

Biotic Indices and Stream Health Metrics

The following macroinvertebrates metrics were calculated from each kick-net sample, to provide an indication of stream health:

- **Total abundance** – the total number of individuals collected in the composite kick-net sample collected at each site. Macroinvertebrate abundance can be a good indicator of stream health, or ecological condition, because abundance tends to increase in the presence of organic enrichment, particularly for pollution-tolerant taxa (e.g. chironomid midgelarvae and oligochaete).
- **Taxonomic Richness** – the total number of macroinvertebrate taxa recorded from the composite kick-net sample collected at each site. Streams supporting high numbers of taxa generally indicate healthy communities, however, the pollution sensitivity/tolerance of each taxon needs to also be considered.
- **EPT taxonomic richness** – the total number of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) from the composite kick-net sample collected at each site. These three insect orders (EPT) are generally sensitive to pollution and habitat degradation and therefore diversity of these insects provides a useful indicator of degradation. High EPT richness suggests high water quality, while low richness indicates low water or habitat quality.
- **EPT taxonomic richness (excl. Hydroptilids)** – the total number of EPT taxa excluding the family Hydroptilidae (free-living caddis). The algal piercing caddisflies belonging to the family Hydroptilidae are generally considered more tolerant to degrading conditions than other EPT taxa. Excluding hydroptilid caddis from the EPT metric is a more conservative approach and more accurately represents the clean-water EPT taxa.
- **% EPT abundance** – the total abundance of macroinvertebrates that belong to the pollution-sensitive ePT orders, relative to the total abundance of all macroinvertebrates found in the composite kick-net collected at each site. High %EPT richness suggests high water quality.
- **% EPT abundance (excl. Hydroptilids)** - the percentage abundance of EPT taxa at each transect, excluding the more pollution – tolerant hydroptilid caddisflies.
- **Macroinvertebrate Community Index (MCI)** – this index is based on tolerance scores for individual macroinvertebrates taxa found in hard- or soft-bottomed streams (Stark, 1985, Stark and Maxted 2007). These tolerance scores, which indicate a taxon’s sensitivity to in-stream environmental conditions, are summed for the taxa present in a sample, and multiplied by 20 to give MCI values ranging from 0-200. The table below provides a summary of how MCI score were used to evaluate stream health.
- **Quantitative Macroinvertebrate Community Index (QMCI)** – this is a variant of the MCI, which instead uses abundance data. The QMCI provides information about the dominance of pollution-sensitive species in hard- or soft-bottomed streams. The table below provides a summary of how QMCI scores were used to evaluate stream health.

Table . Interpretation of MCI and QMCI scores for hard and soft-bottomed streams.(Stark and Maxled 2007)

Stream Health	Water Quality descriptions	MCI	QMCI
Excellent	Clean water	>119	>5.99
Good	Doubtful Quality or possible mild enrichment	100-119	5.00-5.90
Fair	Probable moderate enrichment	80-99	4.00-4.90
Poor	Probable sever enrichment	< 80	<4.00

Sites were ranked from 1 (best) to 9 (worst) for the following biotic indices: taxonomic richness, EPT richness, % EPT richness, and MCI scores. Other biotic indices were not included as many are derivatives of these key indices. These ranks (of included biotic indices) were then summed to give an overall rank for each site, where 1 was the best overall, and 9 was the worst site overall (based on the four biotic indices).

Stark and Maxted 2007. A User Guide for Macroinvertebrate Community Index. Cawthron report No.1166

MCI Tolerance Levels – See Appendix B. Stark et.al. 2001. Protocols for sampling macroinvertebrates in wadeable Streams. NZ Macroinvertebrate Working Group Report. No.1.

Taxa	Common Name	Specie Name	MCI Value
Ephemeroptera	Mayfly	<i>Deleatidium</i>	8
Plecoptera	Stoneflies		8
Megaloptera	Dobson Flies		7
Odonata	Dragonflies, Damselflies		6
Hemiptera	True Bugs, Water bugs		5
Coleoptera	Beetles		6
Diptera	Flys	<i>Chironomus</i>	1
Trichoptera	Caddisfly	<i>Olinga</i>	9
Crustacea	Amphipoda		5
	Ostracoda		3
Mollusca			3
Nematoda	Flat Worm		3
Oligochaeta	Worm – include many species of small freshwater worms		1
Fish – Bullies or Juvenile Trout			10