12.0 STREAM MACRO-INVERTEBRATES

Aquatic macro-invertebrates include a diverse range of freshwater invertebrate animals. Some, such as freshwater shrimps and mussels, are well known to many people, but most are relatively small, obscure animals which live unseen in our streams, rivers and lagoons. Macro-invertebrates can be highly abundant, and play important ecological roles in streams; for example, by processing nutrients and by providing food for fish and waterbirds. Most of the aquatic macro-invertebrates collected in local stream samples are larval stages of aquatic insects. The patterns of abundance of different types of macro-invertebrates can provide a measure of the ecological health of aquatic systems.

Most of the types of macro-invertebrates present in Darwin streams are widespread, tolerant organisms which occur in streams and rivers across large areas of northern Australia. Small coastal streams have a relatively impoverished fauna, and can feature evidence of marine connections in the crustacean macro-invertebrate fauna. Much remains to be learned of the details of the patterns of abundance and distribution of all stream animals in northern Australia. New discoveries do occur from time to time. For example, a new genus of water mites in a family (Nudomideopsidae), previously unrecorded from Australia, has been collected from a site in the Elizabeth River.

Figure 12.1 Larvae of all damselflies (*Ceriagrion aeruginosum* shown above) and dragon flies are aquatic.

Figure 12.2 Freshwater crab *Holthusiana sp*.

The Water Monitoring Branch of DNREA, with the assistance of the Cooperative Research Centre for Freshwater Ecology, has developed a method of assessing the ecological health of streams, known as the AUSRIVAS method. The method is based on comparing the number of types of macro-invertebrates identified in samples to the number of types predicted to be present. When the Observed/Expected (OE50) score is close to one, this indicates the stream macro-invertebrate fauna sampled is similar to reference streams, and not impacted by human activity.

For reporting purposes, scores are classed in bands as either A, B, C, D or X to indicate the extent of departure from reference condition. Several sites in the Darwin urban and rural areas, listed in Table 12.1 and shown in Map 4.1 (p.15), have been monitored for the past four years. Most sites had relatively OE50 close to 1 scores indicating these sites and streams are in relatively good condition. Approximately 64% of 56 assessments were classed in either band A (equivalent to reference condition), or in band X (above reference condition).

Table 12.1 AUSRIVAS model assessment bands and mean OE50 scores for eighteen stream sites in the Darwin area.

Site name	Site code	2001	2002	2003	2004	Mean OE50
Rapid Creek	DW21	C	C	B	B	0.62
Howard River 1	DW43	B	B	B	C	0.63
Howard River 2	DW45	A	A	A	B	0.95
Howard River 3	DW42	A	A	A	-	1.02
Mitchell Creek	DW23	A	A	B	B	0.84
Brooking Creek 1	DW38	A	B	-	-	0.94
Brooking Creek 2	DW41	A	B	B	-	0.77
Wells Creek	DW52	-	-	B	A	0.80
Bees Creek	DW26	A	B	A	A	0.85
Elizabeth River 1	DW40	A	B	A	B	0.94
Elizabeth River 2	DW39	A	A	A	-	1.00
Elizabeth River 3	DW44	-	A	X	-	1.10
Bennetts Creek	DW53	-	-	A	A	0.97
Berry Creek	DW31	X	X	X	A	1.20
Fly Creek	DW46	-	A	A	-	1.07
Darwin River	DW47	-	A	B	-	0.95
Blackmore River	DW36	A	A	B	-	0.98
Peel Creek	DW37	A	A	A	A	1.00

Consistent trends in OE50 scores over time may indicate a change in the ecological health of streams (see Figure 12.3). Trends for sites on a reference stream (Peel Creek, a tributary of Blackmore River), and two potentially impacted streams (Mitchell Creek and Rapid Creek) reveal different patterns. OE50 scores for Peel Creek indicate consistently high ecological health. The trend for Mitchell Creek indicates deterioration potentially associated with catchment disturbance from residential development, whilst the trend for Rapid Creek indicates partial recovery which may be due to improved hydrocarbon interception systems at the Darwin airport implemented in 2001. Without a better understanding and knowledge of the factors that affect macro-invertebrate communities in streams, these results must be interpreted with caution.

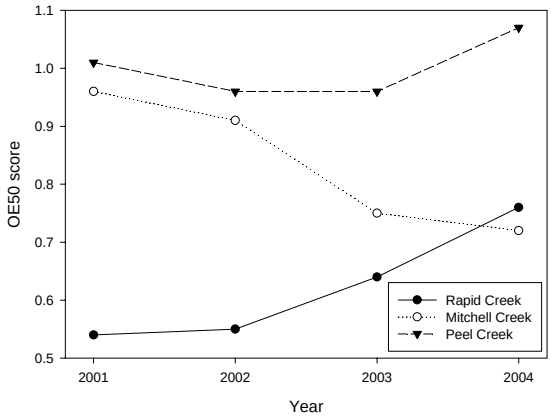

Figure 12.3 Four year trends in OE50 scores for three stream sites in the Darwin area.

An alternative view of changes in macro-invertebrate community structure is provided by ordination analysis. The scatter-plot of ordination results indicates the similarity of macro-invertebrate samples, i.e. sites with similar macro-invertebrate composition are close to each other in ordination space. The relative abundance of macro-invertebrates varies between years at all sites, with Mitchell and Rapid Creek communities being different from Peel Creek.

The relationships between stream health as determined by macro-invertebrate OE50 scores and taxa richness, and disturbance from land clearing and degradation of riparian habitats for Darwin area streams is shown in Figure 12.5. Taxa richness is the number of different types of macro-invertebrates found. The data suggests that there may be a threshold of about 50% below which stream macro-invertebrate communities are robust to the effects of land clearing, but beyond which stream communities respond negatively with increasing land clearing. The actual causes are not clear, but may be related to water pollution or changes in the hydrology of these urban catchments. There are no obvious relationships between indices of stream health and an index of riparian condition for Darwin area streams (see Section 4).

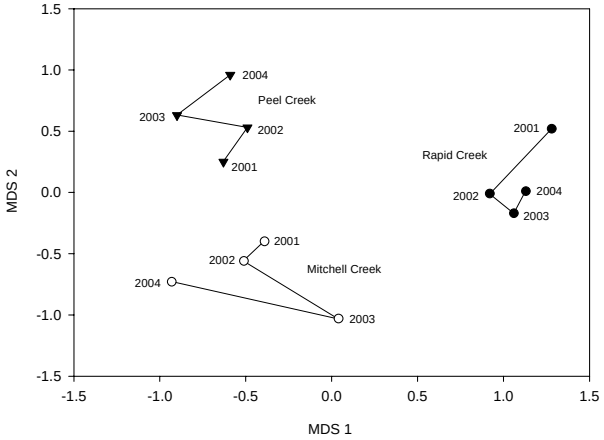

Figure 12.4 Trajectories of macro-invertebrate communities in MDS ordination space.

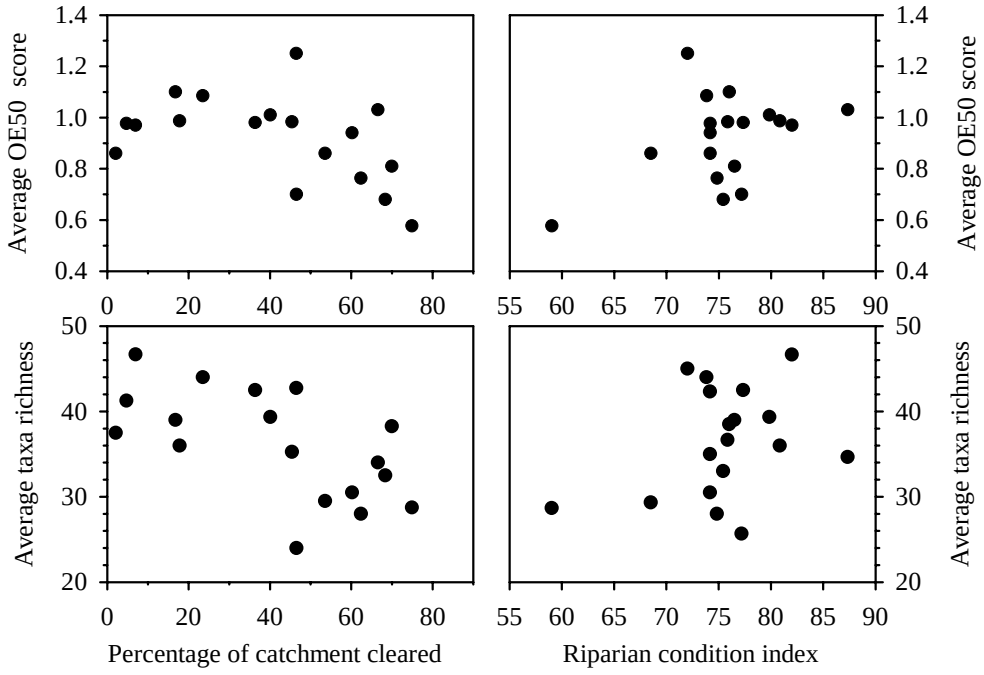

Figure 12.5 Scatterplots of the four year average for OE50 scores and taxa richness plotted against the percentage of catchment cleared of native vegetation and riparian condition index.

Conclusion

Overall, the health of streams in the Darwin Harbour region, based on their macro-invertebrate communities, is good and comparable to nearby regions such as the Mary, Adelaide and Daly River catchments. Macro-invertebrate communities are, however, more likely to have fewer types (or lower taxa richness) in catchments with urban development.

Further Reading

AUSRIVAS web site.
http://ausrivas.canberra.edu.au/Bioassessment/Macroinvertebrates/

Dostine, P.L. (2002). Assessment of the ecological condition of freshwater streams in the Darwin region: evidence from a survey of macro-invertebrate communities and water quality in the early dry season 2001. Report 43/2002. Department of Infrastructure, Planning and Environment, Darwin.

Dostine, P.L.(2005) A predictive model for assessment of stream health in the Darwin-Daly region of the Northern Territory using mostly genus level data. Report No. 6/2005D. Department of Infrastructure, Planning and Environment. Darwin.

Townsend, S.A., Dostine, P.L., Dixon, I., Karfs, R. and Douglas, M.M. (2004). The response of stream macroinvertebrate communities to catchment clearing and riparian condition in the Darwin region (tropical Australia). In 'Proceedings of the 4th Australian Stream Management Conference'. (Ed. Rutherford, I.D., Wiszniewski, I, Askey-Doran, M.J., and Glazik, R. Department of Primary Industries, Water and Environment.). pp 618-622.