A brief investigation into the benthic macroinvertebrate fauna of one section of the Murrumbidgee River, New South Wales, Australia, using kick, net and surber sampling methods

by Dr Trevor J. Hawkeswood*

*270 Terrace Road, North Richmond, New South Wales, 2754, Australia.

Hawkeswood, T.J. (2004). A brief investigation into the benthic macroinvertebrate fauna of one section of the Murrumbidgee River, New South Wales, Australia, using kick, net and surber sampling methods. *Calodema*, 2: 1-5.

Abstract. The relatively fast flowing stream within the Wiradjuri Reserve, Murrumbidgee River, near Wagga Wagga, New South Wales, Australia was sampled during mid April 1994 for aquatic (benthic) macroinvertebrates using kick, net and surber sampling methods. None of the sampling methods alone were able to detect the total number of species present but all three methods used together were able to detect most if not all of the macroinvertebrate species within the stream at that time of the year.

Introduction

The Murrumbidgee River in southern New South Wales, Australia is one of the longest rivers in the country but little is known of the macroinvertebrates of this system and aspects of their population structures. The aim of this short study was to sample (by several collecting methods) a number of closely spaced sites along an upland stream in south-western New South Wales, Australia and to provide identification wherever possible of the identities of the macroinvertebrates.

Materials and Methods

(1) Field site

Wiradjuri Reserve, Murrumbidgee River, near Wagga Wagga, New South Wales, Australia was chosen as an ideal site for the project. At the surveyed site, the river was fast flowing with numerous riffles. Tree roots of mainly *Eucalyptus camaldulensis* Dehn. (Myrtaceae) and *Salix* sp. (Salicaceae) were exposed at the water's edge at various locations. Large rocks formed an embankment on the northern side of the river and the southern area possessed sandy and pebbly areas. The pH of the water was determined as 8.03, the conductivity as 0.80, the turbidity as 47.0, dissolved oxygen as 9.25, while the temperature of the water was 15.8°C and the salinity was virtually zero.

(b) Sampling

The following samples were taken: (a) one 30 second, timed kick sample using a dip net in a riffle area (K); (b) one series of sweeps using a dip net amongst the roots and bark of trees overhanging the bank (N); (c) 4 (four) 20 x 20 cm surber samples from riffle areas only (S1 to S4); (d) 1 (one) surber sample from a sandy area (S5). The contents of the samples were emptied into sorting trays and then removed to either plastic bags or bottles and the labelled for later identification and sorting.

Results

The raw data obtained from these samples are provided in Table 1 below. The mean numbers of organisms per square metre with standard deviations and standard errors are provided in Table 2 below.

Table 1. Species and numbers of macroinvertebrates collected from the Murrumbidgee River, New South Wales Australia, by the various sampling methods explained in the text

Species	Numbers of individuals						
	K	N	S1	S2	S3	S4	S5
D. Chironomidae "unidentified"	37	0	35	10	9	5	7
D. Chironomidae, *Chironomus* sp.	1	0	0	2	0	0	0
P. Griptopterygidae, *Leptoperla* sp. (?) (L)	9	0	0	0	1	0	0
P. Austroperlidae, *Acruroperla* sp. (L)	4	0	0	0	0	0	0
H. Corixidae, *Micronecta* sp.	0	300+	14	2	2	5	2
H. Corixidae, *Agraptocorixia* sp.	0	2	0	0	0	0	0
E. Caenidae, *Tasmanocoenis* sp.	25	0	1	1	2	2	0
E. Ephemerellidae, *Austremerella* sp.	3	0	13	0	1	4	0
E. Leptophlebiidae, *Jappa* sp.	0	0	3	0	0	0	4
T. Hydropsychidae, *Cheumatopysche* sp. (L)	1	0	1	1	0	0	0
T. Hydropsychidae,*Cheumatopysche*.sp. (A)	1	0	0	0	0	0	0
T. Hydrobiosidae, *Taschorema* sp.	1	0	0	0	0	0	0
C. Atyidae, *Paratya australiensis*	0	30	0	0	0	0	0
Oligochaeta	0	0	1	0	0	0	0
Total no. of species	9	3	7	5	5	4	3
Average no. of animals per sq. m. (all samples taken into consideration)				295 $\pm$ 148 (SE)			

D = Diptera, P = Plecoptera, H = Hemiptera, E = Ephemeroptera, T = Trichoptera, C = Crustacea, L = larva, A = adult.

Discussion

There are some marked differences in the number of species and numbers of organisms obtained between the kick and surber samples (S1-S4) (Table 1). Chironomidae (unidentified species) (Diptera) were collected in the highest numbers in the kick samples but at least one surber sample (S1) caught a comparable number. Two species of Plecoptera larvae were collected from the kick sample but these were almost absent or absent from the surber samples (Table 1). Plecopteran larvae usually inhabit fast-flowing streams and unsheltered margins of lakes where they occur clinging to the undersides of rocks and stones on the bottom (Williams, 1980). Therefore it would be expected that there would be more of these nymphs collected from the kick sample (which dislodges them from the stones), than the surber samples which collected organisms mostly from the water flow.

No water bugs, Corixidae (Hemiptera), were collected from the kick sample but were present in small numbers in the surber samples and were collected in very large numbers from the net sample (N) (Table 1) which sampled the submerged roots of the trees on the river bank. This indicates that these bugs are mostly surface dwellers, sheltering during the day under the roots and banks of the river but that a few specimens may be caught in the stream flow if they venture too far away from the banks. Williams (1980) noted that Corixidae are almost ubiquitous in still or only slowly flowing fresh waters where they mostly occur amongst vegetation or on muddy bottoms, and that they are rarely found away from the edges. My data on this species generally supports these observations, although it is obvious that the adult *Micronecta* and also *Agraptocorixia* do not prefer the rocky bottom, at least in this area of the Murrumbidgee River, otherwise these species would have appeared in the kick sample (Table 1). However, *Micronecta* was observed in the sample from the sandy bottom (S5) (Table 1) which was of interest.

Table 2. Mean number of organisms per square metre, standard deviation and standard errors values (data derived from Table 1).

Species	Mean/sq.m	SD	SE
D. Chironomidae “unidentified”	58.9	55.2	21.0
D. Chironomidae, *Chironomus* sp.	1.7	1.9	1.1
P. Griptopterygidae, *Leptoperla* sp. (?) (L)	5.7	12.4	4.7
P. Austroperlidae, *Acruroperla* sp. (L)	2.3	5.6	2.1
H. Corixidae, *Micronecta* sp.	186.0	414.4	156.6
H. Corixidae, *Agraptocorixia* sp.	1.1	2.8	1.1
E. Caenidae, *Tasmanocoenis* sp.	17.7	33.7	12.7
E. Ephemerellidae, *Austremerella* sp.	12.0	17.4	6.6
E. Leptophlebiidae, *Jappa* sp.	9.7	18.1	6.9
T. Hydropsychidae, *Cheumatopysche* sp. (L)	1.7	1.9	0.7
T. Hydropsychidae,*Cheumatopysche* sp..(A)	0.6	1.4	0.5
T. Hydrobiosidae, *Taschorema* sp.	0.6	1.4	0.5
C. Atyidae, *Paratya australiensis*	1.7	4.2	1.6
Oligochaeta	0.6	1.4	0.5

D = Diptera, P = Plecoptera, H = Hemiptera, E = Ephemeroptera, T = Trichoptera, C = Crustacea, L = larva, A = adult.

Another significant difference between the kick and surber samples, was the abundance of *Tasmanocoenis* (Caenidae, Ephemeroptera) in the kick sample while less than 3 specimens were only able to be collected in the surber samples (Table 1). Ephemeroptera usually occur in lakes and reservoirs, but mostly in sluggish, meandering rivers (Williams, 1980). My data suggests, that like the Chironomidae (Diptera), *Tasmanocoenis* larvae prefer to shelter during the day underneath stones, while the *Austremerella* tended to be active in water during the day, having been collected in some numbers in the surber samples, especially in S1, in the shallower water (Table 1). *Jappa* sp. (Ephemeroptera) was absent from the kick sample, but was present in the surber samples (Table 1). This is to be expected since *Jappa* is a burrowing genus, into sand or mud at the bottom or at the banks of streams (Williams, 1980). *Cheumatopysche* sp. (larvae) (Trichoptera) were collected from both kick and surber samples, but the species was present in very low numbers (Table 1). *Taschorema* and adult

Cheumatopysche (both Trichoptera) were only collected from the kick sample (Table 1). The shrimp, *Paratya australiensis* was only collected from the net sample from under the submerged roots of the willow (*Salix* sp., Salicaceae) (Table 1). This result was also expected since these shrimps are also secretive during the day and would not occupy sand or be present in the main water flow during these times.

From an examination of Table 1, it is obvious that the largest number of species was obtained from the kick sample (9) with generally decreasing numbers of species in the surber samples (from 6 to 3) as samples were taken further away from the river bank. Only 3 species were obtained from the sand sample (S5) which compares well with the net sample (Table 1). Generally, the sample with the higher diversity of species had the highest number of individuals (Table 1) but an exception occurred with the net sample, where *Micronecta* (Hemiptera) was present in much higher numbers than any other organism sampled (Table 1). The habitat with the greatest diversity of species was the niche under stones in the riffle areas. This was to be expected since riffle areas have moderate turbulent flow with more oxygen and food continually flowing past and the stones offer protection for the organisms. Sandy areas are depauperate in terms of species since they are difficult to colonize and do not offer as much protection for organisms as does the rocky, stony habitats.

Table 3. Calculations of the minimum number of surber samples to estimate within 20%, 10% and 5% of the mean for Chironomidae (unidentified species) and *Taschorema* sp. (Trichoptera)- (Raw Data Log Transformed).

Estimation Percentage (%)	Chironomidae	*Taschorema* sp
20%		
Mean square	1.6	0.1
Sample (SD)	0.3	0.2
Coefficient of Variation	17.8	244.9
N	21.8	4118.1
10%		
Mean square	1.6	0.1
Sample (SD)	0.3	0.2
Coefficient of Variation	17.8	244.9
N	87.3	16472.4
5%		
Mean square	1.6	0.1
Sample (SD)	0.3	0.2
Coefficient of Variation	167.8	244.9
N	349.3	65889.7

N = minimum number of samples required

The tree roots are a specialized microhabitat containing few species but these species may have larger numbers present. In summary, the areas where water flow is not too turbulent and where stones are present, exhibit the greatest species diversity (but not necessarily the greatest numbers) and thus have the greatest influence on the distribution and abundance of the macroinvertebrates, i.e. flow rate and substrate are the main environmental determinants.

The average number of individuals of each species per m^2, SD and SE were determined for all species (Table 2). This table indicates that there are wide differences in abundance of the various species (despite using only 4 sampling methods). The standard deviation (SD) is very high and often larger than the mean, which indicates that the samples are not sufficient to obtain a value close to the true means of the populations of the various species encountered. The same situation applies to the standard errors (SE) which are large in relation to the mean values (Table 2). This indicates that not enough samples have been undertaken and thus is highlighted in the calculations provided in Table 3 of the minimum numbers if surber samples needed to estimate 20%, 10% and 5% respectively of the true population means for the most common species (i.e. Chironomidae, unidentified species, Diptera) and the least common species in the surber samples (i.e. S1-S5), (*Taschorema* sp., Trichoptera). These calculations clearly show that the sample size was most likely too small to determine accurately the population means and that in most cases, larger numbers of samples needed to be collected, especially for the rarer taxa. However it is likely that if ± 40% of the mean population value is acceptable for a certain survey, then perhaps the data are justified. In any case, the four methods of sampling used together appear to be sufficient to determine the biodiversity of the creek at this time of the year (i.e. during the autumn when the weather is cool and macroinvertebrate activity is declining).

Acknowledgements

I am indebted to Dr David Robertson, previously of the School of Environmental Science, Charles Sturt University, Wagga Wagga, New South Wales, Australia for invertebrate identification and facilities at the University for this research to be undertaken. I also acknowledge the superb lecturing skills of Dr Robertson and his enthusiasm for aquatic biology for students. His resignation from the Charles Sturt University was a great loss for them and for generations of students who would have benefited greatly under his tuition.

Reference

Williams, W.D. (1980). *Australian Freshwater Life: The Invertebrates of Australian Inland Waters.* Sun Books, Melbourne.

****