A Compendium of Ecological Information on Australia's Northern Tropical Rivers

REPORT 6

Aquatic macroinvertebrates

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1 Introduction

The major purpose of the TRIAP sub-project 1 was to undertake a multiple-scale inventory of the habitats and biota of the rivers within Land & Water Australia's program area for the Tropical Rivers funding program. This information would then form the basis upon which to make an initial assessment of the diversity, status and ecological value of aquatic ecosystems across the region. This inventory was to be undertaken using the multiple-scale model for inventory supported by the Ramsar Wetlands Convention and being applied in the Alligator Rivers Region (eg Finlayson et al 2005).

Outputs from TRIAP sub-project 1 were to include habitat typologies based upon water quality, geomorphic and hydrological attributes of stream sites and reaches. Linkage between these typologies and the biota of the rivers was also sought, as a basis and framework for understanding the habitat requirements of aquatic biota and for prediction of the possible occurrence of specific biota and habitats within previously unsurveyed areas (– acknowledging that such modelling cannot be used as a substitute for additional future survey effort).

Aquatic macroinvertebrates are ideal candidates for multi-scalar study, the inventory and assessment model being applied in the broader TRIAP Project. In particular (ANZECC & ARMCANZ 2000):

1. Macroinvertebrates have inherent and traditional virtues for use in monitoring and assessment of environmental quality; and
2. National protocols and guidelines are available that provide for:
   (i) broad-scale (catchment or regional, relatively coarse) river health assessments, to
   (ii) more detailed, site-specific assessments, with respective increase in taxonomic resolution and quantification.

In relation to 2(i), broad-scale, rapid assessment using stream macroinvertebrates in Australia is currently being provided by AUSRIVAS, the Australian River Assessment Scheme (Davies 2000), described in more detail below. Because databases for AUSRIVAS provide extensive and often intensive coverage for the catchments being investigated under TRIAP, they provided the basis for examining additional monitoring potential (over that already undertaken by respective agency custodians) as well as potential linkages to environmental typologies developed in the other TRIAP projects. The following descriptions report on these results, including other aspects of the multi-scalar approach listed in 2 above.

2 Broad-scale river health assessments: An analysis of AUSRIVAS data from wet-dry tropical Australia

AUSRIVAS, the Australian River Assessment Scheme (AUSRIVAS), was developed under Australia's National River Health Program as a national, standardised tool to assess the health of inland riverine environments using the resident macroinvertebrate community (Davies, 2000). Predictive models have been developed for State and Territory agencies of macroinvertebrate community composition expected at a site in the absence of human-related disturbance. Assessment of stream 'health' may then be made based upon an Observed/Expected taxa number ratio. Because AUSRIVAS models are based upon family-level, presence-absence data (only) and unreplicated (at a site) sampling, they are regarded as a relatively coarse, broad-scale screening tool (for 'rapid assessment') (ANZECC & ARMCANZ 2000).

AUSRIVAS bioassessment data were assessed in two ways for TRIAP: (i) evaluating the potential to derive wet-dry tropical AUSRIVAS models, with possible improved precision and resolution with the artifices of jurisdictional boundaries removed (— currently models have been developed for separate states and territory, or regions therein); and (ii) seeking links between macroinvertebrate data and corresponding environmental data, including hydrology, habitat, geomorphic classification and water quality datasets of the respective stream sites (a key objective of the broader TRIAP program).

For examination of environmental relationships between macroinvertebrate and environmental data (i.e. (ii) from above), NT AUSRIVAS data for the Daly River as well as WA agency data, were used. The Daly River in the NT was the subject of other intensive TRIAP investigations that sought to derive hydrological and geomorphic typologies for the catchment. Genus and family-level AUSRIVAS data have also been acquired for a large number of sites in the catchment and so the collective information provided a potentially useful basis for seeking linkages between macroinvertebrate data and these environmental typologies. The WA agency data were selected as exemplary of another bioregion in the TRIAP study area.

2.1 Methods

2.1.1 Data compilation

Family-level (and for NT, some genus-level) data were acquired from WA, NT and QLD agencies, as well as from ERIN, for wet-dry tropical streams of the study area (see section 3.1 for contact details). For the wet-dry tropics, agencies have collected in two seasons, early and late dry seasons. For the purposes of examining a reasonably standardised dataset from across northern Australia, AUSRIVAS data, mostly from the period 1998-2000, were selected and combined for early dry season, edge (QLD, NT) or channel (WA) habitat. ('Channel' habitat was the most similar of the WA habitats sampled to the NT and QLD's 'edge' habitat.) Data gathered after 1996 were regarded as better quality than those gathered in the early years of AUSRIVAS development (1994-1996) (see Humphrey & Thurtell 1997). The resulting dataset comprised 73 WA sites, 155 NT sites and 95 QLD sites – see Figure 1 and Appendix 1 for site details. These data have been entered into the spatially-related database being used for the TRIAP.

For the dataset examined in this study, sampling and sample processing methods were generally consistent within each state/territory and respective agency (but not between agencies – see below). The exception to this was the dataset from WA. Of the 73 WA sites, data from 61 of these were derived from 1998, 11 from 1996 and one from 1995. The 1995 and 1996 samples were incorporated because the relevant sites were not sampled in 1998. Samples collected in the 1995-1996 period were subsampled and sorted in the laboratory whereas the 1998 samples were live-sorted in the field.

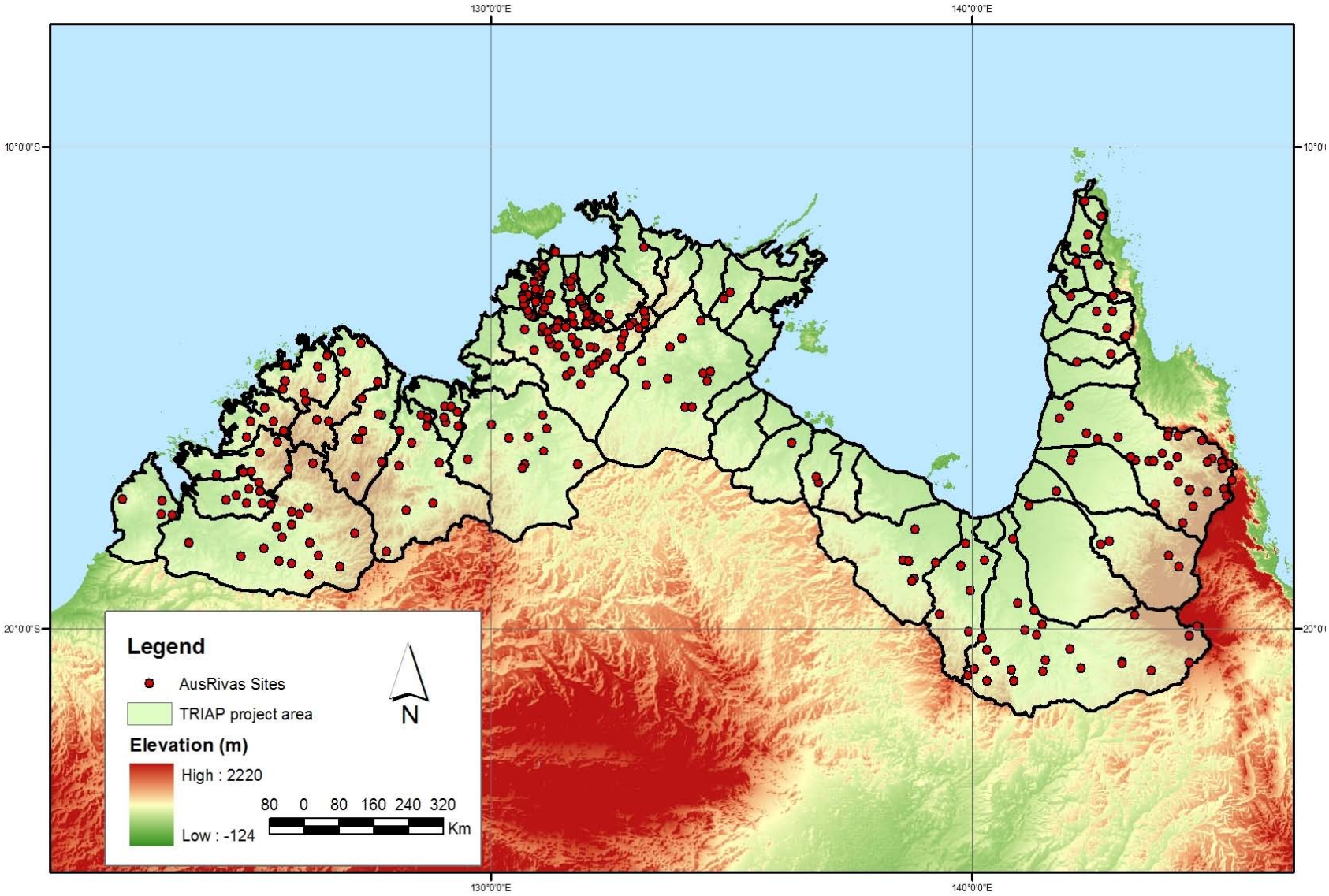

Figure 1. Map of TRIAP river catchments and associated AUSRIVAS sites examined in this study.

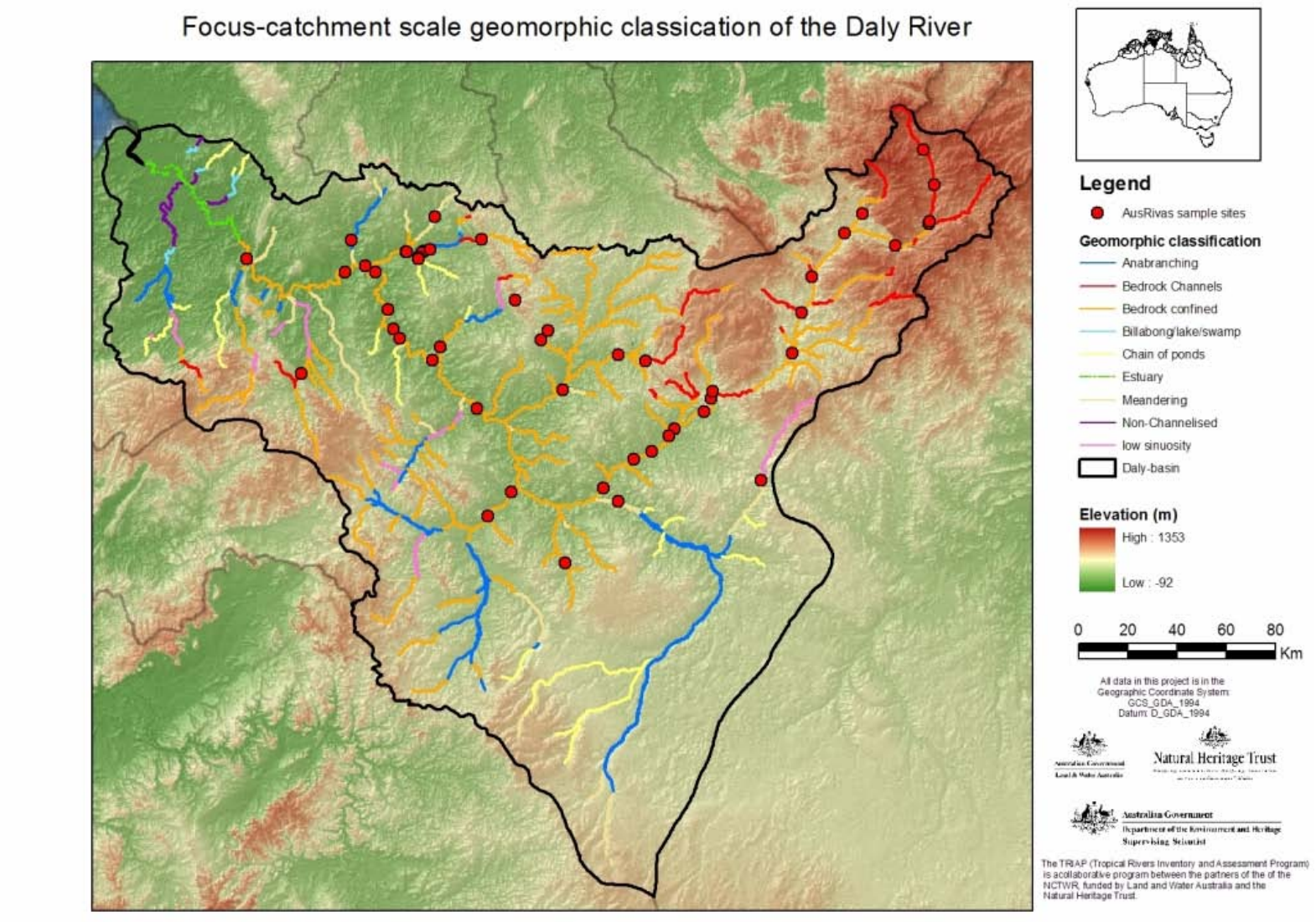

Figure 2. Map of Daly River AUSRIVAS catchment sites and associated TRIAP geomorphic classification assigned to streams in the catchment

2.1.2 Analyses conducted on agency AUSRIVAS data

Single or combined agency datasets were analysed using multivariate procedures from the PRIMER (v6) software package (Clarke & Gorley 2006). Either abundance or presence-absence data were used in analyses (indicated). Four levels of multivariate analysis were applied to the data:

1. Describing pattern amongst the assemblage data using cluster and ordination techniques: The basis of these analyses was Bray-Curtis similarity matrices performed on presence-absence or log(X+1) transformed data. The *clustering technique* used a hierarchical agglomerative method where samples of similar assemblages are grouped and the groups themselves form clusters at lower levels of similarity. A group average linkage was used to derive the resultant dendrogram. The *ordination method* used was Multi-Dimensional Scaling (MDS) (Clark & Warwick 2001). Ordinations were depicted as two-dimensional plots based on the site-by-site similarity matrices.

2. For *a priori* groupings (e.g. states and territory), Analysis of Similarity (ANOSIM) – effectively an analogue of the univariate ANOVA – was conducted to determine if groups were significantly different from one another. The ANOSIM test statistic reflects the observed differences *between* groups (state/territory) with the differences amongst replicates *within* the groups. The test is based upon rank similarities between samples in the underlying Bray-Curtis similarity matrix.

3. The SIMPER routine was used to examine which taxa were contributing to the differences in state/territory groups that the ANOSIM procedure revealed to be significantly different, or otherwise were found to be separated in cluster or ordination analyses.

4. The relationship between environmental and macroinvertebrate data was assessed in two ways:

    a. For visualization, the numeric value of key environmental data were superimposed onto MDS ordinations, as circles of differing sizes – so called ‘bubble plots’.

    b. The BIOENV routine was used to calculate the smallest subset of environmental variables explaining the greatest percentage of variation in the ordination patterns.

    The BIOENV routine was applied to WA agency and NT Daly River catchment data. The environmental data sets comprised locational, water physico-chemistry, sediment/substrate characteristics and/or habitat descriptors of the sampling sites. These variables are standard requirements for measurement in the WA and NT agency AUSRIVAS protocols and are listed in Appendices 2 and 3 for NT and WA respectively. Additional TRIAP variables incorporated in the analyses were:

    (i) For NT Daly River catchment study, a focal catchment geomorphic code derived from the study by Saynor et al (2007). For the purposes of this analysis, one of six geomorphic classes from that study was assigned (from GIS) to each site, the numeric code (1-6), increasing in response to reduced stream power, thus:

Geomorphic class	Geomorphic description
1	Bedrock channel
2	Bedrock confined
3	Anabranching
4	Low sinuosity
5	Meandering
6	Chain of ponds

Figure 2 shows the Daly River catchment sites in relation to the focal catchment geomorphic codes.

(ii) For NT Daly River catchment study, a focal catchment hydrological code derived from the study by Moliere (2007). One of four hydrological classes from that study was assigned (from map overlays) to each site, the numeric code (1-4) increasing in response to greater seasonality and intermittency of stream flow, thus:

Hydrological class	Flow description
1	Perennial
2	Seasonal
3	Dry seasonal
4	Seasonal-intermittent

(iii) For WA, a broad, continental-scale geomorphic code derived from the study by Saynor et al (2007). One of six geomorphic classes from that study was assigned (from GIS) to each site, the numeric code (1-6) (as for the focal catchment classification conducted on NT Daly data) increasing in response to reduced stream power, in turn, corresponding approximately to upland to increasing lowland position in the catchment, thus:

Geomorphic class	Geomorphic description
1	Bedrock channel
2	Bedrock confined
3	Rolling alluvial
4	Undulating alluvial plain
5	Level alluvial plain
6	Lakes/swamps

BIOENV produces similarity matrices of the environmental variables, selecting those that "best explain" patterns in the biological community data. In particular, the procedure takes combinations of the environmental variables, *k* at a time, and derives the best matches of biological and environmental similarity matrices for each *k*, as measured by (in this case) Spearman rank correlation. The routine performs best on a relatively small environmental data set and to this end, it is preferable to eliminate as many correlated variables as possible. A subset of variables from those listed in Appendices 2 and 3 was selected. For these analyses, data were log (X+1) transformed except for pH, log of catchment area (NT Daly) and any categorical or percentage variables. Cross-correlations amongst the environmental data were conducted using PRIMER. Where a correlation coefficient was higher than 0.9 and there was a sound technical explanation for the high correlation, then one or more of the (redundant) variables was eliminated from the data set. This analysis showed the following correlations and redundant variables for NT Daly and WA data sets:

Correlated variable(s) to be eliminated from NT Daly data set:

- Catchment area (correlated with Distance from source),
- Logarithm of catchment area (correlated with Stream order),
- Range of elevation (correlated with Standard deviation of elevation),
- Riparian rainforest in 250, 500 & 1000 m radius (correlated with Riparian rainforest in 100 m radius),

- Spring rainforest in 250, 500 & 1000 m radius (correlated with Spring rainforest in 100 m radius) and
- Total rainforest in 250, 500 & 1000 m radius (correlated with Total rainforest in 100 m radius)

Correlated variable(s) to be eliminated from WA data set:

- $N\text{-}NH_3$ and $N\text{-}NO_3$, (correlated with total N),
- Surface DO (correlated with bottom DO),
- Submerged macrophyte density (correlated with % submerged macrophyte cover within habitat),
- Detritus density (correlated with % detritus cover within habitat), and
- Floating macrophyte density (correlated with % floating macrophyte cover within habitat).

Unless indicated above, default values or procedures recommended in the PRIMER (v6) User Manual (Clarke & Gorley 2006) were employed for PRIMER routines. For BIOENV, environmental variables were normalised prior to analysis.

2.2 Potential for development of unified, wet-dry tropical AUSRIVAS models

MDS ordination was conducted on the combined agency data set using presence-absence data. In a two-dimensional ordination (but with high stress), NT sites generally grouped separately from QLD and WA sites, the latter two state sites tending to group together (Figure 3). ANOSIM results confirmed the moderately to strongly significant separation of NT sites from both WA and QLD sites (Table 1). These observation were generally supported by the corresponding classification (Figure 4) where the great majority of sites were contained in two large clusters separated at a similarity of ~55%: one cluster (115 sites) containing, almost exclusively, NT sites while the other (159 sites) contained a mix of QLD (71), WA (56) and remaining NT (32) sites. The former large NT group was further divided into two discrete groups (indicated). On closer examination, the two NT groups were generally associated with ‘high’ (Group 1) and ‘low’ (Group 2) alkalinity stream waters (see section 2.2.1).

The separation of NT macroinvertebrate samples from QLD and WA may be related to subtle differences in habitat sampled, artefacts of sample sorting methods, real zoogeographical differences across northern Australia, or a mix of any of these factors.

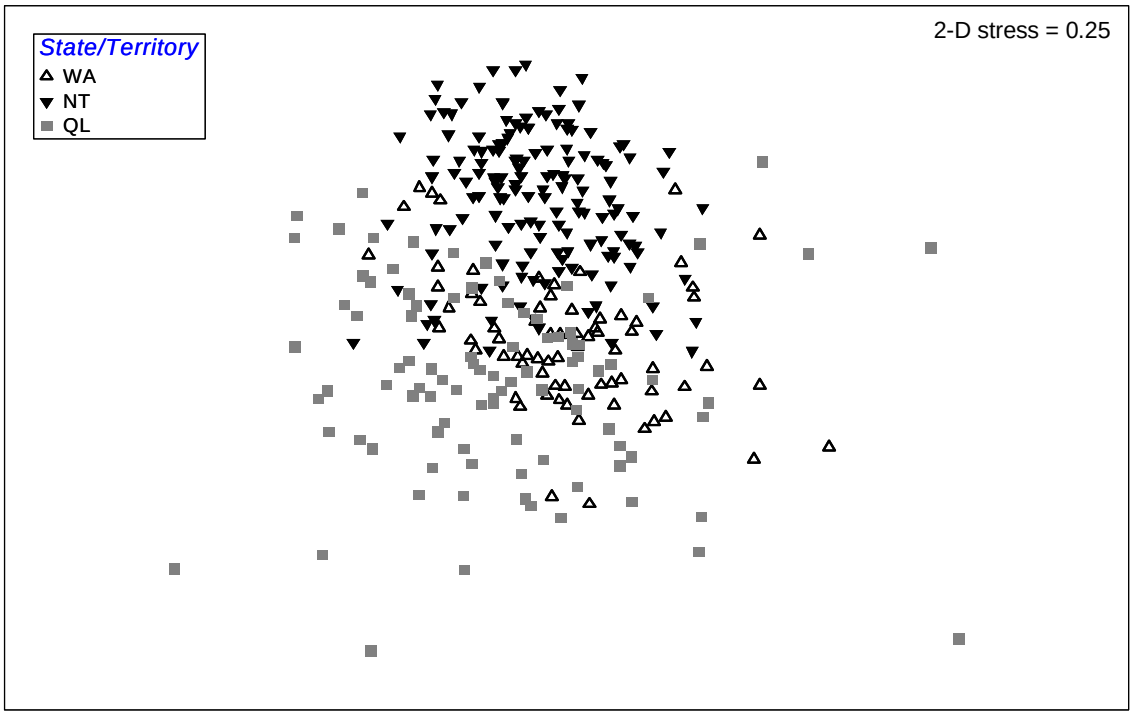

Figure 3. MDS ordination analysis of AUSRIVAS presence/absence data from wet-dry tropical streams, early dry season, edge/channel habitat

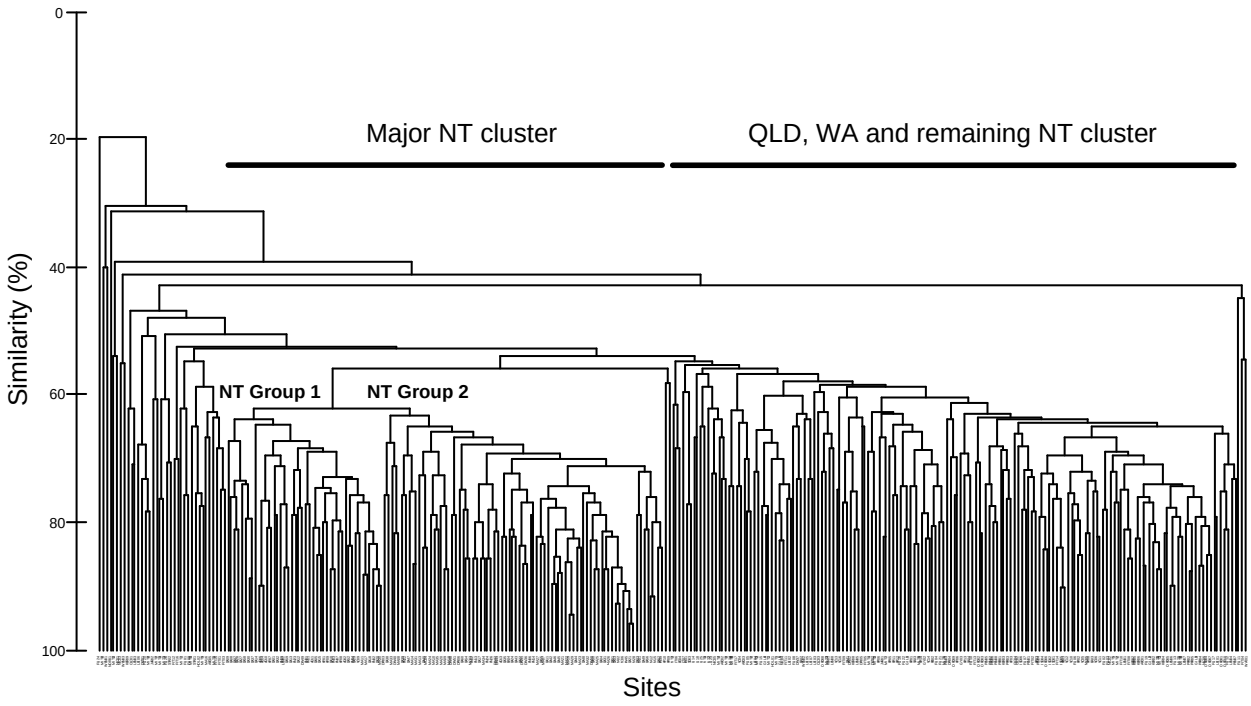

Figure 4. Cluster analysis of AUSRIVAS presence/absence data from wet-dry tropical stream, early dry season, edge/channel habitat

Table 1. **ANOSIM on AUSRIVAS macroinvertebrate compositional (presence-absence) data for the three different States and Territory, giving the significance of the overall test (significance level of sample statistic), and significance of each pairwise State/Territory comparison (significance level %), with degree of separation between groups (R-statistic), where R-statistic > 0.75 = groups well separated, R-statistic > 0.5 = groups overlapping but clearly different, and R-statistic < 0.25 = groups barely separable. A significance level < 5% = significant effect/difference.**

Sample statistic (Global R): 0.415; **Significance level of sample statistic**: 0.1%

Groups	R Statistic	Significance level (%)
WA, NT	0.472	0.1
WA, QL	0.078	0.1
NT, QL	0.512	0.1

The SIMPER routine was used to elucidate possible causes of this separation by examining which taxa were contributing to the differences amongst state/territory agencies in the cluster and ordination analyses. SIMPER results are shown in Table 2 by way of (i) the average dissimilarity between all pairs of inter-group samples, (ii) lists of dominant taxa (10), in decreasing order of importance, in contributing to the average dissimilarity between two groups, and (iii) the cumulative percentage of overall dissimilarity (capped at 90%) contributed by these dominant taxa.

The results of the SIMPER analysis showed that the NT separation from WA and QLD was due primarily to greater proportions in the NT samples of the taxa Orthocladiinae (Chironomidae), Elmidae, Hydroptilidae, Ecnomidae and Oligochaeta, and lower proportions in the NT samples of Hydrophilidae, Coenagrionidae, Libellulidae, Notonectidae, Corixidae, Gerridae, Veliidae and Gomphidae (Table 2). This separation coincides closely with those taxa known to be better represented in laboratory processed (NT) and live-sorted (WA and QLD) macroinvertebrate samples respectively (Humphrey & Thurtell 1997). The former taxa are small and cryptic while the latter are more often large and uncommon in samples with a small probability of being included in laboratory subsamples (unless a dedicated ‘large-pick’ method is employed in the laboratory to recover these taxa).

To examine this potential confounding issue of sample processing method more closely, the data from the 73 WA samples, comprising 61 live-sorted samples from 1998 and 11 laboratory-sorted samples from 1995 and 1996 (with no sites common to all years), were analysed separately. If community composition of samples was affected by sample processing method, an MDS ordination of the data, as well as associated ANOSIM and SIMPER analysis, should reflect a similar separation to those described above for the combined-agency analysis. The resulting ordination (based upon presence-absence data, and with high stress, Figure 5), showed no such separation and the associated ANOSIM, not surprisingly, was not significant (Global R, 0.084; $P > 0.1$). The associated SIMPER analysis is shown in Table 2; these results do not support the same findings of the combined-agency analysis, with field and laboratory sample processing methods having roughly equal probability of recovering greater proportions of taxa normally associated with better recovery in the opposing processing method.

Nevertheless and despite some ambiguity, an early conclusion arising from the analysis of combined agency AUSRIVAS data is that the group separation is not inconsistent with a confounding influence of differences in sample processing methods adopted by the different agencies. This possibility throws into question any further results conducted on combined agency data.

Table 2. SIMPER results for 10 most influential taxa discriminating State-Territory AUSRIVAS sites. Summary statistics are explained in the text. Emboldened taxa in the right column are taxa dominant in (i) NT for respective state comparisons, (ii) WA in the WA-QLD comparison, or (iii) WA field live sort in the WA field live sort-laboratory sort comparison.

Group comparison and summary statistics	Dominant taxa in descending order contributing to separation of groups
NT, WA	Hydrophilidae, **Orthocladiinae**, Notonectidae, **Elmidae**, **Hydroptilidae**, Corixidae, Coenagrionidae, Gerridae, **Ecnomidae**, Libellulidae
Average inter-group dissimilarity (%)	45.5
Cum. % of overall dissimilarity [A] contributed by dominant taxa	32.0
NT, QLD	Libellulidae, **Ecnomidae**, **Hydroptilidae**, Coenagrionidae, **Orthocladiinae**, Hydrophilidae, **Lumbricidae/Oligochaete**, Veliidae, **Elmidae**, Corixidae
Average inter-group dissimilarity	49.9
Cum. % of overall dissimilarity [B] contributed by dominant taxa	32.4
WA, QLD	**Notonectidae**, Veliidae, **Lumbricidae/Oligochaete**, **Gerridae**, **Pleidae**, Palaemonidae, Libellulidae, Coenagrionidae, Gomphidae, **Hydraenidae**
Average inter-group dissimilarity	45.1
Cum. % of overall dissimilarity [B] contributed by dominant taxa	28.3
WA field live sort, WA laboratory sort	Hydraenidae, **Gerridae**, **Ecnomidae**, **Palaemonidae**, **Coenagrionidae**, **Lumbricidae/Oligochaete**, Libellulidae, **Gomphidae**, Nepidae, Pleidae
Average inter-group dissimilarity	40.8
Cum. % of overall dissimilarity [B] contributed by dominant taxa	29.6

[A] Overall dissimilarity is cut off at 90%

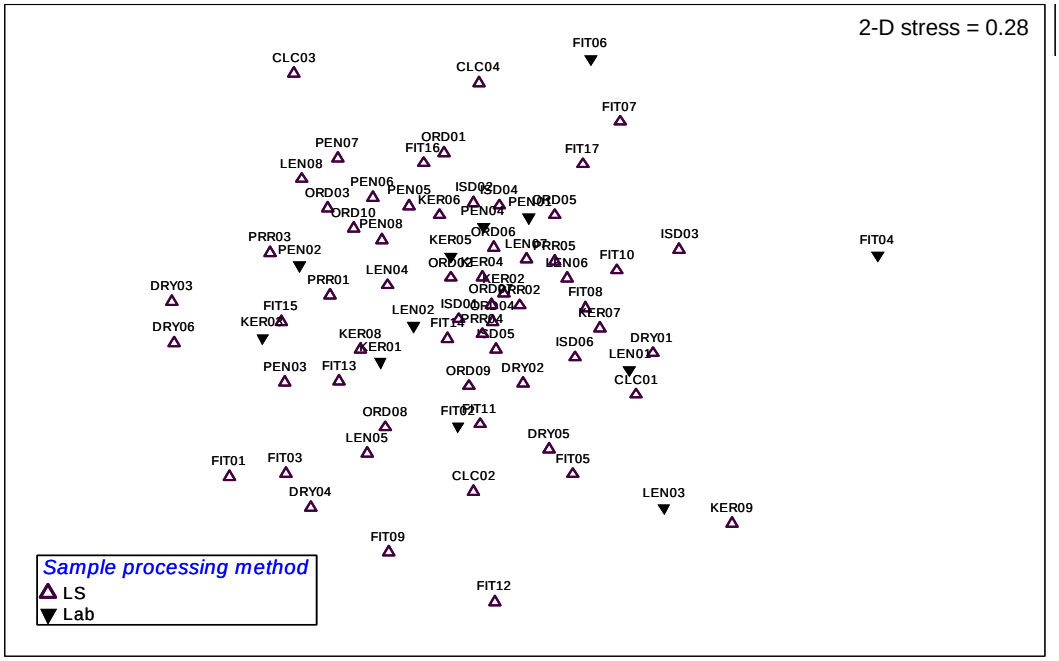

Figure 5. MDS ordination analysis of AUSRIVAS presence/absence data from WA samples processed by different sample processing methods: LS = field live sorted method and Lab = laboratory processed method

2.2 Relationships between macroinvertebrate communities and environmental variables

2.2.1 Analyses conducted on NT Daly River data (AUSRIVAS, genus-level)

Analysis of genus-level NT data was conducted with a particular focus on determining whether patterns in macroinvertebrate communities were reflected in corresponding hydrology, water quality data and geomorphic classifications. Data from 50 Daly River catchment sites were examined for this analysis. Analysis at the lower, genus taxonomic level has the advantage of providing, potentially, better resolution and sensitivity to environmental gradients that may be present in the data.

NT AUSRIVAS data are derived from a quantitative, laboratory sample processing method and so ordination and cluster analyses were conducted on log transformed abundance data. The classification plot is shown in Figure 6; associated environmental data were examined to explain pattern in the clusters. Two major groups were defined at a similarity of ~43%: one cluster containing mostly sites of permanent stream flow, the other containing mostly sites of seasonal flow. Within the cluster of sites of permanent flow, a further division was evident of sites of generally low (upland) and high (lowland) alkalinity (Figure 6). These results are generally consistent with the findings of Dostine (2000) who analysed a similar – but not identical – dataset and configuration of Daly River sites using species-level data. Dostine (2000) identified four major classification types based upon macroinvertebrate composition (presence-absence data): (i) perennial-flow, lowland sites of high alkalinity, (ii) perennial-flow, upland sites of low alkalinity, (iii) seasonal-flow, upland sites of low alkalinity, and (iv) sites from small streams of seasonal flow or pools of larger streams.

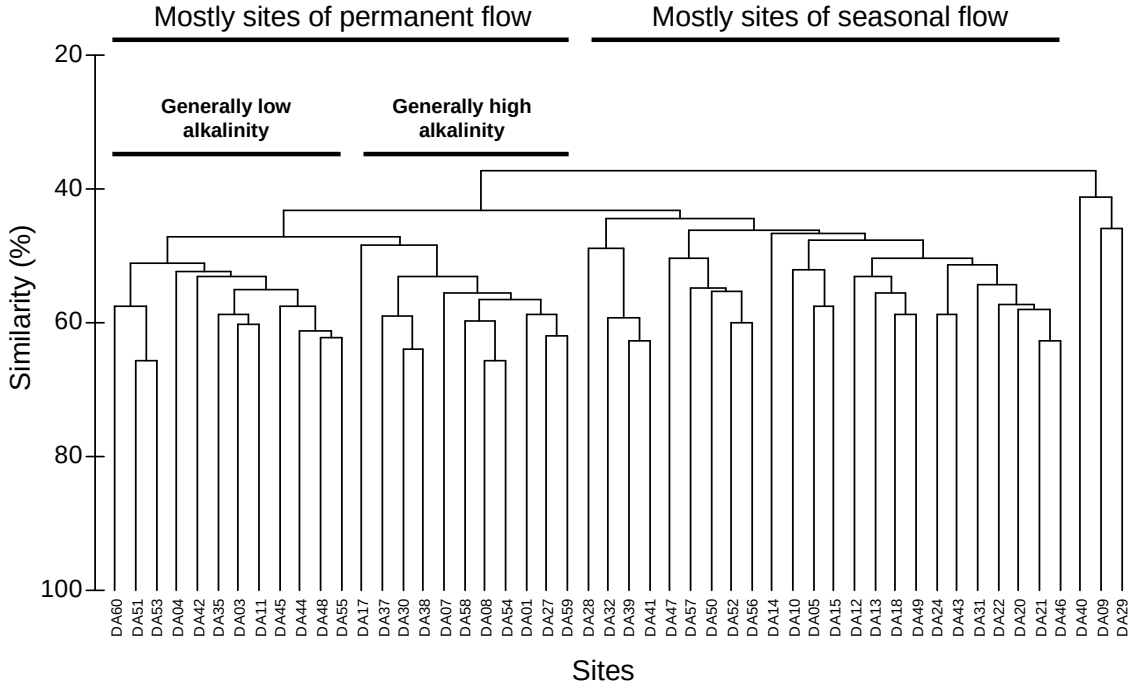

Figure 5. Cluster analysis of AUSRIVAS log(X+1) data from the Daly River catchment, early-mid dry season, edge habitat

Relationships between environmental and macroinvertebrate community data from Daly catchment sites were sought using BIOENV. The best five BIOENV results between environmental and community structure data are shown in Table 3. Day number, alkalinity, average stream velocity and rainforest in some form, are consistently included in these best

five results. The inclusion of day number could imply either temporal confounding and sampling artefacts present in the data (especially changes in macroinvertebrate communities associated with flow reduction over the 68-day period of early dry season sampling) or could simply reflect coincidental sampling of sites of different flow status (e.g. permanent versus seasonally-flowing) at different stages of the recessional flow period.

Table 3. Best 5 BIOENV results between environmental and genus-level macroinvertebrate community data from the Daly River catchment (log (X+1) data).

Spearman rank correlation (p)	Variable combinations
0.379	Day number, Stream order, Alkalinity, Average stream velocity, Total rainforest in 1000m radius
0.374	Longitude, Day number, Alkalinity, Average stream velocity, Total rainforest in 1000m radius
0.373	Day number, Alkalinity, Average stream velocity, Spring rainforest in 100m radius, Riparian rainforest in 500m radius
0.372	Day number, Stream order, Alkalinity, Average stream velocity, Spring rainforest in 100m radius
0.370	Day number, Alkalinity, Average stream velocity, Riparian rainforest in 500m radius, Total rainforest in 1000m radius

The inclusion of riparian rainforest in the BIOENV results (Table 3) could suggest that this variable is simply a surrogate of stream permanence. For the two measures of hydrology included in the analyses, average stream velocity and the TRIAP hydrological code, correlation (R) values (section 2.1.2) amongst measures of rainforest and average stream velocity ranged between 0.00 and 0.13 and for measures of rainforest and the TRIAP hydrological code, between 0.08 and -0.53. Thus while there is some correlation between measures of rainforest and increasing stream permanence (albeit not strong), rainforest presence, *per se*, appears to contribute habitat or other features (e.g. shade, allochthonous inputs, root structure) that influence macroinvertebrate communities, independent of flow status of the stream at the particular site.

Bubble plots were constructed to show the relationship between Daly catchment macroinvertebrate communities and associated alkalinity, average stream velocity and total rainforest cover in a 1000 m radius of the site (Figure 7). It is evident that macroinvertebrate communities are influenced on the X axis (left to right) by increasing average stream velocity and along the Y axis (bottom to top) by increasing alkalinity and, to a lesser extent, greater rainforest cover around the sites. During the dry season, significant groundwater discharges occur into the Daly River along its middle reaches via numerous springs in the channel bed and banks. This groundwater gives the river in this region both its perennial status and high alkalinity (eg Rea et al 2002). Apart from the Daly River, dry season flow, maintained by groundwater discharge, also occurs in parts of the Katherine and Flora Rivers. Sites of low average stream velocity occur in seasonally-flowing streams of the catchment and (presumably) in large, wide pools of the Daly River itself (despite the perennial nature of the River).

Further discussion on relationships between environmental variables and macroinvertebrate communities of the Daly River catchment is provided in section 2.2.3.

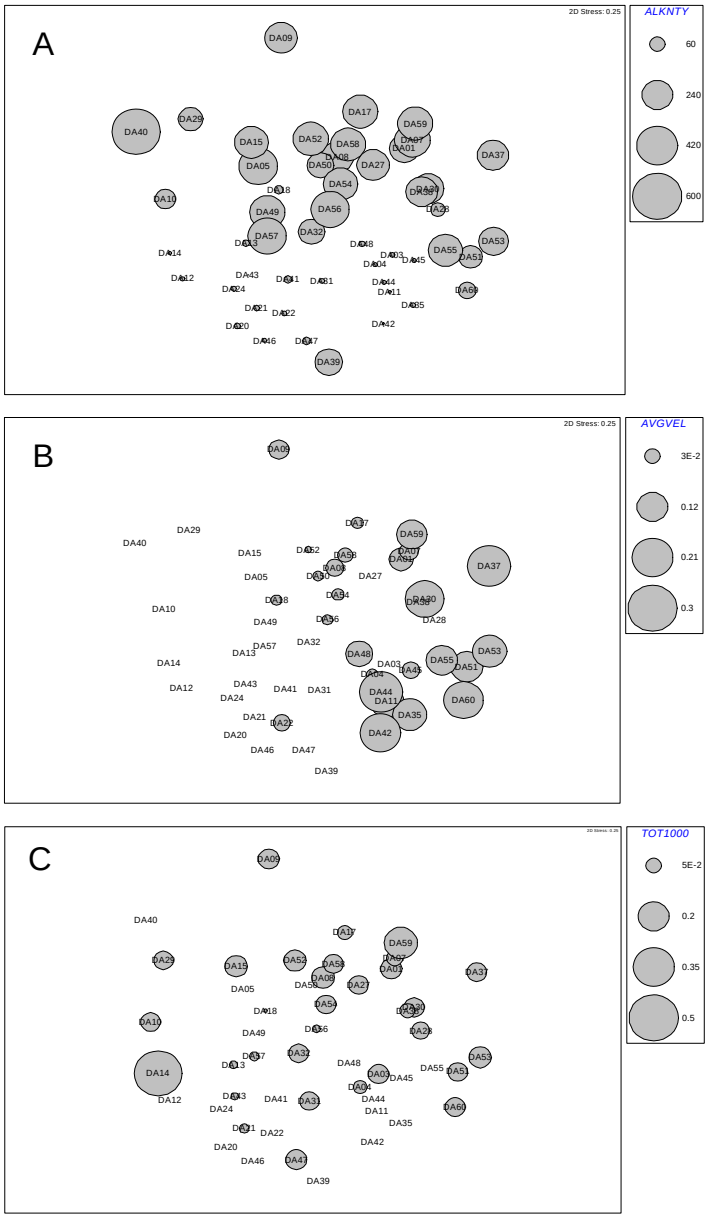

Figure 7. MDS ordinations of AUSRIVAS log(X+1) data from the Daly River catchment, early-mid dry season, edge habitat, superimposed by bubble plots of environmental variables correlated with macroinvertebrate community structure, thus: A, alkalinity of stream waters; B, average stream velocity at the site; and C, total rainforest cover in a 1000 m radius of the site.

2.2.2 Analyses conducted on WA AUSRIVAS family-level data

Relationships between environmental and macroinvertebrate family-level data from the 73 Kimberley sites were examined using BIOENV. Environmental variables consistently represented amongst the best 5 BIOENV results for macroinvertebrate presence-absence and abundance data are shown in Table 4. Of note, only electrical conductivity was recovered as an environmental variable common to both macroinvertebrate presence-absence and abundance data. This observation and the comparatively low correlation observed between environmental and biological data (0.23-0.3, Table 4) suggests lack of strong patterns in macroinvertebrate communities associated with environmental gradients in this Kimberley region.

Further discussion on relationships between environmental variables and macroinvertebrate communities of the Kimberley region of WA is provided below (section 2.2.3).

Table 4. Environmental variables consistently represented amongst best 5 BIOENV results between environmental and family-level macroinvertebrate community data from WA Kimberleys, presence-absence and abundance (log (X+1) data.

Spearman rank correlation (p)	Variable combinations
Presence-absence	
0.229	Mean annual discharge category, TRIAP geomorphological code, electrical conductivity, % detritus cover in habitat
Abundance	
0.295	Latitude, electrical conductivity, soluble reactive phosphorus

2.2.3 Summary of relationships between macroinvertebrate communities and environmental variables in TRIAP catchments

From BIOENV analysis conducted on data from the Daly River catchment, the main environmental factors defining macroinvertebrate groupings were hydrologically and chemically based. There was little correspondence between 6 over-lapping geomorphic classification groups derived for the Daly catchment from the TRIAP study of Saynor et al (2007) and the macroinvertebrate groups identified in this study and that of Dostine's (2000) earlier study. For example, while one of the two major macroinvertebrate clusters from Figure 6 assigned as 'permanent flow' was further divided into low and high alkalinity groups, in geomorphological terms there was little distinction in this collective of sites with 78% of the sites being defined as "bedrock confined channel". Thus, in this example the geomorphic classification subsumes real biological separation and pattern.

BIOENV found that the TRIAP continental-scale geomorphic classification was significantly correlated with family-level macroinvertebrate community data from the WA Kimberleys. However, the associated correlation was weak and, further, was not evident in the analysis of associated abundance data (Table 4).

While a separate TRIAP project has examined hydrological patterns and features of focus catchments for the TRIAP study region (Moliere 2007), the use of these results in better accounting for observed macroinvertebrate patterns is limited. Thus while pattern of stream flow (perennial versus seasonal) has been shown to be important in characterising macroinvertebrate communities in the Daly River catchment (Figure 5), the hydrology typology derived in the study by Moliere is derived from data from a relatively small number of gauging stations and hence has very limited capacity for interpolating or extrapolating stream flow and associated patterns elsewhere in the catchment. Records of stream flow collected at the time of macroinvertebrate sampling are most useful for this purpose.

General relationships between macroinvertebrate communities and environmental variables

Table 5 provides a summary of studies that have examined the relationship between macroinvertebrate communities from TRIAP streams sampled in the early (to mid) dry season (or Autumn for whole-state or large-scale AUSRIVAS models) and associated environmental conditions at the sites. A number of observations may be made:

Table 5. **Summary of studies that have examined the relationship between macroinvertebrate communities sampled in the early (to mid) dry season (or Autumn for whole-state or large scale AUSRIVAS models) and associated environmental conditions at the sites.**

State/territory, region and habitat	Nature of macroinvertebrate data	Reference / information source	Multivariate method linking macroinvertebrate and environmental data	Environmental variables associated with macroinvertebrate data
NT; Daly R; edge habitat	Species-level, presence-absence	Dostine (2000)	PCC, PATN (Belbin 1995)	Top 5 in descending order of importance: Alkalinity, filtered reactive P, electrical conductivity, maximum stream velocity, average stream velocity
NT; Daly R; edge	Genus-level, abundance	This study	BIOENV, PRIMER	Day number, stream order, alkalinity, average stream velocity, total rainforest in 1000m radius
NT; Darwin-Daly; edge	Genus-level, presence-absence	AUSRIVAS website (http://ausrivas.canberra.edu.au/)	Stepwise Multiple Discriminant Function Analysis (MDFA)	Distance from source, stream order, average stream width, alkalinity, average stream velocity, standard deviation of elevation, riparian rainforest in 100 m radius
NT; Darwin-Daly; edge	Family, presence-absence	AUSRIVAS website	MDFA	Latitude, longitude, average stream width, riparian rainforest in 500 m radius
NT; Top End streams; edge	Family, presence-absence	Dostine (2002)	PCC, PATN	Top 5 in descending order of importance: Latitude, week number, catchment area, average stream velocity, altitude,
WA; Kimberley; channel	Family-level, abundance	This study	BIOENV, PRIMER	Latitude, electrical conductivity, soluble reactive phosphorus
WA; Kimberley; channel	Family-level, presence-absence	This study	BIOENV, PRIMER	Mean annual discharge category, TRIAP geomorphological code, electrical conductivity, % detritus cover in habitat
WA; Pilbara, Gascoyne & Kimberley; channel	Family-level, presence-absence	Kay et al (1999)	PCC, PATN	Top 5 in descending order of importance: Latitude, temperature, longitude, electrical conductivity, algal density
WA (entire state); channel	Family-level, presence-absence	AUSRIVAS website; Halse et al (2002)	MDFA	Latitude, average annual rainfall, mean stream width (log10), longitude, substrate particle size index
QLD; Western (inland and Gulf-draining rivers); edge	Family, presence-absence	AUSRIVAS website	MDFA	Latitude, stream order, mean wet season monthly rainfall, range in dry season monthly rainfall means, percentage rainfall in wet season, mean daily min temperature.

(i) For the relatively small-scale, NT Daly or Darwin-Daly analyses conducted on species and genus-level data, distinct biological pattern was revealed and was found to be associated mainly with stream water chemistry and local hydrological conditions;

(ii) Some association between macroinvertebrate communities and water quality (viz conductivity) was evident in Kimberley streams but, as discussed above, these relationships are rather weak. This supports the conclusions of Kay et al. (1999) who, in an analysis of northern WA macroinvertebrate data, suggested a lack of major geographic and climatic barriers in this part of WA was responsible for the relatively weak patterns in associated biota.

(iii) For the two broad-scale analyses conducted, i.e. all of WA and western QLD (Table 5), distinct zoogeographic separation of macroinvertebrate communities is evident, attested to by the inclusion of latitude and longitude (WA) as predictor variables, as well as rainfall patterns (QLD) that distinguish gulf-flowing streams from western flowing streams. (See also Smith et al (1999) who also list taxa unique to either northern or southern WA regions.) This is evident to some extent as well in the northern WA analysis.

3 Macroinvertebrate inventory records for assessments at specific sites and/or for conservation & biodiversity importance

3.1 Meta-data summary of macroinvertebrate species-level data available for Australia's wet-dry tropical streams

At the outset of this TRIAP project, the major objective of the second inventory component, assessments at specific sites and/or for conservation & biodiversity importance, was to acquire species-level data from the several wet-dry tropical streams for which such information was available, as well as acquire other taxonomic information from specialists and national databases. Early in the project, however, it quickly became apparent that it would be impractical to extract and compile macroinvertebrate species-level data from northern Australian streams because of (i) the enormity of the task (involving thousands of species), and (ii) issues associated with data custodianship and ownership that would take excessive time and resources to resolve. Instead, the approach has been to carry out extensive consultations to compile meta-data descriptions of macroinvertebrate species-level data available for Australia's wet-dry tropical streams. The meta-descriptions are designed to assist others, in future, source and compile species-level data should this need be identified, prioritised and adequately resourced.

A number of government agency staff and other specialists from the Commonwealth, states and Territory were consulted in acquiring inventory information. Information was forthcoming from: Bruce Gray, Cameron Slatyer & Alice Wells (DEW), Peter Dostine and Gisela Lamche (NT NRETA), Andrew Storey (UWA), Holly Smith (WA CALM) and Diane Conrick (QLD NRM). Other specialists that were consulted in compiling the meta-descriptions of northern inventory data are listed in Appendix 4.

Available species-level meta-data associated with the freshwater macroinvertebrates of northern Australia's wet-dry tropics were compiled from various sources including State and Territory Museum database collections, relevant online databases, as well as research, inventory and taxonomic literature produced by government agencies, conservation services and other expert researchers.

The following account provides a summary of the type of data found through such consultations. Where available, associated contacts are also provided. This account, at a broad-level, has also been summarised in Appendix 5, while supporting data for two of the large databases are provided in Appendices 6 and 7.

Museum collections

Australian Museum:

The Australian Museum (AM) has an extensive collection of mollusc specimens relevant to the current project area, distributed in all three states/territory. These species-level data have been data-based and include the relevant geo-references (latitude and longitude site co-ordinates) and locality names. The museum's collection has been data-based with funding from DEW for its new database, "The Australian Heritage Assessment Tool" (AHAS).

Contact: Alison Miller (Technical Malacology).

The aquatic insect inventory held at the Australian Museum, relevant to the project area, is not as extensive and shows an overall bias towards the east coast, including Queensland's wet tropics. Taxonomic groups included here are the hemipteran families, Nepidae and Hydrometridae, and coleopterans belonging to the families Hydrophilidae and Dytiscidae. The data have been geo-referenced.

NB: "MS name field" must not be used in publication.

Contact: Dr Dave Brittion (Entomology Collection Manager).

The AM's mollusc and aquatic insect data have been provided to ***eriss*** for the TRP inventory and can be categorised into drainage areas if required.

Museum of WA

The museum mollusc collection includes samples from the Kimberley region of WA and some records from the extreme west of the NT. The molluscs and other freshwater groups in the museum's collection from northern Australia are largely not data-based or identified beyond genus or even family level. Material on loan to other non-WA Museum researchers has been data-based; for example, their mollusc collection has been worked on by Dr Winston Ponder of the Australian Museum (recently retired) and this would be reflected in the Australian Museum's dataset and DEW's AHAS.

The museum is also presently data-basing their water beetle family and odonate records, with funding from DEW (for the AHAS). This collection, too, would be expected to include material from north Western Australia.

Contact – Terry Houston (Senior Curator – Entomology)

Queensland Museum

Freshwater invertebrates have never been a priority in the Queensland Museum's collections. There is a small dataset for freshwater mollusc families, including gastropod families Bithyniidae, Viviparidae and Thiaridae, and the bivalved molluscs Hyriidae and Corbiculidae. The number of specimen lots here would be less than 20 and not all have accurate distributional data associated with them.

(Contact- Dr John Stanisic, Senior Curator, Malacology & Biodiversity Scientist).

The best dataset (catalogued and geo-referenced) in the museum's crustacean collection is for the freshwater prawn, *Macrobrachium* (F. *Palaemonidae*), as a consequence of Dr John Short's (2004) PhD on this genera (see Appendix 8). The museum also holds some patchy

distributional information on the Atyidae shrimps though this is biased to the east coast. Currently, freshwater crab (F. Parathelphusidae) data are being catalogued and geo-referenced and should be completed shortly. The Museum has completed an ABRS-funded taxonomic study (molecular genetics) of this family (Parathelphusidae) in Australia.

Contact - Peter Davie. (Senior Curator - Crustacea)

SA Museum:

Two aquatic groups have been data-based from the South Australian Museum's collection, these being water beetle families and the Odonata (DEW funded – Cameron Slatyer). Dr Chris Watts, based at the SA Museum, maintains his own database of all the aquatic coleopteran in the Museum's collection. This dataset contains a wealth of information relevant to the TRP project area that could be sought for this study.

(Contact – Jan Forrest Senior Collections Manager, Terrestrial Invertebrate Sections)

Museum Victoria:

The Museum of Victoria has not data-based any of its freshwater macroinvertebrate collections, with the exception of its Trichopterans (adults and larvae). These data are currently being entered into a database which is expected to have been completed by October 2006. The tropical data held here will have an expected east coast bias.

(Contact- Dr. Richard Marchant, Senior Curator, Terrestrial Invertebrates)

Museum & Art Gallery of the Northern Territory:

Collections from the NT wet-dry tropics are only partially data-based by the MAGNT. These freshwater groups include, Gastropoda (F. Planorbidae, Lymnaeidae, Bithyniidae, Neritidae, Thiaridae and Viviparidae), Bivalvia (F. Hyriidae and Corbiculidae), Crustacea (F. Palaemonidae, Atyidae, Parasticidae and Parathelphusidae) and the insect order Trichoptera (Helicopsychidae, Hydroptildae and Polycentropodidae).

Distributional information is only provided by way of locality name and distance ('km from') and is not extensive. The most complete collection held at MAGNT is for the Odonata, with records being supplied to DEW who have subsequently data-based this information for the AHAS.

(Contact: Gavin Dally, Collections Manager, Natural Sciences)

Online Databases

ABRS (Australian Biological Resources Study – Faunal Directory)

The species data in this online database is limited to maps showing distribution within the old drainage basin areas. A species list for those specimens recorded for TRIAP catchments has been collated and is provided in Appendix 6.

ANIC

This online publicly-accessible database has a small number of chironomid Diptera, nepid Hemiptera, and elmid, noterid and gyrinid Coleoptera records. Other coleopteran families more extensively data-based here are the hydrophilids and dytiscids. Northern distributed Odonata are extensively data-based though much of the data is based upon adult material, with only a few aquatic nymph entries. The information is provided with locality name and geo-references. Records for TRIAP catchments have been collated and are provided in Appendix 7.

Currently, CSIRO are data-basing theirs and the SA museum's Hemiptera (Nepomorpha) collections into the ANIC database, although, at this stage they are a long way off completion. Dr Tom Weir who is involved in this work maintains his own database of the Gerromorpha hemipteran families (containing over 6770 records obtained from some 49000 specimens), which is clearly a more comprehensive dataset.

OZCAM

"Australia's Fauna" is an online, distributed network of databases that collates information from Australia's museums and other institutional faunal collections. Data pertaining to freshwater macroinvertebrates of Australia's wet-dry tropics is very limited. The best data are held in the ANIC database and this has already been exploited directly. A species list of other holdings has been made as part of the TRP study and can be categorised into drainage divisions, if need be.

Australian Heritage Assessment Tool

This database, currently under construction, comprises about 14 million specimen locality records, derived from state agencies, commonwealth agencies and conservation services. Currently, only a partial range of invertebrate taxa are available, including:

- Freshwater Mollusca (mainly Australian Museum, ~14,000 records biased towards SE Australia)
- Odonata (ANIC and all state museums)
- Adephaga families of diving beetles (mainly SA Museum, ~10, 000 records with good continental coverage)
- Rotifers (4000 records, biased towards the SE Australia)

(Contact - Cameron Slatyer, Assistant Director, Natural Environment Assessment)

3.2 Significant reviews of the biodiversity of macroinvertebrates associated with Australia's wet-dry tropical streams

Publications on the taxonomy, biodiversity and general ecology of macroinvertebrates associated with Australia's wet-dry tropical streams are provided in Appendix 8. This review is far from complete and may be particularly deficient in information from Queensland.

3.3 Summary and recommendations

Work recommended for the future includes the following:

1. Compile species-level information from TRIAP catchments for which this is available including Ord River (WA), Keep River and tributaries (NT and WA), Daly River, East and South Alligator rivers and some tributaries (NT), as well as some upland sites from the Mitchell and Walsh rivers (QLD.)
2. Similar data inventory and assessment projects are also being conducted in the (mainly) Wet tropics. A project being coordinated by Niall Connolly of the Australian Centre for Tropical Freshwater Research (James Cook University) aims to develop a species-level interactive atlas of macroinvertebrates in the Wet Tropics that is proposed to be expanded into other bioregions. This atlas should be extended to include wet-dry tropical data. In the first instance, an exemplary prototype should be developed with a focus on Ephemeroptera. The work would draw upon the results of an NHT-funded project recently completed by Dr Phil Suter (Latrobe University)

which describes habitat profiles of species from some prominent aquatic insect groups.

3. Specimens from AUSRIVAS samples that have been archived by state and territory agencies should be identified to species level and added to a national database.
4. The TRIAP databases described in Appendices 5-7 should be consolidated and combined/populated into a common, all-purpose database for use by practitioners, managers and stakeholders across northern Australia.

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Appendix 1: AUSRIVAS sites and sampling occasions used in TRIAP analyses

State/Territory	Date	Site code	River/stream and location	Catchment	Catchment code	Latitude (S) Decimal	Longitude (E) Decimal	Additonal site description (QLD)
WA	22-Apr-98	CLC01	Culla Culla Creek	Cape Leveque Coast	CLC	-17.33	122.36	
WA	23-Apr-98	CLC02	Fraser River, Bungarragut Pool	Cape Leveque Coast	CLC	-17.37	123.18	
WA	24-Apr-98	CLC03	Logue River, Logue Pool	Cape Leveque Coast	CLC	-17.67	123.39	
WA	24-Apr-98	CLC04	Little Logue, Colourstone Pool	Cape Leveque Coast	CLC	-17.64	123.17	
WA	12-May-98	DRY01	Berkley River, Berkley	Drysdale River	DRY	-14.89	127.66	
WA	12-May-98	DRY02	King George River	Drysdale River	DRY	-14.08	127.31	
WA	12-May-98	DRY03	Drysdale River, Barton Plains	Drysdale River	DRY	-14.26	126.90	
WA	12-May-98	DRY04	Johnson River, Johnson Confluence	Drysdale River	DRY	-14.69	127.00	
WA	13-May-98	DRY05	Gibb River	Drysdale River	DRY	-15.71	126.65	
WA	17-May-98	DRY06	Drysdale River, Miners Pool	Drysdale River	DRY	-15.68	126.40	
WA	25-Apr-98	FIT01	Geegully Creek, Clanmyra Pool	Fitzroy River	FIT	-18.23	123.74	
WA	20-May-96	FIT02	Wilson Creek, Wilson Spring	Fitzroy River	FIT	-17.91	125.56	
WA	27-Apr-98	FIT03	Fitzroy River, Geike Gorge	Fitzroy River	FIT	-18.12	125.68	
WA	17-May-96	FIT04	Palm Springs Creek, Palm Springs	Fitzroy River	FIT	-18.50	126.43	
WA	19-Apr-98	FIT05	Pandanus Creek, Ord Gap	Fitzroy River	FIT	-17.59	125.87	
WA	13-May-95	FIT06	Gap Creek, Gap Creek Channel	Fitzroy River	FIT	-18.66	125.88	
WA	19-Apr-98	FIT07	Fitzroy River, Dimond Gorge	Fitzroy River	FIT	-17.65	126.03	
WA	19-Apr-98	FIT08	Fitzroy River, Sir John Gorge	Fitzroy River	FIT	-17.51	126.22	
WA	26-Apr-98	FIT09	Cunningham River, Jubilee Downs	Fitzroy River	FIT	-18.36	125.30	
WA	28-Apr-98	FIT10	Nipper Creek, Long Hole Billabong	Fitzroy River	FIT	-18.61	125.61	
WA	19-Apr-98	FIT11	Fitzroy River, Near Old Leopold Yard	Fitzroy River	FIT	-17.86	125.88	
WA	29-Apr-98	FIT12	Leopold River, Calder Yard	Fitzroy River	FIT	-18.24	126.25	
WA	19-May-98	FIT13	Hann River	Fitzroy River	FIT	-16.60	126.31	
WA	26-Apr-98	FIT14	Fitzroy River, Noonkanbah Crossing	Fitzroy River	FIT	-18.51	124.83	

WA	30-Apr-98	FIT15	Chrismas Creek, Bohemia Downs	Fitzroy River	FIT	-18.90	126.24	
WA	30-Apr-98	FIT16	Mary River, Mary Pool	Fitzroy River	FIT	-18.73	126.87	
WA	01-May-98	FIT17	Watery River, Wyloo Yard	Fitzroy River	FIT	-18.04	127.18	
WA	17-Apr-98	ISD01	Robinson River, Lower Robinson	Isdell River	ISD	-16.83	124.32	
WA	17-Apr-98	ISD02	Isdell River, Lower Isdell	Isdell River	ISD	-16.76	125.04	
WA	17-Apr-98	ISD03	Charnley River, Lower Charnley	Isdell River	ISD	-16.37	125.21	
WA	17-Apr-98	ISD04	Isdell River, Upper Isdell	Isdell River	ISD	-16.71	125.80	
WA	17-Apr-98	ISD05	Pearson River	Isdell River	ISD	-16.13	125.57	
WA	20-May-98	ISD06	Bell Creek, Bell Gorge	Isdell River	ISD	-16.99	125.20	
WA	21-May-96	KER01	King Edward River, Kulumburu	King Edward River	KER	-14.34	126.62	
WA	13-May-98	KER02	Cole Creek	King Edward River	KER	-14.57	126.41	
WA	21-May-96	KER03	King Edward River, Upper King Edward	King Edward River	KER	-15.29	126.17	
WA	13-May-98	KER04	Mitchell River, Upper Mitchell	King Edward River	KER	-15.03	125.70	
WA	21-May-96	KER05	Mitchell River, Mitchell Falls	King Edward River	KER	-14.88	125.72	
WA	13-May-98	KER06	Camp Creek	King Edward River	KER	-14.88	125.74	
WA	13-May-98	KER07	Crystal Creek	King Edward River	KER	-14.54	125.76	
WA	18-May-98	KER08	Morgan River, Theda	King Edward River	KER	-14.80	126.50	
WA	17-May-98	KER09	King Edward River, Doongan	King Edward River	KER	-15.12	126.13	
WA	20-May-96	LEN01	Lennard River, Lennard River Pool	Lennard River	LEN	-17.35	124.51	
WA	20-May-96	LEN02	Fletcher Creek	Lennard River	LEN	-17.12	124.99	
WA	20-May-96	LEN03	Lennard River, Lennard River Gorge	Lennard River	LEN	-17.17	125.22	
WA	19-Apr-98	LEN04	Richenda River, Richenda Gorge	Lennard River	LEN	-17.45	125.44	
WA	21-May-98	LEN05	Lennard River, Windjana Gorge	Lennard River	LEN	-17.41	124.94	
WA	22-May-98	LEN06	Barker River	Lennard River	LEN	-17.25	124.73	
WA	21-May-98	LEN07	Anne Creek, Anne Creek Mt Hart	Lennard River	LEN	-16.77	124.88	
WA	24-May-98	LEN08	Lennard River, Poulton Pool	Lennard River	LEN	-17.41	125.26	
WA	11-May-98	ORD01	Ord River, Blue Holes Pool	Ord River	ORD	-17.56	128.25	
WA	02-May-98	ORD02	Black Elvire River	Ord River	ORD	-18.42	127.85	
WA	02-May-98	ORD03	Ord River, Kitty's Knob	Ord River	ORD	-17.41	128.81	
WA	03-May-98	ORD04	Behn River	Ord River	ORD	-16.58	128.95	
WA	07-May-98	ORD05	Dunham River, Dunham River Rock Bar	Ord River	ORD	-15.80	128.68	
WA	08-May-98	ORD06	Ord River, Mantinea Flats	Ord River	ORD	-15.58	128.57	
WA	08-May-98	ORD07	Ord River, Button's Crossing	Ord River	ORD	-15.62	128.69	
WA	11-May-98	ORD08	Wilson River	Ord River	ORD	-16.65	128.11	
WA	14-May-98	ORD09	Dunham River, Great Northern Hwy	Ord River	ORD	-16.16	128.37	
WA	15-May-98	ORD10	Emma Creek, Emma Gorge	Ord River	ORD	-15.90	128.13	
WA	22-May-96	PEN01	Wilson Creek, Wilson Creek Pool	Pentecost River	PEN	-15.58	127.75	

WA	22-May-96	PEN02	Durack River, Lower Durack Pool	Pentecost River	PEN	-15.56	127.68	
WA	11-May-98	PEN03	Bamboo Creek	Pentecost River	PEN	-15.90	127.35	
WA	22-May-96	PEN04	Durack River, Royston Creek	Pentecost River	PEN	-16.07	127.21	
WA	11-May-98	PEN05	Durack River, Upper Durack	Pentecost River	PEN	-16.88	127.20	
WA	11-May-98	PEN06	Chamberlain River	Pentecost River	PEN	-16.57	127.74	
WA	12-May-98	PEN07	Forrest River, Forrest	Pentecost River	PEN	-15.23	127.33	
WA	16-May-98	PEN08	Royston Creek, Royston Creek Yards	Pentecost River	PEN	-16.08	127.27	
WA	18-Apr-98	PRR01	Prince Regent River, Upper Prince Regent	Prince Regent River	PRR	-15.90	125.71	
WA	18-Apr-98	PRR02	Youwanjela Creek	Prince Regent River	PRR	-15.71	125.49	
WA	18-Apr-98	PRR03	Perpendicular Creek	Prince Regent River	PRR	-15.43	125.31	
WA	18-Apr-98	PRR04	Glenelg River	Prince Regent River	PRR	-15.71	125.02	
WA	18-Apr-98	PRR05	Sale River	Prince Regent River	PRR	-16.03	124.93	
NT	15-Jul-98	AD02	Adelaide River, north of Daly River Road	Adelaide River	ADR	-13.43	131.09	
NT	15-Jul-96	AD06	Adelaide River, Tortilla Flats at Rocky Bar	Adelaide River	ADR	-13.08	131.25	
NT	13-Jul-98	AD10	Adelaide River, d/s township	Adelaide River	ADR	-13.21	131.15	
NT	13-Jul-98	AD11	Tortilla Flats, d/s pump station	Adelaide River	ADR	-13.09	131.24	
NT	15-Jul-98	AD13	Robin Falls, d/s camping area	Adelaide River	ADR	-13.35	131.13	
NT	16-Jul-98	AD14	Burrell Creek, u/s Haynes Road Crossing	Adelaide River	ADR	-13.19	131.21	
NT	01-Jul-99	DA01	Daly River, Dorisvale crossing	Daly River	DAL	-14.37	131.56	
NT	28-Jul-98	DA03	Katherine River, crossing to Seventeen Mile Creek	Daly River	DAL	-14.33	132.41	
NT	07-Jul-99	DA04	Seventeen Mile Creek	Daly River	DAL	-14.30	132.42	
NT	05-Jul-99	DA05	Flora River	Daly River	DAL	-14.76	131.59	
NT	10-Jul-96	DA07	Daly River, Beeboom Crossing	Daly River	DAL	-13.86	131.07	
NT	05-Jun-96	DA08	Daly River, Mt Nancar	Daly River	DAL	-13.81	130.72	
NT	06-Jun-96	DA09	Daly River, Oolloo Crossing	Daly River	DAL	-14.07	131.25	
NT	05-Jun-96	DA10	Douglas River, u/s Oolloo Road crossing	Daly River	DAL	-13.79	131.36	
NT	29-Jun-99	DA11	Edith River, u/s Mt Todd	Daly River	DAL	-14.19	132.17	
NT	27-Jun-96	DA12	Edith River, d/s Mt Todd	Daly River	DAL	-14.17	132.07	
NT	28-Jun-96	DA13	Stray Creek, Umbrawarra Gorge	Daly River	DAL	-13.97	131.70	
NT	11-Jul-96	DA14	Douglas River, Butterfly Gorge	Daly River	DAL	-13.75	131.57	
NT	06-Jun-96	DA15	Douglas River, Crystal Falls	Daly River	DAL	-13.84	131.15	
NT	10-Jul-96	DA17	Green Ant Creek	Daly River	DAL	-13.75	131.10	
NT	09-Jul-96	DA18	Fish River, u/s road crossing	Daly River	DAL	-14.24	130.91	
NT	12-Aug-96	DA20	Katherine River, Eva Valley Road	Daly River	DAL	-14.16	132.71	
NT	29-Jul-98	DA21	Katherine River, u/s Hardies Creek	Daly River	DAL	-13.77	133.09	
NT	29-Jul-98	DA22	Katherine River, d/s Snowdrop Creek	Daly River	DAL	-13.69	133.21	
NT	12-Jul-97	DA24	Katherine River d/s Gimbat Creek fault line	Daly River	DAL	-13.54	133.2282	

NT	25-Jun-99	DA27	Upstream Oolloo Crossing, Daly River	Daly River	DAL	-14.10	131.27	
NT	28-Jul-98	DA28	Katherine River, at Knott's Crossing	Daly River	DAL	-14.44	132.27	
NT	31-Jul-98	DA29	Katherine River, boat ramp at high level bridge	Daly River	DAL	-14.46	132.26	
NT	28-Jul-98	DA30	Katherine River, d/s Manbulloo homestead	Daly River	DAL	-14.52	132.19	
NT	30-Jul-98	DA31	Katherine River, d/s Maud Creek	Daly River	DAL	-14.38	132.39	
NT	29-Jun-99	DA32	Katherine River, Carbeen Park	Daly River	DAL	-14.65	132.02	
NT	29-Jul-98	DA35	Katherine River, d/s Snake Creek	Daly River	DAL	-14.01	132.74	
NT	28-Jul-98	DA37	Katherine River, at Galloping Jacks	Daly River	DAL	-14.55	132.13	
NT	01-Jul-99	DA38	Ferguson River at Beasely Road	Daly River	DAL	-14.30	131.87	
NT	01-Jul-99	DA39	Eight Mile Creek, Dorisvale Road Crossing	Daly River	DAL	-14.11	131.79	
NT	06-Jul-99	DA40	Scott's Creek, upstream Victoria Highway	Daly River	DAL	-14.93	131.88	
NT	07-Jul-99	DA41	King River, upstream old highway crossing	Daly River	DAL	-14.70	132.07	
NT	08-Jul-99	DA42	Katherine River, upstream Snowdrop Creek intersection	Daly River	DAL	-13.68	133.21	
NT	08-Jul-99	DA43	Katherine River, downstream Gimbat fault line	Daly River	DAL	-13.42	133.19	
NT	08-Jul-99	DA44	Gimbat Creek	Daly River	DAL	-13.65	132.97	
NT	08-Jul-99	DA45	Katherine River, upstream Gimbat Creek intersection	Daly River	DAL	-13.72	132.90	
NT	08-Jul-99	DA46	Katherine River, six mile downstream Sleisbeck	Daly River	DAL	-13.88	132.78	
NT	29-Jul-99	DA47	Hayes Creek	Daly River	DAL	-13.66	131.40	
NT	25-Jul-00	DA48	King River, Stuart Highway	Daly River	DAL	-14.62	132.594	
NT	26-Jul-00	DA49	Flora River, Yarralin campground	Daly River	DAL	-14.67	131.6827	
NT	26-Jul-00	DA50	Six Mile Creek, u/s, road to Claravale Crossing	Daly River	DAL	-14.08	131.8144	
NT	02-Aug-00	DA51	Douglas River, d/s bridge	Daly River	DAL	-13.79	131.3524	
NT	02-Aug-00	DA52	Hayes Creek near confluence with Douglas River	Daly River	DAL	-13.79	131.2971	
NT	02-Aug-00	DA53	Douglas River u/s confluence Hayes Creek	Daly River	DAL	-13.79	131.2983	
NT	03-Aug-00	DA54	Black Bull Yard	Daly River	DAL	-14.19	131.3938	
NT	03-Aug-00	DA55	Stray Creek	Daly River	DAL	-14.14	131.4227	
NT	03-Aug-00	DA56	Middle Creek d/s bridge	Daly River	DAL	-13.81	131.3412	
NT	03-Aug-00	DA57	Middle Creek u/s bridge	Daly River	DAL	-13.81	131.3427	
NT	04-Aug-00	DA58	Daly River, Douglas Daly Research Farm	Daly River	DAL	-13.86	131.1855	
NT	04-Aug-00	DA59	Site 30, Daly River	Daly River	DAL	-14	131.231	
NT	04-Aug-00	DA60	Douglas River u/s bridge	Daly River	DAL	-13.78	131.3853	
NT	29-May-01	DW31	Berry Creek, u/s road crossing	Darwin	DWN	-12.71	131.0034	
NT	12-Jun-01	DW36	Blackmore River, d/s crossing	Darwin	DWN	-12.8	130.9199	
NT	20-Jun-01	DW37	Peel Creek, u/s road crossing	Darwin	DWN	-12.83	130.9087	
NT	24-May-01	DW39	Elizabeth River, on Elizabeth Valley Road	Darwin	DWN	-12.64	131.095	
NT	06-Jun-01	DW40	Elizabeth River, u/s gauging station	Darwin	DWN	-12.61	131.0805	
NT	30-May-01	DW42	Howard River, Pioneer Road Crossing	Darwin	DWN	-12.56	131.1379	

NT	05-Jun-01	DW43	Howard River, u/s Gunn Point Road	Darwin	DWN	-12.46	131.0856	
NT	05-Jun-01	DW45	Howard River, Girraween Road Crossing	Darwin	DWN	-12.53	131.1233	
NT	20-Jun-02	DW48	Walker Creek	Darwin	DWN	-13.08	130.699	
NT	19-Jun-02	DW49	Florence Creek, u/s Buley Rockhole	Darwin	DWN	-13.12	130.7862	
NT	19-Jun-02	DW50	Florence Creek, near 4wd camp-ground	Darwin	DWN	-13.09	130.7833	
NT	20-Jun-02	DW51	Petherick's Creek	Darwin	DWN	-13.12	130.67	
NT	10-Jul-96	EA-02	Cooper Creek, Murganella Road	East Alligator River	EAR	-12.10	133.19	
NT	10-Jul-96	EA-03	Cooper Creek, Maningrida Road	East Alligator River	EAR	-12.20	131.35	
NT	08-Aug-96	EA-04	Cooper Creek, u/s Nabarlek	East Alligator River	EAR	-12.20	131.35	
NT	23-Jul-96	FN01	Sandy Creek, d/s Sandy Creek Falls	Finniss River	FIN	-13.25	130.74	
NT	04-Jun-96	FN02	Reynolds River, d/s Daly River road	Finniss River	FIN	-13.53	130.86	
NT	25-Jul-96	FN03	Reynolds River, pool south of Alligator Creek	Finniss River	FIN	-13.49	130.80	
NT	16-Jul-98	FN04	Sandy Creek, u/s Reynold's River	Finniss River	FIN	-13.28	130.70	
NT	25-Jul-96	FN06	Surprise Creek, Surprise Creek Falls	Finniss River	FIN	-13.41	130.78	
NT	24-Jul-96	FN07	Reynolds River, south Mt Tolmer	Finniss River	FIN	-13.28	130.70	
NT	22-Jul-96	FN09	Little Finniss River, u/s camp Creek station	Finniss River	FIN	-13.23	130.95	
NT	15-Jul-98	FN11	Finniss River, d/s abbatoir	Finniss River	FIN	-13.05	130.99	
NT	15-Jul-98	FN12	Finniss River, d/s Walkers Ford	Finniss River	FIN	-12.92	130.72	
NT	16-Jul-98	FN13	Finniss River, d/s Litchfield Park Road	Finniss River	FIN	-13.02	130.95	
NT	16-Jul-98	FN14	Wangi Creek, d/s plunge pool	Finniss River	FIN	-13.17	130.68	
NT	23-Jun-99	FN22	Fitch Creek d/s road crossing	Finniss River	FIN	-13	131.0297	
NT	23-Jun-99	FN23	East Branch u/s Rum Jungle Mine	Finniss River	FIN	-12.99	131.0265	
NT	24-Jun-99	FN24	Finniss River u/s crossing above EB confluence	Finniss River	FIN	-12.97	130.9525	
NT	23-Jun-99	FN26	Finniss River u/s Hannah's Pool	Finniss River	FIN	-12.97	130.9502	
NT	25-May-95	GY-02	Goyder River, East Arnhem Highway	Goyder River	GOY	-13.03	134.98	
NT	24-May-95	GY-03	Annie Creek, East Arnhem Highway	Goyder River	GOY	-13.16	134.86	
NT	13-Jul-95	KP-03	Bubble Bubble springs	Keep River	KPR	-15.80	129.33	
NT	09-May-00	MA01	Harriet Ck u/s El Sherana Rd Crossing	Mary River	MAR	-13.68	131.9801	
NT	10-May-00	MA02	Mary River d/s GS8180026 (Kakadu Hwy)	Mary River	MAR	-13.6	132.2096	
NT	25-May-00	MA07	Hodgson Ck d/s Mary R Station Rd	Mary River	MAR	-13.64	131.9968	
NT	30-May-00	MA08	Hodgson Ck u/s Mary River confluence	Mary River	MAR	-13.53	132.0498	
NT	31-May-00	MA09	Mary River d/s Hodgson Ck confluence	Mary River	MAR	-13.53	132.0487	
NT	31-May-00	MA10	Mary River u/s Hodgson Ck confluence	Mary River	MAR	-13.53	132.05	
NT	02-Jun-00	MA11	Francis Ck u/s Mary R confluence	Mary River	MAR	-13.48	132.0201	
NT	02-Jun-00	MA12	Big Nellie Ck u/s Kakadu Hwy	Mary River	MAR	-13.68	132.0213	
NT	07-Jun-00	MA13	Mary River d/s O'Neil Ck confluence	Mary River	MAR	-13.6	132.1326	
NT	08-Jun-00	MA14	Unamed Ck2 u/s Mary R confluence	Mary River	MAR	-13.53	132.0621	

NT	11-Jun-00	MA15	Upper Billiard Ck past Scotties Hole	Mary River	MAR	-13.54	132.209	
NT	19-Jun-00	MA16	Mary River u/s Billiard Ck confluence	Mary River	MAR	-13.53	132.0613	
NT	20-Jun-00	MA17	Mary River u/s Maude Ck and d/s Minglo Ck	Mary River	MAR	-13.34	131.9487	
NT	21-Jun-00	MA18	Minglo Ck u/s Mary R confluence	Mary River	MAR	-13.35	131.9593	
NT	21-Jun-00	MA19	Mary River u/s Minglo Ck	Mary River	MAR	-13.35	131.9559	
NT	22-Jun-00	MA20	Maude Ck u/s Mary R confluence	Mary River	MAR	-13.33	131.9386	
NT	22-Jun-00	MA21	Mary River d/s Maude Ck confluence	Mary River	MAR	-13.33	131.9397	
NT	27-Jun-00	MA22	Mary River u/s Francis Ck confluence	Mary River	MAR	-13.48	132.0221	
NT	27-Jun-00	MA23	Mary River d/s Francis Ck confluence	Mary River	MAR	-13.47	132.0213	
NT	03-Jul-00	MA24	Mary River d/s Rockhole Ck confluence	Mary River	MAR	-13.6	132.2081	
NT	04-Jul-00	MA25	Mary River u/s confluence with Little Mary R	Mary River	MAR	-13.64	132.312	
NT	05-Jul-00	MA26	Mary River d/s confluence of Big and Little Mary Rivers	Mary River	MAR	-13.64	132.3004	
NT	05-Jul-00	MA27	Little Mary River u/s confluence with Mary R	Mary River	MAR	-13.64	132.3087	
NT	27-Jul-00	MA28	Rockhole Ck u/s Mary River Junction	Mary River	MAR	-13.58	132.2465	
NT	27-Jul-00	MA29	Mary River u/s Annaburroo Billabong	Mary River	MAR	-12.92	131.6868	
NT	01-Aug-00	MA30	Mary River at Mt Harris Mine Crossing	Mary River	MAR	-13.27	131.9114	
NT	02-Aug-00	MA31	Mary River d/s George Ck	Mary River	MAR	-13.22	131.8984	
NT	09-Aug-00	MA32	Mary River d/s Craig Ck	Mary River	MAR	-13.16	131.8716	
NT	11-Aug-00	MA33	Soda Ck u/s Rockhole Rd Crossing	Mary River	MAR	-12.72	131.7423	
NT	15-Aug-00	MA34	Hardies Ck d/s road to Clarkes Crossing	Mary River	MAR	-12.81	131.604	
NT	12-May-00	MA35	Mary River d/s Clarkes Crossing	Mary River	MAR	-12.81	131.6587	
NT	12-May-00	MC03	Unnamed Ck1 south of Springhill Rd	McKinlay River	MCA	-13.68	131.7322	
NT	22-May-00	MC04	McMinns Ck d/s Mt Wells Rd	McKinlay River	MCA	-13.53	131.7038	
NT	03-Aug-00	MC06	McKinlay River at Mt Douglas GS	McKinlay River	MCA	-13.27	131.7115	
NT	04-Aug-95	MC-05	McArthur River, near Goose lagoon	McArthur River	MCA	-16.16	136.26	
NT	03-Aug-95	RB-02	Robinson River, gorge area u/s Ten Mile yards	Robinson River	ROB	-16.99	136.82	
NT	03-Aug-95	RB-03	Quaker Creek	Robinson River	ROB	-16.87	136.77	
NT	27-May-95	RP-01	Waterhouse River, Beswick	Roper River	RPR	-14.46	133.14	
NT	26-May-95	RP-02	Mainoru River	Roper River	RPR	-13.98	133.98	
NT	25-May-95	RP-03	Wilton River	Roper River	RPR	-13.63	134.37	
NT	22-Aug-95	RP-05	Roper River, Red Rock	Roper River	RPR	-14.70	134.42	
NT	24-Aug-95	RP-06	Hodgson River, south Roper Bar	Roper River	RPR	-14.87	134.50	
NT	23-Aug-95	RP-08	Bella Glen Creek	Roper River	RPR	-15.41	134.05	
NT	23-Aug-95	RP-09	Arnold River, Minimere waterhole	Roper River	RPR	-15.42	134.19	
NT	21-Aug-95	RP-11	Roper River, Moroak station	Roper River	RPR	-14.82	133.68	
NT	24-Aug-95	RP-12	Salt Creek	Roper River	RPR	-14.96	133.25	
NT	22-Aug-95	RP-13	Wilton River, crossing to Ngukurr	Roper River	RPR	-14.68	134.57	

NT	26-May-95	RP-14	Flying Fox Creek, East Arnhem Highway	Roper River	RPR	-14.17	133.74	
NT	31-May-95	SA-03	South Alligator River, Gunlom road	South Alligator River	SAR	-13.50	132.48	
NT	04-Jul-95	SA-04	South Alligator River, south-west Mundogie Hill	South Alligator River	SAR	-13.15	132.27	
NT	21-Jul-95	VC-04	Armstrong River	Victoria River	VIC	-16.61	131.82	
NT	27-Jul-95	VC-05	Victoria River, Dashwood crossing	Victoria River	VIC	-16.33	131.11	
NT	18-Jul-95	VC-06	East Baines River	Victoria River	VIC	-15.77	130.03	
NT	19-Jul-95	VC-09	Wickham River, billabong, road to Mt Samford	Victoria River	VIC	-16.62	130.71	
NT	19-Jul-95	VC-10	Gibbie Creek, road to Mt Samford	Victoria River	VIC	-16.70	130.67	
NT	19-Jul-95	VC-11	Limestone Creek, Limestone Gorge	Victoria River	VIC	-16.05	130.38	
NT	22-Jul-95	VC-12	Victoria River, Victoria River roadhouse	Victoria River	VIC	-15.58	131.10	
NT	21-Jul-95	VC-13	Cow Creek, Cow Creek Falls	Victoria River	VIC	-15.85	131.17	
NT	18-Jul-95	VC-14	Jasper Creek	Victoria River	VIC	-16.03	130.80	
NT	16-Jul-95	VC-16	Boxer Springs Creek	Victoria River	VIC	-16.51	129.54	
QL	01-May-99	9220007	Archer River at shady lagoon	Archer River	ARC	-13.43	142.6	FNARH5/210
QL	01-May-99	922001A	Archer River at telegraph line	Archer River	ARC	-13.42	142.92	FNARH5/211
QL	01-May-99	922101B	Coen River at Racecourse	Archer River	ARC	-13.96	143.18	FNARH5/214
QL	01-May-99	9221002	Coen River d/s Emu Ck	Archer River	ARC	-13.78	142.81	FNARH5/212
QL	01-May-97	9221001	Lankelly Creek at Coen water supply	Archer River	ARC	-13.94	143.2	FNARH1/670
QL	01-May-99	926001A	Ducie River at Bertiehaugh	Ducie River	DUC	-12.13	142.37	FNARH5/219
QL	01-May-99	926002A	Dulhunty River at Doug's pad	Ducie River	DUC	-11.83	142.42	FNARH5/220
QL	01-May-02	9150018	Alick Creek at Minamere	Flinders River	FLI	-20.83	142.27	AM02-1/101
QL	01-May-99	915212A	Cloncurry River at Canobie	Flinders River	FLI	-19.48	140.96	FNARH5/175
QL	01-May-97	915203A	Cloncurry River at Cloncurry	Flinders River	FLI	-20.68	140.49	FNARH1/498
QL	01-May-01	9152001	Cloncurry River at Malbon	Flinders River	FLI	-21.09	140.32	AM01-1/113
QL	01-Jun-96	9152011	Cloncurry River at Sedan Dip	Flinders River	FLI	-20.04	141.11	MRHI4/120
QL	01-May-97	915209A	Corella River at Cloncurry/Normanton Rd	Flinders River	FLI	-20.45	140.32	FNARH1/502
QL	01-May-98	9152009	Corella River at Lake Corella T/W	Flinders River	FLI	-20.85	140.05	FNARH3/339
QL	01-May-97	915206A	Dugald River at railway crossing	Flinders River	FLI	-20.2	140.22	FNARH1/500
QL	01-Jun-96	9152015	Eastern Creek 20 k W Julia Ck	Flinders River	FLI	-20.66	141.54	MRHI4/427
QL	01-May-99	9150002	Flinders River at Euroka Springs	Flinders River	FLI	-19.92	141.47	FNARH5/167
QL	01-May-97	915013A	Flinders River at Glendower	Flinders River	FLI	-20.71	144.52	FNARH1/492
QL	01-May-97	9150019	Flinders River at Punchbowl	Flinders River	FLI	-20.43	142.04	FNARH1/490
QL	01-May-99	9150004	Flinders River at Reedy Springs	Flinders River	FLI	-19.96	144.69	FNARH5/171
QL	01-May-02	915008A	Flinders River at Richmond	Flinders River	FLI	-20.7	143.13	AM02-1/107
QL	01-May-95	915003A	Flinders River at Walkers Bend	Flinders River	FLI	-18.16	140.86	MRHI2/169
QL	01-May-99	915003A	Flinders River at Walkers Bend	Flinders River	FLI	-18.16	140.86	FNARH5/227
QL	01-May-97	9152013	Fountain Springs at Wee McGregor Mine	Flinders River	FLI	-20.97	139.93	FNARH1/496

QL	01-May-98	9152017	Fullarton River at Maronan	Flinders River	FLI	-21.09	140.88	FNARH3/329
QL	01-May-98	9152016	Gilliat Channels at Gidyea Bug Byway	Flinders River	FLI	-20.89	141.48	FNARH3/327
QL	01-May-97	9152012	Julia Creek at Dalgonally	Flinders River	FLI	-20.14	141.35	FNARH1/494
QL	01-May-97	9150017	O'Connell Creek near Richmond	Flinders River	FLI	-20.74	143.12	FNARH1/512
QL	01-May-95	915011A	Porcupine Creek at Mt Emu Plains	Flinders River	FLI	-20.16	144.52	MRHI2/153
QL	01-May-99	9150001	Saxby River at Big Crocodile Waterhole	Flinders River	FLI	-19.63	141.31	FNARH5/165
QL	01-Jun-96	9150016	Walkers Creek anabranch	Flinders River	FLI	-20.88	143.74	MRHI4/433
QL	01-May-99	915211A	Williams River at Landsborough Hwy	Flinders River	FLI	-20.87	140.83	FNARH5/173
QL	01-May-99	9150003	Woolgar River at Soap Spa	Flinders River	FLI	-19.73	143.39	FNARH5/169
QL	01-May-02	917102A	Einasleigh River at Carpentaria Downs	Gilbert River	GIL	-18.73	144.31	AM02-1/143
QL	01-May-99	917106A	Einasleigh River at Einasleigh	Gilbert River	GIL	-18.5	144.1	FNARH5/206
QL	01-May-99	917001D	Gilbert River at Rockfields	Gilbert River	GIL	-18.2	142.87	FNARH5/204
QL	01-May-98	9170006	Gilbert River at Stirling	Gilbert River	GIL	-17.17	141.77	FNARH3/443
QL	01-May-99	917008A	Little River at Inournie	Gilbert River	GIL	-18.27	142.68	FNARH5/205
QL	01-May-99	921002A	Holroyd River at Strathgordon	Holroyd River	HOL	-14.48	142.19	FNARH5/209
QL	01-May-99	9210001	Holroyd River u/s Honeysuckle jcn	Holroyd River	HOL	-14.31	142.89	FNARH5/208
QL	01-May-99	927001B	Jardine River at Monument	Jardine River	JAR	-11.15	142.35	FNARH5/222
QL	01-May-99	9270007	Jardine River at Pedro's swamp	Jardine River	JAR	-11.46	142.69	FNARH5/221
QL	01-May-98	9130001	Alexandra River d/s Talawanta Crossing	Leichhardt River	LEI	-18.59	140.27	FNARH3/440
QL	01-May-01	9130002	Gunpowder Creek at Esperanza	Leichhardt River	LEI	-19.71	139.34	AM01-1/105
QL	01-May-02	913006A	Gunpowder Creek at Gunpowder (d/s impact)	Leichhardt River	LEI	-19.71	139.34	AM02-1/095
QL	01-May-99	9130017	Leichhardt River at Boggy Lagoon	Leichhardt River	LEI	-18.72	139.78	FNARH5/163
QL	01-May-98	913007B	Leichhardt River at Floraville	Leichhardt River	LEI	-18.26	139.88	FNARH3/439
QL	01-May-99	913004A	Leichhardt River at Kajabbi	Leichhardt River	LEI	-20.07	139.94	FNARH5/159
QL	01-May-99	9130016	Leichhardt River at Kamileroi	Leichhardt River	LEI	-19.23	139.98	FNARH5/161
QL	01-May-02	9190016	2 mile Creek at Broad-McGrath Boundary	Mitchell River	MIT	-16.94	145.4	AM02-1/145
QL	01-May-98	9191001	Alice River at Pormpuraaw Road Crossing	Mitchell River	MIT	-15.38	142.02	MRCS2/048
QL	01-May-01	9190002	Bushy Creek at Julatten	Mitchell River	MIT	-16.61	145.34	AM01-1/140
QL	01-May-98	9193050	Cattle Creek at Walsh Junction	Mitchell River	MIT	-17.12	145.25	MRCS2/046
QL	01-May-98	9193005	Chillagoe Creek at Chillagoe	Mitchell River	MIT	-17.15	144.52	MRCS2/041
QL	01-May-98	9193030	Chillagoe Creek at downstream end of Airstrip	Mitchell River	MIT	-17.13	144.53	MRCS2/042
QL	01-May-98	919312A	Elizabeth Creek at Greenmantle	Mitchell River	MIT	-16.65	144.1	MRCS2/028
QL	01-May-98	9190003	Fossilbrook Creek at Vince Ray Causeway	Mitchell River	MIT	-17.82	144.39	MRCS2/029
QL	01-Jun-96	9192004	Glenroy Creek at Palmerville Rd	Mitchell River	MIT	-15.92	144.09	MRHI4/368
QL	01-May-99	9190030	Healeys Lagoon at Healeys Yard	Mitchell River	MIT	-16.07	142.62	MRCS5/040
QL	01-May-99	919010A	Lagoon Creek at Rutland Plains	Mitchell River	MIT	-15.64	141.82	MRCS5/013
QL	01-May-99	9190031	Longreach Lagoon at Western Fence	Mitchell River	MIT	-16.53	143.41	MRCS5/041

QL	01-Jun-96	9190006	Luster Creek at road crossing	Mitchell River	MIT	-16.66	145.25	MRHI4/080
QL	01-May-98	9190007	Lynd River at Mitchell Junction	Mitchell River	MIT	-16.47	143.31	MRCS2/031
QL	01-May-98	919006A	Lynd River at Torwood	Mitchell River	MIT	-17.43	143.82	MRCS2/008
QL	01-May-98	919001C	Mary River at Mary Farms	Mitchell River	MIT	-16.57	145.19	MRCS2/001
QL	01-May-98	919013A	McLeod River at McLeod	Mitchell River	MIT	-16.5	145	MRCS2/015
QL	01-May-98	919014A	Mitchell River at Cooktown Crossing	Mitchell River	MIT	-16.57	144.89	MRCS2/035
QL	01-May-98	9190032	Mitchell River at Font Hills	Mitchell River	MIT	-16.7	145.21	MRCS2/038
QL	01-May-98	919011A	Mitchell River at Gamboola Rd	Mitchell River	MIT	-16.54	143.68	MRCS2/013
QL	01-May-98	919009A	Mitchell River at Koolatah	Mitchell River	MIT	-15.95	142.38	MRCS2/010
QL	01-May-98	9190011	Mitchell River at Mt Mulgrave	Mitchell River	MIT	-16.38	143.97	MRCS2/033
QL	01-May-98	919003A	Mitchell River at OK Bridge	Mitchell River	MIT	-16.47	144.27	MRCS2/003
QL	01-May-98	919205A	North Palmer River at Maytown	Mitchell River	MIT	-16.01	144.29	MRCS2/021
QL	01-May-98	919204A	Palmer River at Drumduff Crossing	Mitchell River	MIT	-16.04	143.04	MRCS2/019
QL	01-May-98	919201A	Palmer River at Goldfields	Mitchell River	MIT	-16.11	144.78	MRCS2/017
QL	01-May-98	9192002	Palmer River at Palmerville	Mitchell River	MIT	-16	144.07	MRCS2/039
QL	01-May-98	919005A	Rifle Creek at Font Hills	Mitchell River	MIT	-16.68	145.23	MRCS2/006
QL	01-May-98	919004A	Tate River at Ootann	Mitchell River	MIT	-17.48	144.6	MRCS2/005
QL	01-May-98	9193033	Walsh River at Collins Weir	Mitchell River	MIT	-17.27	145.29	MRCS2/044
QL	01-May-98	919311A	Walsh River at Flatrock	Mitchell River	MIT	-17.18	144.9	MRCS2/026
QL	01-May-98	919310A	Walsh River at Rookwood	Mitchell River	MIT	-16.98	144.29	MRCS2/024
QL	01-May-98	919309A	Walsh River at Trimbles Crossing	Mitchell River	MIT	-16.54	143.78	MRCS2/022
QL	01-May-98	912101A	Gregory River at Gregory Downs	Nicholson River	NIC	-18.64	139.25	FNARH3/431
QL	01-May-98	912105A	Gregory River at Riversleigh No. 2	Nicholson River	NIC	-18.97	138.8	FNARH3/323
QL	01-May-98	912103A	Lawn Hill Creek at Lawn Hill	Nicholson River	NIC	-18.59	138.57	FNARH3/433
QL	01-May-98	9121039	Little Archies Creek at Lawn Hill	Nicholson River	NIC	-18.61	138.69	FNARH3/437
QL	01-May-98	912116A	Nicholson River at Doomadgee	Nicholson River	NIC	-17.95	138.82	FNARH3/435
QL	01-May-98	9121031	O'Shannassy River at Riversleigh Crossing	Nicholson River	NIC	-19.02	138.76	FNARH3/325
QL	01-May-98	916004A	Walkers Creek at Maggieville	Normanby River	NOR	-17.47	141.18	FNARH3/441
QL	01-May-99	918002A	Mentana Creek at Mentana Yards	Staaten River	STA	-16.38	142.1	FNARH5/207
QL	01-May-98	918003A	Staaten River at Dorunda	Staaten River	STA	-16.53	142.06	FNARH3/445
QL	01-May-99	923001A	Watson River at Jackin Ck	Watson River	WAT	-13.12	142.05	FNARH5/215
QL	01-May-99	925001A	Wenlock River at Moreton	Wenlock River	WEN	-12.46	142.64	FNARH5/217
QL	01-May-99	9250005	Wenlock River at Stones Xing	Wenlock River	WEN	-12.39	142.17	FNARH5/216
QL	01-May-99	925002A	Wenlock River at Wenlock	Wenlock River	WEN	-13.1	142.94	FNARH5/218

Appendix 2: Predictor variables measured, tested and selected for the Darwin-Daly region AUSRIVAS models

Variable (variable code as used in AusRivAS)	Selected for Darwin-Daly GENUS model	Selected for Darwin-Daly FAMILY model
Latitude (LATUDE)		Yes
Longitude (LNGUDE)		Yes
Day number (DAYNUM)		
Distance from source (DFS)	Yes	
Catchment area (CATARE)		
Logarithm of catchment area (LOGCAT)		
Stream order (STORDER)	Yes	
Average width (STREAMWIDTH)	Yes	Yes
Alkalinity (ALKALINITY)	Yes	
Average velocity (AVVELOCITY)	Yes	
Elevation (ELVATN)		
Standard deviation of elevation (SDVTOP)	Yes	
Range of elevation (RNGTOP)		
Riparian rainforest in 100m radius (RIP100)	Yes	
Spring rainforest in 100m radius (SPR100)		
Total rainforest in 100m radius (TOT100)		
Riparian rainforest in 250m radius (RIP250)		
Spring rainforest in 250m radius (SPR250)		
Total rainforest in 250m radius (TOT250)		
Riparian rainforest in 500m radius (RIP500)		Yes
Spring rainforest in 500m radius (SPR500)		
Total rainforest in 500m radius (TOT500)		
Riparian rainforest in 1000m radius (RIP1000)		
Spring rainforest in 1000m radius (SPR1000)		
Total rainforest in 1000m radius (TOT1000)		

Appendix 3: Environmental variables measured when conducting AUSRIVAS in WA

Site variable	Units
Latitude	
Longitude	
Altitude	(m) (Australian Height Datum)
Slope	(m km^{-1})
Distance from source	(km)
Discharge category	(1–6)
Flow pattern	(1–4)
Maximum flow	(cm s^{-1})
Mean depth	(1–5; 1 < 25 cm; 2 < 50 cm; 3 < 100 cm; 4 < 200 cm; 5 > 200 cm)
Mean river width	(m)
Average annual rainfall	(mm)
Geo Code [1]	
Water chemistry variables	
Dissolved oxygen	(% saturation)
pH	
Temperature	(^oC)
Conductivity	(µS cm^{-1})
Alkalinity	(mg L^{-1} $CaCO_3$)
Turbidity	NTU
Nitrogen, ammonia fraction	(mg L^{-1})
Nitrogen, nitrate/nitrite fraction	(mg L^{-1})
Total nitrogen	(mg L^{-1})
Soluble reactive phosphorus	(mg L^{-1})
Total phosphorus	(mg L^{-1})
Habitat variables	
Substrate characteristics	
Bedrock	(% bedrock)
Boulders	(% boulders > 256 mm)
Cobbles	(% cobbles 64–256 mm)
Pebbles	(% pebbles 16–64 mm)
Gravel	(% gravel 4–16 mm)
Sand	(% sand 1–4 mm)
Silt	(% silt < 1mm)
Clay	(%)
Habitat characteristics	
Habitat area	(% area of the habitat within 100m of stream reach)
Mineral substrate	(% cover within habitat)
Emergent macrophyte	(% cover within habitat)
Emergent macrophyte density	(1–5; 1 = sparse, 5 = dense)
Submerged macrophyte	(% cover within habitat)
Submerged macrophyte density	(1–5; 1 = sparse, 5 = dense)
Floating macrophyte	(% cover within habitat)
Floating macrophyte density	(1–5; 1 = sparse, 5 = dense)
Algae	(% cover within habitat)
Algal density	(1–5; 1 = sparse, 5 = dense)
Detritus	(% cover within habitat)
Detritus density	(1–5; 1 = sparse, 5 = dense)
Riparian vegetation	(% cover within habitat)

1 Geo code not an AUSRIVAS variable but derived from this study

Appendix 4: Contacts and/or custodians for geo-referenced freshwater invertebrate taxa for the TRIAP region

Organisation	Name	Position	Contact details	Taxa	Outcome
Museums and Art Galleries of the Northern Territory	Gavin Dally		gavin.dally@nt.gov.au	All freshwater macroinvertebrates in collection	provided all information on data-based material in collection.
WWF Australia	Tanya Vernes	Kimberley Wetlands Project Officer	tvernes@wwf.org.au	All macroinvertebrates found in the Kimberley region WA	provided information on where she found distributional data
Western Australian Museum	Terry Houston		Terry.Houston@museum.wa.gov.au	Aquatic insects in collection	provided all information on aquatic insect data based in their collection
DEW (Assessment Tool)	Cameron Slayter			All group being databased for this project	
N/A	Winston Ponder	Formerly from Australian Museum	wponder@bigpond.net.au	Freshwater Mollusca	
NSW EPA	Gunther Theischinger		theischinger@epa.nsw.gov.au	Odonata	
South Australian Museum	Robert Morris		Morris.Robert@saugov.sa.gov.au		
Museum of Victoria	Jan Frost	Senior Collection Manager	Forrest.Jan@saugov.sa.gov.au	Aquatic insects in collection	
CSIRO	Tom Weir		Tom.Weir@csiro.au	Hemipterans	
MDFRC	John Hawking		jhawkins@alburycity.nsw.gov.au	odonata & pyralids	
Queensland Museum	Geoff Monteith		geoff.monteith@qm.qld.gov.au	Aquatic insects in collection	
Queensland State Department of Natural Resources and Mines	Satish Choy		Satish.Choy@nrm.qld.gov.au	Aquatic insects in collection	
Australian Museum	Roger Springthorpe	Acting Collections Manager in Marine Invertebrates		Freshwater Crustacean	

Department of Conservation and Lands Mangement WA	Stuart Halse	Science Division	stuarth@calm.wa.gov.au	Aquatic insects in collection	
Museum of South Australia	Thierry Laperousaz	Collections Manager of Marine Invertebrates	Laperousaz.Thierry@saugov.sa.gov.au		
Western Australian Museum	Diana Jones	Curator of Crustacea	jonesd@museum.wa.gov.au		
Queensland Museum	Peter Davie	Senior Curator of Crustacea	Peter.Davie@qm.qld.gov.au		
Queensland Museum	John Stanisic	Museum staff Worm section	InquiryCentre@qm.qld.gov.au		
Queensland Museum	Mal Bryant	Museum staff Mollusc section	InquiryCentre@qm.qld.gov.au		
Western Australia Museum	Corey Whisson	Collection Manager Mollusc section	corey.whisson@museum.wa.gov.au		
Department of Conservation and Lands Mangement WA	Adrian Pinder		adrianp@calm.wa.gov.au	Oligochaeta	
CALM- WA (Species & Communities Branch)	Jill Pryde		Jillp@calm.wa.gov.au	Kimberly Mound Spring Survey	
South Australian Museum	Chris Watts	Honorary Research Associate	Watts.Chris@saugov.sa.gov.au	Coleoptera	
NT Gov't NRETA	Gisela Lamche		Gisela.lamche@nt.gov.au		
NT NRETA	Simon Townsend		Simon.Townsend@nt.gov.au		

Appendix 5: Current geo-referenced aquatic invertebrate taxa records for Australia

Source	Wet/Dry tropical taxa for which there are distributional data	Data type & availability
Museum of Victoria	Trichoptera (adults & larvae)	available by the end of 2006
Tom Weir, CSIRO	Hemiptera - Gerromorpha (families: Gerridae, Veliidae, Mesoveliidae, Hydrometridae, Hebridae & Hermatobatidae). Personal data with many records relevant to the wet/dry tropics project area	current contains over 6770 records obtained from some 49000 specimens
	Nepomorpha directly from Tom may be better	
Australian Museum	Has supposedly databased all of their Nepomorpha	
Museum of WA	Adephaga families of diving beetles	currently being databased for DEW Assessment Tool (contact - Cameron Slatyer)
	Odonata	currently being databased for DEW Assessment Tool (contact - Cameron Slatyer)
Museum of SA	Odonata	currently being databased for DEW Assessment Tool (contact - Cameron Slatyer)
	Adephaga families of diving beetles	currently being databased for DEW Assessment Tool (contact - Cameron Slatyer)
Northern Territory Museum	Tricoptera (Helicopsychidae*, Hydroptildae & Polycentropodidae*)	select few, physical locational descriptions only
	Crustacea (Atyidae, Parasticidae, Palaemonidae & Sundathelphusidae)	select few, physical locational descriptions only
	Bivaliva (Hyriidae & Corbiculidae)	select few, physical locational descriptions only
	Gastropoda (Planorbidae, Lymnaeidae, Bithyniidae, Neritidae, Thiaridae & Viviparidae)	select few , physical locational descriptions only
ANIC	Chironomidae	small selection (grapical location given in UTM)
	Coleoptera (Hydrophilidae, Gyrinidae, Dyticidae, Noteridae)	graphical location given in UTM
	Odonata (mainly adults)	graphical location given in UTM
	Hemiptera - Nepomorpha	currently databasing long way to go, will include SA museum & ANIC data
DEW assessment Tool	Adephaga families of diving beetles	not yet avaliable
	Odonata	not yet avaliable
	Mollusca	not yet avaliable
	Rotifers (bias towards SE)	not yet avaliable
Adrian Pinder (CALM–WA)	Oligochaeta	Location description from NT only?
	water beetles	WAM currently databasing their collection (funding DEW)
		SAM collection databased (DEW funded–Cameron Slatyon has information)
Odonata		WAM currently databasing their collection (funding DEW)
		MAGNT provided dataset to DEW– Cameron Slatyon for databasing
		SAM collection databased (DEW funded–Cameron Slatyon has information)
Hemiptera		ANIC currently databasing hemipterans

Appendix 6: ABRS records of current geo-referenced freshwater invertebrate taxa for the TRIAP region

Source	Group	Family (no. of species)	Species	Area Found
ANNELIDA				
	HIRUDINEA	Erpodellidae (Erpobdelloidae) (1)	*Barbronia weberi*	WA, NT & QLD
		Hirudinidae (Gnathobdelloidae) (4)	*Euranophila centrale*	WA, NT & QLD
			Goddardobdella elegans	QLD
			Habeobdella stagni	WA
			Richardsonianus australis	WA, NT & QLD
		Glossiphoniidae (3)	*Helobdella papillornata*	WA
			Placobdelloides bancrofti	QLD
			Placobdelloides octostriata	WA, NT & QLD
		Ozobranchidae (1)	*Bogabdella diversa*	WA
	OLIGOCHAETA	Naididae (Tubificidae) (16)	*Allonais inaequalis*	NT
			Allonais paraguayensis	WA & NT
			Allonais pectinata	WA
			Allonais ranauana	NT & WA
			Branchiodrilus hortensis	WA & NT
			Chaetogaster limnaei	WA
			Dero (Aulophorus) flabelliger	NT & WA
			Dero (Aulophorus) furcatus	NT & WA
			Dero (Aulophorus) vagus	NT & WA
			Dero (Dero) nivea	WA, NT & QLD
			Nais variabilis	WA
			Pristina aequiseta	NT
			Pristina longiseta	NT & WA
			Pristina osborni	NT
			Pristina proboscidae	NT & WA
			Stylaria lacustris	WA
		Rhyacodrilinae (2)	*Ainudrilus billabongus*	NT
			Ainudrilus stagnalis	NT
		Tubificinae (4)	*Antipodrilus magelensis*	NT
			Aulodrilus limnobius	NT & WA
			Aulodrilus pigueti	NT & WA

			Aulodrilus pluriseta	NT
CRUSTACEA				
	ISOPODA	Amphisopodidae (1)	*Eremisopus beei*	WA
		Mesamphisopodidae (1)	*Eophreatoicus kershawi*	NT
		Microparasellidae (1)	*Angeliera rivularis*	QLD
		Isopoda unplaced (1)	*Crenisopus acinifer*	WA
	DECOPODA	Atyidae (7)	*Caridina gracilirostris*	NT & WA
			Caridina celebensis	QLD
			Caridina spelunca	WA
			Caridinides wilkinsi	NT
			Parisia gracilis	NT
			Parisia unguis	NT
			Pycnisia raptor	NT & WA
		Kakaducarididae (2)	*Kakaducaris glabra*	NT
			Leptopalaemon gagadjui	NT
		Palaemonidae (6)	*Macrobrachium australiense*	WA, NT & QLD
			Macrobrachium bullatum	NT & WA
			Macrobrachium handschini	WA, NT & QLD
			Macrobrachium lar	NT
			Macrobrachium rosenbergii	WA, NT & QLD
			Palaemonetes australis	NT & WA
		Parastacidae (5)	*Cherax barretti*	NT
			Cherax bicarinatus	NT
			Cherax nucifraga	NT
			Cherax quadricarinatus	NT & QLD
			Cherax rhynchotus	QLD
		Parathelphusidae (5)	*Austrothelphus tigrina*	QLD
			Austrothelphus agassizi	QLD
			Austrothelphus raceki	QLD
			Austrothelphus transversa	WA, NT & QLD
			Austrothelphus valentula	QLD
INSECTA				
	COLEOPTERA	Dytiscidae (115)	*Platynectes decempunctatus*	NT
			Platynectes monostigma	NT & WA
			Platynectes octodecimmaculatus	WA, NT & QLD

Rhantus suturalis	NT
Copelatus blakewelli	NT & WA
Copelatus clarki	NT
Copelatus daemeli	NT
Copelatus irregularis	WA, NT & QLD
Copelatus marginatus	WA, NT & QLD
Copelatus nigrolineatus	NT & WA
Copelatus tenebrosus	NT
Rhantaticus congestus	WA, NT & QLD
Sandracottus bakewelli	WA, NT & QLD
Austrodytes insularis	WA
Cybister godeffroyi	NT
Cybister loxidiscus	QLD
Cybister tripunctatus	WA, NT & QLD
Cybister weckwerthi	NT
Cybister yulensis	NT & QLD
Onychydrus atratus	NT
Eretes australis	WA, NT & QLD
Hydaticus bihamatus	NT
Hydaticus bihamatus goryi	NT
Hydaticus consanguineus	NT & WA
Hydaticus daemeli	NT & QLD
Hydaticus fabricii	NT
Hydaticus microdaemeli	NT & QLD
Hydaticus vittatus	WA, NT & QLD
Allodessus bistrigatus	NT & QLD
Bidessodes flavosigilatus	NT & QLD
Bidessodes mjobergi	NT & WA
Clypeodytes bifasciatus	NT & QLD
Clypeodytes darlingtoni	QLD
Clypeodytes migrator	NT
Hydroglyphus balkei	NT & WA
Hydroglyphus basalis	WA, NT & QLD
Hydroglyphus daemeli	WA, NT & QLD
Hydroglyphus godeffoyi	NT & WA

Hydroglyphus leai	WA, NT & QLD
Hydroglyphus mastersii	WA, NT & QLD
Hydroglyphus trifasciatus	NT
Limbodessus compactus	NT
Liodessus shuckardii	NT & QLD
Antiporus bakewelli	QLD
Antiporus jenniferae	WA, NT & QLD
Chostonetes gigas	NT & QLD
Megaporus ruficeps	NT & WA
Necterosoma regulare	NT & WA
Necterosoma thoreyi	WA, NT & QLD
Sekaliporus kriegi	NT & WA
Tiporus alastairi	NT & WA
Tiporus centralis	NT & WA
Tiporus collaris	NT & WA
Tiporus denticulatus	NT & QLD
Tiporus georginae	WA
Tiporus giuliani	WA
Tiporus josepheni	WA, NT & QLD
Tiporus moriartyensis	NT
Tiporus undecimmaculatus	WA, NT & QLD
Hydrovatus fasciatus	NT
Hydrovatus nigrita	NT
Hydrovatus opacus	WA, NT & QLD
Hydrovatus ovalis	WA, NT & QLD
Hydrovatus parallelus	WA
Hydrovatus rufoniger	WA, NT & QLD
Hydrovatus weiri	WA
Hyphydrus contiguus	NT
Hyphydrus decemmaculatus	NT
Hyphydrus effeminatus	NT
Hyphydrus lyratus	WA, NT & QLD
Hyphydrus lyratus lyratus	WA, NT & QLD
Laccophilus cingulatus	QLD & NT
Laccophilus clarki	WA, NT & QLD

	Laccophilus quadrimaculatus	NT
	Laccophilus religatus	QLD & NT
	Laccophilus seminiger	NT
	Laccophilus sharpi	WA, NT & QLD
	Laccophilus walkeri	QLD
	Batrachomatus wingii	NT
Gyrinidae (10)	*Dineutus australis*	WA, NT & QLD
	Dineutus neohollandicus	NT
	Gyrinus convexiusculus	NT
	Macrogyrus viridisulcatus	QLD
	Macrogyrus darlingtoni	WA, NT & QLD
	Macrogyrus paradoxus	WA, NT & QLD
	Macrogyrus australis	QLD
	Macrogyrus elongatus laevis	QLD
	Macrogyrus venator	NT
	Macrogyrus gouldii	NT
Haliplidae (11)	*Haliplus alastairi*	WA, NT & QLD
	Haliplus australis	NT & QLD
	Haliplus bistriatus	QLD & WA
	Haliplus ferruginipes	NT
	Haliplus hydei	QLD
	Haliplus sindus	QLD
	Haliplus stepheni	WA, NT & QLD
	Haliplus storeyi	NT
	Haliplus testudo	NT & QLD
	Haliplus timmsi	NT & QLD
	Haliplus wattsi	WA, NT & QLD
Hygrobiidae (1)	*Hygrobia maculata*	NT & QLD
Noteridae (4)	*Canthydrus bovillae*	NT
	Canthydrus ephemeralis	NT & WA
	Hydrocanthus australasiae	NT
	Hydrocanthus waterhousei	NT
Rysodidae (1)	*Omoglymmius okei*	QLD
Elmidae (5)	*Austrolimnius (Neosolus) isdellensis*	WA
	Austrolimnius (Neosolus) tropicus	NT

Hydrophilidae (100)

Austrolimnius (Neosolus) tropicus asper	NT
Austrolimnius (Neosolus) tropicus tropicus	NT
Notriolus minutus	QLD
Georissus kingii	QLD
Hydrochus aschnakiranae	NT, QLD & WA
Hydrochus atratus	NT & WA
Hydrochus australis	NT & WA
Hydrochus burdekinensis	NT, WA & QLD
Hydrochus decorus	NT, WA & QLD
Hydrochus eurypleuron	WA & NT
Hydrochus gitaraiae	QLD & NT
Hydrochus horni	QLD
Hydrochus imamkhani	QLD, NT & WA
Hydrochus interioris	QLD, NT & WA
Hydrochus kunarajahi	NT & WA
Hydrochus laeteviridis	NT, QLD & WA
Hydrochus macroaquilonius	QLD & NT
Hydrochus numerosepunctatus	NT
Hydrochus obscuroaeneus	QLD, NT & WA
Hydrochus radjiei	QLD, NT & WA
Hydrochus simplicicollis	WA
Paracymus australiae	NT
Paracymus gigas	WA
Paracymus opacus	QLD
Paracymus pygmaeus	NT, WA & QLD
Paracymus spenceri	NT, WA & QLD
Paracymus wattsi	NT
Paracymus weiri	WA
Paranacaena horni	QLD
Allocotocerus punctatus	QLD
Allocotocerus tibialis	QLD
Allocotocerus yalumbaboothbyi	NT & WA
Berosus debilipennis	WA & NT
Berosus devisi	QLD
Berosus juxtadiscolor	NT

Berosus macropunctatus	NT
Berosus nutans	QLD
Berosus pulchellus	NT, WA & QLD
Berosus quadrapunctatus	NT
Berosus ralphi	WA
Berosus reardoni	NT
Berosus sarahae	QLD
Berosus subovatus	NT & QLD
Berosus timmsi	QLD
Berosus trishae	QLD
Berosus amoenus	NT
Berosus aquilo	NT
Berosus australiae	NT & WA
Berosus dallasae	NT, WA & QLD
Berosus decipiens	NT & WA
Berosus gibbae	NT & WA
Berosus josephenae	QLD
Berosus macumbensis	NT, WA & QLD
Berosus nicholasi	NT & WA
Berosus sadieae	NT
Berosus vijae	NT & WA
Regimbartia attenuatus	NT, WA & QLD
Amphiops australicus	NT, WA & QLD
Amphiops duplopunctulatus	NT, WA & QLD
Amphiops queenslandicus	NT
Chaetarthria nigerrima	NT, WA & QLD
Agraphydrus coomani	NT & QLD
Chasmogenus nitescens	NT
Enochrus aliciae	NT
Enochrus deserticola	NT, WA & QLD
Enochrus elongatulus	NT, WA & QLD
Enochrus esuriens	NT, WA & QLD
Enochrus eubenangeei	NT
Enochrus malabarensis	NT
Enochrus pseudoweiri	NT

Helochares foveicollis	NT, WA & QLD
Helochares anthonyae	NT
Helochares clypeatus	NT, WA & QLD
Helochares dalhuntyi	NT
Helochares luridus	NT
Helochares loweryae	NT, WA & QLD
Helochares marreensis	NT, WA & QLD
Helochares nigripalpis	NT
Helochares percyi	NT, WA & QLD
Helochares tatei	NT, WA & QLD
Helochares wattsi	NT
Hydrobiomorpha bovilla	NT & QLD
Hydrobiomorpha debbae	QLD
Hydrobiomorpha helenae	NT, WA & QLD
Hydrobiomorpha microspina	NT, WA & QLD
Hydrobiomorpha troxi	NT
Hydrophilus brevispina	NT, WA & QLD
Hydrophilus macronyx	NT
Hydrophilus picicornis	NT, WA & QLD
Hydrophilus wattsi	QLD
Sternolophus australis	NT, WA & QLD
Sternolophus immarginatus	NT, WA & QLD
Sternolophus marginicollis	NT, WA & QLD
Laccobius bicaudatus	NT
Laccobius brittoni	QLD & NT
Laccobius collium	NT
Laccobius matthewsi	NT, WA & QLD
Laccobius quantulus	WA
Laccobius roseiceps	NT
Laccobius tantillus	NT
Spercheus platycephalus	NT & QLD
Spercheus platycephalus platycephalus	NT & QLD
Spercheus wattsi	NT & WA
Cloeon fluviatile	NT
Cloeon virens	WA
EPHEMEROPTERA	Baetidae (2)

		Caenidae (1)	*Irpacaenis kaapi*	QLD
	Leptophlebiidae	Leptophlebiidae (2)	*Jappa edmundsi*	QLD
			Jappa serrata	QLD
DIPTERA		Chironomidae (9)	*Neozavrelia bowmani*	NT
			Tanytarsus barbitarsis	WA
			Tanytarsus dostinei	NT & WA
			Tanytarsus formosanus	NT
			Tanytarsus gulungul	NT & WA
			Tanytarsus hardwicki	NT
			Tanytarsus humphreyi	NT
			Tanytarsus reidi	NT, WA & QLD
			Tanytarsus richardsi	NT, WA & QLD
HEMIPTERA		Nepidae (4)	*Goondnomdanepa britton*	NT
			Goondnomdanepa prominens	NT
			Goondnomdanepa weiri	NT
			Cercotmetus brevipes australis	NT
		Notonectidae (1)	*Anisops dostini*	NT
		Ochteridae (4)	*Ochterus baehri*	NT
			Ochterus baehre riegeri	NT
			Ochterus secundus	NT, WA & QLD
			Ochterus secundus secundus	NT, WA & QLD
MOLLUSCA		Planorbidae (17)	*Amerianna bonushenricus*	NT
			Amerianna carinata	QLD
			Amerianna compar	WA
			Amerianna cumingi	NT
			Amerianna obesula	QLD
			Amerianna reevii	QLD
			Bayardella cosmeta	NT
			Bayardella johni	WA
			Glyptophysa badia	NT
			Glyptophysa georgiana	WA
			Gyraulus gilberti	QLD
			Gyraulus essingtonensis	NT, WA & QLD
			Gyraulus hesperus	NT, WA & QLD
			Gyraulus waterhousei	QLD

		Helicorbis australiensis	QLD
		Helicorbis meniscoides	NT
		Leichhardtia sisurnius	NT & WA
	Physidae (1)	*Physa acuta*	QLD
	Lymnaeidae (3)	*Austropeplea lessoni*	NT, WA & QLD
		Lymnaea viridis	NT, WA & QLD
	Glacidorbidae (1)	*Glacidorbis occidentalis*	WA
	Ancylidae (3)	*Ferrissia petterdi*	NT, WA & QLD
		Ferrissia tasmanicus	NT, WA & QLD
		Stimulator consetti	WA
OLIGOCHAETA	Naididae (16)	*Allonais inaequalis*	NT
		Allonais paraguayensis	NT & WA
		Allonais pectinata	WA
		Allonais ranauana	NT & WA
		Branchiodrilus hortensis	NT & WA
		Chaetogaster limnaei	WA
		Dero flabelliger	NT & WA
		Dero furcatus	NT & WA
		Dero vagus	NT & WA
		Dero nivea	NT, WA & QLD
		Nais variabilis	WA
		Pristina aequiseta	NT
		Pristina longiseta	NT & WA
		Pristina osborni	NT
		Pristina proboscidae	NT & WA
		Stylaria lacustris	WA
	Rhyacodrilinae (2)	*Ainudrilus billabongus*	NT
		Ainudrilus stagnalis	NT
	Tubificinae (4)	*Antipodrilus magelensis*	NT
		Aulodrilus limnobius	NT & WA
		Aulodrilus pigueti	NT & WA
		Aulodrilus pluriseta	NT
ODONATA	Aeshnidae (8 adult spp., only 4 with associated larva)	*Anaciaeschna jaspidea*	NT & QLD

	Anax georgius	WA
	Anax gibbosulus	WA, NT & QLD
	Anax guttatus	WA, NT & QLD
	Austrogynacantha heterogena	WA, NT & QLD
	Gynacantha dobsoni	NT & QLD
	Gynacantha nourlangie	WA, NT & QLD
	Hemianax papuensis	WA, NT & QLD
Telephlebiidae (1)	*Austroaeschna forcipata*	QLD
Austrocorduliidae (2)	*Austrocordulia territoria*	NT
	Micromidia rodericki	QLD
Corduliidae (1)	*Pentathemis membranulata*	WA, NT & QLD
Gomphidae (15)?	*Antipodogomphus acolythus*	QLD
	Antipodogomphus dentosus	NT
	Antipodogomphus edentulus	QLD
	Antipodogomphus neophytus	WA, NT & QLD
	Austrogomphus arbustorum	QLD
	Austrogomphus cornutus	QLD
	Austrogomphus doddi	QLD
	Austrogomphus mjobergi	NT & WA
	Austrogomphus bifurcatus	QLD
	Austrogomphus divaricatus	QLD
	Austrogomphus prasinus	QLD
	Austrogomphus mouldsorum	WA
	Austrogomphus turneri	WA, NT & QLD
	Hemigomphus comitatus	QLD
	Hemigomphus magela	NT
Hemicorduliidae (3)	*Hemicordulia intermedia*	WA, NT & QLD
	Hemicordulia kalliste	NT & QLD
	Hemicordulia tau	WA, NT & QLD
Lebellulidae (42)?	*Agrionoptera insignis*	NT & QLD
	Agrionoptera insignis allogenes	NT & QLD
	Agrionoptera longitudinalis	QLD
	Branchydiplax denticauda	WA, NT & QLD
	Branchydiplax duivenbodei	QLD
	Camacinia othello	NT & QLD

Crocothemis nigrifrons	NT, WA & QLD
Diplacodes bipunctata	NT, WA & QLD
Diplacodes haematodes	NT, WA & QLD
Diplacodes nebulosa	NT, WA & QLD
Diplacodes trivialis	NT, WA & QLD
Huonia melvillensis	NT
Hydrobasileus brevistylus	NT & QLD
Lathrecista asiatica	NT & QLD
Nannodiplax rubra	NT, WA & QLD
Nannophlebia eludens	NT & QLD
Nannophlebia injibandi	NT & WA
Nannophlebia mudginberri	NT & WA
Nannophya pymaea	NT
Neurothemis oligoneura	NT & QLD
Neurothemis stigmatizans	NT, WA & QLD
Neurothemis stigmatizans stigmatizans	NT, WA & QLD
Orthetrum caledonicum	NT, WA & QLD
Orthetrum migratum	NT, WA & QLD
Orthetrum sabina	NT, WA & QLD
Orthetrum sabina sabina	NT, WA & QLD
Orthetrum serapia	NT & QLD
Orthetrum villosovittatum	NT & QLD
Pantala flavescens	NT, WA & QLD
Rhodothemis lieftincki	NT, WA & QLD
Rhodothemis phyllis	NT, WA & QLD
Rhodothemis princeps	NT & QLD
Rhodothemis princeps princeps	QLD
Rhodothemis resplendens	QLD
Tetrathemis irregularis	QLD
Tetrathemis irregularis cladophila	QLD
Tholymis tillarga	NT, WA & QLD
Trapezostigma loewii	NT, WA & QLD
Trapezostigma stenoloba	NT, WA & QLD
Zyxomma elgneri	NT, WA & QLD
Zyxomma peliolatum	NT & QLD

	Lindeniidae (2)?	*Ictinogomphus australis*	NT, WA & QLD
		Ictinogomphus paulini	QLD
	Macromiidae (2)?	*Macromia tillyardi*	NT & QLD
		Macromia viridescens	QLD
	Urothemistidae (2)?	*Macrodiplax cora*	NT, WA & QLD
		Urothemis aliena	NT & WA
ZYGOPTERA	Calopterygidae (1)?	*Neurobasis australis*	QLD
	Coenagrionidae (22)?	*Aciagrion fragilis*	NT & QLD
		Agriocnemis argentea	NT, WA & QLD
		Agriocnemis femina	NT, WA & QLD
		Agriocnemis pygmaea	NT, WA & QLD
		Agriocnemis rubricauda	NT & QLD
		Agriocnemis thoracalis	QLD
		Agriocnemis rubescens	NT & QLD
		Austroagrion watsoni	NT, WA & QLD
		Austrocnemis maccullochi	NT & QLD
		Austrocnemis obscura	WA
		Ceriagrion aeruginosum	NT, WA & QLD
		Ischnura aurora	NT, WA & QLD
		Ischnura aurora aurora	NT, WA & QLD
		Ischnura heterosticta	NT, WA & QLD
		Ischnura heterosticta heterosticta	NT, WA & QLD
		Ischnura pruinescens	NT & QLD
		Pseudagrion aureofrons	NT, WA & QLD
		Pseudagrion ignifer	QLD
		Pseudagrion ignifer aureum	NT, WA & QLD
		Pseudagrion jedda	QLD & NT
		Pseudagrion microcephalum	NT, WA & QLD
		Xanthagrion erythroneurum	NT, WA & QLD
	Isostictidae (8)?	*Austrosticta fieldi*	NT & WA
		Austrosticta frater	QLD
		Austrosticta soror	WA
		Eurysticta kununurra	NT & WA
		Lithosticta macra	NT
		Rhadinosticta banksi	NT, WA & QLD

		Rhadinosticta handschini	NT, WA & QLD
		Rhadinosticta simplex	QLD
	Lestidae (3)?	*Austrolestes insularis*	NT, WA & QLD
		Indolestes tenuissimus	QLD
		Lestes concinnus	NT, WA & QLD
	Megapodagrionidae (1)?	*Podopteryx selysi*	NT
	Protoneuridae (1)?	*Nososticta baroalba*	NT
		Nososticta fraterna	NT
TRICHOPTERA	Calamoceratidae	*Anisocentropus banghaasi*	NT
		Anisocentropus corvinus	WA
		Anisocentropus muricatus	NT & WA
	Ecnomidae (21 adult spp.,)	*Ecnomus ancisus*	NT & WA
		Ecnomus apiculatus	NT & WA
		Ecnomus bishopi	NT & WA
		Ecnomus blythi	NT & WA
		Ecnomus clavatus	NT & WA
		Ecnomus cuspidis	NT & WA
		Ecnomus digrutus	NT & WA
		Ecnomus jimba	NT & WA
		Ecnomus kakaduensis	NT & WA
		Ecnomus kinka	NT & WA
		Ecnomus kitabal	WA
		Ecnomus larakia	WA
		Ecnomus miriwud	NT & WA
		Ecnomus pansus	NT
		Ecnomus pibarensis	NT & WA
		Ecnomus tropicus	NT & WA
		Ecnomus turrbal	NT
		Ecnomus veratus	NT, WA & QLD
		Ecnomus walajandari	NT & WA
		Ecnomus woronan	NT & WA
		Ecnomus yabbura	NT & WA
	Helicopsychidae (3)	*Helicopsyche albidela*	WA
		Helicopsyche alicae	NT & WA
		Helicopsyche kakadu	NT

Hydropsychidae (4)	*Asmicridae capricornica*	NT & WA
	Cheumatopsychidae modica	QLD
	Cheumatopsychidae dostinei	NT & WA
	Cheumatopsychidae kakaduensis	NT
	Cheumatopsychidae suteri	NT & WA
	Cheumatopsychidae wellsae	NT & WA
Hydroptilidae (19)	*Hellyethira cubitans*	NT, WA & QLD
	Hellyethira dentata	NT & WA
	Hellyethira eskensis	NT
	Hellyethira forficata	NT
	Hellyethira imparalobata	WA
	Hellyethira loripes	NT & WA
	Hellyethira naumanni	WA
	Hellyethira pulvina	WA
	Hellyethira radonensis	NT
	Hellyethira ramosa	NT, WA & QLD
	Hellyethira sentisa	WA
	Hellyethira vernoni	NT, WA & QLD
	Hellyethira veruta	NT
	Hydroptila incertula	NT & WA
	Jabitrichia dostinei	NT
	Orphninotrichia originis	NT
	Orthotrichia aculeata	NT & WA
	Orthotrichia alata	NT
	Orthotrichia amnica	NT
	Orthotrichia bellico	NT & WA
	Orthotrichia eurhinata	NT
	Orthotrichia exigua	NT & WA
	Orthotrichia fontinala	NT
	Orthotrichia furcata	NT
	Orthotrichia inornata	NT & WA
	Orthotrichia muscari	NT
	Orthotrichia paranga	NT & WA
	Orthotrichia scutata	NT & WA
	Orthotrichia serrata	NT

	Orthotrichia stipa	WA
	Orthotrichia suteri	NT, WA & QLD
	Orthotrichia tomentosa	NT
	Orthotrichia turrita	NT, WA & QLD
	Orthotrichia tyleri	NT, WA & QLD
	Orthotrichia velata	NT & WA
	Oxethira artuvillosus	WA
	Oxethira incana	NT
	Oxethira plumosa	NT
	Oxethira warramunga	NT
	Oxethira cornutata	NT
	Tricholeiochiton bifurca	NT & WA
	Tricholeiochiton edmondsi	WA
	Tricholeiochiton fidelis	NT, WA & QLD
	Tricholeiochiton jabirella	NT
	Tricholeiochiton tridens	NT & WA
Leptoceridae	*Leptocerus atsou*	NT & QLD
	Oecetis adelaidica	NT
	Oecetis complexa	WA
	Oecetis epekeina	NT, WA & QLD
	Oecetis kakaduensis	NT
	Oecetis laustra	NT, WA & QLD
	Oecetis pechana	NT, WA & QLD
	Oecetis uptoni	NT
	Triaenodes camura	NT
	Triaenodes celata	QLD
	Triaenodes copelata	NT
	Triaenodes corynotra	NT
	Triaenodes dibolia	NT & WA
	Triaenodes drepana	NT & WA
	Triaenodes dysmica	NT
	Triaenodes etheira	NT & WA
	Triaenodes gibberosa	NT & WA
	Triaenodes mataranka	NT
	Triaenodes mouldsi	NT

	Triaenodes nymphaea	WA
	Triaenodes reclusa	QLD
	Triaenodes rutella	WA
	Triaenodes stipulosa	NT, WA & QLD
	Triaenodes theiophora	
	Triaenodes toxeres	QLD
	Triaenodes verberata	QLD
	Triaenodes virgula	NT & WA
	Triplectides australis	NT, WA & QLD
	Triplectides ciuskus ciuskus	NT
	Triplectides ciuskus seductus	NT & WA
	Triplectides helvolus	NT & WA
	Triplectides parvus	NT
Philopotamidae	*Chimarra uranka*	NT, WA & QLD
	Chimarra adaluma	WA
	Chimarra akruna	NT
	Chimarra bungoona	NT
	Chimarra kaiya	NT & QLD
	Chimarra larapinta	WA
	Chimarra locolo	NT
	Chimarra nabilla	NT & WA
	Chimarra orumbera	WA
	Chimarra pillara	WA & NT
	Chimarra pita	NT & WA
	Chimarra ranuka	NT
	Chimarra yandala	QLD
Polycentropodidae	*Paranyctiophylax apicatus*	NT & QLD
	Paranyctiophylax parvus	NT
	Paranyctiophylax rhamphodes	NT
	Paranyctiophylax spiculatus	NT & WA
Psychomyiidae	*Tinodes radona*	NT

Very general distributional information i.e. state/terroritory name, major river, area of state,terroritory given for the following groups: Hemipterans (most Nepomorpha & Gerromorpha), all other diptera except some Chironomidae listed above. No distributional infomation for Acarina.

Appendix 7: ANIC database with geo-referenced aquatic invertebrate taxa records for northern Australia

Taxa	Family	Genus (no. of species)	Families (no. of species)	Catchment
INSECTA				
Coleoptera	Dytiscidae	Allodessus (1)	*Allodessus bistrigatus*	NT: Daly & Victoria Rivers. QLD: Nicholson & Leichhart Rivers. WA: Cape Leveque Coast.
		Antiporus (1)	*Antiporus gilberti*	QLD: Leichhart River
		Austrodytes (1)	*Austrodytes insularis*	WA: Prince Regent & Drysdale Rivers
		Batrachomatus (1)	*Batrachomatus wingi*	NT: Daly River. QLD: Jardine River.
		Bidessodes (5)	*Bidessodes bilita*	QLD: Embley & Wenlock Rivers.
			Bidessodes denticulatus	NT: East Alligator River. QLD: Archer, Wenlock, Ducie, Coleman, Holroyd, Jardine & Embley Rivers.
			Bidessodes flavosignatus	NT: East Alligator & Finnis Rivers. QLD: Embley, Archer, Wenlock, Ducie, Coleman, Mitchell, Holroyd, Jardine Rivers.
			Bidessodes grossus	NT: East Alligator River. QLD: Holroyd River.
			Bidessodes mjobergi	QLD: Archer River
		Clypeodytes (2)	*Clypeodytes bifasciatus*	NT: East Alligator River. QLD: Archer, Ducie, Wenlock, Coleman, Holroyd, Embley & Mitchell Rivers.
			Clypeodytes darlingtoni	QLD: Archer River
			Clypeodytes migrator	QLD: Archer, Wenlock & Mitchell Rivers
			Copelatus bakewelli	NT: South Alligator & Daly Rivers. QLD: Embley River
			Copelatus clarki	NT: East Alligator River. QLD: Embely, Archer, Wenlock, Ducie & Mitchell Rivers
			Copelatus daemeli	QLD: Jardine & Embley Rivers
			Copelatus divisus	QLD: Wenlock & Embley Rivers
			Copelatus irregularis	QLD: Archer, Mitchell, Ducie, Wenlock, Nicholson,Flinders Rivers. WA: Cape Leveque Coast, Drysdale & King Edward Rivers.
			Copelatus nigrolineatus	QLD: Wenlock, Coleman, Mitchell & Archer Rivers. WA: Ord River
			Copelatus tenebrosus	NT: Daly River. QLD: Embley River
			Copelatus marginatus	NT: Finniss, Daly & Roper Rivers. QLD: Embley, Wenlock & Mitchell Rivers
			Copelatus nigrolineatus	NT: East Alligator & Daly Rivers. QLD: Archer River
			Copelatus melanarius	QLD: Embley & Flinders Rivers. NT: East Alligator

		Cybister (2)	*Cybister godeffroyi*	QLD: Coleman & Archer Rivers. NT: Finniss & East Alligator Rivers. WA: King Edward Rvier
			Cybister tripunctatus	NT: South Alligator, Alelaide, Finniss, McArthur, East Alligator & Daly Rivers. QLD: Nicholson, Mitchell & Archer Rivers. WA: Cape Leveque Coast, Fitzroy, King Edward & Ord Rivers
		Eretes (2)	*Eretes australis*	NT: Ord, East Alligator, Victoria, Adelaide, Daly & McArthur Rivers. QLD: Nicholson, Leichhardt, Mitchel & Flinders. WA: Cape Leveque Coast, Fitzroy, Drysdale, Isdell, Ord, Pentecost & Lennard Rivers
			Eretes griseus	NT: East Alligator & Finnis Rivers.
		Hydaticus (4)	*Hydaticus bihamatus*	NT: East Alligator River. QLD: Archer, Ducie, Mitchell, Wenlock & Embley Rivers
			Hydaticus consanguineus	NT: McArthur, Victoria, Daly & Finnis Rivers. Archer, Mitchell, Embley, Wenlock, Ducie, Coleman & Flinders Rivers. WA: King Edward River
			Hydaticus daemeli	NT: Finniss River. QLD: Ducie, Embley & Archer Rivers. WA: King Edward River
			Hydaticus microdaemeli	NT: East Alligator & Adelaide Rivers. QLD: Embley River
			Hydaticus vittatus	NT: East Alligator, Adelaide, Finniss & Roper Rivers. QLD: Archer, Wenlock, Ducie, Jardine, Mitchell & Embley Rivers. WA: Ord & Pentecost Rivers.
		Hydroglyphus (7)	*Hydroglyphus basalis*	NT: South Alligator, Daly, Adelaide, East Alligator, Roper, Wildman Rivers. QLD: Nicholson, Archer, Embley, Wenlock, Coleman, Jardine & Mitchell Rivers
			Hydroglyphus daemeli	
			Hydroglyphus godeffroyi	
			Hydroglyphus leai	
			Hydroglyphus signatus	
			Hydroglyphus trifasciatus	
			Hydroglyphus trilineatus	
		Hydrovatus (6)	*Hydrovatus fasciatus*	
			Hydrovatus nigrita	
			Hydrovatus opacus	
			Hydrovatus ovalis	
			Hydrovatus parallelus	

			Hydrovatus rufoniger	
		Hyphydrus (5)	*Hyphydrus contiguus*	
			Hyphydrus effeminatus	
			Hyphydrus elegans	
			Hyphydrus lyratus	
			Hyphydrus lyratus lyratus	
		Laccophilus (8)	*Laccophilus cingulatus*	
			Laccophilus clarki	
			Laccophilus religatus	
			Laccophilus seminiger	
			Laccophilus sharpi	
			Laccophilus transversalis transversalis	
			Laccophilus univittatus	
			Laccophilus walkeri	
		Limbodessus (1)	*Limbodessus compactus*	
		Megaporus (2)	*Megaporus nativigi*	
			Megaporus ruficeps	
		Onychohydrus (1)	*Onychohydrus atratus*	
		Platynectes (3)	*Platynectes decempunctatus*	
			Platynectes monostigma	
			Platynectes octodecimmaculatus	
		Rhantaticus (1)	*Rhantaticus congestus*	
		Rhantus (1)	*Rhantus suturalis*	
		Sandracottus(1)	*Sandracottus bakewelli*	
		Sternopriscus (4)	*Sternopriscus aquilonaris*	
		Tiporus (4)	*Tiporus alastairi*	
			Tiporus collaris	
			Tiporus josepheni	
			Tiporus undecimmaculatus	
	Elmidae	Austrolimnius (1)	*Austrolimnius tropicus*	
	Gyrinidae	Dineutus (2)	*Dineutus australis*	
			Dineutus neohollandicus	
		Gyrinus (1)	*Gyrinus convexiusculus*	
		Macrogyrus (2)	*Macrogyrus elongatus*	

			Macrogyrus paradoxus	
	Hydrophilidae	Berosus (3)	*Berosus australiae*	
			Berosus macumbensis	
			Berosus pulchellus	
		Chaetarthria (1)	*Chaetarthria nigerrimus*	
		Enochrus (2)	*Enochrus deserticola*	
			Enochrus elongatulus	
		Helochares (4)	*Helochares foveicollis*	
			Helochares marreensis	
			Helochares percyi	
			Helochares tatei	
		Hydrochus (1)	*Hydrochus australis*	
		Hydrophilus (1)	*Hydrophilus brevispina*	
		Laccobius (1)	*Laccobius matthewsi*	
		Paracymus (2)	*Paracymus pygmaeum*	
			Paracymus spenceri	
		Pseudoosternum (1)	*Pseudoosternum brunneum*	
		Spercheus (1)	*Spercheus platycephalus*	
		Sphaeridium (1)	*Sphaeridium discolor*	
		Sternolophus (2)	*Sternolophus immarginatus*	
			Sternolophus marginicollis	
	Noteridae	Hydrocanthus (1)	*Hydrocanthus australasiae*	
		Neohydrocoptus (formerly Hydrocoptus) (1)	*Neohydrocoptus (formerly Hydrocoptus) subfasciatus*	
		Notomicrus (1)	*Notomicrus tenellus*	
Diptera	Chironomidae	Conochironomus (4)	*Conochironomus australiensis*	
			Conochironomus cervus	
			Conochironomus cygnus	
			Conochironomus kakadu	
		Cricotopus (2)	*Cricotopus albitarsis*	
			Cricotopus brevicornis	
		Dicrotendipes (2)	*Dicrotendipes balciunasi*	
			Dicrotendipes lindae	
		Rheotanytarsus (4)	*Rheotanytarsus christinae*	
			Rheotanytarsus gloveri	

			Rheotanytarsus petropholeter	
			Rheotanytarsus trivittatus	
		Riethia (3)	*Riethia cinctipes*	
			Riethia stictoptera	
			Riethia zeylandica	
Hemiptera	Nepidae	Laccotrephes (1)	*Laccotrephes tristis*	
		Ranatra (2)	*Ranatra diminuta*	
			Ranatra dispar	
Odonata		Numerous adult records only		

Appendix 8: Taxonomic literature relevant to freshwater invertebrates of the TRIAP region

REFERENCE	CATCHMENT	TYPE OF LOCALITY DATA	COMMENTS
Andersen NM & Weir TA 1998. Australian water striders of the subfamilies Trepobatinae and Rhagadotarsinae (Hemiptera:Gerridae). *Invertebrate Taxonomy*, 12, 509–544.	NT: East Alligator, South Alligator, Finniss, Mary, Daly, Adelaide, Roper, Wildman and Keep Rivers. QLD: Archer, Flinders, Wenlock, Jardine, Ducie, Holroyd, Coleman, Nicholson & Mitchell Rivers. WA: Ord, Prince Regent & Ord Rivers.	Locality names, distances from & point locations on distribution map.	
Britton EB 1981. The Australian Hygrobiidae (Coleoptera). *Journal of Australian Entomology Society* 20, 83–86.	NT: Finniss, Daly & East Alligator Rivers. QLD: Jardine River.	Locality names & Latitude, Longitude coordinates for 1 species only.	
Bruce AJ 1993. *Kakaducaris glabra* gen. nov., sp. Nov., a new freshwater shrimp from the Kakadu National Park, Northern Territory, Australia, Crustacea: Decapoda: Palaemonidae with the designation of the new subfamily Kakaducaridinae. *Hydrobiologia* 268, 27–44.	NT: South & East Alligator River	General locality names & some latitude, longitude coordinates	
Bruce AJ & Short JW 1993. *Leptopalaemon gagadjui* gen. nov., a new freshwater palaemonid shrimp from Arnhemland, and re-evaluation of *Palaemontes holthuisi* Strenth, with a designation of a new genus, *Calathaemon*. *Hydrobiologia* 257, 73–94.	NT: South & East Alligator River	General locality names & some latitude, longitude coordinates	
Cranston PS 1991. Taxonomy of the Chironomidae of the Alligator Rivers Region. Open File Record 82, Supervision Scientist for the Alligator Rivers Region, Canberra. Unpublished paper.	NT: East Alligator, South Alligator & Wildman Rivers.	Latitude, Longitude coordinates	
Cranston PS 1997. The Australian *Rheotanytarsus* Thienemann & Bause (Diptera: Chironomidae) revised, with emphasis on the immature stages. *Invertebrate Taxonomy* 11, 705–34.	NT: South Alligator, East Alligator, Finniss, Daly & Ropers. QLD:Nicholson River. WA: Prince Regent River, King Edward & Isdell Rivers.	Latitude, Longitude coordinates	
Cranston PS 1999. Two unusual Chironomini (Diptera: Chironomidae) from Australian rainforest streams: one new genus and a neotropical genus new for the region. *Australian Journal of Entomology* 38 (4), 291–299.	NT: South Alligator & East Alligator	Locality names & 1 Latitude, Longitude coordinate for 3 sites	Distributional information for 1 species only (*Anuncotendipes kakadu* sp. n.)
Cranston PS 2006. A new genus and species of Chironominae (Diptera: Chironomidae) with wood-mining larvae. *Australian Journal of Entomology* 45, 227–234.	NT: South Alligator & East Alligator Rivers.	Latitude, Longitude coordinates	

Cranston PS & Hare L 1995, in press. *Conochironomus* Freeman: an afro-Australian Chironomini genus revised (Diptera: Chironomidae). *Systematic Entomology*, 20, 247–64.	NT: East Alligator, South Alligator, Wildman, Finnis, Daly, McArthur & Adelaide Rivers. WA: Pentecost, Prince Regent, King Edward, Drysdale, Lennard, Fitzroy Rivers & Cape Leveque Coast.	Latitude, Longitude coordinates	
Cranston PS (in press). Monsoonal Tropical *Tanytarsus* v.d.Wulp (Diptera: Chironomidae) reviewed: a new species and life histories and aquatic indicator significance. *Australian Entomologist*.	NT: East Alligator, South Alligator, Wildman & Finnis Rivers. WA: Pentecost, King Edward, Isdell, Lennard, Fitzroy & Ord Rivers. QLD: Nicholson River.	Latitude, Longitude coordinates	
Dean JC 2001. New Species of Hydropsychidae (Insecta: Trichoptera) from Northern Australia. *Memoirs of Museum Victoria* 58 (2), 231–246.	NT: East Alligator, South Alligator, Wildman, Finniss & Liverpool Rivers. WA: King Edward & Isdell Rivers. QLD: Archer, Lennard & Ducie Rivers.	Latitude, Longitude coordinates	
Dean JC & Suter PJ 2004. Descriptions of new species and a new genus of leptophlebiid mayflies (Insecta: Ephemeroptera) from Northern Territory, Australia. *Memoirs of Museum Victoria* 61 (1), 111–118.	NT: South Alligator, East Alligator, Goomadeer, Liverpool & Finniss Rivers. WA: King Edward River.	Latitude, Longitude coordinates	
Finlayson CM, J Lowry, MG Bellio, S Nou, R Pidgeon, D Walden, C Humphrey & G Fox 2006. Biodiversity of the wetlands of the Kakadu Region, northern Australia. Aquatic Sciences 68, 374–399.	NT Alligator Rivers Region		
Gentili E 1980. The genera *Laccobius* & *Nothydrus* (Coleoptera, Hydrophilidae) in Australia and New Zealand. *Records of the South Australian Museum* 18 (7), 143–154.	NT: East Alligator & McArthur River. WA: King Edward River. QLD: Archer & Mitchell River.	General locality name & very few latitude longitude site coordinates	
Harvey MS 1996. A review of the water mite family Pionidae in Australia (Acarina: Hygrobatoidae). *Records of the Western Australian Museum* 17, 361–393.	NT: Roper, East Alligator, South Alligator, Daly, Wildman & Finniss Rivers. WA: Ord River.	Locality names & latitude, longitude coordinates for 3 species only.	
Hawking JH 1992. A *preliminary Guide to the Identification of Dragonfly Larvae (Odonata) from the Alligator Rivers Region of the Northern Territory*. Open File Record 38, Supervising Scientist for the Alligator Rivers Region, Canberra. Unpublished paper.	NT: South & East Alligator River	General locality name & very few latitude longitude site coordinates	
Hendrich L 1997. A new species of *Cybister* Curtis from the Kakadu National Park in Northern Australia (Coleoptera: Dytiscidae). *Entomological Problems* 28 (2), 105–107.	NT: South Alligator	General locality name & latitude, longitude coordinates for 1 site.	
Hendrich L & Wang L-J 2006. Taxonomic revision of Australian Clypeodytes (Coleoptera: Dytiscidae, Bidessini). *Entomological Problems*, 36 (1), 1–11, June 2006.	NT: South Alligator, East Alligator, Mary, Adelaide, Victoria, McArthur, Finniss & Daly Rivers. WA: Pentecost, Isdell, Drysdale, King Edward, Prince Regent & Ord Rivers. QLD: Archer, Jardine, Wenlock, Ducie, Coleman, Nicholson, Holroyd & Mitchell Rivers.	Latitude, Longitude coordinates & Point locations on distribution maps.	

Korniushin AV 2000. Review of the family Sphaeriidae (Mollusca: Bivalvia) of Australia, with the description of four new species. *Records of the Australian Museum* 52 (1), 41–102.	NT: Calvert River	Latitude, Longitude coordinates for 1 species only.	
Lansbury I 1984. Some Nepomorpha (Corixidae, Notonectidae and Nepidae) (Hemiptera-Heteroptera) of North-West Australia. *Trans. Of the Royal Society of South Australia*. 108 (1), 35–49.	NT: Mary, South Alligator & Finniss Rivers. WA: King Edward, Prince Regent, Fitzroy, Drysdale & Isdell Rivers. QLD: Coleman River.	Locality names & some latitude, longitude coordinates	
Lansbury I 1985. The Australian Naucoridae (Insect, Hemiptera-Heteroptera) with description of a new species. *Transactions of the Royal Society of South Australia* 109, 109–119.	NT: Adelaide, Daly, Finniss, Mary, East Alligator & South Alligator Rivers. WA: Drysdale River. QLD: Jardine River.	Locality names & some latitude, longitude coordinates for 4 species	
McKenzie KG 1966. Freshwater Ostracod from North-western Australia. *Australian Journal of Freshwater Research*. 17, 259–279.	NT: Victoria River. WA: Ord, Lennard & Fitzory Rivers.	Locality names, distances from & point locations on distribution map.	
Ochs G 1949. A revision of the Australian Gyrinidae. *Records of the Australian Museum.* 22 (2),171–199.	NT: East Alligator, Adelaide, Daly & Finniss Rivers. WA: Fitzroy River. QLD: Jardine, Mitchell & Archer Rivers.	Very general locality names only.	
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Suter PJ 1992. *Taxonomic Key to the Ephemeroptera (Mayflies) of the Alligator Rivers Region, Northern Territory*. Open File Record 96, Supervising Scientist for the Alligator Rivers Region, Canberra. Unpublished paper.	NT: South Alligator, East Alligator & Wildman Rivers.	Latitude, Longitude coordinates	
Suter PJ 1993. *Wundacaenis*, A New Genus of Caenidae (Insecta:Ephemeroptera) from Australia. *Invertebrate Taxonomy* 7, 787–803..	NT: South Alligator, East Alligator & Wildman Rivers. WA: Isdell River. QLD: Ducie & Wenlock Rivers.	Locality names & latitude, longitude coordinates.	
Vondel BJ Van 1995. Revision of the Haliplidae (Coleoptera) of the Australian region and the Molluccas. *Records of the South Australian Museum.* 28 (1): 61–101.	NT: Adelaide, Daly, Finniss, East Alligator, McArthur, Liverpool & Keep Rivers. WA: Drysdale & Ord Rivers. QLD: Mitchell, Archer, Jardine, Embley & Coleman Rivers.	Point locations on distribution maps, locality names & few latitude, longitude coordinates.	
Watts CHS 1987. Revision of Australian *Berosus* Leach (Coleoptera: Hydrophilidae). *Records of the South Australian Museum* 21 (1), 1–28.	NT: Daly, McArthur, East Alligator, South Alligator, Adelaide, Finniss, Roper, Towns/Limmen Bight Rivers. WA: Cape Leveque Coast, Ord & Fitzroy Rivers. QLD: Jardine River.	Point locations on distribution maps, very few locality names & latitude, longitude coordinates.	
Watts CHS 1988a. Revision of Australasian *Hydrophilus* Muller, 1764 (Coleoptera: Hydrophilidae). *Records of the South Australian Museum* 22 (2), 117–130.	NT: Finniss, East Alligator, Adelaide, South Alligator, Daly, McArthur & Buckingham Rivers. WA: Drysdale, King Edwards & Ord Rivers. QLD: Mitchell & Nicholson Rivers.	Locality names & some Latitude, Longitude coordinates	

Watts CHS 1988b. Revision of Australian Halipilidae (Coleoptera).*Records of the South Australian Museum* 22 (1), 21–28.	NT: East Alligator, Daly, McAthur Adelaide & Finnss Rivers. QLD: Jardine River.	Point locations on distribution maps, very few locality names & latitude, longitude coordinates.	
Watts CHS (1989). Revision of Australasian *Sternolophus* Solier (Coleoptera: Hydrophilidae). *Records of the South Australian Museum* 23 (2), 89–95.	NT: Dally, Buckingham, South Alligator, East Alligator, Roper, McArthur, Finniss, Mary & Adelaide Rivers. WA: Keep, King Edward, Ord, Isdell, Drysdale & Fitzroy Rivers. QLD: Archer, Gilbert, Mitchell & Norman Rivers.	Locality names & some Latitude, Longitude coordinates	
Watts CHS 1990. Revision of Australian *Hydrobiomorpha* Blackburn (Coleoptera: Hydrophilidae). *Records of the South Australian Museum* 24 (1), 35–42.	NT: Soth Alligator, East Alligator, Adelaide, Daly, Finniss, Roper & McArthur Rivers. WA: Ord, Fitzroy, King Edward & Lennard Rivers. QLD: Mitchell, Norman, Jardine Rivers.	Locality names & some latitude, longitude coordinates	
Watts CHS 1995. Revision of the Australian genera *Agraphydrus* Regimbart, *Chasmogenus* Sharp and *Helochare*s Mulsant (Coleoptera: Hydrophilidae). *Records of the South Australian Museum* 28 (1), 113–130.	NT: East Alligator, South Aliigator, McArthur, Mary, Daly, Finniss, Adelaide, Roper, Victoria River. WA: Cape Leveque Coast, Fitzroy, Ord, King Edward, Isdell, Lennard, Drysdale River. QLD: Mitchell, Embley, Archer, Leichhardt, Flinders, Norman Rivers.		
Watts CHS 1997. Four new species of *Antiporus* Sharp (Coleoptera, Dyiscidae) from Australia, with notes on *A. Femoralis* (Boh.) and *A. interrogationis* (Clark). *Records of the South Australian Museum* 30 (1), 35–42.	NT: Adelaide River. QLD: Isdell, Archer, Wenlock & Rivers.	Locality names & some latitude, longitude coordinates for 1 species only	
Watts CHS 1998a. Revision of Australian *Amphiops* Erichson, *Allocotocerus* Kraatz and *Regimbartia* Zaitzev (Coleoptera: Hydrophilidae). *Records of the South Australian Museum* 30 (2), 93–106.	NT: McArthur, East Alligator, Finniss, Daly, Keep, South Alligator, Victoria, Roper, Adelaide & Wildman River. WA: King Edward, Drysdale, Fitzroy & Isdell Rivers. QLD: Ducie, Wenlock, Nicholson, Mitchell, Archer, Holroyd, Embley Rivers.	Locality names & some latitude, longitude coordinates	
Watts, C.H.S. (1998b). Revision of Australian *Enochrus* Thomson (Coleoptera: Hydrophilidae). *Records of the South Australian Museum* 30 (2), 137–156.	NT: East Alligator, South Alligator, Adelaide, McArthur, Finniss, Daly, Roper & Mary Rivers. WA: Cape Leveque Coast, Isdell, Fitzroy, Drysdale, King Edward, Ord Rivers. QLD: Archer, Leihhardt, Mitchell, Holroyd, Flinders, Norman, Embley Rivers.	Locality names & some latitude, longitude coordinates	
Watts, C.H.S. (1999). Revision of Australian *Hydrochus* (Coleoptera: Hydrochidae). *Records of the South Australian Museum* 32 (1), 1–43.	NT: South Alligator, East Alligator, Daly, McArthur, Finniss, Adelaide, Victoria, Mary & Wildman Rivers. WA: Isdell, King Edward, Drysdale, Lennard, Prince Regent & Cape Leveque Coast. QLD: Mitchell, Archer, Gilbert, Ducie, Leichhardt, Embley, Norman & Jardine Rivers.	Locality names & some latitude, longitude coordinates	
Watts, C.H.S. (2001). A new species of Australian *Canthydrus* Sharp with a key to the Australian species of Noteridae (Coleoptera). *Records of the South Australian Museum* 34 (2), 61–64.	NT: East Alligator, South Alligator & Finniss Rivers. WA: Pentecost & Fitzroy Rivers.	Locality names & some latitude, longitude coordinates for 1 species only	
Wells, A. (1991). A guide to the caddisflies (Trichoptera) of the Alligators Rivers Region, Northern Territory. Open File Record 84, Supervising Scientist for the Alligator Rivers Region.	NT: East Alligator, South Alligator & Wildman Rivers.	Locality names only for 1 species	

Wells, A. (1995). Larva, pupa and notes on general biology of *Tinodes radona* Neboiss (Trichoptera: Psychomyiidae). *The Beagle, Records of the Museums and Art Galleries of Northern Territory*, 12, 53–59.	NT: South Alligator & Finniss Rivers.	Locality names only for 1 species	
Wells, A. & Cartwright, D. (1993). Females and immatures of the Australian Caddisfly *Hyalopsyche disjuncta* Neboiss (Trichoptera), and a new family placement. *Tansactions of the Royal Society of Australia*, 117 (2), 97–104.	QLD: Ducie River	Locality names & latitude, longitude coordinates	
Wilson, G.D.F. (2006). *Eophreatoicus* in Kakadu. Australian Museum. Draft analysis document, 02/08/2006.	NT: South Alligator & East Alligator Rivers.	Latitude, Longitude coordinates	
Wooldridge, D.P. (1976). Paracymus of the Australian Faunal Region (Coleopterra: Hydrophilidae). *Journal of the Kansas Entomological Society*, 3 (49), 453–463.	NT: Adelaide, Finniss & Daly Rivers. QLD: Archer, Gilbert, Flinders, Mitchell & Norman Rivers.	General locality names only	
Zwick, P. (1977). Australian *Hydraena* (Coleoptera: Hydraenidae). *Australian Journal of Zoology* 25, 147–84.	NT: South Alligator, East Alligator, Daly, Adelaide & Finniss Rivers. WA: Ord River.	Locality names & some latitude, longitude coordinates	

Short JW 2004. A revision of Australian river prawns, *Macrobrachium* (Crustacea: Decapoda: Palaemonidae). *Hydrobiologia* 525: 1-100.