What NEMS means for councils

The predatory stonefly *Stenoperla* species are sensitive to pollution and are found in waterways with very good water quality.

Ecologists Dr Tanya Blakely and Kate Hornblow discuss processing freshwater macroinvertebrate samples at Boffa Miskell's taxonomy laboratory using a new national environmental monitoring protocol.

Dr Tanya Blakely

Kate Hornblow

The recently finalised National Environmental Monitoring Standards (NEMS) Macroinvertebrates was developed to provide national guidance and standard methods for the field collection, and laboratory processing, of macroinvertebrate samples from freshwater habitats.

Regional and unitary councils, and other agencies undertaking State of the Environment (SOE) reporting, may be considering adopting NEMS for future macroinvertebrate monitoring in their region.

Macroinvertebrates are typically present in all freshwater systems; are easy to sample and can reflect the physical, chemical, and biological conditions of waterbodies – making them great indicators of current states and trends in ecosystem health.

The tolerance levels, or sensitivity, of macroinvertebrates to freshwater habitat conditions varies between species. Accordingly, the diversity and abundance of individuals present in a waterbody can be indicative of water and habitat quality.

For example, mayflies (which are typically pollution sensitive) need clean water and high habitat diversity, so their presence in a waterway can indicate good ecosystem health. Conversely, aquatic worms and fly larvae are often tolerant of pollution and can live in poor water quality.

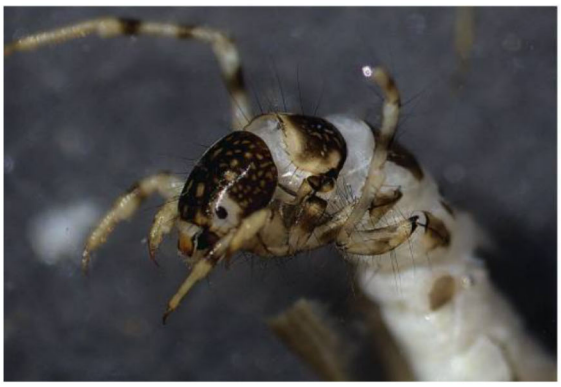
By assessing the whole of the macroinvertebrate community at a site or in a waterway, combined with an understanding of species' tolerance levels, we can relatively quickly gain information on overall ecosystem health.

Nationwide reporting on the state or trends in ecosystem health can then inform if waterways are degrading, stable or improving, if management approaches are effective, or where future management may be needed.

While SOE monitoring by councils has been carried out for many years, the methods in which data are collected in the field and processed in the laboratory has varied.

SOE monitoring methods used by councils have followed protocols outlined in Stark et al. 2001 or used variations of these protocols. These protocols for sampling macroinvertebrates in wade-able streams list four standard field collection methods, where broadly, either multiple kick-nets are taken from riffle habitat until a total area of 0.6 m^2 – 1 m^2 has been sampled, macrophytes (aquatic plants) are swept with a kick net until 0.3 m^2 has been sampled, or

Left: The only aquatic moth larvae in New Zealand, *Hygraula nitens*, are covered in tentacle-like gills and are often found in soft-bottomed waterways with slow flow.



Above: The caddisfly *Triplectides* species can be found in waterways with moderate pollution and are commonly referred to as 'stick caddis' due to individuals typically making their mobile cases from a hollowed stick, or other plant matter.

Surber samples (which have a fixed sampling area due to the attached frame and net e.g., 0.1 m^2) are used to collect macroinvertebrates from a known area of riffle habitat. Some councils have used other collection methods to those in Stark et al. 2001, such as taking kick-net samples from run (rather than riffle) habitat over a set time (e.g, 10 minutes) rather than set area of stream bed. As such, the amount of effort (the time and energy spent, or number of samples gathered) and habitat type sampled varies between councils.

Now that reporting on the ecosystem health of waterways, using attributes such as macroinvertebrate community indices, is required by councils under the National Objectives Framework (NOF) in the National Policy Statement for Freshwater Management (NPS-FM), the NEMS has been developed to provide a consistent best practice approach for field collection and laboratory processing methods.

The NEMS protocol updates and proposes to supersede previous guidelines, providing a framework outlining new standard macroinvertebrate sampling and processing methodologies. Standardisation of macroinvertebrate monitoring methods will ensure that datasets are comparable between regions, or suitable for national reporting on ecosystem health.

The NEMS also considers the NOF and NPS-FM, and best practice methods, ensuring councils can meet the requirement for reporting on ecosystem health of waterways is completed to a high standard.

The NEMS laboratory processing

The laboratory protocol for NEMS sample processing broadly involves thoroughly rinsing and subsampling a macroinvertebrate sample, and identifying and counting all individuals seen in each subsample until at least 200 individual macroinvertebrates have been counted. This may require one or many subsamples to be processed; all macroinvertebrates in any subsample started must be identified and counted, regardless of whether 200 individuals have been counted part way through processing a subsample.

After this step, the remaining, unprocessed sample is scanned for the presence of any 'missed taxa' – or those macroinvertebrate species not found in the subsamples. This method is generally similar to the fixed-count protocol (P2) of Stark et al. 2001.

As with field collection methods, laboratory processing methods currently used by councils vary, including making a minimum count of approximately 100 individuals, or estimating the abundance of each macroinvertebrate species present in sample by using coded abundance categories (ranging from rare to extra abundant), or by identifying and counting all macroinvertebrates present in a sample.

In working with a number of councils to process NEMS samples, we have found the NEMS protocols generally comparable to the P2 Stark et al. protocol in terms of the amount of effort (e.g., time) the laboratory processing takes. Like other laboratory methods, the time required to complete each NEMS sample is variable and depends on the quality of the macroinvertebrate sample, the amount of detritus and filamentous algae present, etc.

We have not compared how much time is required to collect NEMS samples in the field versus the various protocols of Stark et al. and this also needs to be considered.

We have recently been assisting councils with comparing and contrasting the biotic metrics (e.g., the number of species found in a sample, the percent of the sample made up by the pollution sensitive Ephemeroptera, Plecoptera, Trichoptera or EPT) calculated using NEMS processed data with current SOE methods; we have found some variability that needs to be considered.

We note that sources of this variation could be due to collection effort (i.e, amount of or types of habitats sampled) or due to the differences in laboratory processing methods – it has not been possible to tease this apart.

Most importantly, this variation in biotic metrics calculated using NEMS versus currently used SOE methods is something councils will need to be mindful of if transitioning to the NEMS. There may be a transition period where either both current and new field collection and laboratory methods need to be completed concurrently and the data compared.

Or, councils could together decide to switch to a new, nationally consistent approach for monitoring macroinvertebrate communities, but this may have some consequences for national reporting on ecosystem health.

Overall, we see the adoption of a nationally consistent approach to field collection and laboratory processing methods as a great opportunity for councils, better enabling comparisons of regional datasets, and ultimately detecting national trends in SOE monitoring and health of our freshwater systems. **LG**