internal report





# Macroinvertebrate community structure in Magela Creek between 1988 and 1996 - preliminary analysis of monitoring data

by

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## Summary

Macroinvertebrate community data from the macrophytic edge habitat of 2 sites in Magela Creek upstream and downstream of Ranger Uranium Mine were analysed for the years 1988 to 1996 (excluding 1989). These data represented the available information for potential effects of the mine on lotic macroinvertebrate communities in Magela Creek at the time of the 1996 Senate inquiry into uranium mining in Australia. Communities were dominated by chironomid (Diptera) and caenid (Ephemeroptera) species and showed a high degree of interannual variability in total abundance. Multivariate analyses showed the two sites tracking each other over time at both the family and species level. Species level analysis also suggested a gradient in the multivariate ordination linked to separation of sites. These preliminary analyses did not indicate any obvious effects of mining although it is recognised that limitations in design and changes in sampling method over time limit the statistical inference possible.

## 1 Introduction

At the inception of the extensive programs of environmental research conducted by the *eriss* (nee ARRRI) and its consultants in 1978, it was recognised that the major potential impact of mining operations in the Alligator Rivers Region would arise from the dispersion of contaminated mine waste-waters to surface waters (see review of Humphrey & Dostine 1994). Thus, a large part of the research program of the *eriss* has focussed on development of techniques, particularly those incorporating biological indicators, that would be used to monitor and assess such impact.

Some 7 years after the development of the Ranger mine and after completion of a number of baseline ecological studies of local flora and fauna (focussing mainly on lentic waterbodies or 'billabongs'), macroinvertebrate community studies were initiated in the seasonally-flowing portion of Magela Creek in 1988. Whilst it was anticipated that these data would be used as a basis for detecting and assessing mining impact in Magela Creek, it was also recognised that a lead time in development of suitable procedures for monitoring using macroinvertebrate assemblages would be required before techniques were fully refined. Exemplifying the developmental aspect of this work, an external review of the program conducted in 1993 in the form of a workshop recommended changes to the study design from 1994 onward, in line with then-current, 'best practice' in biological monitoring research (Bunn in press). Up until 1995, the environmental protection objective for environmental monitoring in the ARR was for no observable impact.

In 1996 *eriss* was asked to prepare a report for submission to a Commonwealth Government Senate inquiry into uranium mining in Australia. This report was to include an assessment of impacts, if any, upon the environment surrounding the Ranger project resulting from uranium mining. For this purpose, data from a limited number of samples from the Magela Creek study were analysed in order to draw preliminary conclusions about the effects of the Ranger Mine on macroinvertebrate community structure. For the purpose of the Senate inquiry, these data were supported by biological, physical and chemical data collected in association with other studies of the system. In assessing possible mining-related effects upon macroinvertebrate communities, the current report presents all macroinvertebrate data collated for the Senate inquiry. report and, in addition, makes a brief assessment of the efficacy A more detailed assessment of of past, current and future approaches to monitoring using this assemblage of indicator organisms will be presented elsewhere as the outcome of a review of the monitoring program conducted in June 1997. More detailed descriptions of the sampling program conducted between 1988 to 1996 will also be presented as part of the reporting associated with this review.

## 2 Study area

Magela Creek arises in the sandstone plateau of western Arnhem Land. It can be classified into three zones according to flow and channel characteristics. The upper reaches which are perennial and spring-fed, the mid lowland reaches where it exists as an anastomosing sand-bed stream and finally a broad, seasonally-inundated floodplain at which point it feeds into the South Alligator River. Macroinvertebrate studies have concentrated on the middle, seasonallyflowing portion of Magela Creek upstream of the floodplain where up to ten sites have been sampled. Since 1994, sites from five control creeks of similar character have also been sampled. Data from only two sites on Magela Creek will be discussed in this report. Site 1 is located 1.5 km upstream of the Ranger Uranium Mine (RUM) release pipe. Site 3 was located 6 km downstream of the RUM pipe for the period 1988-93 (immediately downstream of the disused Jabiru sewage pipe outlet, at Stone Billabong). As of 1994, the downstream site was re-located approximately 1 km upstream of its previous location (or 200 m downstream of gauging station GS8210009). The upstream site represents a control site while the fauna at the downstream site should reflect any impacts that may have occurred as a result of the dispersion of mine waste-waters to the creek system. It is recognised that such a simple design using a single control site has inherent flaws i.e. without extra controls, inferences surrounding possible impacts arising from mining are considerably weakened (Humphrey et al 1995). As a consequence, the results should be viewed as preliminary.

A variety of habitats have been recognised within the Magela Creek system and it appears the composition and abundance of the invertebrate fauna varies amongst these (Tripodi 1996 & personal observation). For the purposes of this report, only the macrophytic-edge habitat will be considered, mainly because no other habitats were sampled prior to 1994. The band of macrophytes occurring at the edge of the creek channel is generally dominated by the submerged plant *Eriocaulon*, and is exposed to moderate to high stream currents during recessional flows. This habitat is relatively uniform in structure along the length of the creek channel considered here, a factor which should minimise confounding in the detection of mining impact. The macrophyte-edge habitat also appears to support greater abundances of invertebrates than other habitats sampled in the monitoring program (Tripodi 1996 & personal observation).

## 3 Methods

## 3.1 Timing of annual sampling

Within the study area, Magela Creek generally flows for only 6-7 months and hence sampling of aquatic biota in the creek is restricted to this period. Biota has been sampled annually in late April - early May (the Wet-Dry season transition period) for the following reasons: at this time accessibility is enhanced and sampling easily conducted, water clarity is high (a factor important in fish monitoring), measured responses represent the summation of effects of mine waters released during the preceding Wet season, and abundances and taxa richness were believed to be generally highest (Humphrey et al 1990). Tripodi (1996) subsequently reported highest taxa richness and abundances of benthic invertebrates in macrophytic-edge habitat of Magela Creek channel in the mid Wet season, but only a small decline in these attributes was found by the Wet-Dry transition period.

## 3.2 Sampling procedure

From 1988 to 1993, invertebrate samples were collected using a Surber sampler of area  $0.063 \text{ m}^2$  with a sampling net of 500  $\mu$ m mesh. In 1994, a Boulton suction sampler of area  $0.04 \text{ m}^2$  was used for sample collection Boulton (1985). In both instances, five replicate samples were taken at each site.

In 1995 and 1996 a technique similar to that being used in the national Monitoring River Health Initiative was adopted (Davies 1994). A triangular pond net with 0.25 m sides (internal dimensions) and mesh size 250  $\mu$ m was used to sample a pre-defined 2 m strip of the macrophtye-edge habitat. The net was held vertical to, and firmly against, the stream bed with the net pointing downstream whilst macrophytes and substratum were vigorously disturbed by hand in front of the net opening. The net was moved progressively upstream allowing disturbed material to pass with the stream current into the net. Whilst the total area sampled per replicate using the pond net method was 0.5 m<sup>2</sup>, this is almost certainly an overestimate in terms of density estimates, given that this is a semi-quantitative sampling technique and an unknown portion of the sample was swept to the outside of the net after being disturbed from the stream bed. Three replicates were taken at each site using this method.

## 3.3 Processing and identification of samples

#### 3.3.1 Field processing of samples

Preliminary sample processing occurred in the field to minimise the volume of sample requiring preservation and to facilitate subsequent subsampling and sorting. Excessive coarse vegetation was removed from samples by thoroughly rinsing samples through nested 4 or 8 mm and 500  $\mu$ m sieves. On some occasions samples were placed in 20 L buckets two-thirds filled with water and stirred by hand to separate invertebrates from coarse vegetation prior to sieving. Non-organic subtratum (predominantly sand) left in the bucket was elutriated several times through the nested sieves. Material remaining in the coarser sieve was discarded after inspection for remaining invertebrates. Contents of the 500  $\mu$ m sieve were preserved in 70% ethanol in the field (1988-94) or placed in large plastic bags filled with creek water and taken back to the laboratory immediately for 'live-sorting' (1995-96).

#### 3.3.2 Subsampling and sorting in the laboratory

Two main approaches were taken to subsampling and sorting of samples over the course of the study. The approach to subsampling and sorting was linked to whether a 'quantitative' (1988-

94) or 'semi-quantitative' sampling technique (1995-96) was being used at the time. The quantitative approach involved subsampling of preserved samples using a geosplitter (that successively halves samples) or jug splitter. The jug method involved splitting samples volumetrically in a 5 L jug. Full descriptions of these subsampling devices and their efficiency are provided in Storey and Humphrey (1997). In some instances, samples were separated into coarse and fine fractions using sieves and these were subsampled separately. Large, conspicuous taxa were sometimes removed prior to this process to facilitate recovery of a complete taxa list. The aim of subsampling was to minimise sorting and identification time by reducing invertebrate abundance of a given sample to around 200. The lengthy sorting times (> 3 hours) associated with samples containing large amounts of detritus and low invertebrate abundances often meant that this target of 200 animals could not be met. Dissecting microscopes set at least to 10 X magnification were used for sorting of preserved samples. Invertebrate specimens were hand-picked from detritus using 'maze' sorting trays that allow material to be worked through systematically.

A semi-quantitative, 'rapid assessment' method was applied to sample processing in 1995 and 1996 to expedite, in particular, sample sorting time. The aim was to eliminate conventional laboratory subsampling and sorting while still recovering rank abundance of invertebrate taxa. Unpreserved samples from the field were emptied onto white plastic sorting trays of dimensions 680 x 420 mm. Tray bases had lines drawn on them dividing them into ten cells. The sample was gently stirred over the tray base to ensure even distribution (adding stream water to completely cover the sample), before randomly selecting a cell. A perspex ring of 94 mm diameter and 30 mm height was then placed in the selected cell. Rings positioned in this manner were generally found not to lie flush with the tray base because of underlying detritus. To overcome this, the ring was twisted in place until it rested firmly on the tray base. A timer was then activated and the sorter attempted to retrieve all animals within the ring using forceps and Pasteur pipettes. The appropriate stage at which to stop sorting was guided by the time elapsed since the last animal had been retrieved. When about 2 minutes had passed without an animal being found, sorting of that ring ceased and the timer was stopped.

This procedure was repeated, allocating a new ring to successive, randomly-selected cells, until 1 hr had elapsed. If sorting of a ring was incomplete after 1 hr had elapsed, sorting continued regardless until the ring had been completely sorted. Rings for which sorting had been completed were left *in situ* so that the sample was not progressively diluted. It was noticed that more mobile taxa, especially some of the Hemiptera, gathered at the edges of the sorting tray while sorting of the ring was in progress. To minimise this aggregation of specimens, the sample excluded from the rings was stirred prior to the placement of additional rings.

The number of rings used for a given sample was recorded on data sheets. A quick survey of the sample was made at the completion of the sorting process to pick out any conspicuous taxa that had not been found in the rings. These animals were placed in a separate, appropriately labelled vial. This last step was taken to maximise the number of taxa retrieved.

#### 3.3.3 Identification of samples

Invertebrates were identified to the lowest practical taxonomic level using regional and national taxonomic keys and the *eriss* macroinvertebrate reference collection. The exception to this was the Chironomidae from the 1996 samples for which time did not allow. Generally only a family-level of identification was attempted with the Hydracarina due to a lack of local keys. Generic level was only attempted for some described species where it was assessed that species-level identification could not be conducted with accuracy. This was generally for speciose genera where distinguishing features are obscure eg *Austrolimnius* adults, *Ecnomus* and *Orthotrichia* larvae, or where mounting of specimens was required eg *Oecetis* larvae.

Three analysts were involved in identifications and hence quality assurance checks were run by the most experienced analyst on identifications conducted by the other two personnel to maximise consistency.

All invertebrates other that chironomids were identified and counted using Wild M8, MZ8 or M10 dissecting microscopes. The head capsules of chironomids require clearing and mounting on slides to allow their examination at high magnification for species and genus-level identification (Cranston 1991). Specimens were firstly cleared in 5% potassium hydroxide overnight at room temperature. The clearing process was then reversed by placing specimens in glacial acetic acid for at least 15 minutes. Specimens were then briefly immersed in propanol before mounting in Euparal on glass slides. Chironomid material was identified under a compound microscope to the lowest practical level.

#### 3.4 Data analysis

Species-level data were generated from sites 1 and 3 for the years 1988 to 1995 (excluding 1989). Each site and occasion was represented by three replicates except for site 1 in 1992 and 1993 where only two samples were available. Family-level data for both sites were also available for 1996. Raw counts were converted to totals to account for subsampling. For quantitative samples for which coarse and fine fractions were subsampled separately in the laboratory, counts from the different fractions were scaled up to 100% and added together to give a whole sample estimate. For samples collected using the ring live-sort method, whole sample estimates were calculated by extrapolating the area of the tray that was live sorted (ie number of rings of known area) to the total area of the sorting tray. The accuracy of whole sample estimates using this method, therefore, is dependent upon the ability of the sorter to remove all animals in a ring and upon the assumption that the collective contents of the rings are a representative subsample.

An average abundance per taxon per replicate was calculated for each site and occasion. Averages were used because the number of replicates was not equal for each site and occasion. As a consequence of the use of different sampling methods over the duration of the study, per unit area counts varied. Thus, sampling area per replicate for the period 1988-93 was  $0.063 \text{ m}^2$ , for 1994  $0.04 \text{ m}^2$  and for 1995-96 up to  $0.5 \text{ m}^2$ . Count data are generally skewed with many taxa having low abundance and only a few having high abundance. To normalise the data, therefore, data were transformed before analysis by dividing the counts in each sample by the count of the most abundant taxon in each sample. This step can allow both quantitative and qualitative information to be expressed without either dominating the other (Gauch 1982) and allows comparsion of the combined data.

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Multivariate ordination was used to explore variation in this large and complex data set. Ordination summarises data sets according to the similarity between the communities of different samples. The similarity of samples to each other was calculated using the Bray-Curtis dissimilarity measure. The ordination method used in this study was semi-strong-hybrid (SSH) multidimensional scaling, in the PATN statistical package (Belbin 1993). Patterns of association amongst sampling sites and occasions were summarised by plotting the ordination scores of each axis against one another. By this method, the closer samples are to each other in ordination space, the more similar is their community structure. The reduction of data to two or three axes that summarise variation results in some distortion. This distortion is measured in terms of 'stress' and the number of axes selected was determined on the basis of a plateau in the level of reduction in stress value as further dimensions were added.

The principal axis correlation (PCC) module in PATN was used to determine those environmental variables and invertebrate taxa that were correlated with the ordination space (see Faith et al 1995). The MCAO module in PATN (Monte Carlo Analysis) was then used to test the significance of the correlation coefficients. A series of 1000 simulations was run to determine the number of times the original PCC correlation for each variable was exceeded. If none of the simulated values exceeded the original PCC value, there was a 99.9% probability that the particular variable had explanatory value in the ordination.

## 4 Results

### 4.1 Summary statistics

The total number of taxa found in the 40 samples from 1988 to 1995 was 121, representing a total of 42 families (Appendix 1). The Diptera accounted for approximately one-third of the taxa found (43 taxa) with most of those from the chironomid family (30). The next most diverse group was the Trichoptera with 21 taxa. Richness was generally lower at the upstream site (site 1) except for 1994 and possibly 1992 (when there was one less replicate for site 1 than 3 - Table 1). Richness was markedly low in 1988 which may be related to the low overall abundance of invertebrates recorded in that year (Fig. 2), or because of over-subsampling (subsample abundance ranged from 21 to 126). Sample size also tended to be lower for live-sorted material - the number of animals collected by the live sort technique in 1995 varied from 62 to 126 per sample and in 1996, 17 to 67. The low sample size in 1995 still resulted in richness values comparable to those in years when quantitative techniques were used, and so taxa recovery by this method may be adequate.

|      |                                          | and the state of t |
|------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Year | Number of taxa at<br>Magela Creek Site 1 | Number of taxa at<br>Magela Creek Site 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 1988 | 28                                       | 39                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1990 | 49                                       | 49                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1991 | 44                                       | 45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1992 | 39*                                      | 41                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1993 | 41*                                      | 51                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1994 | 47                                       | 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1995 | 41                                       | 48                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

 Table 1 Number of macroinvertebrate taxa (species and above) found at sites 1 and 3 in each year of the study period.

\* n=2 replicates

The caenid mayflies and chironomid Diptera were the two most abundant families recorded overall in the study. The caenids accounted for 34% of the number of invertebrates collected and the chironomids 31% (Table 2). The next most abundant family was the Leptoceridae (caddis flies) which only accounted for 6% of the total abundance (Table 2). Variation in total abundance of macroinvertebrates amongst years was quite marked with peaks in 1990 and 1995 (Fig. 1). As discussed above (section 3.5), sampling area per replicate increased from the period 1988-1994 to 1995-1996 so differences in abundance may be an artefact of different sampling areas. However, high invertebrate abundance in 1990 was due predominantly to large numbers of caenid mayflies present in that year while a range of taxa (baetid mayflies, ceratopogonid midges, hydroptilid and leptocerid caddis and the limnesid water mites) were present in relatively high numbers in 1995 (Table 2).



Figure 1 The average abundance of macroinvertebrates per replicate in Magela Ck at sites 1 and 3 from 1988 to 1996 with one standard error shown. Sites (1 or 3) are labelled under the error bars for each site and sampling occasion.

On half the sampling occasions, total abundance differed significantly between sites (Fig. 1). Abundance was significantly higher at site 1 on three occasions (1992, 1993 and 1994). Abundance values at site 3 in 1988 were unique compared with those in other years in being significantly higher than at site 1 (Fig. 1). Within-site variability in total abundance was sometimes quite high, mainly in years where overall abundance was high (Fig. 1).

| Family          | 1988   | 1988   | 1990     | 1990   | 1991   | 1991   | 1992 1992     | 1993   | 1993   | 1994   | 1994   | 1995   | 1995   | 1996   | 1996   |
|-----------------|--------|--------|----------|--------|--------|--------|---------------|--------|--------|--------|--------|--------|--------|--------|--------|
|                 | SITE 1 | SITE 3 | SITE 1   | SITE 3 | SITE 1 | SITE 3 | SITE 1 SITE 3 | SITE 1 | SITE 3 |
| Baetidae        | 13     | 2      | 10       | 17     | 10     | 13     | 20 7          | 29     | 1      | 8      | 2      | 18     | 80     | 21     | 20     |
| Caenidae        | 17     | 90     | 629      | 764    | 129    | 137    | 240 110       | 322    | 107    | 295    | 17     | 264    | 167    | 30     | 62     |
| Ceratopogonidae | 19     | 20     | 7        | 17     | 7      | 21     | 8 0           | 16     | 12     | 11     | 17     | 52     | 26     | 18     | 19     |
| Chironomidae    | 57     | 205    | 105      | 37     | 35     | 125    | 263 82        | 526    | 173    | 796    | 257    | 170    | 230    | 102    | 70     |
| Hydropsychidae  | 0      | 0      | 165      | 10     | 18     | 9      | 34 0          | 212    | 1      | 12     | 0      | 27     | 0      | 0      | 13     |
| Hydroptilidae   | 8      | 9      | 5        | 12     | 1      | 3      | 13 40         | 1      | 8      | 20     | 17     | 92     | 37     | 29     | 10     |
| Hygrobatidae    | 0      | 0      | 6        | 3      | 7      | 12     | 4 0           | 5      | 3      | 15     | 15     | 0      | 19     | 7      | 89     |
| Leptoceridae    | 3      | 9      | 13       | 76     | 12     | 29     | 27 31         | 5      | 9      | 4      | 15     | 211    | 121    | 8      | 0      |
| Limnesiidae     | 0      | 1      | <b>1</b> | 31     | 2      | 5      | 0 3           | 0      | 5      | 11     | 1      | 56     | 16     | 3      | 0      |
| Naididae        | 1      | 44     | 6        | 27     | 0      | 3      | 1 5           | 1      | 1      | 0      | 0      | 7      | 14     | 0      | 0      |
| Pyralidae       | 0      | 0      | 1        | 4      | 8      | 1      | 33 13         | 4      | 1      | 5      | 0      | 45     | 0      | 3      | 0      |
| Simuliidae      | 0      | 0      | 19       | 4      | 55     | 2      | 30            | 8      | 0      | 0      | 0      | 18     | 12     | 2      | 3      |

Table 2 Average abundance for each site and sampling occasion of macroinvertebrate families that contributed greater than 1% of the total abundance of animals collected over the study.

#### 4.2 Multivariate analyses

#### 4.2.1 Spatial and temporal patterns in community structure

Bray-Curtis dissimilarity values calculated between sites 1 and 3 for each year did not show a consistent trend with time (Table 3), ie community structure at sites did not become more dissimilar with time. Ordination of both species and family level data mirrored this variable difference in community structure between sites over time (Figs 2 and 3). The species level ordination was carried out in three dimensions, resulting in a stress level of 0.13. Differences amongst years were most apparent in vectors 1 and 2 (Fig. 2), whilst vector 3 appeared to represent features of the data separating the two sites is samples from the same site cluster together regardless of year (Fig. 2). The exception to this trend was for years 1994 and 1995 which may be because of the shift in location of site 3, a further 1 km upstream.

| Year | Bray Curtis Dissimilarity<br>(species) | Bray Curtis Dissimilarity<br>(family) |
|------|----------------------------------------|---------------------------------------|
| 1988 | 0.6602                                 | 0.3066                                |
| 1990 | 0.2679                                 | 0.2255                                |
| 1991 | 0.3740                                 | 0.3343                                |
| 1992 | 0.4705                                 | 0.2467                                |
| 1993 | 0.6010                                 | 0.2250                                |
| 1994 | 0.3825                                 | 0.2106                                |
| 1995 | 0.5580                                 | 0.3545                                |
| 1996 | •<br>                                  | 0.4948                                |

 Table 3 Bray Curtis dissimilarity values calculated for Site 1 (upstream of Ranger) vs Site 3 (downstream of Ranger) in each year of sampling.

\* species level data unavailable

PCC correlation analysis and tests of significance by MCAO of species level data showed that *Rheotanytarsus* sp. (Chironomidae, Diptera) and *Tasmanocoenis* indeterminate (Caenidae, Ephemeroptera) were highly correlated with the ordination space (p<0.001, Table 4) and that 21 other taxa were significantly correlated (p < 0.05, Table 4). Taxa that were significantly correlated to be those that were most abundant overall (as would be expected). The gradient represented by vector 2 (Fig. 2) is correlated with high numbers of various chironomid taxa (including *Rheotanytarsus* sp. *Djalmabatista* sp. and indeterminate Tanypodinae) at the positive end and high numbers of indeterminate *Tasmanocoenis* and Anisoptera (dragonfly larvae) at the negative end (Table 4). Vector 1 represents a gradient correlated with high numbers of *Rheotanytarsus* sp. at the positive end and high numbers of a variety of caddis fly taxa (including various hydroptilid and leptocerid taxa) at the negative end (Table 4).



Figure 2 Multivariate ordination plot of the macroinvertebrate community structure, at species level, recorded at two sites in Magela Ck using average abundances from two-three replicates per occasion and with year of sampling indicated.



Figure 3 Multivariate ordination plot of the macroinvertebrate community structure, at family level, recorded at two sites in Magela Ck from 1988 to 1995 using average abundances from two-three replicates per occasion and with year of sampling indicated.

Table 4 Invertebrate taxa significantly correlated (p<0.05) with the SSH ordination of sites 1 and 3</th>from Magela Ck on sampling occasions from 1988 to 1995 showing r values, probabilities anddirection of correlation.

| Invertebrate taxa            | r value | Probability | Direction of correlation |         |         |  |  |  |
|------------------------------|---------|-------------|--------------------------|---------|---------|--|--|--|
|                              |         |             | vector1                  | vector2 | vector3 |  |  |  |
| Ceratopogonidae OSS10L       | 0.7087  | 0.045       | +ve                      | +ve     | +ve     |  |  |  |
|                              |         |             |                          |         |         |  |  |  |
| Rheotanytarsus indeterminate | 0.9220  | < 0.001     | +ve                      | +ve     | -ve     |  |  |  |
|                              |         |             |                          |         |         |  |  |  |
| Ceratopogonidae OSS2L        | 0.7752  | 0.013       | -ve                      | +ve     | -ve     |  |  |  |
| Djalmabatista indeteminate   | 0.7353  | 0.045       | -ve                      | +ve     | -ve     |  |  |  |
| Tanypodinae indeterminate    | 0.7789  | 0.017       | -ve                      | +ve     | -ve     |  |  |  |
| Wundacaenis dostini          | 0.9022  | 0.002       | -ve                      | +ve     | -ve     |  |  |  |
| Leptorussa indeterminate     | 0.8047  | 0.011       | -ve                      | +ve     | -ve     |  |  |  |
| Orthotrichia indeterminate   | 0.8382  | 0.004       | -Vė                      | +ve     | -ve     |  |  |  |
| Triaenodes indeterminate     | 0.7132  | 0.040       | -ve                      | +ve     | -ve     |  |  |  |
| Limnesiidae                  | 0.7514  | 0.017       | -ve                      | +ve     | -ve     |  |  |  |
| Oxidae                       | 0.7091  | 0.031       | -ve                      | +ve     | -ve     |  |  |  |
|                              |         |             |                          |         |         |  |  |  |
| Tanytarsus indeterminate     | 0.7612  | 0.019       | -ve                      |         | +ve     |  |  |  |
| Pyralidae OSS9L              | 0.7393  | 0.046       | -ve                      | +ve     | +ve     |  |  |  |
| Anisoptera indeterminate     | 0.7211  | 0.014       | -ve                      | +ve     | +ve     |  |  |  |
| Naididae                     | 0,7068  | 0.029       | -ve                      | +ve     | +ve     |  |  |  |
|                              |         |             |                          |         |         |  |  |  |
| Tasmanocoenis indeterminate  | 0.9061  | <0.001      | -ve                      |         | <br>+ve |  |  |  |
| Hellyethira forficata        | 0.8455  | 0.002       | -ve                      | -ve     | +ve     |  |  |  |
|                              |         |             |                          |         |         |  |  |  |
| Simulium papuense(?)         | 0.7673  | 0.034       |                          | -ve     | -ve     |  |  |  |
| Cloeon fluviatile            | 0.8143  | 0.007       | -ve                      | -ve     | -ve     |  |  |  |
| Tasmanocoenis spD*           | 0.8119  | 0.001       | -ve                      | -ve     | -ve     |  |  |  |
| Hydroptilidae indeterminate  | 0.7340  | 0.020       | -ve                      | -ve     | -ve     |  |  |  |
| Triplectides ciuskus         | 0.7795  | 0.020       | -ve                      | -ve     | -ve     |  |  |  |
| Unionicolidae                | 0.7724  | 0.018       | -ve                      | -ve     | -ve     |  |  |  |

\* from Suter (1992)

#### 4.2.2 Species vs family data

Dissimilarity values calculated between sites 1 and 3 were always lower for family level data than species level data (Table 3). Thus, sites appeared to be more alike when family data was used. Presumably as taxonomic resolution decreases, the proportion of taxa in common between the two sites increases. Ordination of sites and occasions according to macroinvertebrate family-level data only required two dimensions (Fig. 3) to achieve a stress level similar to that achieved in three dimensions with species-level data. The two gradients appear to correspond to the 'temporal' species ordination (vectors 1 and 2) where differences amongst years were highlighted rather than differences between sites (Fig. 3). It is noteworthy that the alignment of years between the species and family ordinations is similar (if the family level ordination is rotated upside down and back to front) and if years are tracked, the greatest distances between consecutive years coincides (ie 1988 to 1990 and 1994 to 1995).

Correlation analysis showed that the Caenidae and Chironomidae were highly correlated with the family level ordination space (p < 0.001) and that 12 other families were significantly correlated (p < 0.05, Table 5). Vector 2 in the family level ordination is similar to the species level ordination in that it represents a gradient of high abundance of caenid mayflies at one end (in this case the positive) and high abundance of chironomids at the other end (the negative). The gradient represented by vector one appears to mainly separate the samples from 1995 and 1996 from the other years (Fig. 3). All taxa significantly correlated with the ordination were negatively correlated with vector 1 (Table 5). In other words, samples from 1995 and 1996 at the negative end of vector 1, had higher abundances of the significant taxa (eg Hydroptilidae, Baetidae, Ceratopogonidae and a range of Acarina families).

| Invertebrate family | r value | Probability | Direction o | f correlation |
|---------------------|---------|-------------|-------------|---------------|
|                     |         |             | vector1     | vector2       |
| Caenidae            | 0.9307  | <0.001      | -ve         | +ve           |
| Ecnomidae           | 0.6247  | 0.023       | -ve         | +ve           |
| Oxidae              | 0.6423  | 0.014       | -vê         | +ve           |
| Haliplidae          | 0.6558  | 0.020       | -ve         |               |
| Ceratopogonidae     | 0.7546  | 0.001       | -ve         | -ve           |
| Chironomidae        | 0.8772  | <0.001      | -ve         | -ve           |
| Baetidae            | 0.7387  | 0.005       | -ve         | -ve           |
| Corixidae           | 0.6466  | 0.013       | -ve         | -ve           |
| Coenagrionidae      | 0.6739  | 0.008       | -ve         | -ve           |
| Hydroptilidae       | 0.6600  | 0.02        | -ve         | -ve           |
| Atyidae             | 0.6983  | 0.014       | -ve         | -ve           |
| Hygrobatidae        | 0.6179  | 0.09        | -ve         | -ve           |
| Mideopsidae         | 0.5923  | 0.023       | -ve         | -ve           |
| Torrenticolidae     | 0.5919  | 0.017       | -ve         | -ve           |

**Table 5** Invertebrate families significantly correlated (p<0.05) with the SSH ordination of sites 1 and 3 from Magela Ck on sampling occasions from 1988 to 1996 showing r values, probabilities and direction of correlation.

## 5 Discussion

## 5.1 Detection of impact

BACIP (Before, After, Control, Impact, Paired differences) study designs (Stewart-Oaten et al. 1986) involve simultaneous collection of samples from single impact and control sites before and after the impact has occurred. These designs are based on the premise that the differences in responses measured between control and impacted sites in a stream, will change after an impact. In analysing macroinvertebrate community structure data, Faith et al (1991) chose multivariate dissimilarities as the measure of difference between the sites at each time of sampling. The means of sets of differences between the two areas before and after are compared by a t-test or the equivalent. A series of studies have been conducted in streams within the Alligator Rivers Region (ARR) to assess the utility of the so-called BACIP designs for detecting the effects of anthropogenic disturbance upon aquatic communities Results from the South Alligator River indicated that BACIP designs using multivariate dissimilarity values may, under particular circumstances, be very sensitive in detecting mining impact (Faith et al 1995).

Over the period 1988 to the present, national and international changes in the accepted thinking on design (eg development of the beyond BACI approaches) and sampling strategy (from quantitative techniques to rapid assessment protocols) in macroinvertebrate community studies have taken place. Changes in accepted 'best practice' were often accompanied by changes in sampling strategy for the Magela Creek program from year to year. This means that there are certain limitations with using this data to assess whether mining operations at Ranger Uranium Mine have had an impact on Magela Creek. Potential intrinsic constraints arising from the present study are those associated with lack of additional control sites (Faith et al 1995), insufficient sampling effort per site per sampling occasion (Jones 1995) and differences in sampling and sample processing methods. For these reasons statistical differences between years were not tested for (as per the BACIP approach) in this study.

In terms of the BACIP approach, control and before-impact sites can vary with time but they should vary parallel to each other (Faith et al 1995). This 'tracking' of sites over time was evident in both the species and family level ordinations for Magela Creek data (Figs 2 & 3). There was also no consistent trend over time in dissimilarity values between upstream and downstream sites, ie sites didn't become increasingly dissimilar (Table 3). These results, therefore, do not indicate any obvious impact. However, the sensitivity of these analyses may be low given the results of other studies in the region which suggest dissimilarity values between sites in seasonally-flowing creeks are highest and most variable at the time sampling occurred in Magela Creek ie the beginning of the Dry season (Stowar 1997). The difference between 1988 samples and 1990 samples in both species and family ordination space (Figs 2 & 3) may, however, warrant further investigation. The other major difference from 1994 to 1995 (Figs 2 and 3) may be an artefact of the change from a quantitative to semi-quantitative sampling technique. The tracking of sites in Magela Creek over time, however, bodes well for application of BACIP analyses to these and other data collected from control creeks from 1994 onward.

Differences in community structure between any two stream sites will occur naturally as a consequence of habitat changes and longitudinal zonation. The differences noted between sites 1 and 3 on Magela Creek (Tables 1 & 2, Fig 2) may be partly attributable to the proximity of site 1 to permanent headwaters facilitating greater recolonisation of site 1 from this source than site 3 further downstream (Paltridge 1992). Site 1 also experiences faster stream currents than site 3 (*eriss*, unpublished data). This was evident, for example in the much higher incidence at site 1 of *Cheumatopsyche* spp. (caddis fly larvae, family Hydropsychidae) and Simuliidae (black fly larvae - Table 2) which are both flow-dependent filter-feeders.

Dissimilarity values between sites on Magela Creek tended to be more variable than those reported by Faith et al (1995) and Stowar (1997) from other catchments in the ARR. This may be related to the stage in the flow cycle that was sampled (discussed above) and also the distance between sites, which was greater in Magela Creek. The relocation of site 3 in 1994 corresponded to a change in macroinvertebrate community structure evident in the species level ordination of data where samples from site 3 clustered together except for years 1994 and 1995 (Fig 2). These results indicate that relocation of sampling sites may have confounded any other changes in macroinvertebrate community structure.

In the ARR, impacts of both mining and increased turbidity from a road crossing have been detected using family level macroinvertebrate community data (Faith et al 1995, O'Connor et al 1995, Stowar 1997). Species and family data also gave similar interpretations of temporal patterns in Magela Creek (Figs 2 & 3). Given the high conservation value of aquatic systems in the region it is likely that species level identification will be the preferred option where taxonomic information allows. However, noisy data may necessitate the use of family level data for statistical analyses to detect impact.

## 5.2 Future directions

A commitment to an ongoing monitoring program for Magela Creek will require definition of the environmental protection objectives through consultation with stakeholders. Design of the monitoring strategy needs to then be ratified and protocols documented. A priority in this process is determination of an appropriate level of replication for riffle habitats which will allow calibration of past sampling efforts with more intensive sampling. Analysis of data from control streams by the BACIP techniques used in other studies within the ARR (Faith et al 1995, Stowar 1997) would test their usefulness in the Magela system and indicate which streams provide the most suitable controls.

Additional macroinvertebrate studies conducted in Magela Creek (and/or processing of additional samples held by *eriss*) would be required to evaluate the influence of between-site distance and stage of the annual hydrological cycle in affecting the magnitude of derived dissimilarity values and their temporal variation. Further analysis of the current data will also include an evaluation of patterns and magnitude of flow in the preceding Wet season in affecting dissimilarity values calculated at the Wet-Dry transition period.

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| Order/Class     |                              | 1988   |        |        |        |        |        | 1990   |        |        |        |        |        |
|-----------------|------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family          | Genus and species            | Site 1 |        |        | Site 3 |        |        | Site 1 |        |        | Site 3 |        |        |
|                 |                              | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 4 | Rep. 2 | Rep. 3 | Rep. 4 |
|                 | sample no.                   | 1846   | 1847   | 1848   | 1866   | 1867   | 1868   | 1885   | 1886   | 1888   | 1916   | 1917   | 1918   |
| Coleoptera      |                              |        |        |        |        |        |        |        |        |        |        |        |        |
| Dytiscidae      | Antiporus OSS4L              |        |        |        | 4      | 4      |        | 4      |        | 4      |        |        |        |
| Dytiscidae      | Batracomatus wingi (A)       |        |        |        |        |        |        |        |        |        |        |        |        |
| Dytiscidae      | Cybister OSS1L               |        | 5      |        |        |        |        |        |        |        |        |        |        |
| Dytiscidae      | OSS6L                        |        |        |        |        |        |        |        | 2      |        |        |        |        |
| Dytiscidae      | Tiporus nr josephini (A)     |        |        |        |        |        |        |        |        |        |        |        |        |
| Dytiscidae      | indet. (L)                   |        |        |        |        |        |        |        |        | 4      |        |        |        |
| Elmidae         | Austrolimnius sp2A (L)*      |        |        |        |        |        |        | 4      |        |        |        |        |        |
| Elmidae         | Austrolimnius sp2B (L)*      |        |        |        |        |        |        |        | 2      | 6      |        | 12     |        |
| Elmidae         | Austrolimnius sp4 (L)*       |        |        |        |        |        |        |        |        |        |        |        |        |
| Elmidae         | Austrolimnius sp9 (L)*       |        |        |        |        |        |        |        |        |        |        |        |        |
| Elmidae         | Austrolimnius indet. (A)     |        |        |        |        |        |        |        |        | 12     | 4      |        |        |
| Elmidae         | Austrolimnius indet. (L)     |        |        |        |        |        |        | 4      |        |        |        |        | 1      |
| Elmidae         | Genus E sp74E (L)*           |        |        |        |        |        |        |        |        |        |        |        |        |
| Haliplidae      | OSS1L                        |        |        |        |        |        | 4      |        |        |        |        |        |        |
| Hydrophilidae   | OSS1L                        | 4      | 2      | 5      |        |        |        |        |        |        | 4      |        | 5      |
| Noteridae       | Hydrocophus subfasciatus (A) |        |        |        |        |        |        |        |        |        |        |        | -      |
| Diptera         |                              |        |        |        |        |        |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS1L                        |        |        |        |        |        |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS2L                        |        | 8      | 28     | 8      | 12     | 4      |        | 2      | 12     | 4      |        | 14     |
| Ceratopogonidae | OSS3L                        |        |        |        |        |        |        |        |        |        | 2      |        |        |
| Ceratopogonidae | OSS5L                        |        |        |        |        |        |        |        |        |        | _      |        |        |
| Ceratopogonidae | OSS6L                        |        |        |        |        | 4      |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS8L                        |        |        | 8      |        |        |        |        |        |        | 4      |        | 2      |
| Ceratopogonidae | OSS9L                        |        |        | 8      |        | 4      |        |        | 4      |        |        |        | 2      |
| Ceratopogonidae | OSS10L                       |        |        |        |        |        | 4      |        | -      |        |        |        | -      |
| Ceratopogonidae | OSS12L                       |        |        |        |        |        |        |        |        |        |        |        |        |
| Ceratopogonidae | indet.                       |        |        | 4      | 16     |        | 8      |        |        | 4      | 18     | 4      | 1      |
| Chironomidae    | Ablabesmyia notabilis        |        |        |        |        |        |        |        |        |        |        | •      | •      |
| Chironomidae    | Ablabesmyia indet.           |        |        |        |        |        |        |        |        |        |        |        |        |
| Chironomidae    | Chironomus indet.            |        |        |        |        |        |        |        |        |        |        |        |        |
| Chironomidae    | Cladotanytarsus indet.       |        | 4      |        | 4      |        |        | 4      |        |        |        |        |        |
| Chironomidae    | Conochironomus indet.        |        |        |        | 8      | 3      | 20     | •      |        |        |        |        |        |

| Order/Class  |                                   | 1988   |        |        |        |        |        | 1990   |        |        |        |        |               |
|--------------|-----------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------------|
| Family       | Genus and species                 | Site 1 |        |        | Site 3 |        |        | Site 1 |        |        | Site 3 |        |               |
|              |                                   | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 4 | Rep. 2 | Rep. 3 | Rep. 4        |
|              | sample no.                        | 1846   | 1847   | 1848   | 1866   | 1867   | 1868   | 1885   | 1886   | 1888   | 1916   | 1917   | 1 <b>91</b> 8 |
| Chironomidae | Cricotopus albitarsis             |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Cricotopus brevicornis            |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Cricotopus indet.                 |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Cryprochironomus griseidorsum     |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Cryptochironomus indet.           |        |        |        |        |        | 4      |        |        |        |        |        |               |
| Chironomidae | Dicrotendipes lindae              |        |        |        | 4      |        | 4      |        |        | 4      | 2      |        |               |
| Chironomidae | Dicrotendipes indet.              |        |        |        |        |        |        |        | 4      |        |        |        |               |
| Chironomidae | Djalmabatista indet.              | 12     | 4      | 36     | 92     | 80     | 92     |        | 2      |        | 12     |        | 1             |
| Chironomidae | Kiefferulus tinctus               |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Kiefferulus indet.                |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Larsia albiceps                   |        |        |        | 4      | 4      | 4      | 4      | - 4    |        |        |        | · 1           |
| Chironomidae | Nanocladius OSS1L                 |        |        |        |        |        |        |        | 2      |        |        |        |               |
| Chironomidae | Nilotanypus indet.                |        |        |        |        |        |        |        |        | 2      |        |        |               |
| Chironomidae | Parametriocnus nr ornaticornis    |        |        |        |        |        |        |        |        | 4      |        |        |               |
| Chironomidae | Paratanytarsus indet.             |        |        |        |        |        |        |        |        | 8      |        |        |               |
| Chironomidae | Paratendipes indet.               |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Polypedilum leei                  |        | 4      |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Polypedilum nubifer               |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Polypedilum watsoni               |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Polypedilum indet.                |        |        |        |        | 4      |        |        | 2      |        |        |        | 2             |
| Chironomidae | Procladius paludicola             |        |        |        |        |        | 4      |        |        | 4      |        |        |               |
| Chironomidae | Rheocricotopus indet.             |        |        |        |        |        |        | 20     | 2      | 56     | 2      |        |               |
| Chironomidae | Rheotanytarsus indet.             | 24     | 24     | 32     | 12     | 8      |        | 20     | 26     | 50     | 4      | 12     | 1             |
| Chironomidae | Robackia indet.                   |        |        |        |        |        |        |        |        |        | 2      |        | 1             |
| Chironomidae | Stempellina indet.                |        |        |        |        |        | 16     |        |        |        |        |        |               |
| Chironomidae | Stenochironomus indet.            |        | 4      |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Stictochironomus indet.           |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Tanytarsus indet.                 |        |        | 8      | 44     | 52     | 72     | 12     | 40     |        | 24     |        | 10            |
| Chironomidae | Thienemanniella spA##             |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Thienemanniella indet.            |        |        |        |        |        |        |        |        |        |        |        |               |
| Chironomidae | Thienemannimyia indet.            |        |        |        |        |        |        |        | 2      | 2      |        |        |               |
| Chironomidae | Chironominae (subfamily) indet.   |        |        |        |        |        | 4      |        | 2      |        | 4      | 8      |               |
| Chironomidae | Orthocladiinae (subfamily) indet. |        |        |        | 4      |        |        | 4      |        |        |        |        |               |

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| Order/Class     |                                | 1988   |        |        |        |        |        | 1990   |        |        |        |        |        |
|-----------------|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family          | Genus and species              | Site 1 |        |        | Site 3 |        |        | Site 1 |        |        | Site 3 |        |        |
|                 |                                | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 4 | Rep. 2 | Rep. 3 | Rep. 4 |
|                 | sample no.                     | 1846   | 1847   | 1848   | 1866   | 1867   | 1868   | 1885   | 1886   | 1888   | 1916   | 1917   | 1918   |
| Chironomidae    | Tanypodinae (subfamily) indet. |        | 8      |        | 4      | 8      | 12     | 4      |        |        |        |        |        |
| Chironomidae    | indet. (L)                     |        |        |        | 4      | 4      | 12     |        |        | 2      | 6      |        | 1      |
| Chironomidae    | indet. (P)                     | 4      | 4      | 4      |        | 4      | 24     | 4      | 4      | 20     | 12     |        | 6      |
| Simuliidae      | Simulium papuense (?)          |        |        | 1      |        |        |        | 20     | 4      |        | 2      | 4      |        |
| Simuliidae      | Simulium indet.                |        |        |        |        |        |        | 4      |        | 14     | 6      |        |        |
| Simuliidae      | indet. (L)                     |        |        |        |        |        |        |        |        |        |        |        |        |
| Simuliidae      | indet. (P)                     |        |        |        |        |        |        | 4      | 2      | 8      |        |        |        |
| Tabanidae       | Tabanus indet.                 |        |        | 4      |        |        |        |        |        | 16     |        |        |        |
| Tabanidae       | indet.                         |        |        |        |        |        |        |        |        |        |        |        |        |
| Tipulidae       | OSS1L                          | 4      | 2      | 1      |        |        |        |        |        |        |        | 8      | 3      |
| Tipulidae       | OSS4L                          | 1      | 4      | 25     | 1      | 9      | 12     |        |        | 4      | 10     |        | 5      |
| Tipulidae       | indet.                         |        |        |        |        |        |        |        |        |        | 2      |        |        |
| Ephemeroptera   |                                |        |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Baetis sp1**                   |        |        |        |        |        |        |        |        |        |        |        | 2      |
| Baetidae        | Baetis indet.                  |        |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Centroptilum OSS1N             |        |        |        | 4      |        | 1      |        |        |        |        |        |        |
| Baetidae        | Cloeon fluviatile              |        |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Genus B sp1**                  |        |        | 24     |        |        |        |        |        | 16     | 10     | 12     | 1      |
| Baetidae        | Genus B indet.                 |        |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Genus C indet.                 |        |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | indet.                         | 4      | 4      | 8      |        |        |        |        | 8      | 6      | 12     | 4      | 2      |
| Caenidae        | Tasmanocoenis arcuata          |        |        |        |        |        |        |        | 2      |        |        |        | _      |
| Caenidae        | Tasmanocoenis spD**            |        |        |        |        | 4      |        | 12     | 62     | 86     | 64     | 36     | 19     |
| Caenidae        | Tasmanocoenis spE**            |        |        |        |        |        |        | 36     |        |        | 68     | 4      | 23     |
| Caenidae        | Tasmanocoenis spH**            |        |        |        |        |        |        |        |        |        |        |        |        |
| Caenidae        | Tasmanocoenis spJ**            |        |        |        | 85     | 13     | 28     |        |        |        |        | 4      |        |
| Caenidae        | Tasmanocoenis indet.           |        | 8      |        |        | 12     | 84     | 796    | 284    | 558    | 886    | 796    | 386    |
| Caenidae        | Wundacaenis dostini            | 16     | 20     |        | 16     | -      |        | 8      | 4      | 12     |        |        |        |
| Caenidae        | indet.                         |        | -      | 8      | 20     |        | 8      | •      | 16     | 12     | 4      |        | 1      |
| Leptophlebiidae | Thraulus indet.                |        |        | -      |        |        | •      |        |        |        | •      |        |        |
| Leptophlebiidae | indet.                         |        |        |        |        |        |        |        |        |        |        |        |        |

| Order/Class           |                           | 1988   |        |        |        |        |        | 1990   |        |        |        |        |        |
|-----------------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family                | Genus and species         | Site 1 |        |        | Site 3 |        |        | Site 1 |        |        | Site 3 |        |        |
|                       |                           | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 4 | Rep. 2 | Rep. 3 | Rep. 4 |
|                       | sample no.                | 1846   | 1847   | 1848   | 1866   | 1867   | 1868   | 1885   | 1886   | 1888   | 1916   | 1917   | 1918   |
| Hemiptera             |                           |        |        |        |        |        |        |        |        |        |        |        |        |
| Corixidae             | Micronecta indet.         |        |        |        |        |        |        |        |        |        |        |        | 1      |
| Mesoveliidae          | indet.                    |        |        |        |        |        |        |        |        |        |        |        |        |
| Lepidoptera           |                           |        |        |        |        |        |        |        |        |        |        |        |        |
| Pyralidae             | OSS1L                     |        |        | 1      |        |        |        |        |        | 4      | 2      | 4      | 3      |
| Pyralidae             | OSS2L                     |        |        |        |        |        |        |        |        |        |        |        |        |
| Pyralidae             | OSS9L                     |        |        |        |        |        |        |        |        |        |        | 4      |        |
| Pyralidae             | OSS10L                    |        |        |        |        |        |        |        |        |        |        |        |        |
| Pyralidae             | indet.                    |        |        |        |        |        |        |        |        |        |        |        |        |
| Odonata               |                           |        |        |        |        |        |        |        |        |        |        |        |        |
| Coenagrionidae        | Austrocnemis maccullochi  |        |        |        |        |        |        |        |        |        |        |        |        |
| Coenagrionidae        | indet.                    |        |        |        |        |        |        |        |        |        |        |        |        |
| Corduliidae           | Hemicordulia intermedia   |        |        |        | 1      |        |        |        |        |        |        |        |        |
| Gomphidae             | Antipodogomphus neophytus |        |        |        |        |        |        |        |        |        |        |        |        |
| Gomphidae             | Antipodogomphus indet.    |        |        |        |        |        |        |        |        |        |        |        |        |
| Gomphidae             | Austrogomphus mjobergi    |        |        |        |        |        |        |        |        |        |        |        |        |
| Gomphidae             | Austrogomphus indet.      |        |        |        |        |        |        |        |        |        |        |        |        |
| Libellulidae          | Diplacodes haematodes     |        |        |        |        |        | 1      |        |        |        |        |        |        |
| Libellulidae          | Nannophlebia indet.       |        |        |        |        |        |        |        |        |        |        |        |        |
| Libellulidae          | Orthetrum caledonicum     |        |        |        | 1      |        |        |        |        |        |        |        |        |
| Libellulidae          | indet.                    |        | ·      |        | 4      |        |        |        |        |        |        |        |        |
| Anisoptera (suborder) | indet.                    |        |        |        |        |        | 8      |        |        |        |        |        |        |
| Zygoptera (suborder)  | indet.                    |        |        |        |        |        |        |        |        |        |        |        |        |
| Trichoptera           |                           |        |        |        |        |        |        |        |        |        |        |        |        |
| Calamoceratidae       | Anisocentropus muricatus  |        |        |        |        |        |        |        |        |        |        |        |        |
| Ecnomidae             | Ecnomina indet.           |        |        |        |        |        |        |        |        |        |        |        |        |
| Ecnomidae             | Ecnomus indet.            |        |        |        |        |        | 4      |        |        |        | 4      |        |        |
| Ecnomidae             | indet.                    |        |        |        |        |        |        |        | 2      |        |        |        |        |
| Hydropsychidae        | Asmicridea sp3#           |        |        |        |        |        |        |        |        |        |        |        |        |
| Hydropsychidae        | Chematopsyche kakaduensis |        |        |        |        |        |        | 24     | 4      | 216    |        |        |        |
| Hydropsychidae        | Cheumatopsyche suteri     |        |        |        |        |        |        | 12     | 8      | 136    | 14     | 16     | 1      |
| Hydropsychidae        | Cheumatopsyche wellsae    |        |        |        |        |        |        |        |        |        |        |        |        |
| Hydropsychidae        | Cheumatopsyche indet.     |        |        |        |        |        |        | 20     |        | 76     |        |        |        |
|                       |                           |        |        |        |        |        |        |        |        |        |        |        |        |

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| Order/Class          |                           | 1988   |        |         |        |        |        | 1990   |        |        |        |        |        |
|----------------------|---------------------------|--------|--------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family               | Genus and species         | Site 1 |        |         | Site 3 |        |        | Site 1 |        |        | Site 3 |        |        |
|                      |                           | Rep. 1 | Rep. 2 | Rep. 3  | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 4 | Rep. 2 | Rep. 3 | Rep. 4 |
|                      | sample no.                | 1846   | 1847   | 1848    | 1866   | 1867   | 1868   | 1885   | 1886   | 1888   | 1916   | 1917   | 1918   |
| Hydroptilidae        | Hellyethira cubitans (L)  |        |        |         |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Hellyethira forficata (L) |        |        |         |        |        |        |        |        |        | 4      | 4      | 4      |
| Hydroptilidae        | Hellyethira forficata (P) |        |        |         |        |        |        |        |        |        | 2      | 4      |        |
| Hydroptilidae        | Hellyethira indet. (L)    |        |        |         |        |        |        | 4      | 4      |        | 4      |        | 2      |
| Hydroptilidae        | Hellyethira ramosa (L)    |        |        |         |        | 4      | 8      |        | 2      |        | 2      | 4      | 1      |
| Hydroptilidae        | Hellyethira ramosa (P)    |        |        |         |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Hellyethira vernoni (L)   |        |        |         |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Oxyethira indet. (L)      |        |        |         |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Orthotrichia turrita      |        |        |         |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Orthotrichia indet. (L)   |        | 12     | 12      | 8      | 8      |        | 8      | 6      | 6      | 60     | 44     | 47     |
| Hydroptilidae        | Orthotrichia indet. (P)   |        |        |         |        |        |        |        |        | 4      | 10     |        | 5      |
| Hydroptilidae        | indet. (L)                |        |        |         |        |        |        |        | 4      |        | 2      |        | 3      |
| Hydroptilidae        | indet. (P)                |        |        |         |        |        |        |        |        |        |        |        |        |
| Leptoceridae         | Leptorussa indet.         | 4      |        |         | 8      |        |        |        |        | 2      | 22     |        |        |
| Leptoceridae         | Oecetis epekeina          |        |        |         |        |        |        |        |        |        |        |        |        |
| Leptoceridae         | Oecetis spA#              |        |        |         |        |        |        |        |        |        |        | 8      |        |
| Leptoceridae         | Oecetis spE#              |        |        |         |        |        |        |        |        |        |        |        |        |
| Leptoceridae         | Oecetis indet.            |        |        |         | 8      | 4      |        | 4      |        |        |        | 8      |        |
| Leptoceridae         | Triaenodes indet.         |        | 4      |         | 6462 A | 4      |        |        |        | 4      | 4      |        | 1      |
| Leptoceridae         | indet.                    |        | · .    | e se si | · · 4  |        |        |        |        | 4      | 18     |        |        |
| Philopotamidae       | Chimarra spB #            |        |        |         |        |        |        |        |        | 6      |        |        |        |
| Polycentropodidae    | indet.                    |        |        |         |        |        |        |        |        |        |        |        |        |
| Triplectides         | ciuskus                   |        |        |         |        |        |        |        |        |        |        |        |        |
| Triplectides         | indet.                    |        |        |         |        |        |        |        |        |        |        |        |        |
| Acarina              |                           |        |        |         |        |        |        |        |        |        |        |        |        |
| Hydryphantidae       | indet.                    |        |        |         |        |        |        |        |        |        | 8      |        |        |
| Hygrobatidae         | Australiobates indet.     |        |        |         |        |        |        | 8      |        |        | -      |        |        |
| Hygrobatidae         | indet.                    |        |        |         |        |        |        | 4      |        | 6      | 4      |        | 4      |
| Limnesiidae          | indet.                    |        |        |         |        |        | 4      | •      | 2      | •      | 60     | 20     | 12     |
| Mideopsidae          | indet.                    |        |        |         |        |        | •      |        | -      |        |        |        | •=     |
| Oribatida (suborder) | indet.                    |        |        |         |        |        |        | 4      |        |        | 92     |        | 4      |
| Oxidae               | indet.                    |        | 4      | 4       |        |        |        |        |        |        | 72     |        | 1      |
|                      |                           |        | •      | •       |        |        |        |        |        |        |        |        | •      |

| Order/Class            |                          | 1988   |        |        |        |        |        | 1990   |        |        |        |        |        |
|------------------------|--------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family                 | Genus and species        | Site 1 |        |        | Site 3 |        |        | Site 1 |        |        | Site 3 |        |        |
|                        |                          | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 4 | Rep. 2 | Rep. 3 | Rep. 4 |
|                        | sample no.               | 1846   | 1847   | 1848   | 1866   | 1867   | 1868   | 1885   | 1886   | 1888   | 1916   | 1917   | 1918   |
| Torrenticolidae        | indet.                   |        |        |        |        |        |        |        |        |        | 4      |        |        |
| Unionicolidae          | indet.                   |        |        |        | 4      |        |        |        |        |        |        |        |        |
|                        | indet.                   |        |        |        |        |        |        |        |        | 8      |        |        |        |
| Decapoda               |                          |        |        |        |        |        |        |        |        |        |        |        |        |
| Atyidae                | Caridina gracilirostris  |        |        |        |        |        |        |        |        |        |        |        |        |
| Atyidae                | Caridinides wilkinsi     |        |        |        |        |        |        |        |        |        |        |        |        |
| Atyidae                | indet.                   |        |        |        |        |        |        |        |        |        |        |        |        |
| Palaemonidae           | Macrobrachium bullatum   |        |        |        |        |        |        |        |        |        |        |        |        |
| Palaemonidae           | Macrobrachium rosenbergi |        |        |        |        |        |        |        |        |        |        |        |        |
| Palaemonidae           | Macrobrachium indet.     |        |        |        |        |        |        |        |        |        |        |        |        |
| Palaemonidae           | indet.                   |        |        |        |        |        | 1      |        |        |        |        |        |        |
| Gastropoda             |                          |        |        |        |        |        |        |        |        |        |        |        |        |
| Planorbidae            | Amerianna indet.         |        |        |        |        |        |        |        |        |        |        |        | 1      |
| Nematoda               | indet.                   |        | 4      |        |        |        |        | 4      | 14     | 16     | 20     |        | 3      |
| Oligochaeta            |                          |        |        |        |        |        |        |        |        |        |        |        |        |
| Enchytraeidae          | indet.                   |        | 12     |        |        | 4      |        |        | 2      | 30     |        | 8      |        |
| Naididae               | indet.                   |        | 4      |        | 32     | 72     | 28     | 4      | 2      | 12     | 42     | 36     | 2      |
| Tubificidae            | indet.                   |        |        |        | 12     |        | 8      |        |        | 8      | 4      |        |        |
| Magadrili (superorder) | indet.                   | 2      | 4      | 2      | 3      | 3      | 3      | 8      | 2      | 4      | 18     | 12     | 1      |
|                        | indet.                   |        |        |        |        |        |        | 8      |        |        |        |        |        |
| indet = indeterminate  | 1                        |        |        |        |        |        |        |        |        |        |        |        |        |
|                        |                          |        |        |        |        |        |        |        |        |        |        |        |        |

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\* Glaister 1991 # Wells 1991

\*\* Suter 1992

## Cranston 1991

| Order/Class     |                              | 1991   |        |        |         |        |        | 1992   |        |        |        |        |
|-----------------|------------------------------|--------|--------|--------|---------|--------|--------|--------|--------|--------|--------|--------|
| Family          | Genus and species            | Site 1 |        |        | Site 3  |        |        | Site 1 |        | Site 3 |        |        |
|                 |                              | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1  | Rep. 2 | Rep. 3 | Rep. 2 | Rep. 5 | Rep. 1 | Rep. 3 | Rep. 4 |
|                 | sample no.                   | 1935   | 1936   | 1937   | 1965    | 1966   | 1967   | 1986   | 1989   | 2015   | 2017   | 2018   |
| Coleoptera      |                              |        |        |        |         |        |        |        |        |        |        |        |
| Dytiscidae      | Antiporus OSS4L              |        |        |        |         |        |        |        |        |        |        |        |
| Dytiscidae      | Batracomatus wingi (A)       |        |        |        |         |        |        |        |        |        |        |        |
| Dytiscidae      | Cybister OSS1L               |        |        |        |         |        |        |        |        |        |        |        |
| Dytiscidae      | OSS6L                        | 1      |        | 5      |         | 2      |        |        | 2      |        | 1      |        |
| Dytiscidae      | Tiporus nr josephini (A)     |        |        |        |         |        |        |        |        |        |        | 8      |
| Dytiscidae      | indet. (L)                   | 2      |        |        |         |        |        | 4      | 2      |        |        |        |
| Elmidae         | Austrolimnius sp2A (L)*      |        |        |        |         |        |        |        |        |        | 1      | 8      |
| Elmidae         | Austrolimnius sp2B (L)*      | 1      | 4      | 4      |         |        |        | 4      |        |        | 1      |        |
| Elmidae         | Austrolimnius sp4 (L)*       |        |        |        |         |        |        |        |        |        |        |        |
| Elmidae         | Austrolimnius sp9 (L)*       |        |        |        |         |        |        |        |        |        | 1      |        |
| Elmidae         | Austrolimnius indet. (A)     | 10     | 8      | 3      |         |        | 6      |        |        |        |        |        |
| Elmidae         | Austrolimnius indet. (L)     | 2      | 4      | 2      |         |        | 2      |        |        |        |        |        |
| Elmidae         | Genus E sp74E (L)*           |        |        |        |         |        |        |        | 4      |        |        |        |
| Haliplidae      | OSS1L                        |        |        |        |         |        |        |        |        |        |        |        |
| Hydrophilidae   | OSS1L                        |        |        |        |         |        |        | 12     | 4      |        | 1      |        |
| Noteridae       | Hydrocophus subfasciatus (A) |        |        |        |         |        |        |        |        |        |        |        |
| Diptera         |                              |        |        |        |         |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS1L                        |        |        |        |         | 2      |        |        |        |        |        |        |
| Ceratopogonidae | OSS2L                        | 2      |        | - 2    | · · · . |        | 2      |        |        |        |        |        |
| Ceratopogonidae | OSS3L                        |        |        |        |         |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS5L                        |        |        |        |         |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS6L                        |        |        |        |         |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS8L                        | 4      |        |        |         | 10     | 6      |        | 14     |        |        |        |
| Ceratopogonidae | OSS9L                        |        | 8      | 2      | 2       | 10     | 10     |        |        |        |        |        |
| Ceratopogonidae | OSS10L                       |        |        |        |         |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS12L                       |        |        |        |         |        |        |        |        |        |        |        |
| Ceratopogonidae | indet.                       | 4      |        |        |         | 14     | 6      |        | 2      |        |        |        |
| Chironomidae    | Ablabesmvia notabilis        | -      |        |        |         | • •    | -      |        |        |        |        |        |
| Chironomidae    | Ablabesmvia indet.           |        |        |        |         |        |        |        |        |        |        |        |
| Chironomidae    | Chironomus indet.            |        |        |        |         | 2      |        |        |        |        |        |        |
| Chironomidae    | Cladotanytarsus indet.       |        |        |        |         | ~      |        |        |        |        |        |        |
| Chironomidae    | Conochironomus indet.        |        |        |        |         |        |        |        |        |        |        |        |
|                 |                              |        |        |        |         |        |        |        |        |        |        |        |

| Family         Genus and species         Site 1         Site 3         Rep. 1         Rep. 2         Rep. 3         Rep. 4         Rep. 4         Rep. 5         Rep. 4           | Order/Class  |                                   | 1991   |              |        |        |        |        | 1992   |        |        |        |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------------------|--------|--------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Rep. 1         Rep. 2         Rep. 3         Rep. 3         Rep. 4         Rep. 4         1986         1980         2015         2017         2018           Chironomidae         Cricotopus albitarsis         4         4         2         1         2         1         2017         2018         2015         2017         2018           Chironomidae         Cricotopus brevicorris         2         4         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         2         2         2         2         2         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1                                                                                                                                                                               | Family       | Genus and species                 | Site 1 |              |        | Site 3 |        |        | Site 1 |        | Site 3 |        |        |
| sample no.         1935         1936         1936         1966         1966         1986         1988         2015         2017         2018           Chironomidae         Cricotopus brevicornis         2         4         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1                                                                                                                                                                                             |              |                                   | Rep. 1 | Rep. 2       | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 2 | Rep. 5 | Rep. 1 | Rep. 3 | Rep. 4 |
| Chironomidae       Cricotopus albitarsis       4         Chironomidae       Cricotopus indet.       2       1         Chironomidae       Criporohironomus griseidorsum       1       2       4         Chironomidae       Criporohironomus indet.       2       2       4       1         Chironomidae       Dicrotendipes indet       2       2       4       1         Chironomidae       Dicrotendipes indet.       2       4       4       6         Chironomidae       Dicrotendipes indet.       2       4       4       6       1         Chironomidae       Kiefferulus tinctus       2       4       4       6       1         Chironomidae       Kiefferulus tinctus       2       4       4       6       1         Chironomidae       Larsia albiceps       4       4       2       4       2         Chironomidae       Parametriconus nr ornaticomis       2       4       2       4       2         Chironomidae       Parametriconus nr ornaticomis       2       4       2       4       2         Chironomidae       Parametriconus nr ornaticomis       2       4       4       2       3       8                                                                                                                                                                                                     |              | sample no.                        | 1935   | 19 <b>36</b> | 1937   | 1965   | 1966   | 1967   | 1986   | 1989   | 2015   | 2017   | 2018   |
| Chironomidae       Cricotopus brevicomis       2       1         Chironomidae       Crototopus indet.       2       4       5         Chironomidae       Cryptochironomus griseidorsum       1       2       4       1         Chironomidae       Cryptochironomus griseidorsum       1       2       4       1         Chironomidae       Dicrotendipes indet.       2       2       4       1         Chironomidae       Dicrotendipes indet.       2       4       4       6       1         Chironomidae       Diamabalista indet.       2       4       4       6       1         Chironomidae       Kiefferulus indet.       2       4       1       1       1         Chironomidae       Nanocladius OSS1L       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1<                                                                                                                                                                                                                                       | Chironomidae | Cricotopus albitarsis             |        |              |        |        |        | 4      |        |        |        |        |        |
| Chironomidae       Cricotopus indet       2         Chironomidae       Cryptochironomus griseidorum       1         Chironomidae       Dicrotendipes lindae       2       2       4       1         Chironomidae       Dicrotendipes lindae       2       2       4       1         Chironomidae       Dicrotendipes lindat       2       2       4       1         Chironomidae       Dicrotendipes lindat       2       4       4       6       1         Chironomidae       Kiefferulus tinctus       2       4       4       6       1         Chironomidae       Kiefferulus tinctus       4       2       4       2       4       2         Chironomidae       Larsia albiceps       4       2       4       2       4       2         Chironomidae       Nanocladius OSS1L       1       2       4       2       4       2         Chironomidae       Paratendipes indet.       2       4       2       4       2       4       2         Chironomidae       Paratendipes indet.       2       4       2       4       2       4       1       2         Chironomidae       Polypedilum nubifer                                                                                                                                                                                                                   | Chironomidae | Cricotopus brevicornis            |        |              |        |        |        |        |        | 2      |        | 1      |        |
| ChironomidaeCryptochironomus ginseidorsum1ChironomidaeCirytochironomus indet.224ChironomidaeDicrotendipes indet.2241ChironomidaeDicrotendipes indet.22446ChironomidaeDiambatista indet.24461ChironomidaeKiefferulus inclus24461ChironomidaeKiefferulus indet.24461ChironomidaeKiefferulus indet.244242ChironomidaeNanocladius OSS11.242422ChironomidaeParametriconus nr ornaticornis2424242ChironomidaeParatendipes indet.42424242ChironomidaePolypedilum nubifer242424124ChironomidaePolypedilum indet.2283881124381124412412441244124412441241241244124124124124124114124 <td< td=""><td>Chironomidae</td><td>Cricotopus indet.</td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td></td<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Chironomidae | Cricotopus indet.                 |        |              |        |        |        | 2      |        |        |        |        |        |
| ChironomidaeCryptochironomus indet.224ChironomidaeDicrotendipes indet.22241ChironomidaeDialmabatista indet.224465ChironomidaeKiefferulus indet.24461ChironomidaeKiefferulus indet.74461ChironomidaeKiefferulus indet.7411ChironomidaeNanocladius OSS1L724242ChironomidaeNanocladius OSS1L7242421ChironomidaeParametriocrus nr ornaticomis7242421ChironomidaeParametriocrus nr ornaticomis724242424242424242424242424242424242424242424242424242424242424242424242424242424242424243838383                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Chironomidae | Cryprochironomus griseidorsum     | 1      |              |        |        |        |        |        |        |        |        |        |
| ChironomidaeDicrotendipes indet22241ChironomidaeDicrotendipes indet.2446ChironomidaeKiefferulus tinctus2446ChironomidaeKiefferulus tinctus2446ChironomidaeKiefferulus tinctus2446ChironomidaeKiefferulus tinctus3411ChironomidaeNanocladius OSS1L2442ChironomidaeNanocladius OSS1L24242ChironomidaeParametricorus nr ornaticornis24242ChironomidaeParatanytarsus indet.424242ChironomidaePolypedilum nubifer24452838ChironomidaePolypedilum nubifer2446220838ChironomidaePolypedilum nubifer2446220838ChironomidaePolypedilum nubifer24444244ChironomidaeRheotanytarsus indet.24442838ChironomidaeRheotanytarsus indet.24444444444444444444444 <td>Chironomidae</td> <td>Cryptochironomus indet.</td> <td></td> <td></td> <td></td> <td>2</td> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Chironomidae | Cryptochironomus indet.           |        |              |        | 2      | 4      |        |        |        |        |        |        |
| ChironomidaeDiorotendipes indet.2ChironomidaeDialmabatista indet.2446ChironomidaeKiefferulus tinctus2446ChironomidaeLarsia albiceps41ChironomidaeNanotadius OSS1L2424ChironomidaeNanotadius OSS1L2424ChironomidaeNanotadius OSS1L2424ChironomidaeParametricorus nr onaticornis2424ChironomidaeParatantytarsus indet.4242ChironomidaeParatantytarsus indet.4242ChironomidaePolypedilum nubifer2445ChironomidaePolypedilum nubifer220838ChironomidaePolypedilum nubifer220838ChironomidaeRheocricotopus indet.220838ChironomidaeRheocricotopus indet.24442ChironomidaeRheotantytarsus indet.44444ChironomidaeStempellina indet.44444ChironomidaeStempellina indet.5144844214ChironomidaeStempellina indet.55144844216ChironomidaeThienemaniella indet.55 <td< td=""><td>Chironomidae</td><td>Dicrotendipes lindae</td><td></td><td></td><td>2</td><td>2</td><td></td><td>2</td><td>4</td><td></td><td></td><td>1</td><td></td></td<>                                                                                                                                                                                                                                                                                                                                                                                       | Chironomidae | Dicrotendipes lindae              |        |              | 2      | 2      |        | 2      | 4      |        |        | 1      |        |
| ChironomidaeOjamabatista indet.2446ChironomidaeKiefferulus tinctusIIIChironomidaeLarsia albiceps4IIChironomidaeNanocladius OSS1LIIIChironomidaeNanocladius OSS1LIIIChironomidaeNanocladius OSS1LIIIChironomidaeParametricorus nr ornaticornisIIIChironomidaeParametricorus nr ornaticornisIIIChironomidaeParametricorus nr ornaticornisIIIChironomidaePolypedilum leeiIIIIChironomidaePolypedilum nubiferIIIIChironomidaePolypedilum vatsoniIIIIIChironomidaePolypedilum indet.IIIIIIChironomidaeRheotanytarsus indet.IIIIIIIChironomidaeRheotanytarsus indet.IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Chironomidae | Dicrotendipes indet.              |        |              |        |        | 2      |        |        |        |        |        |        |
| ChironomidaeKiefferulus tinctusChironomidaeKiefferulus indet.ChironomidaeLarsia albiceps4ChironomidaeNanocladius OSS1LChironomidaeNanocladius OSS1LChironomidaeNanocladius OSS1LChironomidaeParametriocrus nr ornaticornisChironomidaeParametriocrus nr ornaticornisChironomidaeParatendipes indet.ChironomidaeParatendipes indet.ChironomidaeParatendipes indet.ChironomidaePolypedilum nubiferChironomidaePolypedilum nubiferChironomidaePolypedilum nubiferChironomidaePolypedilum nubiferChironomidaePolypedilum nubiferChironomidaePolypedilum nubiferChironomidaePolypedilum nubiferChironomidaePolypedilum nubiferChironomidaePolypedilum indet.ChironomidaeRheocritopus indet.ChironomidaeRheocritopus indet.ChironomidaeRheocritopus indet.ChironomidaeStempellina indet.ChironomidaeStempellina indet.ChironomidaeStetochironomus indet.ChironomidaeThienemanniella spA##ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.Chironomidae </td <td>Chironomidae</td> <td>Djalmabatista indet.</td> <td></td> <td></td> <td></td> <td>2</td> <td>4</td> <td>4</td> <td></td> <td>6</td> <td></td> <td></td> <td></td> | Chironomidae | Djalmabatista indet.              |        |              |        | 2      | 4      | 4      |        | 6      |        |        |        |
| ChironomidaeKiefferulus indet.41ChironomidaeLarsia albiceps41ChironomidaeNanocladius OSS1L242ChironomidaeNilotanypus indet.24242ChironomidaeParametriocnus nr ornaticornis24242ChironomidaeParatentjnes indet.2445244ChironomidaePolypedilum nubiler24452838ChironomidaePolypedilum nubiler2446220838ChironomidaePolypedilum indet.228388124308161124ChironomidaePolypedilum indet.2444244128561441285614441261441261441214442161614421616144216161442161614421616161442161616161616161616161616161616161616161616161616161616161616 </td <td>Chironomidae</td> <td>Kiefferulus tinctus</td> <td></td>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Chironomidae | Kiefferulus tinctus               |        |              |        |        |        |        |        |        |        |        |        |
| ChironomidaeLarsia albiceps41ChironomidaeNanocladius OSS1L242ChironomidaeParametricorus no ronaticornis242ChironomidaeParatendipes indet.4242ChironomidaeParatendipes indet.4242ChironomidaeParatendipes indet.4242ChironomidaePolypedilum nubifer7777ChironomidaePolypedilum nubifer2777ChironomidaePolypedilum nubifer2777ChironomidaePolypedilum nubifer2777ChironomidaePolypedilum nubifer2777ChironomidaePolypedilum nubifer2777ChironomidaePolypedilum nubifer2777ChironomidaePolypedilum nubifer2777ChironomidaeProcladus paludicola27838ChironomidaeRheotanytarsus indet.2485181664624308161124ChironomidaeStenchironomus indet.4441268561448ChironomidaeThienemanniella spA##787871448ChironomidaeThienemanniella indet.77871448Chi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Chironomidae | Kiefferulus indet.                |        |              |        |        |        |        |        |        |        |        |        |
| ChironomidaeNanocladius OSS1LChironomidaeNilotanypus indet.242ChironomidaeParametriocnus nr ornaticornis242ChironomidaeParatanytarsus indet.4244ChironomidaeParatanytarsus indet.4244ChironomidaePolypedilum leeiChironomidaePolypedilum nubiferChironomidaePolypedilum vatsoniChironomidaePolypedilum indet.220838ChironomidaeProcladius paludicolaChironomidaeRheocricotopus indet.9446220838ChironomidaeRheotanytarsus indet.2485181664624308161124ChironomidaeRheotanytarsus indet.1444ChironomidaeStenochironomus indet4-4ChironomidaeThenemanniella spA##38261441268561448ChironomidaeThienemanniella indet8 <td< td=""><td>Chironomidae</td><td>Larsia albiceps</td><td></td><td></td><td></td><td></td><td>4</td><td></td><td></td><td></td><td></td><td>1</td><td></td></td<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Chironomidae | Larsia albiceps                   |        |              |        |        | 4      |        |        |        |        | 1      |        |
| ChironomidaeNilotanypus indet.242ChironomidaeParametricorus nr ornaticornis4242ChironomidaeParatanytarsus indet.42442ChironomidaeParatanytarsus indet.4244544ChironomidaePolypedilum leei244518161124ChironomidaePolypedilum nubifer2446220838ChironomidaePolypedilum nubifer2446220838ChironomidaePolypedilum indet.2446220838ChironomidaeRheotanytarsus indet.2485181664624308161124ChironomidaeRobackia indet.1444244244ChironomidaeStenochironomus indet.1441268561448ChironomidaeThienemaniella spA##38261441268561448ChironomidaeThienemanniella spA##514484244216ChironomidaeThienemanniella spA##5144244216ChironomidaeChironomiae (subfamily) indet. <t< td=""><td>Chironomidae</td><td>Nanocladius OSS1L</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Chironomidae | Nanocladius OSS1L                 |        |              |        |        |        |        |        |        |        |        |        |
| ChironomidaeParametriocnus nr ornaticornisChironomidaeParatanytarsus indet.424ChironomidaeParatendipes indet.424ChironomidaePolypedilum leei244ChironomidaePolypedilum nubifer255ChironomidaePolypedilum watsoni25518ChironomidaePolypedilum indet.220838ChironomidaePolypedilum indet.25181664624308161124ChironomidaeRheocritotopus indet.944444241268561444ChironomidaeRheothironomus indet.1441268561448412685614484216164324421616442161644216442161644216442161644216164421644216442164421644216442164421644216462430361448484848484848484848484848484844 </td <td>Chironomidae</td> <td>Nilotanypus indet.</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>2</td> <td>4</td> <td>2</td> <td></td>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Chironomidae | Nilotanypus indet.                |        |              |        |        |        |        |        | 2      | 4      | 2      |        |
| ChironomidaeParatanytarsus indet.424ChironomidaeParatendipes indetChironomidaePolypedilum leeiChironomidaePolypedilum nubiferChironomidaePolypedilum nubifer2ChironomidaePolypedilum nubifer2ChironomidaePolypedilum nubifer2ChironomidaePolypedilum indet.2ChironomidaeRheocricotopus indet.9446220838ChironomidaeRheocricotopus indet.2485181664624308161124ChironomidaeRheotanytarsus indet.14441268561448ChironomidaeStenochironomus indetChironomidaeTanytarsus indet.38261441268561448ChironomidaeTanytarsus indet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Chironomidae | Parametriocnus nr ornaticornis    |        |              |        |        |        |        |        |        |        |        |        |
| ChironomidaeParatendipes indet.ChironomidaePolypedilum leeiChironomidaePolypedilum watsoniChironomidaePolypedilum indet.ChironomidaePolypedilum indet.ChironomidaePolypedilum indet.ChironomidaePolypedilum indet.ChironomidaePolypedilum indet.ChironomidaePolypedilum indet.ChironomidaePolypedilum indet.ChironomidaePolypedilum indet.ChironomidaeRheocricotopus indet.ChironomidaeRheotanytarsus indet.ChironomidaeRobackia indet.ChironomidaeRobackia indet.ChironomidaeStempellina indet.ChironomidaeStenochironomus indet.ChironomidaeTanytarsus indet.ChironomidaeTanytarsus indet.ChironomidaeThienemanniella spA##ChironomidaeThienemanniella indet.ChironomidaeThienemanninyja indet.ChironomidaeChironomidaeThienemanninyja indet.4ChironomidaeChironomidaeChironomidaeThienemanninyja indet.ChironomidaeChironomiaeChironomidaeThienemanninyja indet.ChironomidaeChironomiaeChironomidaeChironomiaeChironomidaeChironomiaeChironomidaeChironomiaeChironomidaeChironomiaeChironomidaeChironomiaeChironomidaeChironomiaeChironomidaeChironomiaeChironomidaeChironomiae </td <td>Chironomidae</td> <td>Paratanytarsus indet.</td> <td></td> <td>4</td> <td></td> <td></td> <td></td> <td>2</td> <td>4</td> <td></td> <td></td> <td></td> <td></td>                                                            | Chironomidae | Paratanytarsus indet.             |        | 4            |        |        |        | 2      | 4      |        |        |        |        |
| ChironomidaePolypedilum nubiferChironomidaePolypedilum nubiferChironomidaePolypedilum indet.ChironomidaePolypedilum indet.ChironomidaeProcladius paludicolaChironomidaeRheocricotopus indet.Q83ChironomidaeRheotanytarsus indet.2485ChironomidaeRobackia indet.14ChironomidaeStempellina indet.ChironomidaeStenochironomus indet.ChironomidaeStenochironomus indet.ChironomidaeStenochironomus indet.ChironomidaeStenochironomus indet.ChironomidaeTanytarsus indet.ChironomidaeTanytarsus indet.ChironomidaeThienemanniella spA##ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeChironomiae (subfamily) indet.ChironomidaeChironomiae (subfamily) indet.ChironomidaeChironomiae (subfamily) indet.ChironomidaeChironomiae (subfamily) indet.ChironomidaeChironomiae (subf                                                                                                                                                                                            | Chironomidae | Paratendipes indet.               |        |              |        |        |        |        |        |        |        |        |        |
| ChironomidaePolypedilum nubiferChironomidaePolypedilum watsoniChironomidaePolypedilum indet.ChironomidaeProcladius paludicolaChironomidaeProcladius paludicolaChironomidaeRheocricotopus indet.Q44ChironomidaeRheotanytarsus indet.ChironomidaeRobackia indet.ChironomidaeRobackia indet.ChironomidaeStempellina indet.ChironomidaeStempellina indet.ChironomidaeStenochironomus indet.ChironomidaeStenochironomus indet.ChironomidaeTanytarsus indet.ChironomidaeTanytarsus indet.ChironomidaeThienemanniella spA##ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeChironominae (subfamily) indet.ChironomidaeChironominae (subfamily) indet.ChironomidaeChironominae (subfamily) indet.ChironomidaeChironominae (subfamily) indet.ChironomidaeChironominae (subfamily) inde                                                                                                                                                        | Chironomidae | Polypedilum leei                  |        |              |        |        |        |        |        |        |        |        |        |
| ChironomidaePolypedilum watsoniChironomidaePolypedilum indet.2ChironomidaeProcladius paludicolaChironomidaeRheocricotopus indet.9446220838ChironomidaeRheotanytarsus indet.2485181664624308161124ChironomidaeRobackia indet.14444121124ChironomidaeStempellina indet.144444121114ChironomidaeStenochironomus indet.1441268561448141268561448141268561448141268561448141268561448141268561448141268561448141268561448141412685614481414126856144814141268561448141516161616161616161616161616161616161616161616161616161616161616161616                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Chironomidae | Polypedilum nubifer               |        |              |        |        |        |        |        |        |        |        |        |
| ChironomidaePolypedilum indet.2ChironomidaeProcladius paludicola2ChironomidaeRheocricotopus indet.9446220838ChironomidaeRheotanytarsus indet.2485181664624308161124ChironomidaeRobackia indet.14444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Chironomidae | Polypedilum watsoni               |        |              |        |        |        |        |        |        |        |        |        |
| ChironomidaeProcladius paludicolaChironomidaeRheocricotopus indet.9446220838ChironomidaeRheotanytarsus indet.2485181664624308161124ChironomidaeRobackia indet.144444444ChironomidaeStempellina indet.1444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Chironomidae | Polypedilum indet.                |        |              | 2      |        |        |        |        |        |        |        |        |
| ChironomidaeRheocricotopus indet.9446220838ChironomidaeRheotanytarsus indet.2485181664624308161124ChironomidaeRobackia indet.144444444ChironomidaeStempellina indet.1444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Chironomidae | Procladius paludicola             |        |              |        |        |        |        |        |        |        |        |        |
| ChironomidaeRheotanytarsus indet.2485181664624308161124ChironomidaeRobackia indet.144444444ChironomidaeStempellina indet.1444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444<                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Chironomidae | Rheocricotopus indet.             | 9      |              | 4      | 4      | 6      | 2      | 20     | 8      |        | 3      | 8      |
| ChironomidaeRobackia indet.144ChironomidaeStempellina indet.44ChironomidaeStenochironomus indet.4ChironomidaeStictochironomus indet.4ChironomidaeStictochironomus indet.3ChironomidaeTanytarsus indet.3ChironomidaeThienemanniella spA##ChironomidaeThienemanniella indet.ChironomidaeThienemanninyja indet.ChironomidaeThienemanninyja indet.ChironomidaeChironominae (subfamily) indet.ChironomidaeChironominae (subfamily) indet.ChironomidaeOrthocladiinae (subfamily) indet.ChironomidaeOrthocladiinae (subfamily) indet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Chironomidae | Rheotanytarsus indet.             | 24     | 8            | 5      | 18     | 166    | 46     | 24     | 308    | 16     | 11     | 24     |
| ChironomidaeStempellina indet.4ChironomidaeStenochironomus indet.ChironomidaeStictochironomus indet.ChironomidaeTanytarsus indet.ChironomidaeTanytarsus indet.ChironomidaeThienemanniella spA##ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeThienemannimyia indet.ChironomidaeChironominae (subfamily) indet.ChironomidaeOrthocladiinae (subfamily) indet.ChironomidaeOrthocladiinae (subfamily) indet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Chironomidae | Robackia indet.                   | 1      |              |        | 4      | 4      |        |        |        |        |        |        |
| ChironomidaeStenochironomus indet.ChironomidaeStictochironomus indet.ChironomidaeTanytarsus indet.ChironomidaeThienemanniella spA##ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeThienemanniella indet.ChironomidaeChironominae (subfamily) indet.ChironomidaeChironominae (subfamily) indet.ChironomidaeOrthocladiinae (subfamily) indet.ChironomidaeOrthocladiinae (subfamily) indet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Chironomidae | Stempellina indet.                |        |              |        |        |        |        |        | 4      |        |        |        |
| ChironomidaeStictochironomus indet.ChironomidaeTanytarsus indet.38261441268561448ChironomidaeThienemanniella spA##ChironomidaeThienemanniella indet.886141212121212121212121212121448ChironomidaeThienemanniella indet.8881212141212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212121212 <td< td=""><td>Chironomidae</td><td>Stenochironomus indet</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Chironomidae | Stenochironomus indet             |        |              |        |        |        |        |        |        |        |        |        |
| ChironomidaeTanytarsus indet.38261441268561448ChironomidaeThienemanniella spA##ChironomidaeThienemanniella indet.8ChironomidaeThienemannimyia indet.8ChironomidaeChironominae (subfamily) indet.44244216ChironomidaeOrthocladiinae (subfamily) indet.44244216                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Chironomidae | Stictochironomus indet.           |        |              |        |        |        |        |        |        |        |        |        |
| Chironomidae       Thienemanniella spA##         Chironomidae       Thienemanniella indet.         Chironomidae       Thienemannimyia indet.         Chironomidae       Chironomiae         Chironomidae       Chironomiae         Chironomidae       Chironomiae         Chironomidae       Chironomiae         Chironomidae       Quitable         Chironomidae       Quitable         Chironomidae       Quitable         Orthocladiinae (subfamily) indet.       4       4       2       16         Quitable       Orthocladiinae (subfamily) indet.       2       4       2       16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Chironomidae | Tanytarsus indet.                 | 3      | 8            | 2      | 6      | 14     | 4      | 12     | 68     | 56     | 14     | 48     |
| Chironomidae       Thienemanniella indet.       8         Chironomidae       Thienemannimyia indet.       8         Chironomidae       Chironominae (subfamily) indet.       4       4       2       4       4       2       16         Chironomidae       Orthocladiinae (subfamily) indet.       4       4       2       4       4       2       16         Chironomidae       Orthocladiinae (subfamily) indet.       5       2       5       2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Chironomidae | Thienemanniella spA##             |        |              |        |        |        |        |        |        |        |        |        |
| ChironomidaeThienemannimyia indet.ChironomidaeChironominae (subfamily) indet.4424216ChironomidaeOrthocladiinae (subfamily) indet.224216                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Chironomidae | Thienemanniella indet.            |        |              |        |        |        |        |        | 8      |        |        |        |
| Chironomidae     Chironominae (subfamily) indet.     4     4     2     4     4     2     16       Chironomidae     Orthocladiinae (subfamily) indet.     0     2     2     2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Chironomidae | Thienemannimyia indet.            |        |              |        |        |        |        |        | -      |        |        |        |
| Chironomidae Orthocladiinae (subfamily) indet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Chironomidae | Chironominae (subfamily) indet.   | 4      |              |        | 4      |        | 2      |        | 4      | 4      | 2      | 16     |
| $\mathbf{v} = \mathbf{u}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Chironomidae | Orthocladiinae (subfamily) indet. |        |              |        |        |        |        |        | 2      |        |        |        |

| Order/Class     |                                | 1991   |        |        |        |        |        | 1992   |        |        |        |        |
|-----------------|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family          | Genus and species              | Site 1 |        |        | Site 3 |        |        | Site 1 |        | Site 3 |        |        |
|                 |                                | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 2 | Rep. 5 | Rep. 1 | Rep. 3 | Rep. 4 |
|                 | sample no.                     | 1935   | 1936   | 1937   | 1965   | 1966   | 1967   | 1986   | 1989   | 2015   | 2017   | 2018   |
| Chironomidae    | Tanypodinae (subfamily) indet. |        |        |        |        | 2      |        |        |        |        | 1      |        |
| Chironomidae    | indet. (L)                     | 2      | 4      |        |        | 14     | 4      |        | 4      | 12     |        |        |
| Chironomidae    | indet. (P)                     | 11     | 8      | 4      |        | 24     | 14     | 8      | 38     | 12     | 1      | 8      |
| Simuliidae      | Simulium papuense (?)          | 9      | 4      | 26     |        | 4      |        |        |        |        | 1      |        |
| Simuliidae      | Simulium indet.                | 27     | 8      | 82     |        | 2      |        |        | 6      |        |        |        |
| Simuliidae      | indet. (L)                     | 4      |        | 1      |        |        |        |        |        |        |        |        |
| Simuliidae      | indet. (P)                     | 1      |        | 4      |        |        |        |        |        |        |        |        |
| Tabanidae       | Tabanus indet.                 | 2      | 8      | 3      |        | 4      |        |        |        |        |        |        |
| Tabanidae       | indet.                         |        |        |        |        |        |        |        |        |        |        |        |
| Tipulidae       | OSS1L                          | 3      | 4      | 2      |        |        |        | 16     | 4      |        | 1      |        |
| Tipulidae       | OSS4L                          | 3      | 8      |        |        |        | 6      |        | 4      |        | 2      | 8      |
| Tipulidae       | indet.                         | 2      |        |        |        |        | 2      |        |        |        |        |        |
| Ephemeroptera   |                                |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Baetis sp1**                   |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Baetis indet.                  |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Centroptilum OSS1N             |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Cloeon fluviatile              |        |        | 1      |        |        |        |        |        |        |        |        |
| Baetidae        | Genus B sp1**                  | 11     |        | 6      |        | 26     | 8      | 8      | 8      | 16     | 5      |        |
| Baetidae        | Genus B indet.                 |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Genus C indet                  |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | indet.                         | 2      |        | 10     |        |        | 4      | 4      | - 4    |        |        |        |
| Caenidae        | Tasmanocoenis arcuata          |        |        |        |        |        |        |        |        |        |        |        |
| Caenidae        | Tasmanocoenis spD**            | 7      | 16     | 1      | 4      | 20     | 6      | 12     |        | 12     | 17     | 24     |
| Caenidae        | Tasmanocoenis spE**            | 8      | 4      | 2      |        | _4     | 20     | 8      | 12     |        | 32     |        |
| Caenidae        | Tasmanocoenis spH**            |        |        |        |        |        |        |        |        |        |        |        |
| Caenidae        | Tasmanocoenis spJ**            |        |        |        |        |        |        |        |        |        |        |        |
| Caenidae        | Tasmanocoenis indet.           | 180    | 96     | 63     | 30     | 178    | 140    | 220    | 86     | 44     | 147    | 8      |
| Caenidae        | Wundacaenis dostini            | 2      | 4      | 3      |        | 6      | 4      | 28     | 114    | 20     | 9      | 16     |
| Caenidae        | indet.                         |        |        |        |        |        | -      |        |        |        | -      |        |
| Leptophlebiidae | Thraulus indet.                |        |        |        |        |        |        |        |        |        |        |        |
| Leptophlebiidae | indet.                         |        |        |        |        |        |        |        |        |        |        |        |

| Ord  | ler/Class             |                           | 1991   |        |        |        |        |        | 1992   |        |        |        |        |
|------|-----------------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|      | Family                | Genus and species         | Site 1 |        |        | Site 3 |        |        | Site 1 |        | Site 3 |        |        |
|      |                       |                           | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 2 | Rep. 5 | Rep. 1 | Rep. 3 | Rep. 4 |
|      |                       | sample no.                | . 1935 | 1936   | 1937   | 1965   | 1966   | 1967   | 1986   | 1989   | 2015   | 2017   | 2018   |
| Herr | niptera               |                           |        |        |        |        |        |        |        |        |        |        |        |
|      | Corixidae             | Micronecta indet.         |        |        |        |        |        |        |        |        |        |        |        |
|      | Mesoveliidae          | indet.                    |        |        |        |        |        |        |        |        |        |        | 8      |
| Lepi | doptera               |                           |        |        |        |        |        |        |        |        |        |        |        |
|      | Pyralidae             | OSS1L                     | 8      |        | 6      | 4      | •      |        | 32     | 34     | 20     |        | 8      |
|      | Pyralidae             | OSS2L                     |        |        |        |        |        |        |        |        |        |        |        |
|      | Pyralidae             | OSS9L                     | 3      | 4      |        |        |        |        |        |        | 4      |        | 8      |
|      | Pyralidae             | OSS10L                    |        |        |        |        |        |        |        |        |        |        |        |
|      | Pyralidae             | indet.                    | 2      |        |        |        |        |        |        |        |        |        |        |
| Odo  | nata                  |                           |        |        |        |        |        |        |        |        |        |        |        |
|      | Coenagrionidae        | Austrocnemis maccullochi  |        |        |        |        |        |        |        |        |        |        |        |
|      | Coenagrionidae        | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
|      | Corduliidae           | Hemicordulia intermedia   |        |        |        |        |        |        |        |        |        |        |        |
|      | Gomphidae             | Antipodogomphus neophytus |        |        |        |        |        |        |        |        |        |        |        |
|      | Gomphidae             | Antipodogomphus indet.    |        |        |        |        |        |        |        |        |        |        |        |
|      | Gomphidae             | Austrogomphus mjobergi    |        |        |        |        |        |        |        |        |        |        |        |
|      | Gomphidae             | Austrogomphus indet.      |        |        |        |        |        |        |        |        |        |        |        |
|      | Libellulidae          | Diplacodes haematodes     |        |        |        |        |        |        |        |        |        |        |        |
|      | Libellulidae          | Nannophlebia indet.       |        |        |        |        |        |        |        |        |        |        |        |
|      | Libellulidae          | Orthetrum caledonicum     |        |        |        |        |        |        |        |        |        |        |        |
|      | Libellulidae          | indet.                    |        |        | ·      | - 11   |        |        |        |        |        |        |        |
|      | Anisoptera (suborder) | indet.                    |        |        |        |        |        |        |        |        |        | 1      |        |
|      | Zygoptera (suborder)  | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
| Tric | hoptera               |                           |        |        |        |        |        |        |        |        |        |        |        |
|      | Calamoceratidae       | Anisocentropus muricatus  |        |        |        |        |        |        |        |        |        |        |        |
|      | Ecnomidae             | Ecnomina indet.           |        |        |        |        |        |        |        |        | 4      |        |        |
|      | Ecnomidae             | Ecnomus indet.            |        |        |        |        |        |        |        |        |        | 1      |        |
|      | Ecnomidae             | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
|      | Hydropsychidae        | Asmicridea sp3#           | 1      |        | 2      | 1      |        |        |        |        |        |        |        |
|      | Hydropsychidae        | Chematopsyche kakaduensis | 3      | 4      | 4      |        |        |        | 12     | 20     |        |        |        |
|      | Hydropsychidae        | Cheumatopsyche suteri     | 15     |        | 13     | I      | 6      | 5 12   | 20     | 12     |        |        |        |
|      | Hydropsychidae        | Cheumatopsyche wellsae    |        |        |        |        | 4      | ļ      |        |        |        |        |        |
|      | Hydropsychidae        | Cheumatopsyche indet.     | 6      | 4      | 3      | I      | 6      | ;      |        | 4      |        |        |        |

| Order/Class          |                           | 1991   |        |        |        |        |        | 1992   |        |        |        |        |
|----------------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family               | Genus and species         | Site 1 |        |        | Site 3 |        |        | Site 1 |        | Site 3 |        |        |
|                      |                           | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 2 | Rep. 5 | Rep. 1 | Rep. 3 | Rep. 4 |
|                      | sample no.                | 1935   | 1936   | 1937   | 1965   | 1966   | 1967   | 1986   | 1989   | 2015   | 2017   | 2018   |
| Hydroptilidae        | Hellyethira cubitans (L)  |        |        |        |        |        |        |        |        |        | 1      |        |
| Hydroptilidae        | Hellyethira forficata (L) |        |        |        |        | 4      |        | 12     | 4      | 4      | 24     | 40     |
| Hydroptilidae        | Hellyethira forficata (P) |        |        |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Hellyethira indet. (L)    |        |        |        |        | 4      |        |        |        | 8      | 10     | 24     |
| Hydroptilidae        | Hellyethira ramosa (L)    |        |        |        |        |        |        |        | 4      | 4      | 1      |        |
| Hydroptilidae        | Hellyethira ramosa (P)    |        |        | ·.     |        |        |        |        |        |        | 1      |        |
| Hydroptilidae        | Hellyethira vernoni (L)   |        |        |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Oxyethira indet. (L)      |        |        |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Orthotrichia turrita      |        |        |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Orthotrichia indet. (L)   | 8      | 4      |        | 12     | 24     | 6      |        | 16     | 8      | 14     | 32     |
| Hydroptilidae        | Orthotrichia indet. (P)   | 11     | 4      |        | 4      | 24     | 2      | 8      | 10     | 4      | 2      |        |
| Hydroptilidae        | indet. (L)                | 4      |        |        |        |        |        |        | 6      | -      | _      |        |
| Hydroptilidae        | indet. (P)                |        |        |        |        |        |        |        |        | 4      |        |        |
| Leptoceridae         | Leptorussa indet          |        |        |        |        |        |        |        |        |        |        |        |
| Leptoceridae         | Oecetis epekeina          |        |        |        |        |        |        |        |        |        |        |        |
| Leptoceridae         | Oecetis spA#              |        |        |        |        |        |        |        |        |        |        |        |
| Leptoceridae         | Oecetis spE#              |        |        |        |        |        |        |        |        |        |        |        |
| Leptoceridae         | Oecetis indet.            | 1      | 4      |        |        | 4      |        |        | 4      |        |        |        |
| Leptoceridae         | Triaenodes indet.         |        |        |        | 1 .t   | •      |        | 4      | •      |        | 1      |        |
| Leptoceridae         | ind <del>e</del> t.       |        | 4      |        |        | 8      | 2      | 4      | 8      | 16     | 1      | 16     |
| Philopotamidae       | Chimarra spB #            |        |        |        |        | -      | -      | •      |        |        |        |        |
| Polycentropodidae    | indet.                    |        |        |        |        | 4      | 2      |        |        | 4      |        |        |
| Triplectides         | ciuskus                   |        |        |        |        |        | -      |        |        | •      |        |        |
| Triplectides         | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
| Acarina              |                           |        |        |        |        |        |        |        |        |        |        |        |
| Hydryphantidae       | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
| Hygrobatidae         | Australiobates indet.     |        |        |        |        |        |        |        |        |        |        |        |
| Hygrobatidae         | indet.                    | 13     | 4      | 3      | 4      | 28     | 4      | 8      |        |        | 1      |        |
| Limnesiidae          | indet.                    | 2      | 4      | -      | 2      |        | 4      | •      |        | 4      | 5      |        |
| Mideopsidae          | indet.                    | _      | -      |        | _      | 2      | -      |        |        | •      | Ŭ      |        |
| Oribatida (suborder) | indet.                    |        |        |        |        | 2      | 2      |        | 4      |        |        |        |
| Oxidae               | indet.                    |        |        |        | 2      | 2      | 4      |        | ·      |        |        |        |

| Order/Class            |                          | 1991     |        |        |        |        |        | 1992   |        |        |        |        |
|------------------------|--------------------------|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family                 | Genus and species        | Site 1   |        |        | Site 3 |        |        | Site 1 |        | Site 3 |        |        |
|                        |                          | Rep. 1   | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 2 | Rep. 5 | Rep. 1 | Rep. 3 | Rep. 4 |
|                        | sample                   | no. 1935 | 1936   | 1937   | 1965   | 1966   | 1967   | 1986   | 1989   | 2015   | 2017   | 2018   |
| Torrenticolidae        | indet.                   | 2        |        |        |        |        | 2      |        |        |        | 1      |        |
| Unionicolidae          | indet.                   | 2        |        |        | 2      |        |        |        |        |        |        |        |
|                        | indet.                   |          |        |        |        | 6      |        |        | 6      |        |        |        |
| Decapoda               |                          |          |        |        |        |        |        |        |        |        |        |        |
| Atyidae                | Caridina gracilirostris  |          |        |        |        |        |        |        |        |        |        |        |
| Atyidae                | Caridinides wilkinsi     |          |        |        |        |        |        |        |        |        |        |        |
| Atyidae                | indet.                   |          |        |        |        |        |        |        |        |        |        |        |
| Palaemonidae           | Macrobrachium bullatum   |          |        |        |        |        |        |        | 8      |        |        |        |
| Palaemonidae           | Macrobrachium rosenbergi |          |        |        |        |        |        |        |        |        |        |        |
| Palaemonidae           | Macrobrachium indet.     |          |        | 1      |        |        |        |        |        |        |        |        |
| Palaemonidae           | indet.                   |          |        |        |        |        |        |        |        |        |        |        |
| Gastropoda             |                          |          |        |        |        |        |        |        |        |        |        |        |
| Planorbidae            | Amerianna indet.         |          |        |        |        |        |        |        |        |        |        |        |
| Nematoda               | indet.                   | 2        |        |        |        | 10     | 2      |        | 58     |        |        |        |
| Oligochaeta            |                          |          |        |        |        |        |        |        |        |        |        |        |
| Enchytraeidae          | indet.                   | 2        |        |        |        | 8      |        | 4      |        |        | 1      | 8      |
| Naididae               | indet.                   |          |        |        |        | 10     |        |        | 2      |        |        | 16     |
| Tubificidae            | indet.                   | 2        |        |        |        | 12     |        |        |        |        | 1      |        |
| Magadrili (superorder) | indet.                   | 2        |        | 1      | 2      | 4      | 2      |        | 6      | 4      | 3      |        |
|                        | indet.                   |          |        |        | 2      |        | 2      |        | 4      | 4      |        |        |
| indet = indeterminate  | •                        |          |        |        |        |        |        |        |        |        |        |        |

\* Glaister 1991 # Wells 1991

\*\* Suter 1992

## Cranston 1991

| Order/Class     |                              | 1993   |        |        |        |        | 1994   |        |        |        |        |        |
|-----------------|------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family          | Genus and species            | Site 1 |        | Site 3 |        |        | Site 1 |        |        | Site 3 |        |        |
|                 |                              | Rep. 1 | Rep. 5 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 |
|                 | sample no.                   | 1107   | 1110   | 1137   | 1139   | 1140   | 471    | 472    | 473    | 491    | 492    | 493    |
| Coleoptera      |                              |        |        |        |        |        |        |        |        |        |        |        |
| Dytiscidae      | Antiporus OSS4L              |        |        |        |        |        |        | 4      |        |        |        |        |
| Dytiscidae      | Batracomatus wingi (A)       |        | 2      |        | 4      | 2      |        |        |        |        |        |        |
| Dytiscidae      | Cybister OSS1L               |        |        |        |        |        |        |        |        |        |        |        |
| Dytiscidae      | OSS6L                        | 2      |        |        |        |        |        |        |        |        |        |        |
| Dytiscidae      | Tiporus nr josephini (A)     |        |        |        | 2      |        |        |        |        | 4      |        |        |
| Dytiscidae      | indet. (L)                   |        |        |        |        |        |        |        |        |        |        |        |
| Elmidae         | Austrolimnius sp2A (L)*      |        | 2      |        |        | 2      |        |        | 4      |        |        |        |
| Elmidae         | Austrolimnius sp2B (L)*      |        | 2      | 14     | 6      | 6      |        |        | 8      |        |        |        |
| Elmidae         | Austrolimnius sp4 (L)*       |        |        | 30     |        |        |        |        |        |        |        |        |
| Elmidae         | Austrolimnius sp9 (L)*       |        |        | 24     |        |        |        |        |        |        |        |        |
| Elmidae         | Austrolimnius indet. (A)     |        | 4      |        | 2      |        |        |        |        |        |        |        |
| Elmidae         | Austrolimnius indet. (L)     |        |        | 10     |        | 6      |        |        |        |        |        |        |
| Elmidae         | Genus E sp74E (L)*           |        |        |        |        |        |        |        |        |        |        |        |
| Haliplidae      | OSS1L                        |        |        |        |        |        |        |        |        |        |        |        |
| Hydrophilidae   | OSS1L                        | 2      |        |        |        |        |        |        |        |        |        |        |
| Noteridae       | Hydrocophus subfasciatus (A) |        |        |        |        |        |        |        |        |        |        |        |
| Diptera         |                              |        |        |        |        |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS1L                        |        |        |        |        |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS2L                        | 8      | 8      | 6      |        | 6      |        | 12     |        | 12     | 2      | 12     |
| Ceratopogonidae | OSS3L                        |        |        |        |        |        |        |        |        |        | _      |        |
| Ceratopogonidae | OSS5L                        |        |        |        | 2      |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS6L                        |        |        |        |        |        |        |        |        |        |        |        |
| Ceratopogonidae | OSS8L                        |        |        |        | 6      | 2      |        |        | 4      | 8      |        | 4      |
| Ceratopogonidae | OSS9L                        | 10     | 6      |        |        | 6      |        | 4      |        | 4      | 4      | 4      |
| Ceratopogonidae | OSS10L                       |        |        |        |        |        |        |        | 4      | -      | -      | -      |
| Ceratopogonidae | OSS12L                       |        |        |        | 2      | 2      |        |        |        |        |        |        |
| Ceratopogonidae | indet.                       |        |        |        | _      | 4      |        |        | 8      |        |        |        |
| Chironomidae    | Ablabesmvia notabilis        |        |        |        |        |        |        |        | •      | 4      |        |        |
| Chironomidae    | Ablabesmvia indet.           |        |        |        |        |        |        |        |        | •      |        |        |
| Chironomidae    | Chironomus indet.            |        |        |        |        |        |        |        |        |        |        |        |
| Chironomidae    | Cladotanytarsus indet.       |        |        |        |        | 2      | 8      | 16     | 12     | 8      | 4      | 4      |
| Chironomidae    | Conochironomus indet.        |        |        |        |        | -      | -      |        |        | •      | 4      | 4      |

| Order/Class  |                                   | 1993   |        |         |        |        | 1994   |        |        |        |        |        |
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| Family       | Genus and species                 | Site 1 |        | Site 3  |        |        | Site 1 |        |        | Site 3 |        |        |
|              |                                   | Rep. 1 | Rep. 5 | Rep. 1  | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 |
|              | sample no.                        | 1107   | 1110   | 1137    | 1139   | 1140   | 471    | 472    | 473    | 491    | 492    | 493    |
| Chironomidae | Cricotopus albitarsis             |        |        |         |        |        | 8      |        |        |        |        |        |
| Chironomidae | Cricotopus brevicornis            | 4      |        |         |        |        |        |        | 8      |        |        |        |
| Chironomidae | Cricotopus indet.                 |        |        |         |        |        |        |        |        |        |        |        |
| Chironomidae | Cryprochironomus griseidorsum     |        |        |         |        |        |        |        |        |        |        |        |
| Chironomidae | Cryptochironomus indet.           |        | 2      | 2       | 6      | 4      | 4      |        |        |        |        | 4      |
| Chironomidae | Dicrotendipes lindae              |        |        |         | 4      |        | 12     | 4      |        | 8      | 14     |        |
| Chironomidae | Dicrotendipes indet.              |        |        |         | 2      |        | 4      | 8      |        |        | 6      |        |
| Chironomidae | Djalmabatista indet.              |        |        |         | 2      | 4      |        |        |        | 16     | 26     | 12     |
| Chironomidae | Kiefferulus tinctus               |        |        | 52      |        |        |        |        |        |        |        |        |
| Chironomidae | Kiefferulus indet.                |        |        | 4       |        |        | 4      |        |        |        |        |        |
| Chironomidae | Larsia albiceps                   |        |        |         |        |        |        | 12     |        | 4      |        |        |
| Chironomidae | Nanocladius OSS1L                 |        |        |         |        |        |        | 8      |        |        | 2      |        |
| Chironomidae | Nilotanypus indet.                |        |        |         | 4      | 2      | 4      |        |        |        |        |        |
| Chironomidae | Parametriocnus nr ornaticornis    |        |        |         |        |        |        |        |        |        |        |        |
| Chironomidae | Paratanytarsus indet.             |        | 4      |         | 2      |        | 12     |        |        |        |        |        |
| Chironomidae | Paratendipes indet.               |        |        |         |        | 2      |        |        |        |        |        |        |
| Chironomidae | Polypedilum leei                  |        |        |         |        |        | 4      |        |        |        |        |        |
| Chironomidae | Polypedilum nubifer               |        |        |         |        |        |        |        |        |        | 2      |        |
| Chironomidae | Polypedilum watsoni               | 2      |        |         |        |        |        |        |        |        | 2      | 28     |
| Chironomidae | Polypedilum indet.                | 4      | · .    | · · · · | 6      | 4      |        | 28     |        | 20     | 4      | 28     |
| Chironomidae | Procladius paludicola             |        |        |         |        |        |        |        |        |        |        |        |
| Chironomidae | Rheocricotopus indet.             | 22     | 28     |         | 6      |        | 8      |        | 28     |        |        |        |
| Chironomidae | Rheotanytarsus indet.             | 326    | 340    | 12      | 44     | 32     | 780    | 152    | 568    | 176    | 64     | 208    |
| Chironomidae | Robackia indet.                   | 2      |        |         | 4      | 4      |        |        | 4      |        |        |        |
| Chironomidae | Stempellina indet                 |        |        |         | -      | -      |        |        | 4      |        |        |        |
| Chironomidae | Stenochironomus indet.            |        |        |         | 8      | 2      |        |        | -      | 8      |        |        |
| Chironomidae | Stictochironomus indet.           |        |        |         |        | _      |        |        |        | •      |        | 8      |
| Chironomidae | Tanytarsus indet.                 | 16     | 24     | 54      | 116    | 56     | 108    | 180    | 176    | 24     | 16     | 4      |
| Chironomidae | Thienemanniella spA##             | 2      | 2      |         |        |        |        |        |        |        |        | •      |
| Chironomidae | Thienemanniella indet.            |        | _      |         |        |        |        |        |        |        |        |        |
| Chironomidae | Thienemannimyia indet.            |        |        |         |        |        | 4      |        |        |        |        | 4      |
| Chironomidae | Chironominae (subfamily) indet.   | 6      | 4      | 10      | 4      |        | 20     | 36     | 20     | 4      |        | 8      |
| Chironomidae | Orthocladiinae (subfamily) indet. | 4      | 4      | 4       | ·      | 2      |        |        | 20     |        |        | •      |

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| Order/Class     |                                | 1993   |        |        |        |        | 1994   |        |        |        |        |        |
|-----------------|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family          | Genus and species              | Site 1 |        | Site 3 |        |        | Site 1 |        |        | Site 3 |        |        |
|                 |                                | Rep. 1 | Rep. 5 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 |
|                 | sample no.                     | 1107   | 1110   | 1137   | 1139   | 1140   | 471    | 472    | 473    | 491    | 492    | 493    |
| Chironomidae    | Tanypodinae (subfamily) indet. | 2      | 2      |        |        | 2      | 4      | 8      | 4      | 4      | 6      | 4      |
| Chironomidae    | indet. (L)                     | 238    |        | 6      |        |        | 12     | 12     | 8      |        | 2      |        |
| Chironomidae    | indet. (P)                     | 4      | 10     | 6      | 10     | 34     | 52     | 32     | 12     | 16     | 2      | 8      |
| Simuliidae      | Simulium papuense (?)          | 2      | 2      |        |        |        |        |        |        |        |        |        |
| Simuliidae      | Simulium indet.                | 6      | 6      |        |        |        |        |        |        |        |        |        |
| Simuliidae      | indet. (L)                     |        |        |        |        |        |        |        |        |        |        |        |
| Simuliidae      | indet. (P)                     |        |        |        |        |        |        |        |        |        |        |        |
| Tabanidae       | Tabanus indet.                 |        | 8      |        | 2      |        |        |        |        |        |        |        |
| Tabanidae       | indet.                         | 2      |        |        |        |        |        |        |        |        |        |        |
| Tipulidae       | OSS1L                          | 2      |        |        |        |        |        |        |        |        |        |        |
| Tipulidae       | OSS4L                          |        |        |        | 2      |        |        |        |        |        |        |        |
| Tipulidae       | indet.                         |        |        | 2      |        | 2      |        | 4      |        |        |        |        |
| Ephemeroptera   |                                |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Baetis sp1**                   |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Baetis indet.                  |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Centroptilum OSS1N             |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Cloeon fluviatile              |        |        |        |        |        |        |        |        | 4      |        |        |
| Baetidae        | Genus B sp1**                  | 10     | 20     |        |        |        |        |        | 4      |        |        |        |
| Baetidae        | Genus B indet.                 |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | Genus C indet.                 |        |        |        |        |        |        |        |        |        |        |        |
| Baetidae        | indet.                         | 26     |        |        | 2      | 2      | 4      | 12     | 4      |        | 2      |        |
| Caenidae        | Tasmanocoenis arcuata          |        |        | 4      |        |        |        | 32     |        |        |        |        |
| Caenidae        | Tasmanocoenis spD**            | 26     | 10     | 10     | 12     | 8      | 36     | 12     | 24     |        |        |        |
| Caenidae        | Tasmanocoenis spE**            | 6      | 18     | 2      |        | 8      |        |        | 56     |        |        |        |
| Caenidae        | Tasmanocoenis spH**            |        |        |        |        |        |        |        |        |        |        |        |
| Caenidae        | Tasmanocoenis spJ**            |        |        |        |        |        |        |        |        |        |        |        |
| Caenidae        | Tasmanocoenis indet.           | 184    | 326    | 76     | 136    | 32     | 148    | 112    | 376    | 8      | 8      | 12     |
| Caenidae        | Wundacaenis dostini            | 24     | 28     | 2      | 24     | 4      | 32     | 8      | 40     | 12     | 4      | 8      |
| Caenidae        | indet.                         | 22     |        |        | 2      | -      |        | 8      |        |        |        | •      |
| Leptophlebiidae | Thraulus indet.                |        | 2      |        | -      |        |        | •      |        |        |        |        |
| Leptophlebiidae | indet.                         | 6      | 2      |        |        |        |        |        |        |        |        |        |

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| Order/Class           |                           | 1993   |        |        |        |        | 1994   |        |        |        |        |        |
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| Family                | Genus and species         | Site 1 |        | Site 3 |        |        | Site 1 |        |        | Site 3 |        |        |
|                       |                           | Rep. 1 | Rep. 5 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 |
|                       | sample no.                | 1107   | 1110   | 1137   | 1139   | 1140   | 471    | 472    | 473    | 491    | 492    | 493    |
| Hemiptera             |                           |        |        |        |        |        |        |        |        |        |        |        |
| Corixidae             | Micronecta indet.         |        |        |        |        |        |        |        |        |        |        |        |
| Mesoveliidae          | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
| Lepidoptera           |                           |        |        |        |        |        |        |        |        |        |        |        |
| Pyralidae             | OSS1L                     | 2      | 2      | 4      |        |        | 4      |        | 1      |        |        |        |
| Pyralidae             | OSS2L                     | 2      |        |        |        |        | 4      |        |        |        |        |        |
| Pyralidae             | OSS9L                     | 2      |        |        |        |        |        |        |        |        |        |        |
| Pyralidae             | OSS10L                    |        |        |        |        |        |        |        | 1      |        |        |        |
| Pyralidae             | indet.                    |        |        |        |        |        |        | 4      |        |        |        |        |
| Odonata               |                           |        |        |        |        |        |        |        |        |        |        |        |
| Coenagrionidae        | Austrocnemis maccullochi  |        |        |        |        |        |        |        |        |        |        |        |
| Coenagrionidae        | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
| Corduliidae           | Hemicordulia intermedia   |        |        |        |        |        |        |        |        |        |        |        |
| Gomphidae             | Antipodogomphus neophytus |        |        |        |        |        |        |        |        |        |        |        |
| Gomphidae             | Antipodogomphus indet.    |        |        |        |        |        |        |        |        |        |        |        |
| Gomphidae             | Austrogomphus mjobergi    |        |        |        |        |        |        |        |        |        |        |        |
| Gomphidae             | Austrogomphus indet.      |        |        |        |        |        |        |        |        |        |        |        |
| Libellulidae          | Diplacodes haematodes     |        |        |        |        |        |        |        |        |        |        |        |
| Libellulidae          | Nannophlebia indet.       |        |        |        |        |        |        |        |        |        |        |        |
| Libellulidae          | Orthetrum caledonicum     |        |        |        |        |        |        |        |        |        |        |        |
| Libellulidae          | indet.                    |        |        |        | - 1    |        |        |        |        |        |        |        |
| Anisoptera (suborder) | indet.                    |        |        |        |        |        |        | 4      |        |        |        |        |
| Zygoptera (suborder)  | indet.                    |        |        |        |        |        |        | 12     |        |        |        |        |
| Trichoptera           |                           |        |        |        |        |        |        |        |        |        |        |        |
| Calamoceratidae       | Anisocentropus muricatus  |        |        |        |        |        |        |        |        |        |        |        |
| Ecnomidae             | Ecnomina indet.           |        |        |        |        |        |        |        |        |        |        |        |
| Ecnomidae             | Ecnomus indet.            |        | 2      |        | 2      |        |        |        |        | 4      | 2      |        |
| Ecnomidae             | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
| Hydropsychidae        | Asmicridea sp3#           |        |        |        |        |        |        |        |        |        |        |        |
| Hydropsychidae        | Chematopsyche kakaduensis |        | 4      |        |        |        |        |        | 4      |        |        |        |
| Hydropsychidae        | Cheumatopsyche suteri     | 78     | 78     |        | 2      | !      |        |        | 1      |        |        |        |
| Hydropsychidae        | Cheumatopsyche wellsae    | 30     | 102    |        |        |        | 4      |        |        |        |        |        |
| Hydropsychidae        | Cheumatopsyche indet.     | 76     | 56     | i      |        |        | 24     |        | 4      |        |        |        |

| Order/Class          |                           | 1993   |        |        |        |        | 1994   |        |        |        |        |        |
|----------------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family               | Genus and species         | Site 1 |        | Site 3 |        |        | Site 1 |        |        | Site 3 |        |        |
|                      |                           | Rep. 1 | Rep. 5 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 |
|                      | sample no.                | 1107   | 1110   | 1137   | 1139   | 1140   | 471    | 472    | 473    | 491    | 492    | 493    |
| Hydroptilidae        | Hellyethira cubitans (L)  |        |        |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Hellyethira forficata (L) |        |        |        |        |        |        |        |        | 12     | 4      | 4      |
| Hydroptilidae        | Hellyethira forficata (P) |        |        |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Hellyethira indet. (L)    |        |        | 4      | 6      |        | 4      |        |        |        | 2      |        |
| Hydroptilidae        | Hellyethira ramosa (L)    |        |        | 4      | 6      | 4      |        |        |        | 4      | 2      | 4      |
| Hydroptilidae        | Hellyethira ramosa (P)    |        |        |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Hellyethira vernoni (L)   |        |        |        |        |        |        |        |        |        | 2      |        |
| Hydroptilidae        | Oxyethira indet. (L)      |        |        |        |        |        |        |        |        |        | 4      |        |
| Hydroptilidae        | Orthotrichia turrita      |        |        |        |        |        |        |        |        |        |        |        |
| Hydroptilidae        | Orthotrichia indet. (L)   | 2      |        |        | 2      | 4      | 8      | 20     | 16     | 8      | 2      |        |
| Hydroptilidae        | Orthotrichia indet. (P)   |        |        |        |        |        |        | 4      |        |        |        |        |
| Hydroptilidae        | indet. (L)                | 2      |        |        |        |        | 8      |        |        |        |        |        |
| Hydroptilidae        | indet. (P)                |        |        |        |        |        |        |        |        |        | 4      |        |
| Leptoceridae         | Leptorussa indet.         |        |        |        | 4      |        |        |        |        | 4      |        |        |
| Leptoceridae         | Oecetis epekeina          |        |        |        |        |        |        |        |        |        |        |        |
| Leptoceridae         | Oecetis spA#              |        |        |        |        |        |        |        |        |        |        | 8      |
| Leptoceridae         | Oecetis spE#              |        |        |        |        |        |        |        |        |        |        |        |
| Leptoceridae         | Oecetis indet.            |        |        | 2      | 6      |        |        |        |        |        | 4      | 4      |
| Leptoceridae         | Triaenodes indet.         |        | 4      | 2      |        |        |        |        |        |        |        | 4      |
| Leptoceridae         | indet.                    | 4      |        |        |        | 6      | 12     |        |        | 4      | 16     |        |
| Philopotamidae       | Chimarra spB #            | 2      | 2      |        |        |        |        |        |        |        |        |        |
| Polycentropodidae    | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
| Triplectides         | ciuskus                   |        |        |        |        |        |        |        |        |        |        |        |
| Triplectides         | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
| Acarina              |                           |        |        |        |        |        |        |        |        |        |        |        |
| Hydryphantidae       | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
| Hygrobatidae         | Austratiobates indet.     |        |        |        |        |        |        |        |        |        |        |        |
| Hygrobatidae         | indet.                    | 4      | 6      | 6      | 4      |        | 4      | 16     | 24     | 28     | 4      | 12     |
| Limnesiidae          | indet.                    |        |        | 10     | 2      | 2      | 12     | 12     | 8      |        | 4      |        |
| Mideopsidae          | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
| Oribatida (suborder) | indet.                    |        |        |        |        |        |        |        |        |        |        |        |
| Oxidae               | indet.                    |        |        |        |        | 2      |        |        |        |        | 4      |        |

| Order/Class            |                          | 1993   |        |        |        |        | 1994   |        |        |        |        |        |
|------------------------|--------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Family                 | Genus and species        | Site 1 |        | Site 3 |        |        | Site 1 |        |        | Site 3 |        |        |
|                        |                          | Rep. 1 | Rep. 5 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 |
|                        | sample no                | . 1107 | 1110   | 1137   | 1139   | 1140   | 471    | 472    | 473    | 491    | 492    | 493    |
| Torrenticolidae        | indet.                   |        |        |        |        |        |        |        |        |        |        |        |
| Unionicolidae          | indet.                   |        |        |        |        |        |        | 4      |        | 4      |        |        |
|                        | indet.                   |        |        |        |        |        |        |        |        |        |        |        |
| Decapoda               |                          |        |        |        |        |        |        |        |        |        |        |        |
| Atyidae                | Caridina gracilirostris  |        |        |        |        |        |        |        |        |        |        |        |
| Atyidae                | Caridinides wilkinsi     |        |        |        |        |        |        |        |        |        |        |        |
| Atyidae                | indet.                   |        |        |        |        |        |        |        |        |        |        |        |
| Palaemonidae           | Macrobrachium bullatum   |        |        |        | 4      | 2      |        |        |        |        |        |        |
| Palaemonidae           | Macrobrachium rosenbergi |        |        |        |        |        | 1      |        |        |        |        |        |
| Palaemonidae           | Macrobrachium indet.     |        |        |        |        |        |        |        |        |        |        |        |
| Palaemonidae           | indet.                   |        |        |        |        |        |        |        |        |        |        |        |
| Gastropoda             |                          |        |        |        |        |        |        |        |        |        |        |        |
| Planorbidae            | Amerianna indet.         |        |        |        |        |        |        |        |        |        |        |        |
| Nematoda               | indet.                   | 4      |        |        |        | 30     |        | 20     |        |        |        |        |
| Oligochaeta            |                          |        |        |        |        |        |        |        |        |        |        |        |
| Enchytraeidae          | indet.                   |        |        |        |        | 2      |        |        |        |        |        | 8      |
| Naididae               | indet.                   |        | 2      |        |        | 2      |        |        |        |        |        |        |
| Tubificidae            | indet.                   |        | 2      |        |        | 6      |        |        |        |        |        | 20     |
| Magadrili (superorder) | indet.                   |        |        | 2      | 16     | 8      |        |        |        | 8      | 3      |        |
|                        | indet.                   |        |        |        |        |        |        |        |        |        |        |        |
| indet = indeterminate  | 2                        |        |        |        |        |        |        |        |        |        |        |        |
|                        | •                        |        |        |        |        |        |        |        |        |        |        |        |

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## Cranston 1991

| Order/Class |                 | 1995                         |        |        |        |        |        |        |
|-------------|-----------------|------------------------------|--------|--------|--------|--------|--------|--------|
|             | Family          | Genus and species            | Site 1 |        |        | Site 3 |        |        |
|             |                 |                              | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 |
|             |                 | sample n                     | o. 1   | 2      | 3      | 13     | 14     | 15     |
| Cole        | eoptera         |                              |        |        |        |        |        |        |
|             | Dytiscidae      | Antiporus OSS4L              |        |        |        |        |        |        |
|             | Dytiscidae      | Batracomatus wingi (A)       |        |        |        |        |        |        |
|             | Dytiscidae      | Cybister OSS1L               |        |        |        |        |        |        |
|             | Dytiscidae      | OSS6L                        |        |        |        |        |        |        |
|             | Dytiscidae      | Tiporus nr josephini (A)     | 4      |        |        |        |        |        |
|             | Dytiscidae      | indet. (L)                   |        |        |        |        |        |        |
|             | Elmidae         | Austrolimnius sp2A (L)*      |        |        |        |        |        |        |
|             | Elmidae         | Austrolimnius sp2B (L)*      |        |        |        |        |        |        |
|             | Elmidae         | Austrolimnius sp4 (L)*       |        |        |        |        |        |        |
|             | Elmidae         | Austrolimnius sp9 (L)*       |        |        |        |        |        |        |
|             | Elmidae         | Austrolimnius indet. (A)     |        |        | 8      |        |        |        |
|             | Elmidae         | Austrolimnius indet. (L)     |        |        |        | 10     |        |        |
|             | Elmidae         | Genus E sp74E (L)*           |        |        |        |        |        |        |
|             | Haliplidae      | OSS1L                        |        |        |        |        |        |        |
|             | Hydrophilidae   | OSS1L                        | 4      |        |        |        | 10     |        |
|             | Noteridae       | Hydrocophus subfasciatus (A) | 4      |        |        |        |        |        |
| Dipt        | era             |                              |        |        |        |        |        |        |
|             | Ceratopogonidae | OSS1L                        |        |        |        |        |        |        |
|             | Ceratopogonidae | OSS2L                        | 12     | 62     | 8      | 10     | 31     | 8      |
|             | Ceratopogonidae | OSS3L                        |        | 21     |        |        |        |        |
|             | Ceratopogonidae | OSS5L                        |        |        |        |        |        | 8      |
|             | Ceratopogonidae | OSS6L                        |        |        | 33     |        |        |        |
|             | Ceratopogonidae | OSS8L                        |        |        |        | 10     |        |        |
|             | Ceratopogonidae | OSS9L                        |        | 21     |        |        |        |        |
|             | Ceratopogonidae | OSS10L                       |        |        |        |        |        |        |
|             | Ceratopogonidae | OSS12L                       |        |        |        |        |        |        |
|             | Ceratopogonidae | indet.                       |        |        |        |        | 10     |        |
|             | Chironomidae    | Ablabesmyia notabilis        |        |        |        |        |        |        |
|             | Chironomidae    | Ablabesmyia indet.           |        |        |        |        | 10     |        |
|             | Chironomidae    | Chironomus indet.            |        |        |        |        |        |        |
|             | Chironomidae    | Cladotanytarsus indet.       |        |        | 8      | 21     | 31     | 8      |
|             | Chironomidae    | Conochironomus indet.        |        |        |        | 10     |        |        |

| Order/Class  |                                   | 1995   |        |        |        |        |        |
|--------------|-----------------------------------|--------|--------|--------|--------|--------|--------|
| Family       | Genus and species                 | Site 1 |        |        | Site 3 |        |        |
|              |                                   | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 |
|              | sample no.                        | 1      | 2      | 3      | 13     | 14     | 15     |
| Chironomidae | Cricotopus albitarsis             |        |        |        |        |        |        |
| Chironomidae | Cricotopus brevicornis            |        |        |        |        |        |        |
| Chironomidae | Cricotopus indet.                 | 4      | 82     | 8      |        |        |        |
| Chironomidae | Cryprochironomus griseidorsum     |        |        |        |        |        |        |
| Chironomidae | Cryptochironomus indet.           |        |        |        |        |        | 8      |
| Chironomidae | Dicrotendipes lindae              | 8      |        |        |        |        |        |
| Chironomidae | Dicrotendipes indet.              |        | 21     | 16     | 10     |        |        |
| Chironomidae | Djalmabatista indet.              |        | 21     | 8      | 62     | 82     | 66     |
| Chironomidae | Kiefferulus tinctus               |        |        |        |        |        |        |
| Chironomidae | Kiefferulus indet.                |        |        |        |        |        |        |
| Chironomidae | Larsia albiceps                   |        |        |        | 10     |        |        |
| Chironomidae | Nanocladius OSS1L                 |        |        |        |        |        |        |
| Chironomidae | Nilotanypus indet.                |        |        |        |        |        |        |
| Chironomidae | Parametriocnus nr ornaticornis    |        |        |        |        |        |        |
| Chironomidae | Paratanytarsus indet.             |        |        |        |        | 10     |        |
| Chironomidae | Paratendipes indet.               |        |        |        |        |        |        |
| Chironomidae | Polypedilum leei                  |        |        |        |        | 10     |        |
| Chironomidae | Polypedilum nubifer               |        |        |        |        |        |        |
| Chironomidae | Polypedilum watsoni               |        |        |        |        |        |        |
| Chironomidae | Polypedilum indet.                |        |        |        |        |        |        |
| Chironomidae | Procladius paludicola             |        |        |        |        |        |        |
| Chironomidae | Rheocricotopus indet.             |        |        |        |        |        |        |
| Chironomidae | Rheotanytarsus indet.             | 16     | 185    | 8      | 175    | 21     | 99     |
| Chironomidae | Robackia indet.                   |        |        |        |        |        |        |
| Chironomidae | Stempellina indet.                |        |        |        |        |        |        |
| Chironomidae | Stenochironomus indet             |        |        |        |        | 10     |        |
| Chironomidae | Stictochironomus indet.           |        |        |        |        |        |        |
| Chironomidae | Tanytarsus indet.                 | 16     | 62     |        |        |        |        |
| Chironomidae | Thienemanniella spA##             |        |        |        |        |        |        |
| Chironomidae | Thienemanniella indet.            |        |        |        |        |        |        |
| Chironomidae | Thienemannimyia indet.            |        |        |        |        |        |        |
| Chironomidae | Chironominae (subfamity) indet.   |        |        |        |        |        |        |
| Chironomidae | Orthocladiinae (subfamily) indet. |        |        |        |        |        |        |
|              | ••                                |        |        |        |        |        |        |

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| Order/Class |                 | 1995                           |        |        |        |        |            |            |
|-------------|-----------------|--------------------------------|--------|--------|--------|--------|------------|------------|
|             | Family          | Genus and species              | Site 1 |        |        | Site 3 |            |            |
|             |                 |                                | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2     | Rep. 3     |
|             |                 | sample no.                     | 1      | 2      | 3      | 13     | 14         | 15         |
|             | Chironomidae    | Tanypodinae (subfamily) indet. |        |        |        |        | 21         |            |
|             | Chironomidae    | indet. (L)                     |        | 22     | 8      | 10     |            | 16         |
|             | Chironomidae    | indet. (P)                     |        |        | 16     |        |            |            |
|             | Simuliidae      | Simulium papuense (?)          |        | 21     | 33     | 21     |            |            |
|             | Simuliidae      | Simulium indet.                |        |        |        |        |            | 16         |
|             | Simuliidae      | indet. (L)                     |        |        |        |        |            |            |
|             | Simuliidae      | indet. (P)                     |        |        |        |        |            |            |
|             | Tabanidae       | Tabanus indet.                 |        |        |        |        |            |            |
|             | Tabanidae       | indet.                         |        |        |        |        |            |            |
|             | Tipulidae       | OSS1L                          |        |        | 1      |        |            |            |
|             | Tipulidae       | OSS4L                          |        |        |        |        |            |            |
|             | Tipulidae       | indet.                         |        |        |        |        |            |            |
| Ephe        | meroptera       |                                |        |        |        |        |            |            |
|             | Baetidae        | Baetis sp1**                   |        |        |        |        |            |            |
|             | Baetidae        | Baetis indet.                  |        |        |        |        |            | 66         |
|             | Baetidae        | Centroptilum OSS1N             |        |        |        |        |            |            |
|             | Baetidae        | Cloeon fluviatile              |        | 41     |        | 21     | 10         |            |
|             | Baetidae        | Genus B sp1**                  |        |        |        |        |            |            |
|             | Baetidae        | Genus B indet.                 |        |        |        | 51     |            |            |
|             | Baetidae        | Genus C indet.                 |        |        |        |        | 10         |            |
|             | Baetidae        | indet.                         |        |        | 8      | 62     | 10         |            |
|             | Caenidae        | Tasmanocoenis arcuata          |        |        |        |        |            |            |
|             | Caenidae        | Tasmanocoenis spD**            | 8      | 103    | 247    | 82     |            | <b>4</b> 1 |
|             | Caenidae        | Tasmanocoenis spE**            |        |        |        | 21     |            | 8          |
|             | Caenidae        | Tasmanocoenis spH**            |        |        |        |        | 21         | 8          |
|             | Caenidae        | Tasmanocoenis spJ**            |        |        |        | 10     |            |            |
|             | Caenidae        | Tasmanocoenis indet.           | 78     | 41     | 58     | 103    | <b>4</b> 1 | 49         |
|             | Caenidae        | Wundacaenis dostini            | 45     | 165    | 25     | 62     | 31         | 25         |
|             | Caenidae        | indet.                         |        | 21     |        |        |            |            |
|             | Leptophlebiidae | Thraulus indet.                |        |        |        |        |            |            |
|             | Leptophlebiidae | indet.                         |        |        |        |        |            |            |

| Order/Class           |                           | 1995   |        |        |        |        |        |
|-----------------------|---------------------------|--------|--------|--------|--------|--------|--------|
| Family                | Genus and species         | Site 1 |        |        | Site 3 |        |        |
|                       |                           | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 |
|                       | sample no                 | . 1    | 2      | 3      | 13     | 14     | 15     |
| Hemiptera             |                           |        |        |        |        |        |        |
| Corixidae             | Micronecta indet.         |        |        |        |        |        |        |
| Mesoveliidae          | indet.                    |        |        |        |        |        |        |
| Lepidoptera           |                           |        |        |        |        |        |        |
| Pyralidae             | OSS1L                     |        | 83     | 1      |        |        |        |
| Pyralidae             | OSS2L                     |        | 21     |        |        |        |        |
| Pyralidae             | OSS9L                     |        | 21     |        |        |        |        |
| Pyralidae             | OSS10L                    |        |        |        |        |        |        |
| Pyralidae             | indet.                    |        |        | 8      |        |        |        |
| Odonata               |                           |        |        |        |        |        |        |
| Coenagrionidae        | Austrocnemis maccullochi  |        |        |        | 10     |        |        |
| Coenagrionidae        | indet.                    |        |        |        |        | 21     |        |
| Cordutiidae           | Hemicordulia intermedia   |        |        |        |        |        |        |
| Gomphidae             | Antipodogomphus neophytus |        |        | 8      |        |        |        |
| Gomphidae             | Antipodogomphus indet.    |        | 2      |        |        |        |        |
| Gomphidae             | Austrogomphus mjobergi    |        |        | 1      |        |        |        |
| Gomphidae             | Austrogomphus indet.      |        |        |        | 1      |        |        |
| Libellulidae          | Diplacodes haematodes     |        |        |        |        |        |        |
| Libellulidae          | Nannophlebia indet.       |        |        |        |        | 10     |        |
| Libellulidae          | Orthetrum caledonicum     |        |        |        |        |        |        |
| Libellulidae          | indet.                    |        |        |        |        |        |        |
| Anisoptera (suborder) | indet.                    |        |        |        |        |        |        |
| Zygoptera (suborder)  | indet.                    |        |        |        |        |        |        |
| Trichoptera           |                           |        |        |        |        |        |        |
| Calamoceratidae       | Anisocentropus muricatus  |        |        |        |        | 10     |        |
| Ecnomidae             | Ecnomina indet.           |        |        |        |        |        |        |
| Ecnomidae             | Ecnomus indet.            |        | 41     |        |        |        |        |
| Ecnomidae             | indet.                    |        |        |        |        |        |        |
| Hydropsychidae        | Asmicridea sp3#           |        |        |        |        |        |        |
| Hydropsychidae        | Chematopsyche kakaduensis |        |        |        |        |        |        |
| Hydropsychidae        | Cheumatopsyche suteri     |        |        | 59     | 1      |        |        |
| Hydropsychidae        | Cheumatopsyche wellsae    |        |        |        |        |        |        |
| Hydropsychidae        | Cheumatopsyche indet.     |        | 21     |        |        |        |        |

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| Order/Class          |                           |        |        |        |        |        |        |  |
|----------------------|---------------------------|--------|--------|--------|--------|--------|--------|--|
| Family               | Genus and species         | Site 1 |        |        | Site 3 |        |        |  |
|                      |                           | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 |  |
|                      | sample no.                | 1      | 2      | 3      | 13     | 14     | 15     |  |
| Hydroptilidae        | Hellyethira cubitans (L)  |        |        |        |        |        |        |  |
| Hydroptilidae        | Hellyethira forficata (L) | 37     | 165    | 25     | 31     |        | 49     |  |
| Hydroptilidae        | Hellyethira forficata (P) |        |        |        |        |        |        |  |
| Hydroptilidae        | Hellyethira indet. (L)    |        |        |        |        |        |        |  |
| Hydroptilidae        | Hellyethira ramosa (L)    |        |        |        | 10     |        |        |  |
| Hydroptilidae        | Hellyethira ramosa (P)    |        |        |        |        |        |        |  |
| Hydroptilidae        | Hellyethira vernoni (L)   |        |        |        |        |        |        |  |
| Hydroptilidae        | Oxyethira indet. (L)      |        |        |        | 10     |        |        |  |
| Hydroptilidae        | Orthotrichia turrita      |        |        |        | 62     |        |        |  |
| Hydroptilidae        | Orthotrichia indet. (L)   | 21     | 185    | 49     |        |        | 49     |  |
| Hydroptilidae        | Orthotrichia indet. (P)   |        |        |        |        |        |        |  |
| Hydroptilidae        | indet. (L)                | 8      | 41     |        | 10     |        |        |  |
| Hydroptilidae        | indet. (P)                |        |        |        |        |        |        |  |
| Leptoceridae         | Leptorussa indet.         | 119    | 82     | 82     | 93     |        | 25     |  |
| Leptoceridae         | Oecetis epekeina          |        | 1      |        |        |        |        |  |
| Leptoceridae         | Oecetis spA#              |        |        |        |        |        |        |  |
| Leptoceridae         | Oecetis spE#              |        | 21     |        |        |        |        |  |
| Leptoceridae         | Oecetis indet.            | 8      |        | 16     | 82     |        | 25     |  |
| Leptoceridae         | Triaenodes indet.         |        | 21     |        |        |        |        |  |
| Leptoceridae         | indet.                    |        |        | 16     | 1      |        |        |  |
| Philopotamidae       | Chimarra spB #            |        |        |        |        |        |        |  |
| Polycentropodidae    | indet.                    |        |        |        |        |        |        |  |
| Triplectides         | ciuskus                   | 4      | 1      | 8      |        | 10     | 8      |  |
| Triplectides         | indet.                    |        |        |        | 10     |        |        |  |
| Acarina              |                           |        |        |        |        |        |        |  |
| Hydryphantidae       | indet.                    | 8      |        | 99     |        |        |        |  |
| Hygrobatidae         | Australiobates indet.     |        |        |        |        |        |        |  |
| Hygrobatidae         | indet.                    |        |        |        | 21     | 21     | 16     |  |
| Limnesiidae          | indet.                    | 45     | 82     | 41     | 31     | 10     | 8      |  |
| Mideopsidae          | indet.                    |        |        |        |        |        |        |  |
| Oribatida (suborder) | indet.                    |        |        |        |        |        |        |  |
| Oxidae               | indet.                    | 8      | 82     | 41     |        | 10     |        |  |
|                      |                           |        |        |        |        |        |        |  |

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| Ord  | ler/Class              |                          | 1995   |        |        |        |        |        |
|------|------------------------|--------------------------|--------|--------|--------|--------|--------|--------|
|      | Family                 | Genus and species        | Site 1 |        |        | Site 3 |        |        |
|      |                        |                          | Rep. 1 | Rep. 2 | Rep. 3 | Rep. 1 | Rep. 2 | Rep. 3 |
|      |                        | sample no.               | 1      | 2      | 3      | 13     | 14     | 15     |
|      | Torrenticolidae        | indet.                   |        |        |        |        |        |        |
|      | Unionicolidae          | indet.                   | 8      |        | 25     | 21     | 21     |        |
|      |                        | indet.                   |        |        |        |        |        | 8      |
| Dec  | apoda                  |                          |        |        |        |        |        |        |
|      | Atyidae                | Caridina gracilirostris  |        |        |        | 21     | 51     |        |
|      | Atyidae                | Caridinides wilkinsi     |        |        |        |        | 21     |        |
|      | Atyidae                | indet.                   | 4      |        |        |        |        |        |
|      | Palaemonidae           | Macrobrachium bullatum   |        |        |        |        |        |        |
|      | Palaemonidae           | Macrobrachium rosenbergi |        |        |        |        |        |        |
|      | Palaemonidae           | Macrobrachium indet.     |        |        |        | 10     |        |        |
|      | Palaemonidae           | indet.                   |        |        |        |        | 10     | 16     |
| Gas  | tropoda                |                          |        |        |        |        |        |        |
|      | Planorbidae            | Amerianna indet.         |        |        |        |        |        |        |
| Nen  | natoda                 | indet.                   |        |        |        |        |        |        |
| Olig | ochaeta                |                          |        |        |        |        |        |        |
|      | Enchytraeidae          | indet.                   |        |        |        | . :    |        |        |
|      | Naididae               | indet.                   |        | 21     |        |        | 41     |        |
|      | Tubificidae            | indet.                   |        |        |        |        | 41     |        |
|      | Magadrili (superorder) | indet.                   |        | 23     |        | 10     |        |        |
|      |                        | indet.                   |        |        |        |        |        |        |
|      | indet = indeterminate  |                          |        |        |        |        |        |        |

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