Appendix A:

Survey of Regional Council Protocols for Macroinvertebrate Monitoring

Introduction

A survey was undertaken in late 2000 to determine the methods currently used for aquatic biological monitoring in New Zealand. This survey forms part of a wider programme aimed at developing protocols for the use of macroinvertebrates in monitoring of wadeable streams. The study was funded by MFE Sustainable Management Fund, with contributions from several Regional Councils.

The questionnaire was extensive and asked detail of all elements of macroinvertebrate sampling:

- Sampling equipment,
- Sampling frequency,
- Sample collection,
- Sample transportation and storage,
- Sample sieving and sorting,
- Taxonomic identification,
- Habitat and environmental information,
- Data management.

Different methods may be used for different purposes (e.g., State of the Environment (SOE) monitoring, compliance monitoring, or resource surveys). The survey focused on SOE monitoring.

Response to Questionnaire

Thirteen responses were received in total: 11 from Regional Councils, 1 from NIWA (National River Water Quality Network methodology), and 1 from a private consultancy. Only the 11 Regional Councils responses are detailed below.

Invertebrate Sample Collection

Frequency of sampling.

Seventy per cent (70%) of respondents undertake SOE monitoring on only one occasion per year, which is during summer months. The remaining 30% of Councils undertake SOE monitoring biannually, with sample collection occurring during spring and autumn each year.

Sampling Equipment

The predominant sampling device is a D-frame kick net, with an average aperture width of 30 × 40 × 15 cm. A 0.5 mm (500 μm) net mesh aperture is the most commonly used (63%) netting during sampling (refer to Fig. 1.1).

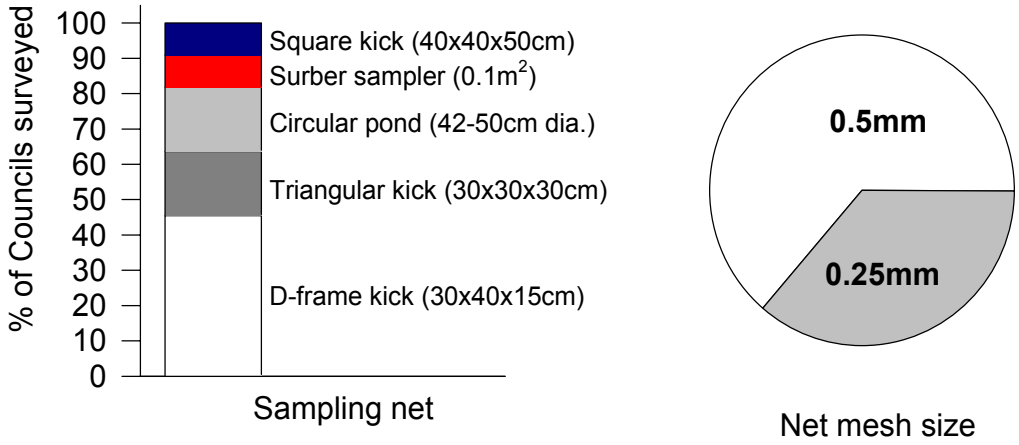

Fig. 1.1 Sampling methods and net mesh sizes used in SOE monitoring by Regional Councils in New Zealand.

Sampling Locations

The type of habitat that invertebrate samples are collected from varied amongst respondents, ranging from 100% run habitat to habitats in proportion to their occurrence. Overall, riffles and runs were the predominant habitat sampled. Other comments that were provided include:

- 100% run, but can include other habitat if undertaking transect sampling.
- Proportional sampling of riffle, run and pool habitats available at a given site.
- General comments provided for stony bottoms and edge habitat was also noted.

Sampling Effort

The following lists the sampling effort used by Councils for SOE macroinvertebrate monitoring:

- 400 ml standard volume (2 Councils)

- 500 ml standard volume (2 Councils)
- 2 m^2 standard kick sample (1 Council)
- 0.2 - 0.6 m^2 kick netting in total, but sampling in more than one place (1 Council).
- Standard time of 30 seconds (3 Councils), 1 minute (2 Councils) or 10 minutes (1 Council).

Sampling was set within a standardised range depth less than knee height (less than 0.5m), while using thigh waders.

Where mixed habitats are sampled, Councils often sample each differently (e.g., 60% sample effort in riffles; 30% runs; 10% pools).

Stream reach length sampled varied amongst respondents, ranging from 5 m (1 Council) to 100 m (1 Council). One respondent based sampling effort on 3 transects across a run.

Number of Replicates

Figure 1.2 outlines sample replication undertaken by Councils during state of the environment monitoring. Replicate sampling was undertaken by 3 Councils, which collected 3, 4 and 5 replicate samples per site respectively.

Three Councils pool replicate samples to result in a single composite sample. Of these, one Council composites 3 replicate riffle samples, one Council pools samples taken in proportion to habitat occurrence, and a third Councils pools 15 point samples from 3 transects.

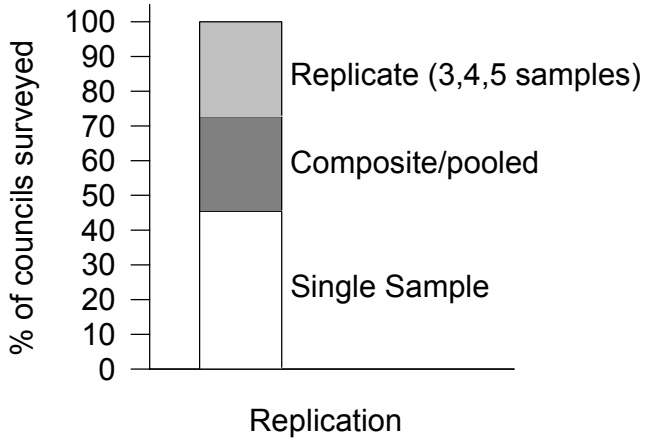

Fig. 1.2 Macroinvertebrate sample replication undertaken by Regional Councils for SOE monitoring.

Pre-conditioning of sample

All Councils undertake some form of macroinvertebrate sample pre-conditioning, but the methodology differs. Other pre-conditioning ranges from elutriation of sample to removing large stones and sticks.

Environmental conditions prior to sampling

All respondents take account of the environmental conditions prior to sampling. Clear criteria were supplied in most cases as follows:

- No sampling within 3 weeks of flood.
- No sampling within 4 weeks of flood.
- No sampling within 10 days if 7x median flow, nor within 7 days if 3x median flow.
- No sampling within 4 weeks of flood with return period > 5 years, nor within 2 weeks of annual return period.

Transportation and Storage

The following provides a list of general comments related to the transportation and storage of invertebrate samples by Councils:

- Samples are transported preserved (72% of Councils) or in chillybins with ice (1 Council) before sorting.
- Samples are preserved with ethanol (43% of Councils), ethanol/methanol (43%) or formalin (14%).
- Samples are stored for 2 weeks to 6 months prior to sorting.
- Samples are retained indefinitely by 63% of Councils while the remaining Councils (37%) store their sorted samples for approximately 2 years before disposal.

All invertebrates are stored in labelled vials, but it was unclear how long these vials were kept, or where the labelling occurred (i.e., lid, side of container, paper inside). Invertebrate storage ranged from only 3 individuals of each taxon to all individuals sorted per sample.

Storage containers ranged from screwtop containers to small pottles.

Sample Processing

Sieving

Four respondents elutriate the invertebrate samples in the field prior to preservation. The remaining 7 Councils made no comment regarding elutriation. Samples were returned to the laboratory for sieving using:

- Single sieve of 0.5 mm mesh (3 Councils).
- A series of sieves: 2.0, 1.0 and 0.5 mm mesh (1 Council); 4.0, 1.0 and 0.5 mm mesh (1 Council); 2.0 and 0.25 mm (2 Councils).
- Single 1mm mesh sieve (1 Council).

Staining

One respondent noted the occasional use of Rose Bengal as a sample stain. All other Councils did not stain samples.

Sample Sorting

Overall, the Councils surveyed followed slightly different sorting procedures. White flat bottom-sampling trays are the most common form of trays used for sorting, with Bogorov trays used by one Council.

Most Councils sort preserved macroinvertebrate samples. Only one Council live-sorted macroinvertebrate samples.

Sorting Procedure

Sorting procedure varied greatly amongst respondents (Fig. 1.3). Full sample counts are undertaken by 3 Councils (27%), and fixed count and coded abundance regimes by 4 Councils (37%) each (Table 1.1). Councils using a 100 fixed count regime generally employ a scan for rare taxa following sample sorting.

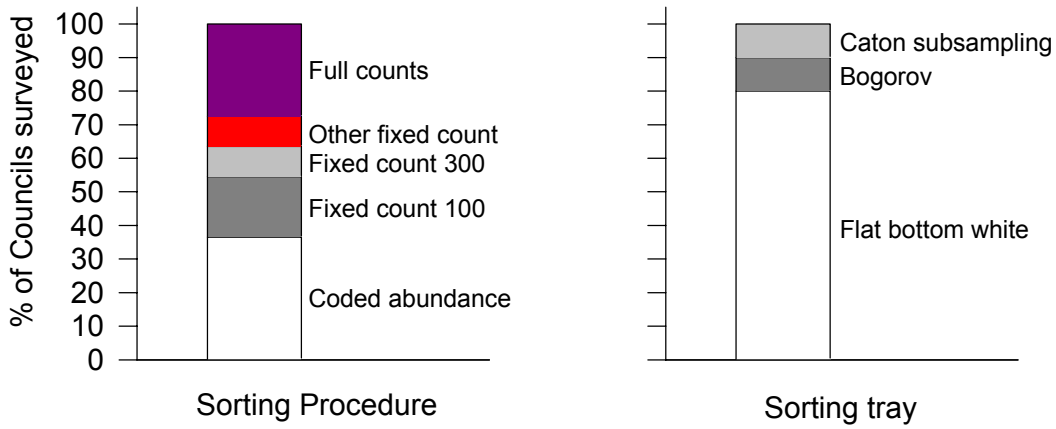

Fig. 1.3 Macroinvertebrate sorting procedures used by Regional Councils for SOE monitoring.

Of the four Councils using coded abundance methodology for macroinvertebrate sorting:

- Two Councils follow the 5-point coded abundance scale suggested by Stark (1998) (i.e., rare = 1 – 4 animals per sample, common = 5 – 19, abundant = 20 – 99, very abundant = 100 – 499, very, very abundant = 500+).
- One Council uses a modified 4-point coded abundance scale (i.e., rare = <5 animals per sample, common = 5 – 19, abundant = 20 – 1,000, very abundant = >1,000).
- One Council uses a 12-point coded abundance scale (i.e., 1 = 1 animal per sample, 2 = 2 animals per sample, 3=3, 4=4, 5=5, 6 =6 - 20, 7 = 20 – 50, 8 = 50 – 100, 9 = 100 – 500, 10 = 500 – 1,000, 11= 1,000 – 2,000, 12 = 2,000 – 3,000). This scale is backwardly compatible with the 5-point scale of Stark (1998).

Subsampling

Subsampling is undertaken when samples have high animal abundance, either for the entire sample or for specific invertebrate taxa. Of the respondents, four use no additional subsampling methods at all (but note that many already use a specific sorting procedure designed to reduce sorting time, e.g., 100 fixed count) (Table 1.1).

Table 1.1 Sorting and subsampling procedures undertaken by Regional Councils for macroinvertebrate SOE monitoring.

Council	Sorting Procedure	Count	Subsampling	Subsampling methods	Notes
A	Coded abundance		No		
B	Fixed count	100 + scan	Yes for samples with high abundance	Sample splitter	Sorting along Bogorov tray
C	Coded abundance		Subsample only for specific taxa		
D	Fixed count	300	No	Sorting tray divided into squares	Use Caton tray for subsampling
E	Coded abundance				
F	Fixed time	2 hours + 30 min. scan	Yes for samples with high total abundance	Other (unspecified)	
G	Full sort	Full count	Subsample only for specific taxa	Sorting tray divided into squares	
H	Fixed count	100 + scan		Sorting tray divided into squares	Occasionally use sample splitter for high sediment samples
I	Full sort		No		
J	Coded abundance	+ scan		Sorting tray divided into squares	3-4 of 20 squares

Incomplete specimens

Councils do not count empty cases (caddisflies etc) of benthic taxa.

Seven Councils indicated that they count heads only as a single individual and ignore 'headless' body parts.

Other Councils ignored incomplete specimens.

One Council indicated that partial body part counting was dependent on the quality of the preserved part. If well preserved, animal parts may be counted, but the precise criteria used were unclear.

Quality Control (QC)

Seven of the 11 Councils reported that samples are always checked by a second person when:

- A student sorter is being used.
- When staff are being trained.

Apart from this, only 2 Councils have established QC systems. These systems involve checks of a percentage of samples by a second person (2% and 10% of

sorted samples respectively), regardless of whether the sorter was well-trained or not. The remaining 4 Councils indicated that there was no QC and samples were not checked by a second person. In some instances, rare or unusual taxa are sent to specialists for identification.

Taxonomic Quality Control Procedures

All Councils surveyed maintained reference collections, and with the exception of 3 Councils, sorting and identification is undertaken by Council staff. Three Councils use a subcontracted taxonomist.

Acceptable levels for sampling error generally were unspecified. However, those that undertake analysis of identification error suggest that 10% (2 Councils) to 20% (1 Council) error is acceptable.

Taxonomic level

With one exception, all Councils identify macroinvertebrates to the MCI or genus (generally the same) level. One Council identifies macroinvertebrates to the lowest practical taxonomic level (usually species).

Habitat and Environmental Information

All of the Councils surveyed indicated that some form of habitat and environmental data are collected during SOE monitoring. However, the habitat and environmental data gathered by each Council varied (Fig 1.4 and 1.5).

Nine Councils collect at least 4 physicochemical parameters, while one Council do not collect any physicochemical data. For one Council, only temperature is measured during SOE monitoring; however 25% of the sites surveyed during SOE monitoring are part of a monthly physicochemical monitoring programme.

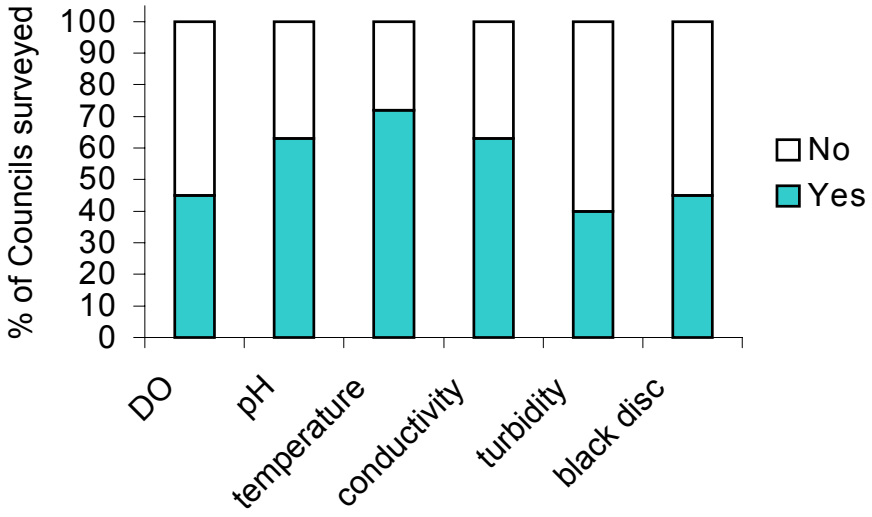

Fig. 1.4 Percentage of Councils that collect physicochemical data during benthic invertebrate field sampling.

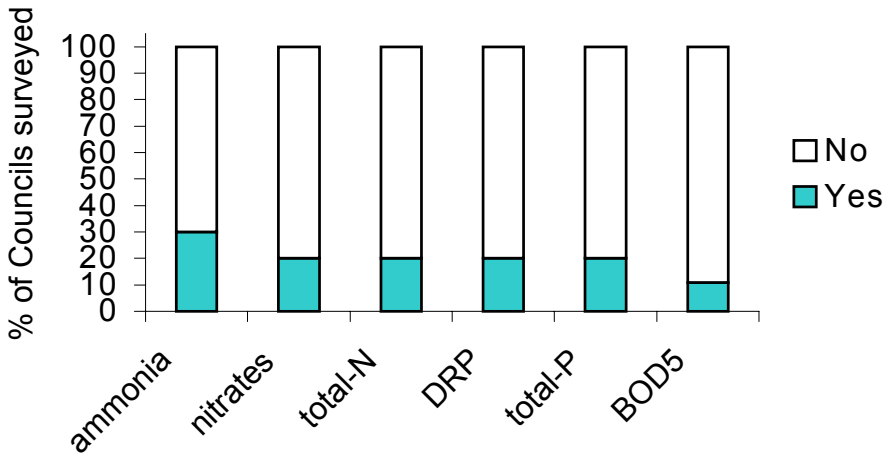

Fig 1.5 Percentage of Councils that collect nutrient data during benthic SOE invertebrate field sampling.

Fig 1.5 shows that less than 30% of the Councils undertake nutrient analysis as part of SOE monitoring. Of the 11 Councils surveyed, only 2 Councils sample for nutrients and one Council sampled only for ammonia. The other 8 Councils do not sample for nutrients as part of macroinvertebrate SOE monitoring. Note, however, that most Councils operate separate water quality sampling programmes where additional water quality information is gathered.

An analysis of habitat information collected for SOE monitoring was difficult as not all Councils returned habitat data sheets.

Data management

The following list provides a summary of the data management practices undertaken by the 11 Councils surveyed.

- Councils store invertebrate data using either Excel (6 Councils), Access (3 Councils) or both (1 Council) electronic mediums.
- With the exception of 1 Council, all data collected is published in some report form (e.g., wall maps with MCI scores, freshwater biological publications).
- Database storage is in-use by one Council, the remaining Councils surveyed indicate that databases are in development.
- Ten Councils undertake invertebrate data entry by the individual involved with the taxonomy, or by a relevant technician.
- Only one Council checks a percentage of the data entered into electronic form.
- One Council indicates that 10% of the samples are recounted, with the acceptable input error being 5% of the original count.