

The NMBAQC Scheme – Friend of Foe to the Benthic Ecologist?

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In the Summer 2008 issue of Porcupine (No.24), Peter Garwood presented a Porcupine Piece expressing his personal view on the BEQUALM / NMBAQC Scheme. Peter has already made his views known to the NMBAQC committee who have responded in some detail on several occasions, providing explanations and clarifications on all issues he has raised. As much of this discussion post-dates the submission of Peter's article (in Jan 2008) it seems worthwhile to re-iterate some key points here in order to put the record straight on factual matters and to dispel some misconceptions about the scheme. (Detailed information about the origin, purpose, and scope of the scheme is available at www.nmbaqcs.org.uk).

I would like to offer a view of the scheme from a broader perspective. I am a fellow Porcupiner, and share with Peter, a long held enthusiasm for taxonomy of marine benthic invertebrates. However, I also wear additional hats as an NMBAQC participant, from its inception 15 years ago, as a senior scientist employed by the Scottish Environment Protection Agency (SEPA) which is one of the Competent Monitoring Authorities (CMAs) and also as a member of the NMBAQC committee. With a foot in all these different camps, I can perhaps appreciate the scheme in its wider context and espouse some of its positive attributes.

What and who is the NMBAQC Scheme for?

The UK National Marine Biological Analytical Quality Control (NMBAQC) Scheme was initially set up by the Department for Environment, Food and Rural Affairs (DEFRA) in 1994 to provide a Quality Assurance (QA) scheme for government agencies collecting marine macrobenthic data as part of the UK National Marine Monitoring Programme (NMMP). No appropriate scheme existed then and the NMBAQC still appears to be the only such scheme in the UK. A similar scheme operates in Germany run by the federal government for their labs. The various agencies (now referred to as CMAs) include the EA, SEPA, NIEA, FRS, CEFAS, JNCC, and CCW and they are all required to participate fully in the relevant auditing and training exercises of the scheme.

DEFRA policy now requires QA of all data contributing to national, European, or international programmes, such as UK CSEMP (formerly NMMP), the European WFD (Water Framework Directive), or OSPAR (Oslo/Paris Commission) assessments. With the implementation of the WFD by various UK CMAs, from 2007 any data utilised for an ecological quality assessment must be validated via a recognised national QA scheme (where such a scheme exists). Hence data provided by contractors or licensees to CMAs, including aquaculture assessment data, is now treated in a similar manner to any other CMA data and the participation of contractors in a QA scheme is required to ensure an acceptable quality standard. While it may seem to some that contractors are being "forced" to join the scheme, CMAs merely require the minimum level of participation (i.e. Own Samples audits) which is generally less onerous than the quality assurance undertaken within most CMA

laboratories. It seems reasonable when awarding a contract to expect good quality assurance and if the DEFRA have set up a unique UK scheme for that very purpose, it also seems logical that CMAs insist that their contractors utilise that scheme. As we say in Scotland “He who pays the piper calls the tune”!

What the scheme is not.

It is explicitly stated on the NMBAQC website that it is *not* an accreditation scheme and has never been portrayed as such. The scheme is not intended as a substitute for laboratory accreditation or good internal quality control procedures but aims to augment these. Performance within the scheme can be used as evidence of external auditing or quality control for a laboratory seeking accreditation from an authorised body, or a CMA may legitimately use performance as a gauge of a contractor’s competence, either before or after awarding a contract. However, neither of these are the intended purpose of the scheme. The aim is to benefit the CMAs by providing and reporting quality assurance for data sets being produced for, or by, the CMAs, based on an independent selection of samples for audit.

The “emerging monster”?

In 2003 the NMBAQC Scheme was adopted by BEQUALM (Biological Effects Quality Assurance in Monitoring Programmes) as a model to progress its Community Structure Analysis component. This involved offering the services of the UK scheme to other European laboratories taking part in international or national monitoring programmes. While the scheme is clearly appropriate to adjacent European countries monitoring NE Atlantic waters, actual take up by European labs has so far has been rather piece-meal. Perhaps with the commencement of European WFD monitoring from 2007 the QA mantra may become more deeply instilled in our continental colleagues.

With the arrival of WFD the NMBAQC has recently begun to expand its remit from the Macrobenthic Invertebrate Component (and supporting Particle Size Analysis) to cover all the WFD Ecological Quality components for marine waters which includes invertebrates, phytoplankton, macroalgae, and fish.

For the newer components of the scheme, the initial focus has been on training exercises rather than sample auditing exercises. Many CMA analysts are new to these fields and all need to achieve an equal and acceptable standard. The training exercises act as a pre-cursor to the subsequent development of exercises which actually audit real samples (in as far as that will be possible). However, for the Invertebrate Component which has become well established over the last 15 years, the emphasis is shifting from training to auditing exercises. The invertebrate Ring Test exercises, for example, which until recently, were mandatory for all, are no longer so – although they are still very strongly recommended. Indeed, recent feedback from new participants in the scheme indicated that they found this module more valuable than anticipated.

Sitting in on NMBAQC meetings I see no “emerging monster” trying to take over marine monitoring in the UK or Europe. Sure we want the quality mantra to spread, but we are not the “benthic police” – just a bunch of committed marine ecologists

arguing about how best to do things! Arguing about sampling equipment and sampling techniques, about fixing and preserving, about sieving and storing, about sorting and staining or about blotting and weighing. We have lengthy deliberations too on faunal identifications, on taxonomic keys and literature, on setting targets and standards (not to mention keeping the scheme financially viable) – all directed towards the end product – Quality Assured data! It should be noted that all the committee members' costs are met by their respective CMA's and not by the scheme. This is even the case for the contractor's representative, who sits on the committee to bring any issues raised by contractors to the table.

Scheme flexibility and costs

The methodologies utilised by the CMAs for NMMP/CSEMP and WFD macrobenthic monitoring programmes (ie. 0.1m² Day or Van Veen Grabs, processed on 0.5 or 1.0mm sieves) are sufficiently similar for both to be incorporated into the NMBAQC scheme Invertebrate Component. There has been some discussion whether aquaculture monitoring programmes (which use smaller grab samples, 0.02 or 0.025m²) should be assessed in the same manner, and at the same cost, as CSEMP or WFD samples. Evidence to date suggests that aquaculture macrofaunal samples are often just as diverse (and just as costly to audit) as the larger grab samples. Although this may seem counter-intuitive it may be related to a broader mix of sediment types around fish farms in shallower waters, including coarser grits or maerls with very rich infaunal communities. Hence the audit procedure has been deemed appropriate for both CSEMP/WFD and aquaculture samples. The committee do review the scheme's scope and operation and it would be misleading, as has been suggested, that the Invertebrate Component is currently being used to assess survey work for which it was not designed.

While it has been argued that sample audit costs within the scheme should reflect the actual audit costs of individual samples of varying size or type, this would present considerable administrative difficulties as the Invertebrate Component is required to be costed and funded as a whole in advance. Therefore, the costing is based on the estimated average costs of sample processing plus reporting and the administrative overheads of the exercises of the schemes contractor. Provided the range of sample types is not too large then this is generally simpler and fairer. While the scheme does aim to be flexible it also has to be cost efficient. Conducting and reporting quality assurance is expensive and analytical labs frequently spend 20-25% of their budgets on quality control alone. Separating identified macrofaunal taxa into individual vials, for example, may be considered a tedious burden by some analysts but is routine practice in many CMA labs to facilitate internal and external QA procedures. Such practices do have additional costs and may seem like extra hoops to jump through, but they are necessary for proper auditing. There is little point in carrying out expensive monitoring programmes if they don't produce good quality assured data. Quality assurance is not something that should "be avoided" – it should pervade all the processes from beginning to end (O'Reilly, 2001). The thoroughness of the QA procedures provides considerable added value to the data.

While the costs of participation can be budgeted for by CMAs they may represent a significant burden to individual persons/analysts vying for CMA contracts. A shared membership option has been introduced to help alleviate this difficulty. Contractors

can and do, of course, pass the costs back to the CMAs via elevated charges for sample analysis. Of course it might be better if DEFRA funded the scheme up front with a generous block grant. However, government departments have their own ways of funding operations which might seem arcane to us scientists and, try as we might, it is difficult for a committee of marine ecologists to influence government fiscal policy.

Benefiting the benthic ecologist

Putting aside all the in and outs of costs and charges, just how does participation in the Invertebrate Component benefit the marine ecologist behind the microscope? Although sample auditing is at the core of the scheme, it is very much more than an auditing service. The scheme promotes best practice for sampling and analytical methodologies and development of standard operating procedures (see Cooper & Rees 2002, Proudfoot *et al.* 2003). These are of vital importance for quality, but are not always appreciated by the practising marine ecologist. I remember when quality assurance was first mooted in our lab (perhaps 20 years ago?) being initially horrified at the suggestion we would actually have to re-analyse 10% of our samples! The quality concept has come a long way since then. The scheme also aims to improve standards and develop taxonomic/identification skills. The exercises are designed to identify sources of error in analytical processes and these are highlighted in bulletins and reports. There have been numerous training workshops on field techniques or taxonomic identification of invertebrates run under the NMBAQC banner. The taxonomic workshops may be set at a level for beginners introducing them to various groups, including some tricky ones such as Oligochaetes that most beginners try and avoid (see Worsfold, 2003). Alternatively there are “expert workshops” for more experienced analysts, focused on particular difficult invertebrate groups and led by a recognised expert in that group. Participants can bring along their own problem taxa or view reference material brought along by the workshop organiser.

The Ring Test training exercises circulate specimens of a wide range of invertebrate fauna from the northern North Sea to waters off the southern UK coast. These may include poorly known species whose occurrence in UK waters has been overlooked (i.e. missing from standard keys), new arrivals moving north with global warming, or alien taxa spreading into new habitats. Targeted Ring Tests focus on difficult faunal groups, such as Cirratulids, Oligochaetes, or small Gastropods.

The Lab Ref. exercise encourages participants to establish their own reference collections by enabling them to get voucher specimens verified, or alternatively they can use the exercise as an “Identification Amnesty” and send in a collection of specimens of which they are uncertain and the scheme contractor will try and establish the identities. Participants are encouraged to challenge the scheme contractor if they disagree with species determinations in any of the exercises. In such cases the opinions of recognised experts may be sought. Sharing knowledge gained from such discussions is of benefit to all participants. While opinions of experts may vary, the “correct” answer is out there – though it may require some revisions and re-descriptions from experts to clarify the matter. This is one way that taxonomy moves forward, with ecologists, at the blunt end of monitoring, puzzling over their unusual finds and feeding information and specimens to specialists!

As a practising macrobenthic taxonomist working in coastal waters of south-west Scotland for over 25 years, you might expect that I had seen it all by now, had honed my identification skills to tiptop and was an expert in the invertebrate fauna of my local area. Not so! In recent years I have had to review many of my determinations on Cirratulids, Maldanids, or Oligochaetes (to name just a few) in the light of new information received through the scheme exercises or workshops. In fact I am still turning up species new to my own area, or even new to UK waters. The scheme has very much been at the forefront of this process. The provision of an up-to-date searchable literature guide for marine invertebrate taxa around UK waters, along with new or revised keys is a prerequisite to help me keep abreast of taxonomic developments. The taxonomic guides produced for NMBAQC workshops, eg. on Cirratulids (by Tim Worsfold, 1996, 2006) or, more recently, on Maldanids (by Peter Garwood, 2007), are written to deal with typical samples of preserved specimens of various sizes which are often incomplete or fragmented. These new guides represent a huge advance on previous published keys which are rarely comprehensive, often out of date taxonomically, and tend to assume all material is in perfect condition. Indeed, additional guides, funded by the NMBAQC have been published in Porcupine (Worsfold, T. M. 2006, 2007). All in all, the scheme enables the ecologist, whether greenhorn or old-timer, to get hands-on experience of a broad range of marine invertebrates, sharing information with other ecologists on distributions, key features, problems or errors in existing keys, and new or obscure literature sources. In my experience, over the last 15 years, the scheme has been instrumental in developing the field and analytical skills of its participants and has been of enormous practical help to the benthic ecologist at the lab bench.

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