comparisons of methodology. However, the laboratories were encouraged to complete all three variations (open quadrat, 5x5 gridded quadrat and 9 x 9 crosshairs quadrat) of both the macroalgae and seagrass exercise in order to facilitate comparisons of the methods.

6.2 Summary of results

Identification of intertidal macroalgae
Images of twenty macroalgae specimens were distributed to the four subscribing laboratories. Round ten of the ring test produced a good degree of agreement between

identifications made by participating laboratories and initial identification as made by Wells Marine. The ring test tried to incorporate a variety of common and more challenging species which was reflected in the number of correct identifications which was slightly fewer than seen in the previous year. Although the results were broadly comparable with those of previous years (RT08 and RT09) there is a noticeable decrease in the level of agreement between participating laboratories and the AQC. As per previous years the test included a number of cryptic and taxonomically challenging species as well as those considered more common. Such genera included *Ulva* sp. and *Hincksia* sp. which are notoriously difficult to identify to species level. *Mesogloia vermiculatacan* also been easily misidentified due to confusions with other morphologically similar species such as *Liebmannia* sp. and in general it is very difficult to tell these species apart from each other. These genera require an increased depth of knowledge on the cellular attributes, which can be remarkably similar between species, as well as other characteristics, such as overall texture, which can be used to separate such species.

As intended by the scheme these tests aim to challenge participants and assist with training by stimulating the use of various keys and increasing familiarity with taxonomic terminology. Further, it allows problem taxa to be identified stimulating areas for inclusion in workshops, and targeting such taxa within future exercises. Photographs used within the ring tests may be retained within the participating laboratories for future reference, with some descriptions allowing the comparison of taxonomically similar species.

No one participant managed to identify all species and genera correctly and there were only 9 species for which all laboratories were successful in their identification. The most problematic species were *Mesogloia vermiculata* and *Colpomenia peregrina* which may be considered relatively difficult to identify due to the occurrence of morphologically similar species such as *Liebmannia* sp. and *Leathesia difformis*, respectively. Those characteristics which are considered more specific and may be used to distinguish such species were detailed within the Bulletin. With an increased number of species with misidentification it could be concluded that this test was slightly more difficult than previous tests so has little reflection on the level of competency of the participants since the pass rate was lower across all participants.

Biomass of macroalgae

A single test consisting of three biomass samples was distributed. Each sample consisted of a synthetic mix of j-cloths, wool and synthetic stuffing material, which are considered to imitate opportunist macroalgae species. Cloths were cut to different sizes to represent different taxa (e.g. laminar or tubular taxa). Each sample was contaminated with debris and sediment of a sandy-muddy nature consistent with the substrate type known to support opportunist macroalgal blooms.

Of the eight samples distributed to eight laboratories all submitted results. Although many of these laboratories do not routinely measure dry mass for macroalgae, this is still a necessary part of this exercise as it enables the procedure to be reviewed for inter-laboratory differences. The level of accuracy still remains greater for comparisons of dry weight than for wet weight. However, this is significantly less for smaller or mid-range sample weights e.g. weight from 10g to 40g. This suggests the techniques used between laboratories to rinse and squeeze vary considerably and may also do so between participants within the same laboratory.

Results for wet weight of biomass varied between laboratories with some laboratories producing high measures of biomass compared against the average biomass and actual/expected biomass. The dry weights showed a similar level of variability. One laboratory failed to remain within the Z-score limit of +/- 2.0 for the average sample dry weight, there were, however, no 'Fails' for wet weight against the mean due to high standard deviation caused by a high range of results.

Three further laboratories showed significant deviation from the actual sample dry weight; this means of assessment is not as accommodating towards outliers. Sample B had a significant number of 'Fails' for wet weight when compared against the 'expected' wet weight, in total 6 out of 8 laboratories 'Failed' this sample assessment. A further one lab 'Failed' the wet weight for sample A. Most participating laboratory results were higher than the actual sample dry weight suggesting no loss of sample material during processing with two marginally lower dry weight results being attributed to limited decimal places.

Cover of macroalgae & seagrass

Two sets of fifteen quadrat photographs showing various % covers of opportunist macroalgae and seagrass were used for the exercise. These sets of photographs were duplicated to produce the three separate modules incorporating the different assessment methods utilised by the various participating laboratories. The set of quadrat photos differed by the use of grid squares of varying quantities; open quadrat, 5 x 5 square grid and 9 x 9 crosshairs quadrat grid. Each photo represented natural levels of opportunist macroalgae and seagrass cover.

Results for % cover of both opportunist macroalgae and seagrass varied between participants and between the different methods used. A number of results deviated from the sample mean and from the % cover as calculated by image analysis. However deviation from the latter was more noticeable. There was a much higher range of results submitted for seagrass which appears to be more difficult to estimate % cover and may be attributed, in part, to its patchy nature. Although there was a slight preference for using method C (9 x 9 crosshairs quadrat grid) for the macroalgae the results using this method was less accurate as seen in previous years.

In total ten laboratories signed up for the % cover component of the macroalgae/seagrass element for RT07. All ten laboratories returned data. Of those laboratories that did submit data 19 completed method A, 15 completed method B and 26 completed method C for the macroalgae component. For the seagrass component 20 completed method A, 13 completed method B and 20 completed method C. Fifteen participants completed all three macroalgae and thirteen completed all three seagrass methods.

Macroalgae Results from Participating Laboratories

Test A Results (open quadrat)

Test A consisted of 19 participants and was the second most popular of the three methods. The range of results per quadrat varied considerably with the largest range of results produced for quadrats 2, 12 and 14 with a range of 40%. Quadrats 5, 11, and 13 all displayed a range of 35% all of which lay between 30% and 75%. The smallest range was for quadrat 3 from 1% to 5%, the remaining quadrats had % cover ranges of between 15 and 28. Z-scores calculated against the population mean resulted in six laboratories failing between 1 and 5 quadrats. In total there was a 94% pass rate for test A when using Z-scores derived from the mean which is consistent with previous years' results. The deviation from % cover as calculated using ImageJ was much greater than seen when using the population mean. Participants showed an average % cover deviation from image analysis % cover ranging between 4.9% and 13.02%. The pass rate was equally much lower using Z-scores derived from image analysis estimates of % cover with 18 out of 19 participants failing at least one quadrat. The overall pass rate was lower at 82.8%. These results were also consistent with those from RT07 with similar pass rates.

Test B Results (5 x 5 gridded quadrat)

Test B had the least number of participants with 15. As with test A there was a greater degree of correlation of % cover against population mean compared with the image analysis. A total of 73% of participants (11 out of the 15) consistently produced Z-scores of less than 2.0, which is regarded as a 'pass'. The remaining 4 labs failed between 1 and 4 quadrats. The largest range of % covers per quadrat was a range of 40% cover recorded in quadrat 15 and 12 differing considerably from the results seen in test A. The lowest range of % cover estimates was for quadrat 3 which resulted in the same range (4%) as for test A. Consistent with test A, test B also showed a higher degree of deviation from the image analysis results compared with the population mean, with all 14 out of 15 participants failing at least one quadrat and an overall pass rate of only 82% compared with a pass rate of 96% using Z-score from the population mean although this results is better than seen in previous years. The greatest number of 'Fails' could be attributed to quadrat 7, with 9 'Fails' followed by quadrat 1 and quadrat 6, with 6 and 5 'Fails' respectively. Despite these results method B resulted in similar levels of deviation from % cover as calculated by ImageJ and mean % cover.

Test C Results (9 x 9 crosshairs quadrat)

A total of 26 participants opted to complete Test C using the 100 square method with varying levels of deviation from the population mean. As seen in previous years this was the most popular of the estimation methods. The results verified that as with the other two test methods there was a higher degree of deviation when comparing results against the image analysis % cover as opposed to the population mean. The average range of percentage covers per quadrat was 29%, higher than in RT06, with quadrat 12 producing the highest range of 59% with % cover ranges between 25% and 84% ((it is unclear at this stage if this was a typing error or misuse of the methodology). Ten participants failed at least one quadrat using Z-scores from the mean with 5 participants failing 1 quadrat and 3 participants failing between 5 and 8 quadrats and an overall pass rate of 94%. There were also more 'Fails' using Z-scores from image analysis with all participants failing between 1 and 6 quadrats and an overall pass rate of 79%. Quadrat 1 had the greatest number of 'Fails' with 23 out of the 26 participants scoring higher than +/- 2.0, followed by quadrats 10 and 4, with 15 and 14 'Fails' respectively.

Seagrass Results from Participating Laboratories

Test A Results (open quadrat)

Test A consisted of 20 participants and as with the macroalgae this was the second most popular method. The range of results submitted per quadrat also varied considerably as with the macroalgae test. The largest range was for quadrats 1, 4, 9 and 12 with between 40 and 45 percent ranges, these quadrats all had image analysis % cover results of between 48% and 69% cover providing evidence that this mid range of % cover is difficult to estimate. No quadrats had a particularly small range of results even for those with very little cover. Z-scores calculated against the population mean resulted in seven people failing between 1 and 4 quadrats. In total there was a 94% pass rate for test A when using Z-scores derived from the mean.When comparing results against % cover as calculated using ImageJ, the number of 'Fails' per laboratory was greater with a total number of 92 'Fails' (84% pass rate) with all participants failing at least three quadrats. Those quadrats with the highest number of 'Fails' were quadrats 8, 10, 13 and 14 with between 15 and 17 'Fails' each , contributing to 72% of all 'Fails'. The average deviation of results from image analysis % cover per lab ranged from 6.7 to 18.2, which was higher than the average deviation per participant when derived from the mean (2.4 to 13.3).

Test B Results (5 x 5 gridded quadrat)

Test B had the least number of participants with a total of 13 participants opting to complete the 5 x 5 square grid quadrat method, resulting in varying levels of deviation from the population mean. This test followed the same trend as the other tests for both macroalgae and seagrass with comparisons against image analysis resulting in a greater number of failures using the Z-score than when comparing against mean % cover. The range of % cover values showed a similar level of variation as described for test A with most quadrats having % cover ranges in the order of between 20% and 40% indicating a high level of discrepancy between participants. Quadrat 1 had the largest range of between 46% and 81%. Comparing against mean % covers resulted in a just 5 'Fails' distributed between 3 labs with the number of 'Fails' being distributed between several quadrats. There was an overall pass rate of 97%. In comparison, the total number of 'Fails' using image analysis was higher at 50 and was distributed among all 13 participants. The overall pass rates using image analysis % cover was 74%. These results are consistent with previous ring tests with similar numbers of 'Fails' and pass rates.Consistent with method A the overall deviation from the mean quadrat % cover and that calculated by image analysis was considerably different with a deviation from the mean ranging from 2.49% to 11.97% and deviation from image analysis ranging from 8.18% to 16.07.

Test C Results (9 x 9 crosshairs quadrat)

Test C had a total of 20 participants. The % cover ranges were much higher for test C than for tests B and C with all bar one quadrat having a % cover range between 20%

and 52% indicating a much high level of discrepancy between participants again with quadrat 11 having the largest range of between 23% and 75%. Comparison of results against the mean resulted in 12 'Fails' with one participant having 8 'Fails ' and the remaining 4 'Fails' being distributed among 3 other participants. Comparing results against the image analysis resulted in 47 'Fails' with pass rates of 84% with all participants failing at least one quadrat. Most 'Fails' against image analysis could be attributed to quadrat 13 which had a total of 19 out 20 participants failing. Although the range for this quadrat was relatively small between 79% and 99% and a mean of 91% it was much higher than the % cover as calculated by image analysis which was 71.13% causing significant deviation from image analysis.

6.3 Issues and recommendations

Identification of intertidal macroalgae

There were still a number of incorrect spellings; therefore participants are urged to take more care prior to submitting results to ensure all names are spelled correctly. This is equally important when submitting data records or reports where scientific names are incorporated. It should also be noted that a number of data spreadsheets were not fully completed, often missing out the keys or guides that were used. This may seem trivial information but can help identify where the participant has been misled with the keys or help explain how or why an alternative identification was reached. For future ring tests it is requested that the data spreadsheets be completed in full, including level of confidence in the identification Participants should include the authority alongside taxon names, as this also aids in the analysis of returns.

As with some previous tests there was some disagreement as to the correct identification of some species. Descriptions of some species have recently changed; some have resulted in nomenclatural changes or use of more specific characteristics that were previously considered more generic. New studies in species taxonomy are regularly highlighting previously unidentified (cryptic) species, splitting one species into two based on a previously unknown characteristic. Keying out such species often shows very little difference except for some basic morphological differences, or at the microscopic level which was not fully evident through the photos provided. This problem highlights the need for more definitive photos, specimens and descriptions to be provided in future exercises so as to save confusion.

Biomass of macroalgae

The lack of consistency in wet weight indicates a high level of variation in pressure applied during squeezing of samples. However, this is highly difficult to regulate between field workers. It is the wet weight that is most commonly used during routine opportunist monitoring, therefore this lack of consistency in methodology should be fully addressed within the standard operating procedures especially in association with areas of high biomass. Each lab should have its own in-house training and competence assessment measures. It is recommended within the test methods that 'Where the sample is large it should be divided into smaller clumps for squeezing' and 'This should be achieved by hand using samples no larger than the size of a tennis ball to ensure it fits in the palm of the hand and can be properly squeezed'. Most laboratories produced a dry weight greater than that of the actual biomass of the sample; this would be due to insufficient drying or rinsing of the sample a level of which can be expected during such a test. However, two laboratories produced dry weights less than that of the actual biomass which due to the minor loss of weight may be attributed solely to the lack of use of decimal places in their submitted results.

It was suggested that various debris be added to the sample to enable a more realistic comparison with field procedures. There are further suggestions that more *Hydrobia* could be added to the sample or material to mimic *Hydrobia*. This is definitely something that will be considered and applied for future tests.

It is evident that the larger samples create a greater margin of error with far less consistency between laboratories. However, it has been suggested that these samples are more appropriate in terms of representing natural conditions. This will be taken on board when compiling future tests whereby they will be aimed at including a good range of weights but focusing on some much larger biomass weights.

Cover of macroalgae & seagrass

There is evidently still a high degree of difference between tests as well as between participants and this may prompt the need for a specific workshop whereby methods can be discussed and possibly % cover estimations compared in the field. It is not possible from the current ring test to conclude which % cover estimation method provides the most accurate results, however it is evident through the number of participants that during RT07 Tests A and C were the most favoured methods for macroalgae and seagrass.

There is still a high level of difference between z-scores calculated from the mean and z-scores calculated from image analysis results and given the varied levels of deviation between the two it is unclear which is the most accurate method to compare participants' results.

It may be considered that during field sampling it may be possible to estimate % cover of opportunist algae with a higher degree of accuracy than when using photos. The nature of the photographs can produce difficulties when assessing the density of the algae and the presence of some shadows and the grids can hinder this further. This point has been highlighted by a couple of labs and in subsequent tests further efforts will be made to ensure this doesn't hinder the ability to accurately estimate the % cover. However, it is to be noted that many seagrass beds remain waterlogged regardless of tidal height and sun reflection may be a problem but all attempts will be made in the future to ensure clear photos are distributed with a broad range of % covers.

It has be noted that when using the 9 x 9 cross hair method it is difficult to keep orientated when zooming in and out to check cross hair points, therefore it has been suggested that a central grid in an alternative colour be place on both axis, thereby dividing the quadrat into four, to assist with the method.

Many labs use a slightly alternative method of a 10 x 10 grid and counting the presence within in each square. This is a point worth discussion should a workshop be held.

6.4 Taxonomic literature & reports

Identification of intertidal macroalgae

RM RT10 Final report 2016

Wells, E., 2016. National Marine Biological Analytical Quality Control Scheme- Macroalgae Identification Module Report -RM RT10 2016 Year 22. Report to the NMBAQC Scheme participants. Wells Marine Surveys.

RM RT10 Preliminary report 2016

Wells, E., 2016. National Marine Biological Analytical Quality Control Scheme- Macroalgae Identification Module Report -RM RT10 2016 Year 22. Report to the NMBAQC Scheme participants. Wells Marine Surveys.

Biomass of macroalgae

OMB RT07 Final Report 2016

Wells, E., 2016 National Marine Biological Analytical Quality Control Scheme- Macroalgae Biomass Module Report -OMB RT07 2016. Report to the NMBAQC Scheme participants. Wells Marine Surveys.

OMB RT07 Preliminary Report 2016

Wells, E., 2016. National Marine Biological Analytical Quality Control Scheme- Macroalgae Biomass Module Report -OMB RT07 2016. Report to the NMBAQC Scheme participants. Wells Marine Surveys.

Cover of macroalgae & seagrass

OMC Macroalgae & Seagrass RT07 Final Results Bulletin 2016

Wells, E., 2016. National Marine Biological Analytical Quality Control Scheme- Macroalgae and Seagrass % Cover Module Report - OMC RT07 2016. Report to the NMBAQC Scheme participants. Wells Marine Surveys.

OMC Macroalgae RT07 Preliminary Results Bulletin 2016

Wells, E., 2016. National Marine Biological Analytical Quality Control Scheme- Macroalgae and Seagrass % Cover Module Report - OMC RT07 2016. Report to the NMBAQC Scheme participants. Wells Marine Surveys.

OMC Seagrass RT07 Preliminary Results Bulletin year 2016

Wells, E., 2016. National Marine Biological Analytical Quality Control Scheme- Seagrass % Cover Module Report - OMC RT07 2016. Report to the NMBAQC Scheme participants. Wells Marine Surveys.

7 Epibiota component

Component Administrator: Amy Ridgeway, JNCC.

7.1 Summary of activities

JNCC have been working on a draft of the Epibiota Interpretation Guidelines and comments from the NMBAQC Committee, NMBAQC participants and other interested parties were welcomed and included. This is a follow on from the Operational guidelines which were published last year.

7.2 Summary of results

The Interpretation Guidelines provide a summary of current best practice for the interpretation of video and stills imaging data of benthic substrata and epibenthic species to ensure that data are interpreted to fulfil the objectives of a survey. They were published on the NMBAQC web site and are now freely available.

A next step might be a small ringtest or a workshop to discuss the way forward.

7.3 Taxonomic literature & reports

NMBAQC Epibiota interpretation guidelines, 2016

Turner, J.A., Hitchin, R., Verling, E., van Rein, H., 2016. Epibiota remote monitoring from digital imagery: Interpretation guidelines.

8 Zooplankton component

Component Administrator: David Johns & Astrid Fischer, SAHFOS.

8.1 Summary of activities

In July 2015 a workshop was held to discuss the outcomes of the trial UK Ring test and to discuss a way forward for the zooplankton component.

8.2 Summary of results

Although the component was run in 2014/2015, the report and workshop were held in 2015/2016. All the participants were very enthusiastic about the trial ring test and agreed that it had been a useful training exercise. For the future, an enumeration component should be incorporated. Going forward, SAHFOS is aiming to run a first real ringtest in 2016/2017, and to include an enumeration component as requested.

8.3 Taxonomic literature & reports

Zooplankton UK Trial Ring Test 2014/2015, Astrid Fischer, Marianne Wootton and David Johns, SAHFOS, 2015.

http://www.nmbaqcs.org/media/1606/zooplankton-trial-ring-test-2015-report.pdf

Appendix 1 - NMBAQC Co-ordinating Committee – 2015/2016

Name	Organisation	Position
David Johns	Sir Alister Hardy Foundation for Ocean Science (SAHFOS)	Chair
Tim Mackie	Environment & Heritage Service, NI	CMA Representative
Graham Phillips	Environment Agency	Finance Manager
Myles O'Reilly	Scottish Environment Protection Agency	Invertebrate Contract Manager
Joe Silke/ Rafael Salas	Marine Institute, Ireland	Phytoplankton Contract Manager
Clare Scanlan	Scottish Environment Protection Agency	Macroalgae Contract Manager
Grant Rowe	Fugro EMU Ltd	Contractors' Representative
Amy Ridgeway	Joint Nature Conservation Committee	Epibiota Contract Manager
Jim Ellis	Centre for Environment, Fisheries & Aquaculture Science (Cefas)	Fish Contract Manager
Claire Mason	Cefas	PSA Contract Manager
Keith Cooper	Cefas	CMA Representative
Matthew Green	Natural Resources Wales	CMA Representative
Astrid Fischer	SAHFOS	Technical Secretary

Appendix 2 - NMBAQC scheme participation for 2015/2016

ORGANISATION	**FISH**	**MACROALGAE**	**PSA**	**BENTHIC INVERTS**	**PHYTO**
Agri-Food Biosciences Institute (AFBI)	✔		✔	✔	✔
Alfred Wegener Institute					✔
APEM Ltd	✔		✔	✔	✔
Aquagestión S.A.					✔
Aristotle University of Thessaloniki					✔
ARPA FVG					✔
ARPA Puglia					✔
ARPAC- Agenzia Regionale Protezione Ambientale Campania					✔
ARPAM (Agenzia Regionale per la Protezione Ambientale delle Marche)					✔
Benthic Solutions Limited			✔	✔	
Biotikos Limited				✔	
Bureau Waardenburg B.V.				✔	
CBBA					✔
Cefas	✔		✔	✔	✔
CMACS Ltd			✔	✔	
Complete Laboratory Solutions (CLS)					✔
Consorzio per il Centro Interuniversitario di Biologia Marina ed Ecologia Applicata "G. Bacci" (CIBM)	✔				
Cyfoeth Naturiol Cymru / Natural Resources Wales - Llanelli			✔		
DHI Water and Environment (S) Pte Ltd					✔
Ecospan Environmental Ltd.				✔	
Environment Agency	✔	✔		✔	
Fish Vet Group			✔	✔	
Fondazione Centro Ricerche Marine					✔
Fugro EMU Limited	✔	✔	✔	✔	
Gardline Environmental Limited Laboratory			✔		
Grontmij Nederland B. V., Team Ecologie				✔	
Hebog Environmental				✔	
Hunter Biological and Sue Hamilton				✔	
IECS (Institute of Estuarine & Coastal Studies)	✔		✔	✔	
IFREMER					✔
ILVO (Institiute for Agricultural and Fisheries Research) - ANIMALAB				✔	
IMARES Wageningen UR				✔	✔

ORGANISATION	FISH	MACROALGAE	PSA	BENTHIC INVERTS	PHYTO
Instituto de Fomento Pesquero					✔
Instituto del Mar del Peru - IMARPE					✔
Instituto Federal de Santa Catarina IFSC					✔
IRTA					✔
Isle of Man Government Laboratory					✔
Istituto Zooprofilattico Sperimentale delle Venezie					✔
Jacobs UK Limited				✔	✔
Kenneth Pye Associates			✔		
Laboratorio de Control de Calidad de los Recursos Pesqueros					✔
Laboratorios Acuícolas S.A.					✔
Laboratorios de Control de la Calidad Ambiental					✔
Marine Ecological Surveys Ltd				✔	
Marine Farm Services, Shetland Seafood Quality Control (SSQC Ltd)				✔	
Marine Institute Bantry					✔
Marine Institute Galway					✔
Marine Invertebrate Ecological Services				✔	
Marine Scotland Laboratory Service			✔		✔
Marine Scotland Science			✔		
MEA-NL					✔
Microalgal Services					✔
Monitor Taskforce, Royal Netherlands Institute for Sea Research				✔	
Myriad Taxonomy				✔	
National Laboratory Service - EA			✔		
Natural England			✔	✔	
Natural Resources Wales	✔	✔		✔	
NIEA - (DOE (NI) and Marine Group Laboratory)	✔	✔	✔	✔	✔
Obricon A/S					✔
Ocean Ecology Limited	✔		✔	✔	
OCEANSNELL					✔
Precision Marine Survey Ltd	✔		✔	✔	
SAMS					✔
Scottish Environment Protection Agency (SEPA)	✔	✔	✔	✔	✔

ORGANISATION	FISH	MACROALGAE	PSA	BENTHIC INVERTS	PHYTO
Seastar Survey Ltd				✔	
Sir Alister Hardy for Ocean Science					✔
SMHI/ Swedish Meteorological and Hydrological Institute					✔
Sydney Water					✔
Thomson Unicomarine Ltd	✔		✔	✔	

Appendix 3 - BEQUALM/NMBAQC Scheme Taxonomic Workshop

Agenda Bequalm Phytoplankton Intercomparison workshop

Danhostel, Hillerød, Denmark, 8-12 Nov 2015.

	Morning 9.00-12.00	**Afternoon 13.30-17.00**
Sunday 8 Nov		Arrival to Danhostel at 16.00
Monday, 9 Nov	Intercomparison exercise results Enumeration and identification exercise results, Rafael Salas. Ocean teacher online HABs quiz exercise results, Rafael Salas	Presentations by the participants
Tuesday, 10 Nov	Lecture and microscope demonstration Update on *Pseudo-nitzschia*, Nina Lundholm	Field samples from participants, Nina Lundholm, Rafael Salas, Jacob Larsen
Wednesday 11 Nov	Lecture and microscope demonstration Planktonic *Prorocentrum* species Jacob Larsen	Lecture and microscope demonstration *Protoperidnium*, Jacob Larsen
Thursday 12 Nov	10 am, departure	